Science
Grade Six
Topic E and Reviews
Revised Edition
Grade Six

Topic E

Trees and Forests
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Materials Needed</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
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<td>10</td>
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<tr>
<td>15</td>
<td>tree branches: one coniferous, one deciduous</td>
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<tr>
<td>16</td>
<td></td>
</tr>
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<td>*leaf samples: coniferous and deciduous</td>
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<tr>
<td>19</td>
<td>*leaf samples: coniferous and deciduous</td>
</tr>
<tr>
<td>20</td>
<td>poster: Between the Stands</td>
</tr>
<tr>
<td>21</td>
<td>[photos of trees with bark showing]</td>
</tr>
<tr>
<td>22</td>
<td>[photos of trees]</td>
</tr>
<tr>
<td>23</td>
<td>tree twigs – showing various branching patterns</td>
</tr>
<tr>
<td>24</td>
<td>*twig from deciduous tree</td>
</tr>
<tr>
<td>25</td>
<td>*tree cookies</td>
</tr>
<tr>
<td>26</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>poster: Between the Stands</td>
</tr>
<tr>
<td>29</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

*Samples of deciduous tree leaves, twigs, bark, and tree cookies are available from science supply companies. One such kit is called “How a Tree Grows” from the Young Naturalist Company. One of its Canadian suppliers is Ward’s of Canada, Ltd. (www.wardsci.com).
Comprehensive Materials List

(optional materials are in brackets)

branches or twigs (showing various branching patterns)

bags (clear plastic with twist ties)

leaves (samples from coniferous and deciduous trees)

pictures of trees

pictures of trees (bark showing)

poster: Between the Stands (provided)

pyramid (geometric solid)

tree cookies

twig from deciduous treee
Grade Six
Topic E
Trees and Forests
Mini Textbook
## Contents

### Part I: The Forest Ecosystem

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>4</td>
</tr>
<tr>
<td>What are Trees and Forests?</td>
<td></td>
</tr>
<tr>
<td>Trees</td>
<td>5</td>
</tr>
<tr>
<td>Forests</td>
<td>6</td>
</tr>
<tr>
<td>The Importance of Trees and Forests</td>
<td>8</td>
</tr>
<tr>
<td>A Forest is an Ecosystem</td>
<td>10</td>
</tr>
<tr>
<td>The Biotic Factors</td>
<td></td>
</tr>
<tr>
<td>Producers</td>
<td>12</td>
</tr>
<tr>
<td>The Forest Levels</td>
<td>13</td>
</tr>
<tr>
<td>Food Chains, Consumers</td>
<td>15</td>
</tr>
<tr>
<td>Food Pyramids</td>
<td>16</td>
</tr>
<tr>
<td>Decomposers</td>
<td>18</td>
</tr>
<tr>
<td>The Nutrient Cycle</td>
<td>20</td>
</tr>
<tr>
<td>The Oxygen Cycle</td>
<td>22</td>
</tr>
<tr>
<td>The Water Cycle</td>
<td>23</td>
</tr>
<tr>
<td>What Is a Tree? Let’s Review</td>
<td>25</td>
</tr>
<tr>
<td>Parts of a Tree</td>
<td>26</td>
</tr>
<tr>
<td>Deciduous and Coniferous Trees</td>
<td>28</td>
</tr>
</tbody>
</table>
Part II: Leaves, Branches, and Tree Cookies

Leaves
Parts of a Leaf
Types of Leaves
Leaf Shapes
Leaf Margins
Leaf Arrangements

Using a Dichotomous Key

Trees
Tree Bark Patterns
Tree Shapes
Branching Patterns
Location of Branches
Growth Patterns
Buds and Growth Rings
Tree Cookies

Part III: Using Our Forests Wisely

Traditional First Nations Uses of Forest Products

Modern Day Uses of Forest Products

How Human Activity Impacts a Forest Ecosystem
Tree Harvesting
Reforestation and Regeneration Methods
Clearing Forests for Development
Trees and Forests

Introduction

If you live in Alberta, there is a good chance that you have at least one tree on or near your property. Even for those who move into brand new houses, the planting of a tree or two somehow makes your home feel more complete. In some areas such as the prairies, trees only grow naturally in river valleys. In other areas such as the parkland, boreal forest, foothills, and Canadian shield trees are part of the natural environment.

Trees are one of the most beneficial forms of plant life on the planet. They provide humans with everything from shelter and food to chewing gum and Aspirin. What’s more, trees are one of the largest contributors to the oxygen supply on Earth. It is important that we demonstrate the importance of trees to our lives by taking good care of them.
Part I: The Forest Ecosystem

What Are Trees and Forests?

Trees

Trees are part of the plant kingdom. But what exactly is a tree? Most experts agree that there are certain characteristics that generally distinguish trees from other types of plant life.

1. **Perennial.** Perennials are plants that grow year after year without having to be replanted or reseeded.

2. **Self-supporting Trunk.** It can hold itself up and erect.

3. **Woody Trunk.** The main trunk and its main branches have an outer layer of strong tough material.

4. **One Main Stem.** The main stem is called the trunk.

5. **Tall.** They grow to at least a height of four metres.

The above are the main characteristics of trees. However, there are a few members of the plant kingdom that many agree are trees that do not fit the criteria. For example, mugo pines and clump birch trees have two or three trunks; yet they are classified as trees. Banana plants can grow as tall as 13 – 14 metres, but do not have woody trunks or stems. Many consider the banana a tree.

On the other hand, many varieties of shrubs can grow to be quite tall, have woody and self-supporting stems, and are perennials. Shrubs are not considered to be trees, however. For now think of the first three (above) as the main characteristics of trees.

The Douglas fir (left), clump birch (middle), and Japanese lilac (right) are all types of trees.
Forests

Many who live in the southern part of Alberta have never been to or even seen a forest. Many who live in central and northern Alberta include forests as part of their natural environment. A forest is more than a bunch of trees living close together. It includes all the other living and non-living things found in and amongst the trees.

There are several different types of forests, depending on the location in the world. All forests must have the climatic conditions and soil to support a wide variety of organisms. That is, there must be enough moisture, soil nutrients, and heat. Forests are never found in areas such as deserts, prairies, and the far north because these areas lack some of the environmental conditions necessary to support the rich variety of organisms found in forests.

What is a forest?

Generally, a forest is a large area of land with trees and brush growing thickly. Forests are home to many different living things.

The most noticeable component of a forest is the trees. However, it includes much more. A forest is an ecosystem. *An ecosystem is a community of living and non-living things that interact.* Trees, shrubs, ferns, grasses, birds, animals, bacteria, worms, rocks, water, air, and soil are all part of a forest ecosystem.

Even though all forests need certain environmental conditions to exist, there is a large variety of forest types that can be found in various parts of the world. Some forests are found in extremely hot and humid climates. Some are found in rainy but cooler climates. Still others are found in cooler and drier climates. The important thing to remember is that a forest is an ecosystem. Humans must remember to treat forests with respect. As with all ecosystems, each of the things in the ecosystem is affected by the other things in that ecosystem. Human activities often damage one part of a forest ecosystem, impacting all other parts of the ecosystem to some degree.

Boreal forests, like the one in the photo, are found in the northern two-thirds of Alberta. The word *boreal* means northern.
This maple forest is found in Manitoba. It gets its name from the large number of Manitoba maple trees. However, maple trees are but a fraction of the total number of living things found in this forest.

This photograph of a temperate rain forest was taken in Haida Gwaii, just off the west coast of central British Columbia. The main trees in this forest are coniferous trees, some of whom are hundreds of years old.

This photograph was taken in a tropical rain forest in Borneo, a island in the country of Indonesia on the western edge of the Pacific Ocean. The equator runs through the island. It is always hot, humid, and rainy in this part of the world.
The Importance of Trees and Forests

As a group trees are the largest members of the plant kingdom. They are important to humans and other organisms for many different reasons. Trees and forests are considered renewable resources, but as humans we must make every effort to use them wisely. Wise use of forests means that we must take steps to ensure they are sustainable. A sustainable resource is one that we use in such a way that they will be there for future use. Like all plants, trees reproduce. Humans should always keep in mind that in order to make forests sustainable, we cannot destroy forests faster than they can reproduce.

It might be tempting to think that clearing small areas of forest will have no effect on our lives on Earth. However, if enough of these “small” areas are destroyed, it can and is making a significant difference.

Why Are Trees and Forests Important?

There are countless ways in which trees and forests are important. Here are a few of main ones.

1. **Produce Oxygen.** As green plants, trees carry out photosynthesis. During photosynthesis, they take in carbon dioxide and give off oxygen. Oxygen is vital to all forms of life.

2. **Provide Shelter.** Humans and some animals and birds rely on trees to provide them with materials with which to construct houses. Most human shelter is made from lumber, which has been cut from trees.

3. **Furniture Making.** For hundreds of years humans have been using trees to make cupboards, chairs, tables, and beds.

4. **Making Pulp and Paper Products.** Wood is ground up and treated with chemicals so that it can be made into paper, cardboard, and other similar products.

5. **Control Soil Erosion.** Tree roots help to hold soil in place.

6. **Enrich soil.** When trees lose their leaves, the leaves decay and become part of the soil. The nutrients that were present in the live trees become part of the soil. When trees die, they also decay and make the soil richer.
7. **Provide the Basic Needs for Wildlife.** Forests provide food, shelter, and homes for animals and birds that live in or near them.

8. **Provide Food.** Trees provide us with fruits and nuts.

9. **Provide Protection.** Trees shelter us from strong winds and shield us from the hot sun. They also act as sound barriers.

10. **Add Beauty and Enjoyment.** We plant trees to adorn our homes. We marvel at the beauty of forests. Forests provide a great place for hiking, camping, and sightseeing.

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1. Many musical instruments such as the guitar are made from trees.

2. Rubber trees are tapped for their sap. The sap is used to make latex, which can be used to make several different products including automobile tires.

3. The main ingredient in Aspirin is acetylsalicylic acid. It comes from a variety of willow tree.
A Forest is an Ecosystem

An ecosystem is a community of biotic (living) and abiotic (non-living) things that interact. The biotic things in an ecosystem make up its biome. A forest is an ecosystem. Each forest has its own distinct biome.

Like any ecosystem, a forest ecosystem is complex. There is constant change in a forest. If a sudden winter storm comes up, some animals may die. This affects other animals that feed on those that died. This also affects the trees and plants in the undergrowth. The dead animals decay and make the soil richer. The demand for some plants as food will decrease. The changes continue in a chain reaction.

Biotic and Abiotic Factors

Biologists are scientists who study living things. They prefer to use the term “factors” instead of things when describing ecosystems. This is simply because “things” does not really seem appropriate to describe some parts of ecosystems.

Biotic Factors

The biotic factors in a forest ecosystem are numerous and varied. They can include

- trees
- shrubs
- ferns
- grasses
- fungi
- birds
- mammals
- fish
- insects
- bacteria

While almost all plants are rooted in the soil, most organisms from the animal kingdom as well as bacteria can live in many different locations in a forest, from the tree tops to deep in the soil.

What biotic factors can you spot in this photo?

Why is it that you cannot see all the biotic factors in this forest ecosystem?

Would the woman in the photo be a biotic factor? Why or why not?
Abiotic Factors

Abiotic factors are not alive, yet they are essential in any ecosystem, including forest ecosystems. Some of the abiotic factors might include

- temperature
- soil
- wind
- sunlight
- moisture
- water
- rocks
- air
- human-made items (e.g., pop bottles)
- pollutants

Abiotic factors have a direct effect on biotic factors. Often human activity alters one or more abiotic factors, which in turn can affect other abiotic factors and biotic factors.

Mangrove forests are found only in parts of the world with tropical climates. They are unique in that the mangrove trees grow in brackish (partly salty) water. They are usually located where fresh water from rivers and streams mix with the salty water from the ocean.

This photo shows a fen surrounded by forested land. Fens are wetlands with water that contains a large amount of dissolved minerals. This affects the types of organisms that grow in and near the fen, including the forest.
The biome in a forest ecosystem consists of all the interacting biotic factors present in the forest. The organisms living in any particular forest depends on the forest itself. A mangrove forest will be home to different organisms than a temperate rain forest or a boreal forest. The organisms living in any forest ecosystem can be divided into three main categories. An organism is placed in one of these categories depending on its role in the ecosystem. The three categories are producer, consumer, and decomposer. A forest ecosystem must have a balance of producers, consumers, and decomposers to be healthy.

**Producers**

*Role:* Use nutrients from the soil, carbon dioxide, and sunlight to produce oxygen and sugars.

*Facts:* Producers are the only organisms that can make their own food. Only green plants can do this.

*Examples:* Tree, shrub, grass, fern

**Consumers**

*Role:* Consume (eat) other organisms in the biome.

*Facts:* Some consumers eat only plants. Some eat only animals, including insects, birds, and other members of the animal kingdom. Others eat members of both the plant and animal kingdoms.

*Examples:* deer, cougar, hawk, bear, rabbit, woodpecker, squirrel, bumblebee

**Decomposers**

*Role:* Break down dead and decaying matter.

*Facts:* Decomposers are some of the tiniest organisms in a biome, but they are the most numerous. Because of the work of decomposers, the soil becomes enriched, making it possible for new plants to grow.

*Examples:* bacteria, earthworm, fungus, ant, millipede
Producers

Producers are an essential part of any ecosystem, including a forest. Producers can make their own food by using carbon dioxide, soil nutrients, sunlight, and water; no other organisms can do this. These other organisms rely on producers (which are green plants), for their food, either directly or indirectly.

Producers affect and are affected by abiotic factors in a forest ecosystem. For example, plants add moisture to the air. They absorb water through their roots. It travels up through the trunk and branches and exits through tiny holes in the leaves. This process is called transpiration. On the other hand, plants can be harmed by the lack of moisture. When there is not enough water, plants do not grow well. The forest dries up and is more susceptible to fire caused by lightning and human carelessness.

Plants affect and are affected by biotic factors too. For example, the mountain pine beetle bores holes through the bark of pine trees to lay its eggs. The adults carry a fungus, which infects the tree. Eventually, the tree dies. Some experts agree that there is a benefit to the mountain pine beetle. They say it is nature’s way of ensuring that too many trees do not grow in one spot, allowing sunlight to reach the forest floor.

Let us now take a closer look at how trees are affected by abiotic and biotic factors.

Abiotic Factors and Trees

Abiotic factors can affect the health of trees and the forest in general.

1. Temperature. Forest trees are of varying sizes. But regardless of their size, they provide shade to the lower parts of the forest. The result is that near the forest floor, it is often much cooler. These lower temperatures help other organisms live more comfortably and survive.

2. Soil. Trees affect soil in two main ways. First, the trees’ roots help hold the soil in place. This is especially important when there is a rainstorm. Without trees, soil erosion would be a problem. Second, trees drop leaves and needles. These trees and needles eventually decay and make the soil richer.

3. Wind. Trees are nature’s wind break. Trees provide sheltered areas for other plants and animals that live in the forest. Trees cut down the force of the wind. This is because trees are thick with leaves and branches. When the wind hits a tree, the leaves and branches slow it down considerably.

4. Moisture. Trees help to keep moisture levels up. First, the shade they provide keeps temperatures lower and this means less water from the ground evaporates into the air. Second, trees add moisture to the air through transpiration. (Refer to page 12.)

5. Sunlight. All green plants need sunlight to survive. Some need less sunlight than others. In fact, if some plants have too much sunlight, they cannot survive. This is true of many plants that live on the forest floor. Forest trees often block some of the sunlight from hitting the forest floor. This enables those plants that grow best in partial sunlight to thrive.
Biotic Factors and Trees

Many biotic factors can be harmful to trees.

1. **Leaf Miner.** Leaf miner is an term used to describe the larvae of many different types of insects, which live in and eat the leaves of trees. The vast majority of leaf-mining insects are moths and flies. Leaf miners get their names because they tunnel between the upper and lower parts of leaves to get their food.

2. **Tent Caterpillar.** Tent caterpillars are the larvae of moths. The adults lay eggs in the branches of a tree. When the eggs hatch, the larvae build silk “tents” in the branches of the trees. The larvae are hungry for leaves. They can eat all the leaves from a tree in just days. This is called “defoliation”. When there is a tent caterpillar infestation, the caterpillars can defoliate tens of thousands of hectares of forest.

3. **Yellow-bellied Sapsucker.** The yellow bellied sapsucker is a member of the woodpecker family. It gets its names from the yellow colour on its breast. Its head is black and red. Its back and tail are black with white stripes down the sides. The yellow-bellied sapsucker lives in forested areas. It uses its sharp beak to drill rows of regularly-spaced holes in the trees. This causes sap to seep out of the hole. The sapsucker eats the sap. Not only this, the sweet sap attracts insects, which the sapsucker eats as well. Sometimes a tree will lose so much sap that it will die.

4. **Blight.** Blight is a disease which causes browning of the leaves and small branches of a tree. This can cause the tree to die. A substance called chlorophyll in leaves makes them green. When a tree has blight, the chlorophyll is destroyed and the tree cannot make its own food. Then it cannot survive.

5. **Deer.** Deer are consumers. In a forest they eat the leaves of trees. Most often they do not destroy a tree. But sometimes they eat the tender bark of younger trees, causing them to die. Deer have also been known to eat almost all the leaves of shorter trees. The tree cannot survive without leaves.
A forest can be divided into levels vertically. The levels change gradually from one to the next. Each level has a different environment than the others. Each of the levels is home to different species of animals, plants, fungi, and bacteria.

NOTE: The illustration above does not show this, but the upper canopy takes up the most vertical space of all the layers.

1. **Upper Canopy.** The Upper Canopy is sometimes called the Emergent layer. It is the top level of the forest formed by the leaves and branches of the tallest trees. Up to 35 percent of the precipitation falling on a forest is intercepted by the canopy. Different birds, such as owls, orioles, eagles, and hawks live here. In addition, many insects, such as aphids and tent caterpillars make their homes here.

2. **Understory.** This level is also referred to as the Middle Level. This level is home to smaller trees and larger shrubs. It provides a sheltered place for birds and small mammals to travel. Many insects, lichens, squirrels, woodpeckers, and many other birds are found in the understory.

3. **Underbrush.** This level is also called the Herb or Shrubbery Layer. Ferns, wildflowers, and other soft-stemmed plants, tree seedlings, butterflies, dragonflies, mice, weasels, deer, porcupines, skunks, and rabbits find their food sources in this layer.

4. **Forest Floor.** This level includes the ground cover and the soil. The ground cover includes leaf litter, mushrooms, insects, salamanders, toads, moss, and flowers. The soil is the storehouse for growth. There are thin layers of organic and mineral materials covering bedrock. Worms, bacteria, soil insects, tree roots, spiders, millipedes, and centipedes are found here.
Food Chains

Remember that the organisms living in a forest biome can be classified as producers, consumers, and decomposers. Producers are green plants. They can make their own food. Consumers live off producers and other consumers. Finally, decomposers break down decaying and dead organisms so that their nutrients enrich the soil.

One way to show the relationship between producers and consumers is by using food chains. **Food chains explain “what eats what” in a biome.** In any forest ecosystem there can be a hundred or more different food chains. Some will be short; others long. Any one organism is almost always part of more than one food chain. A food chain always begins with a producer and ends with a consumer.

Here is a food chain you might find in a forest ecosystem in northern India. You can “read” a food chain. The arrow (→) is read “is eaten by”.

```
  tree → deer → tiger
```

“The tree is eaten by the deer. The deer is eaten by the tiger.”

Consumers

Unlike producers, consumers get their nutrition by eating other living things. Scientists have two ways to classify consumers:

1. **By What They Eat**

   - **Herbivore** – eats plants only; examples: mouse, grasshopper, deer, elephant
   - **Carnivore** – eats animals only; examples: dragonfly, wolf, eagle, snake
   - **Omnivore** – eats both plants and animals; examples: human, pig, grizzly bear, rat

2. **Their Places in a Food Chain**

   - **Primary Consumer** – eats a producer.
   - **Secondary Consumer** – eats a primary consumer
   - **Tertiary Consumer** – eats a secondary consumer

In the food chain above, the deer is the primary consumer and the tiger is the secondary consumer.
Here is a food chain that is longer. You might find this food chain in a boreal forest in Alberta.

We would read the food chain as follows:

“The grass is eaten by the grasshopper.”
“The grasshopper is eaten by rat.”
“The rat is eaten by the snake.”
“The snake is eaten by the osprey.”

Now let us classify the consumers in the food chain by what they eat.

**grasshopper** – herbivore
**rat** – omnivore (In the above food chain the rat is eating an organism from the animal kingdom, but rats also eat food from the plant kingdom, such as wheat.)
**snake** – carnivore
**osprey** – carnivore

If we classify the consumers in the food chain above by their places in the food chain, we would have the following:

**grasshopper** – primary consumer
**rat** – secondary consumer
**snake** – tertiary consumer
**osprey** – quaternary consumer (Because the osprey’s position is fourth in the food chain after the producer, some scientists call it a quaternary (fourth) consumer.)

Food chains are important when studying forests. When something happens to the population of one organism, it affects the populations of the other organisms in the food chain. Since most organisms are part of several different food chains, a change in population in one organism can affect the populations of many different organisms.
Food Pyramids

Food pyramids are another way to look at the relationships among the organisms in an ecosystem. They are similar to food chains but provide information in a slightly different way. Food pyramids serve to show two different, but related ideas:

- The levels of organisms in food chains
- The relative populations of organisms at various levels

A food pyramid should be viewed as three-dimensional like a geometric solid, and not two-dimensional like a picture. A food pyramid better represents the numbers of each type of organism at each level. Refer to the food pyramid on the next page. It shows

- The grizzly bear is at the top of the food chain. This means no other organism hunts and eats a grizzly. It is a tertiary consumer.

- It takes many secondary consumers to support an animal at the top of a food pyramid.

- Similarly, to support one secondary consumer, it takes many primary consumers.

- And to support one primary consumer, it takes many producers.

Maintaining a Balance

Ecosystems always try to maintain a balance somehow. If something happens to one part of a food chain, the other parts of the food chain are affected. Example:

**Food Chain:** grass $\rightarrow$ rabbit $\rightarrow$ coyote

**Chain of Events**

A farmer sets out poison to kill all the coyotes.

- There are only a few coyotes left to eat rabbits.

- The rabbit population grows rapidly.

- There are so many rabbits that they eat almost all the grass the rabbits become weak.

- The weakened rabbits are easier for the remaining coyotes to hunt.

- Soon the coyotes grow stronger and the coyote population increases.
Food Pyramid
(Ecological Pyramid)

9 Kilocalories per square meter per year available in bodies of secondary consumers

Secondary Consumers
Predators

90 Kilocalories per square meter per year available in bodies of primary consumers

Primary Consumers
Herbivores

Primary Producers: Trees, shrubs, ferns, grasses, flowers

9000 Kilocalories per square meter per year available for primary consumers
Decomposers

Decomposers are essential in any healthy ecosystem. A forest ecosystem is no exception. Decomposers are break down dead and decaying organisms to such an extent that they dissolve in soil moisture. The dissolved nutrients can then be absorbed by plants through their root systems. Without decomposers plants would have no nutrients. Dead plants and organisms would pile up.

The yeast used to make bread rise and the mould you find on decaying fruit and cheese are both types of decomposers.

Decomposers have the greatest population in any ecosystem. Most decomposers are very small. Some are so small they cannot be seen with the naked eye. Examples of decomposers include

- Bacteria
- Fungi
- Ants
- Millipedes
- Centipedes
- Earthworms
- Lichens

Let us take closer look at some of the one family of decomposers you might find in a forest – the fungi.

Fungi

Fungi are organisms that lack roots, stems, and leaves like that of other plants. They are not green and contain no chlorophyll, so they cannot make their own food. Therefore, they must live where they can absorb minerals and water as well as biotic material. Fungi do not have seeds. Instead they have tiny particles called spores. The spores are carried by the wind to other places. If a spore lands on a suitable spot, it begins to grow. Mildew, smuts, mushrooms, puffballs, yeasts, and moulds are all types of fungi.

There many many different types of fungi.

1. **Conks.** Conks are a type of fungus found attached to tree trunks. They grow out from the trunks like steps or shelves and have growth rings like trees. They appear to be soft, like mushrooms, but they are actually hard and firmly attached to the trunk. There are different types of conks, found in different colours and forms.

2. **Lichens.** Lichens are a “composite” organism created by a relationship between fungi and algae. The fungus absorbs the water and nutrients, while the alga produces the food since it contains chlorophyll. This partnership between fungus and alga creates the plant, lichen. Lichens grow on walls, rocks, tree bark, and other places where neither fungi nor algae could exist alone. Lichens grow very slowly and live for a long time. Some lichens, found in the Arctic, may be more than 4000 years old.
Lichens will go into a dormant stage if there is not enough water. They can withstand extremes of heat or cold, but not smoke or fumes. Because of this fact, they are good indicators of air quality. They are not usually found in cities, industrial areas, or other areas where there may be polluted air.

Lichens can be found in several different colours. There are six types of lichens. Three of the more common are

**Crustose** (crusty) – which grow flat or may be embedded in bark or on rocks.

**Foliose** (leaflike) – which curl up off the surface from which they grow, and look like crumbled leaves. They are attached to the surface of the rock by many rootlike threads.

**Fruticose** (treelike or shrubby) – is like a branched plant. They grow upright or hang from the surface from which they grow and are only attached to the surface at the base.

3. **Mushrooms** are a type of fungus. They produce spores. Beneath the surface of the ground or bark is the main part of the mushroom. This is the mycelium, which is the thread-like part that collects the water and nutrients for growth. Mushrooms can be found in a wide range of shapes, colours, and locations of the forest.

4. **Mycorrhizal Fungi** grow on the roots of trees. When sugar is produced in the leaves of a tree, it is sent out to provide food for all parts of the tree, including the roots. The fungi feed on the sugar provided to the roots. In return, the mycorrhizal fungi break down the nitrogen and phosphorous in the soil so that the tree can use it. They have blackish fruit called **truffles**, which are eaten by mice.
The Nutrient Cycle

Nutrients are the substances we need in order to live. All organisms need them. The minerals found in the soil are nutrients for green plants. These same nutrients get passed on to primary consumers when they eat plants. Similarly, secondary consumers get these nutrients from eating primary consumers. When decomposers break down dead and decaying organisms, they are helping to return these nutrients to the soil. The process repeats and repeats. This is called the nutrient cycle.

1. Nutrients are dissolved in the water found in the soil. Plants absorb the dissolved nutrients through their roots. The nutrients make their way to the branches and leaves.

2. A first order consumer, such as a deer eats the grass and leaves to get the nutrients. When a wolf hunts, kills, and eats the deer, it will get those nutrients.

3. When plants and animals die, they decay. Decomposers break down the organic matter.

4. Once the decomposers break down the plant and animals, the nutrients are released back into the soil. Now the nutrients can once again be absorbed by plants.
Nature is the most important recycler on Earth. Like the minerals that were recycled in the nutrient cycle to provide nutrients to all the organisms in an ecosystem, oxygen is also continually recycled. The two main processes involved in the oxygen cycle are photosynthesis and respiration.

**Photosynthesis**

Photosynthesis is the process by which plants make sugars. Plants use a green substance called chlorophyll to trap solar energy. This energy is then used to combine carbon dioxide and water to form sugar and oxygen. The sugar is food for the plant. The oxygen is given off into the air along with water.

\[
\text{carbon dioxide (CO}_2\text{) + water (H}_2\text{O) + chlorophyll = sugar (C}_6\text{H}_{12}\text{O}_6\text{) + oxygen (O}_2\text{)}
\]

**Respiration**

During respiration, animals including humans take in oxygen and breathe out carbon dioxide and water vapour.

1. **During photosynthesis** green plants use sunlight, carbon dioxide, and water to produce sugar and oxygen.

2. **During respiration** animals take in oxygen and give off carbon dioxide and water vapour.
The Water Cycle

Another important cycle that takes place in a forest ecosystem is the water cycle. Water is essential for the survival of all organisms. Like nutrients and oxygen, it goes through a continuous cycle. Plants contribute to the water cycle through a process called transpiration.

Transpiration

Transpiration is the evaporation of water into the air through tiny openings called stomata, which are found on the underside of leaves. The top part of a leaf is covered with a waxy material called cuticle, which tends to waterproof the leaf. Water in the tree is replaced with water absorbed by the roots from the soil.

1 Water enters the air through transpiration. Transpiration is the process where trees take in water through the roots and release it into the air through the stomata, on the undersides of their leaves. Leaves release this water in the form of water vapour.

2 Water also enters the air through evaporation. In evaporation it changes from a liquid into water vapour.

3 The water vapour in the air condenses and forms clouds.

4 The clouds produce precipitation in the form of rain and snow.

5 Much of the precipitation runs off into lakes, rivers, and oceans.

6 Much of the precipitation is absorbed by the soil where it is used by plants once more.
What Is a Tree? Let’s Review

Characteristics of All Green Plants
- stem (a trunk is a type of stem)
- roots
- leaves
- flowers (cone-bearing trees, such as pine, spruce, and fir do not have true flowers)
- seeds/fruit

Plants that are not trees are called herbaceous plants.

<table>
<thead>
<tr>
<th>Trees</th>
<th>Herbaceous Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>trunk</td>
<td>stem</td>
</tr>
<tr>
<td>hard woody trunk</td>
<td>soft stem</td>
</tr>
<tr>
<td>leaves</td>
<td>leaves</td>
</tr>
<tr>
<td>may have flowers</td>
<td>may have flowers</td>
</tr>
<tr>
<td>roots</td>
<td>roots</td>
</tr>
<tr>
<td>bark</td>
<td>no bark</td>
</tr>
<tr>
<td>seeds and/or fruit</td>
<td>seeds and/or fruit</td>
</tr>
<tr>
<td>branches</td>
<td>may or may not have branches</td>
</tr>
</tbody>
</table>

Major Differences
- Trees are larger than herbaceous plants.
- Trees have thicker stems.
- Trees have harder, woody stems and branches.
- A tree’s leaves are usually bigger.
- Trees have bigger roots.

Main Parts of a Tree

Roots
- anchor the tree
- take up water and minerals from the soil to feed the tree

Trunk
- provides support to the tree
- contains the “plumbing” of the tree, where water and minerals are carried from the roots to the rest of the tree, and sugars from the leaves to the other parts of the tree
- is the place where all other plant parts are attached
- A tree’s outer bark is made of hardened, dead cells and serves to protect the tree from damage and disease.

Leaves
- Like a mini-factory, leaves make food for the tree through a chemical reaction called photosynthesis. Chlorophyll, the green colour in leaves, is necessary for this reaction to occur. Carbon dioxide from the air is combined with water from the roots, in the presence of sunlight, to produce sugar and oxygen.
Roots – anchor the tree to the ground and absorb water and minerals from the soil.

Crown – the upper part of a tree, made up of branches, twigs, leaves, needles, buds, and cones.

Outer Bark (Cork) – outer part of the trunk. It is made up of dead tissue and protects the living parts underneath.

Inner Bark (Phloem) – is next to the outer bark and transports sap up and down a tree. The tree will die if this layer is damaged.

Cambium – thin yellowish-white layer found between the sapwood and the inner bark, which produces new xylem cells (wood) every year.
Sapwood – thin layer of active xylem or wood that surrounds the heartwood. This is where water and dissolved minerals are transported through the cells called the xylem, from the roots to the leaves.

Heartwood – non-living core of the tree stem, giving the stem strength

Cross-Section Cut of a Tree Stem
Deciduous and Coniferous Trees

Scientists divide trees into two main groups, deciduous and coniferous. As trees they have many characteristics in common, but they differ in appearance, the way they form seeds, and in the climates to which they are most suited.

Left: An apple is a typical deciduous tree.

Right: A pine is a typical coniferous tree.

The following charts shows how deciduous and coniferous trees are similar and different.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Deciduous</th>
<th>Coniferous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shedding of Leaves</td>
<td>• shed leaves in fall</td>
<td>• shed leaves continuously (Most do not shed leaves in one season.)</td>
</tr>
<tr>
<td>Shape of Leaves</td>
<td>• broad-leaved (a few are needle-shaped)</td>
<td>• needle-shaped</td>
</tr>
<tr>
<td>Water Retention</td>
<td>• leaves have waxy topsides and large surface area on underside, causing moisture loss</td>
<td>• thick, waxy coating reduces water loss from transpiration</td>
</tr>
<tr>
<td>Temperature Resistance</td>
<td>• do not withstand temperature extremes</td>
<td>• can withstand temperature extremes</td>
</tr>
<tr>
<td>Seeds</td>
<td>• most have flower which contain the seeds</td>
<td>• cone-bearing</td>
</tr>
</tbody>
</table>

The larch (also known as the tamarack) has characteristics of both deciduous and coniferous trees. It loses its leaves in the fall and is also cone-bearing.
Part II: Leaves, Branches, and Tree Cookies

Introduction

In Part I of *Trees and Forests* you learned that scientists divide trees into two main categories, deciduous and coniferous. In Part II, you will learn about other ways to classify trees. You will also find how scientists use what they observe to make inferences about trees.

Specifically in Part II, you will examine the parts of a leaf from a deciduous tree, the types of leaves, leaf shapes, leaf arrangements. Then you will go on to find out more about tree bark patterns, tree shapes, and branching patterns. Finally, you will study how to infer a tree’s history by examining buds, twigs, and tree cookies.

Leaves

We classify leaves in several different ways:

**Type** – broad leaf or needle

**Number** – singles or bunches

**Shape**

**Margins** – what the edges look like

**Arrangement on a Branch**

--
Parts of a Leaf

If you examine leaves from several different deciduous trees, you will notice they have some basic similarities. All broad leaves have the same parts.

**blade** – This the large flat part.

**petiole** – This is the part that looks like a little stem. It attaches the blade to a branch.

![Diagram of a leaf with labeled parts]

Parts of the Blade

**base** – the place where the blade is attached to the petiole

**apex** – the very tip of the blade. It is at the opposite end of the blade from the base.

**margin** – the edge of the blade

**midrib** – also called the midvein. It is the large vein that runs from the base up to or close to the apex. It is the main way that water and nutrients get to the blade.

**veins** – branch out from the midrib. They distribute water and nutrients to a leaf’s cells.
## Types of Leaves

### DECIDUOUS TREE LEAVES

- **Simple Leaves:** (one blade and one petiole)
- **Compound Leaves:** (more than one blade per petiole)
- **Double Compound Leaves:** (several petioles that branch out; each petiole has several blades.)

### CONIFEROUS TREE LEAVES

- **Needle:** (leaves are very long and thin)
- **Scaly:** (flat and scaly)
Leaf Shapes

Deciduous Trees

When examining the shapes of deciduous tree leaves, we look at the outline it makes.

<table>
<thead>
<tr>
<th>Linear</th>
<th>Oblong</th>
<th>Oval</th>
<th>Ovate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cordate</td>
<td>Deltoid</td>
<td>Lobed</td>
<td>Orbicular</td>
</tr>
<tr>
<td>(heart-shaped)</td>
<td>(triangular)</td>
<td></td>
<td>(round)</td>
</tr>
</tbody>
</table>

Coniferous Trees

When examining coniferous leaf shapes, we are look at the shape of a cross-section cut of a needle or scale.

4 sided needle

\[\text{(cross section cut)}\]

Flattened needle

\[\text{(cross section cut)}\]
Leaf Margins

When examine the edges of deciduous trees leaves, you will notice that they are not all the same.

**smooth**

Examples: dogwood, magnolia, persimmon

**fine-toothed**

Examples: willow, balsam poplar, aspen

**Coarse-toothed**
(or serrated)

Examples: elm, birch, white poplar

**scalloped**
(or wavy)

Examples: oak, arbutus
Leaf Arrangements

Leaf arrangements are categorized according to how individual leaves are attached to a branch.

**DECIDUOUS TREE**

<table>
<thead>
<tr>
<th>Diagram</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td>opposite</td>
</tr>
<tr>
<td><img src="image2" alt="Diagram" /></td>
<td>alternate</td>
</tr>
<tr>
<td><img src="image3" alt="Diagram" /></td>
<td>whorl</td>
</tr>
<tr>
<td><img src="image4" alt="Diagram" /></td>
<td>basal</td>
</tr>
</tbody>
</table>

**CONIFEROUS TREES**

<table>
<thead>
<tr>
<th>Diagram</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Diagram" /></td>
<td>bundles of 2</td>
</tr>
<tr>
<td><img src="image6" alt="Diagram" /></td>
<td>bundles of 5</td>
</tr>
<tr>
<td><img src="image7" alt="Diagram" /></td>
<td>singly on a twig</td>
</tr>
<tr>
<td><img src="image8" alt="Diagram" /></td>
<td>scale-like</td>
</tr>
<tr>
<td><img src="image9" alt="Diagram" /></td>
<td>in clusters of more than 5</td>
</tr>
</tbody>
</table>
Using a Dichotomous Key

A dichotomous key is a way of classifying and organizing organisms. It can be very large and complex or relatively simple, depending on the range of organisms to be organized. Whether complex or simple, dichotomous keys are arranged in much the same way. The prefix “di” means two. A large group is first divided into two subgroups. Each of the subgroups has a characteristic that the other does not. Then each of the subgroups is further divided into two subgroups. This dividing continues until you get down to a specific variety or species.

The dichotomous key on the next page shows how deciduous trees in the Pacific Northwest United States can be organized. Notice how each group in the chart is subdivided. Some branches of the chart subdivide more than others; this is typical of dichotomous keys.

How to Use a Dichotomous Key

A dichotomous key is used to identify an unknown type of organism. To do this follow these steps:

- First, make sure the dichotomous key is appropriate for identifying your organism. If you want to identify the name of a particular deciduous tree, then a dichotomous key for coniferous trees will not work.
- Decide which of the first two subgroups best describes your organism.
- If the subgroup divides again, decide which of those subgroups best describes your organism.
- Continue doing this until the subgroup no longer subdivides. At this point the dichotomous key will identify the name of a type of organism.

Practice

For practice, use the dichotomous key on the next page to identify each of the deciduous trees below.
*The pith of a twig is the soft centre section. A plated pith is divided into sections called chambers. A non-plated pith is not divided into chambers.

From the Previous Page. Tree A: ash       Tree B: aspen
Tree Bark Patterns

A characteristic that is often used to describe trees is the outer bark. This is the part that we can see without actually having to cut the tree down. The bark is made up of dead cells. It serves to protect the inner layers from weather, insects, and any organisms living in or using the tree.

There are holes in the bark, which allow the tree to take in oxygen from the air. As a tree grows, the inner layers become too large such that the outer bark cannot cover them. There is always new bark being produced in the inner bark or phloem to replace the outer bark. When this occurs, the outer bark cracks and splits, creating interesting patterns and lines.

Tree bark patterns can be divided into five main categories.

- horizontal
- vertical
- scaly patches
- vertical and wavy
- horizontal and scaly

Tree bark also varies in colour and texture, which are other ways used to describe trees.
Silhouettes

A tree’s shape refers to the outline it makes as you look at it from a distance. This shape is referred to as its *silhouette*. Tree silhouettes can be divided into five basic shapes.

Tree Silhouettes and the Environment

Any particular tree’s silhouette depends on the environment in which it grows.

**Symmetrical** – usually grows in an environment where there are good growing conditions: enough moisture, little wind, no interference from other trees or structures

**Leaning** – usually found in locations where there are constant, strong winds

**Asymmetrical** – usually caused when a tree grows very close to another tree or some kind of structure like a building, fence, or even a steep hillside

**Irregular** – usually caused by poor growing conditions, such as drought or by damaged done by humans or animals
Branching Patterns

Branching patterns have to do with the way in which branches are attached to the trunk or the way twigs are attached to branches. Branching patterns involve three main things:

1. the direction the branches point
2. growth patterns
3. where on the trunk branches grow

Direction of Branches

Branch direction refers to how the branches point when they grow out of the main trunk. There are three main branch directions. They can be illustrated by using stick figures with their arms pointing in three different ways.

<table>
<thead>
<tr>
<th>Outward</th>
<th>Downward</th>
<th>Upward</th>
</tr>
</thead>
</table>

Left: lodgepole pine (outward)  
Right: elm (upward)  
Middle: black spruce (downward)
## Location of Branches

There is an interesting variety when it comes to where branches are attached to a tree’s main trunk. While some trees have branches growing all along the trunk, others have branches growing only at the top. Following are the three main types of branch locations.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excurent</td>
<td>The main trunk goes the entire height of the tree, with branches forming patterns; e.g., spruce</td>
</tr>
<tr>
<td>Decurrent</td>
<td>The main trunk continues up about halfway, then splits into more than one main branch; e.g., apple</td>
</tr>
<tr>
<td>Columnar</td>
<td>The main branch continues the full height of the tree, with the branches forming only at the top; e.g., palm</td>
</tr>
</tbody>
</table>

Left: balsam fir (excurent)  Middle: cherry (decurrent)  Right: palm (columnar)
## Growth Patterns

Branch growth pattern has to do with the way in which the branches grow from the main branch.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>opposite</strong></td>
<td>Branches grow from the opposite sides of the trunk, across from each other</td>
</tr>
<tr>
<td><strong>alternate</strong></td>
<td>Branches grow on opposite sides from each other, but one will be farther up the trunk than the first</td>
</tr>
<tr>
<td><strong>whorled</strong></td>
<td>Branches are attached in groups of two or three from the same location on the trunk.</td>
</tr>
<tr>
<td><strong>spiral</strong></td>
<td>Branches grown alternately along the trunk, but in a spiral pattern like a corkscrew or circular staircase, moving up the trunk.</td>
</tr>
</tbody>
</table>

Left: ash (opposite branching)  
Right: willow (spiral branching)
Buds and Growth Rings

You learned earlier that you can make inferences about a tree’s growing conditions by examining its silhouette. For example, if a tree has only a few short branches on one side and is full with many branches on the other, it is likely that it was growing very close to another tree, a fence, or a building. You can also learn about a tree’s growing history by examining its twigs. Twigs are small and slender and are found at the end of branches. New growth takes place at the twigs.

Parts of a Twig

**bud** – Buds are undeveloped shoots. They can be found along the twig (*lateral bud*) or at the end of the twig (*terminal bud*). Buds develop into leaves.

**leaf scar** – Leaf scars are scars left where leaves from the previous year were attached to tree.

**lenticel** – Lenticels are pores (tiny holes) in the stem. They are the path for the exchange of gases between the atmosphere and the tree.

**growth ring** – A growth ring is a noticeable thickening where the terminal bud from the previous year dropped off.

![Diagram of a twig showing terminal bud, leaf scar, and lenticel]

What Secrets Does a Twig Reveal?

By examining a twig you can make inferences about the growth of the tree in past years. The growth rings give the most information. The distance between growth rings shows how much the branch grew from one year to the next. A longer distance indicates there were good growing conditions: plenty of rain, sunshine, and nutrients. On the other hand, a shorter distance most likely shows poor growing conditions, perhaps drought, poor soil, or too much shade.
Another way that scientists use to make inferences about a tree’s history is to examine tree cookies. **Tree cookies are cross-section slices of a tree trunk. Tree cookies are also called dendrodiscs.** Each dendrodisc is unique because each tree is unique and has a unique history. In order to learn about a tree, it is important to examine a tree cookie very carefully.

**What can a tree cookie tell you?** Lots! It can tell you

1. **the tree’s age.** The number of rings on the tree tells you how old the tree is. One year’s growth is one light and dark ring. The lighter wood is called **early wood.** It grows in spring and summer. The darker wood is called **late wood.** Late wood grows in fall and winter.

![Tree cookies showing growth rings](image)

2. **if there were good growing conditions.** In years when there was plenty of light, moisture, space, nutrients, and a long growing season, the rings will be wide and evenly spaced. Wide, evenly spaced rings mean that the tree grew on a fairly flat place and that there was no damage inflicted on the tree itself.

![Tree cookies showing wide rings](image)

3. **if there were poor growing conditions.** Sometimes the rings are narrow. This can happen when there are a lot of trees growing closely together. The trees have to compete for sunlight, moisture, and nutrients, resulting in slow growth. If there is a drought or a shortened growing season, the rings will be close together as well.

![Tree cookies showing narrow rings](image)

4. **if the tree grew close to an object.** Often you notice that the rings are wider on one side than on the other. This is an indication that the tree grew more on one side than on the other. This can happen if the tree grew very closely to another tree, to a fence, a building, or even on a very steep slope.

![Tree cookies showing asymmetric growth](image)
5. **if there was a fire.** If a tree survives a fire, often a *fire scar* is left. The fire was hot enough to damage the tree, but not hot enough to kill it.

6. **if there was insect damage.** Insects, such as the mountain pine beetle feed on the phloem of the tree. Mountain pine beetles also carry a fungus that leaves a blue stain.

7. **if a dead branch was broken off.** When a branch dies and is broken off, it leaves a scar. The scar is usually at right angles to the tree rings.

Interpreting a tree’s history from examining a dendrodisc is an exercise in inference. Unless a person followed the tree’s life from germination to the time the cookie was made, he or she can only infer the tree’s history. Some of the symptoms closely resemble each other. For example, a scar left from fire damage and that left by insect damage are very similar.
Reading a Tree’s Life in a Dendrodisc

Examine the dendrodisc below. The numbers tell you about its history.

1. **Centre ring** – the tree is born.
2. **Broad, evenly spaced rings** – indicate plenty of moisture and light. The tree is growing rapidly.
3. **Wider rings on one side** – indicate that the tree may have been growing on a slope or that another tree was growing right next to it, preventing one side from growing as much as the other. This tree may have been removed at a later date.
4. **Narrow rings** – indicate the tree may have been growing in crowded conditions where it had to compete for nutrients and water with other trees, or it could indicate drought conditions.
5. **Tree scar** – in one area could be an indication that there was a fire that burned that side of the tree or that the tree’s trunk suffered some damage at that spot.
6. **Wider rings** – indicate good growing conditions. Perhaps some of the surrounding trees were cut down, leaving more nutrients, water, and space for this tree.
7. **Tree scar** – damage could have occurred if a dead branch was torn off or there was some insect damage.
8. **Numerous narrow rings** – are a sign that there were drought conditions for several years.
9. **A smaller series of narrow rings** – may have resulted from an insect attack or another period of drought.
10. **The tree is harvested.**
Part III: Using Our Forests Wisely

Trees have been a natural resource for thousands of years. Many of the ways in which they were used in the past are much the same as we use them today. However, with advancements in technology, new uses for trees and forests developed. This section of Trees and Forests examines some of the past and present uses of forests.

Traditional First Nations Use of Forest Products

One of the most important lessons modern-day Canadians have learned is something that traditional First Nations practised; that is, it is important to take from nature only what you need. It is wrong to waste. With regard to their use of trees and other forest products, First Nations wasted little and reused and recycled when possible.

Plains First Nations used lodgepole pine trees for teepee poles. They were precious items because lodgepole pine trees did not grow naturally on the plains.

1. Medicine
   - Tea brewed from stem of dogwood for relief of illness.
   - Alder bark tea used to stop cramps.
   - Alder leaves used to cure a fever.
   - Mountain ash bark used to stop stomach pain.
   - Mountain ash berries used to treat scurvy.
   - Spruce bark tea used to cure scurvy.
   - Sap of the lodgepole pine boiled and used to cure tuberculosis.
   - Gummy sap of the lodgepole pine used to cure a toothache.
   - Sap of the lodgepole pine applied to wounds to avoid infection.

2. Homes
   - Lodgepole pine poles were used as a frame for teepees.
   - Logs for cabins.
   - Furniture/back rests
   - Wood used for basic fuels
   - Fences
   - Bent willow used as frame for shelter
3. **Foods**
   - Berries – Saskatoons, blueberries, raspberries, low bush cranberries, gooseberries
   - Fruits – apples
   - Nuts – walnuts, chestnuts
   - Sugar
   - Syrup

4. **Transportation**
   - Travois poles
   - Wagons
   - Canoes and boats
   - Snowshoes

   *Travois were used to haul goods. Long poles acted as a frame that were harnessed to dogs.*

5. **Tools**
   - Handles
   - Arrows made from heartwood of birch
   - Bows require knot-free section of yew tree
   - Hammers
   - Bent willow provides spring for rabbit snare

6. **Leisure**
   - Toys
   - Totem poles
   - Jewellery
   - Games (dice)

   *Pacific Northwest Coast First Nations used cedar trees to carve totem poles. Cedar has a natural resilience to rotting.*
Modern Day Uses of Forest Products

Today’s uses of trees and other forest products are varied. Gradually, we are learning from First Nations in that we are learning to make better use of waste products from lumber mills and other forestry activities. For example, once almost all the sawdust produced at sawmills was burned. Today, much of the sawdust is used to make composite woods, where sawdust is mixed with glue to make a wood product.

1. Wood
   • Fuel, pulpwood (for paper products), sports equipment, construction materials, houses, boats, wood alcohol, furniture and decorations, lumber veneer, charcoal briquettes, pencils, musical instruments.

2. Pulpwood
   • Oils, soaps, paints, turpentine, polishes, cleaning fluids, cellulose

3. Bark
   • Tannin (used in leather making and in the production of inks), oils, drugs, cork, dye, soil conditioner, adhesives

4. Sap
   • Maple syrup, maple sugar
   • Natural rubber

5. Gums
   • Drugs, varnishes, chewing gum, confections

6. Food Products
   • Nuts, fruits, seeds, chocolate, coffee

7. Leaves and Blossoms
   • Oils, perfumes, pollen, nectar, pot pourri

8. Human Recreation Activities
   • Picnicking, camping, hiking, trails, fishing, hunting, skiing, lodging, boating, snowmobiling, bird watching, horseback riding, bicycling, golfing

9. Jobs
   • Tree farmer, tree harvester, forester, park ranger, bulldozing, road construction, camp management, wildlife officer, trail guide, tree planter, botanist, biologist, trapper, engineer, heavy equipment operator, factory worker, truck driver, millworker, carpenter
How Human Activity Impacts a Forest Ecosystem

Human are very dependent on trees and forests. Without them our quality of life would be very negatively affected. Humans have the intelligence to develop technologies that enable us to invent new and improved products, which help us to do things more efficiently, more quickly, and more effectively. Unfortunately, we do not always understand and appreciate the consequences of these technologies.

It is important that all people become more acquainted with how our activities affect a forest ecosystem. In order for forests to become sustainable resources, we must learn to use them responsibly. Our modern society has done many things to threaten forests. Now it is time for us to concentrate on ways we can enhance them.

The table below shows a few ways that human activity threatens forest ecosystems and a few ways that it enhances it.

<table>
<thead>
<tr>
<th>How Human Activity Threatens Forest Ecosystems</th>
<th>How Human Activity Enhances Forest Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Factories send pollutants into the air, which combine with water in the air to form acid rain. This kills forests.</td>
<td>• People do not leave litter when hiking or camping in forests.</td>
</tr>
<tr>
<td>• Careless people start forest fires.</td>
<td>• People are careful to harvest only the trees that are needed.</td>
</tr>
<tr>
<td>• Vehicles on highways through forests kill wildlife.</td>
<td>• People do not harvest trees in areas where they will not easily grow back.</td>
</tr>
<tr>
<td>• Overharvesting of trees.</td>
<td>• Governments create parks where tree harvesting is not allowed and the hunting of wildlife is banned.</td>
</tr>
<tr>
<td>• Overuse of sprays near forested areas can damage trees and be harmful to forest animals and birds.</td>
<td>• People respect forest wildlife by not feeding animals and birds.</td>
</tr>
</tbody>
</table>

Factory pollutants have caused many forests to be killed by acid rain.
Tree Harvesting

Tree harvesting refers to the cutting of trees for use by humans. As the world has become more populated, the demand for trees has increased. Forestry companies are eager to harvest increasingly larger areas of forestland. Their interest in making higher profits has made it important that government regulations strike a balance between the forestry companies’ desire to make money and society’s need to ensure that trees remain a sustainable resource.

Tree Harvesting Methods

There are two main ways that trees are harvested, clear cutting and selective cutting.

<table>
<thead>
<tr>
<th>CLEAR CUTTING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What It Is:</strong> All trees in a particular area are cut down. This includes large trees, smaller trees, and shrubs.</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>• Less expensive for forestry company</td>
</tr>
<tr>
<td>• Convenient for forestry company</td>
</tr>
</tbody>
</table>

**Interesting Fact:** Forestry companies have found that forest plant life, including trees, grow back fairly quickly after clear cutting.

Mountain side after clear cutting.
**SELECTIVE CUTTING**

**What It Is:** The trees to be cut are marked. Only the tallest are cut by lumberpersons, leaving the others to grow.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Allows shorter trees to get more sunlight, allowing them to grow more naturally.</td>
<td>• Costs more for forestry companies to harvest using this method. This cost is passed on to people who use forest products to build houses, furniture, and so on.</td>
</tr>
<tr>
<td>• Habitat for animals and birds is not affected drastically.</td>
<td>• Harvesting will take much longer.</td>
</tr>
<tr>
<td>• Not harvesting all the trees means that they will regenerate naturally.</td>
<td></td>
</tr>
</tbody>
</table>

**Interesting Fact:** The trees remaining after selective cutting grow more quickly because more sunlight reaches the understory and forest floor.

In selective cutting only the largest trees are harvested. The others are harvested once they have increased in size. Selective cutting has an impact on the ecosystem, but it is minimal.
Reforestation and Regeneration Methods

In Canada, forestry companies are required to take steps to ensure that an area of forest that has been harvested is reforested in some way. This helps to ensure that our forests remain sustainable.

There are several different methods of reforestation and regeneration used today.

<table>
<thead>
<tr>
<th>NATURAL REGENERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What It Is:</strong> Seeds fall to the forest floor from existing trees. They germinate and grow.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is a natural process.</td>
<td>Slow process</td>
</tr>
<tr>
<td>Only the strongest seeds will sprout, producing the best trees.</td>
<td>Not as effective in clear cut areas</td>
</tr>
</tbody>
</table>

Natural regeneration is effective, but takes a great deal of time. The small trees in the foreground grew from seeds dropped by the taller trees in the background.

<table>
<thead>
<tr>
<th>DIRECT SEEDING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What It Is:</strong> Cones and seeds are gathered and sown from tractors and airplanes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be done quickly and inexpensively in areas where clear cutting has occurred.</td>
<td>More difficult to use in areas where selective harvesting has occurred</td>
</tr>
<tr>
<td>Not all seeds dropped will germinate and grow into mature trees.</td>
<td>Often seeds do not germinate and grow, usually because of drought conditions.</td>
</tr>
</tbody>
</table>
Helicopters are often used when direct seeding over rough terrain.

<table>
<thead>
<tr>
<th>PLANTING SEEDLINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What It Is:</strong> Planters plant seedlings by hand over the area where trees have been harvested. This method is used where clear cutting has occurred.</td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td>• Planted seedlings have high survival rate.</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Tree planting is difficult and dangerous work.
Clearing Forests for Development

As the population of the world increases, there is an increasing demand for land for agriculture and for building cities. In order to meet this demand, vast areas of forested land are being bulldozed and burned. Environmentalists are concerned for several reasons. Two of these reasons are

1. **loss of wildlife habitat.** Many hundreds of thousand of hectares of land have been ploughed under, leaving no place for wild plants, animals, and birds to live. In some areas, this loss of habitat has resulted in the extinction of species of plants and animals.

2. **increase in greenhouse gases.** Carbon dioxide is one of the gases that holds the Earth’s heat in. Forests take in large amounts of the world’s carbon dioxide and release oxygen when trees and other plants photosynthesize. The loss of vast areas of forest mean that less carbon dioxide is being absorbed by plants and less oxygen is released into the air. The increased amount of carbon dioxide is leading to more greenhouse gases in the atmosphere, resulting in global warming. This has caused a change in climate and weather patterns, leading to increased violent weather and drought.

**Much of the Brazilian rainforest is being cleared to make way for more farmland. Foreground shows forest that has been cleared.**

Bamboo forests in China have been cleared to make way for the development of farms and cities. This has resulted in a loss of habitat for the giant panda, which is now an endangered species.
Topic E

Trees and Forests

Revised Edition
Topic E: Trees and Forests

Part I: The Forest Ecosystem

Lesson One: Introduction to Trees and Forests
Lesson Two: Importance of Trees and Forests
Lesson Three: The Forest Is an Ecosystem
Lesson Four: Forest Ecosystem: Biotic Factors
Lesson Five: The Interaction Between Biotic and Abiotic Factors
Lesson Six: The Forest Levels
Lesson Seven: Food Chains
Lesson Eight: Food Pyramids
Lesson Nine: Decomposers
Lesson Ten: The Nutrient Cycle
Lesson Eleven: The Oxygen Cycle
Lesson Twelve: The Water Cycle
Lesson Thirteen: What Is a Tree?
Lesson Fourteen: Parts of a Tree
Lesson Fifteen: Deciduous Versus Coniferous Trees
Lesson Sixteen: Trees and Forests – Part I Review
Lesson Seventeen: Trees and Forests – Part I Test
Lesson Eighteen  Leaf Classification  25
Lesson Nineteen  Leaf Shapes, Margins, and Arrangements  26
Lesson Twenty  Leaf Classifications: Using a Dichotomous Key  27
Lesson Twenty-one  Tree Bark Patterns  28
Lesson Twenty-two  Tree Shapes  29
Lesson Twenty-three  Branching Patterns  30
Lesson Twenty-four  Buds and Growth Rings  31
Lesson Twenty-five  Determining the History of a Tree  32

Lesson Twenty-six  Past and Present Uses of Forests  34
Lesson Twenty-seven  Identifying Household Items Derived from Trees  35
Lesson Twenty-eight  How Human Activity Impacts Forest Ecosystems  36
Lesson Twenty-nine  Trees and Forests – Parts II and III Review  37
Lesson Thirty  Trees and Forests – Parts II and III Test  38
**About Part I**

In Part I of *Trees and Forests* students learn what distinguished trees from other plants. They investigate forests as ecosystems and how a change in more part of a forest ecosystem impacts other parts. Students learn that biotic and abiotic factors are essential elements in a forest and that there is on going interaction between the two. They do this by examining the dynamics of a forest ecosystem including food chains, food pyramids, the water cycle, the nutrition cycle, and the oxygen cycle.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Concept</th>
<th>Mini Textbook Pages</th>
<th>Hands On?</th>
<th>Non Hands On Option?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to Trees and Forests</td>
<td>4 – 7</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Importance of Trees and Forests</td>
<td>8 – 9</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>The Forest Is an Ecosystem</td>
<td>10 - 11</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Forest Ecosystem: Biotic Factors</td>
<td>12</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>The Interaction Between Biotic and Abiotic Factors</td>
<td>13 – 14</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td>The Forest Levels</td>
<td>15</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td>Food Chains</td>
<td>16 – 17</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Food Pyramids</td>
<td>18 – 19</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Decomposers</td>
<td>20 – 21</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>The Nutrient Cycle</td>
<td>22</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>The Oxygen Cycle</td>
<td>23</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td>The Water Cycle</td>
<td>24</td>
<td>Partly</td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td>What Is a Tree?</td>
<td>25 – 26</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>14</td>
<td>Parts of a Tree</td>
<td>26 – 27</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>15</td>
<td>Deciduous Versus Coniferous Trees</td>
<td>28</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>16</td>
<td>Trees and Forests – Part I Review</td>
<td>...........</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>17</td>
<td>Trees and Forests – Part I Test</td>
<td>...........</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Lesson One

Concept: Introduction to Trees and Forests

Resources/Materials: Mini Textbook, pages 4 - 7
Worksheet #6E.1 (student copies)

Introduction: Have students come up with as many things they can think of that are made of or from wood in the school, at home, in the colony, and elsewhere.

Conclude that because we use wood to make so many things, it is important that we know how to ensure that we have an on-going supply. Explain that the next grade six science unit is called “Trees and Forests”.

Introduction:

1. Ask students to answer the question “What is a tree?”. Discuss.


3. Ask students “What is a forest?”. Most students will say it is a large group of trees. Explain that while it is true that a forest has lots of trees, it is more than trees. It also includes all the living and non-living things in the area, such as wildlife, plant life, air, water, rocks, and so on. Stress that a forest is an ecosystem – a community of living and nonliving things that interact.


5. Have students makes notes using the information from the Mini Textbook with the headings:

What is a Tree?

What is a Forest?

6. OPTION 1. Have students make a title page for the unit. They must be sure to include
   - the title of the unit.
   - an illustration depicting a forest as an ecosystem.

7. OPTION 2. To enable students to become more familiar with the vocabulary associated with the unit, have them do the word search on Worksheet #6E.1.

Assignments:

2. Make notes: What is a Tree? What is a Forest?
3. OPTION. Make title page for the unit.
4. OPTION. Do the word search on Worksheet #6E.1.
Forests

Bark
Cambium
Coniferous
Deciduous
Ecosystem
Environment

Erosion
Firedependent
Fire resistant
Forest
Heartwood
Phloem

Photosynthesis
Prescribed burn
Sapwood
Spacing
Sustainable
Thinning
Lesson Two

Concept: Importance of Trees and Forests.

Resources/Material: Mini Textbook, pages 8 and 9
Worksheet #6E.2 (student copies)

Introduction: Review with students some of the uses that people have for trees. Explain that trees have been a natural resource for people for thousands and thousands of years. Today’s lesson will concentrate on the importance of trees.

Procedure:

1. With students decide if forests are a renewable or non-renewable resource. (renewable) Explain that just because a resource is renewable, it does not mean people can use them carelessly. Explain that we must do things to ensure that we keep forest sustainable; that is, use them carefully so that they will be there for the future.

2. Explain that although people use them for many things, there are other benefits we do not always think about. Start making a list such as:
   Why Are Trees and Forests Important?
   • Produce oxygen
   • We use them to make buildings and furniture
   • We use them to make paper and paper products.
   • Control soil erosion
   • Enrich the soil
   • Provide food, homes, and shelter for wildlife
   • Protect us from the Sun’s heat and from strong, cold winds
   • Act as sound barriers
   • Add beauty and enjoyment to our lives

3. Have students turn to Mini Textbook, page 8 and read pages 8 and 9 independently.

4. In notebooks, have students use the information from Mini Textbook, pages 8 and 9 to make notes about “Why Trees and Forests Are Important”.

5. Distribute Worksheet #6E.2. Go over the directions, if necessary.

Assignments:
1. Read Mini Textbook, pages 8 and 9.
2. Make notes on “Why Trees and Forests Are Important”.
3. Do Worksheet #6E.2.
**Direction:** In the boxes below illustrate and write captions for two human and two natural uses of forests.

<table>
<thead>
<tr>
<th>Human Uses</th>
<th>Natural Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
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</tbody>
</table>
Lesson Three

Concept: The Forest is an Ecosystem

Resources/Materials: Mini Textbook, pages 10 and 11
Poster: “Between the Stands”
Worksheet #6E.3a (student copies)
Worksheet #6E.3b (optional, student copies)

Note: The “Between the Stands” poster will be used extensively in the unit. You may want to consider having it laminated.

Introduction: Review the term ecosystem as a community of living and nonliving things that interact with each other. Also review that a forest is an ecosystem. Explain that the next few lessons will be about the forest ecosystem.

Procedure:

For the Teacher
The “Between the Stands” poster is composed of several different parts, most of which will be used in the “Trees and Forests” unit. The large front section shows a forest with human activity. The two smaller sections on the back show a mixed and a coniferous forest in their natural state.

1. Explain that in science we refer to living things like plants, animals, insects, and fungi as biotic things or factors. Nonliving things such as water, sunlight, air, rocks, and soil are referred to as abiotic factors.

2. Display the “Between the Stands” poster. Have students first examine the two “natural” forests, naming the biotic and then the abiotic factors in each.

3. Then display the forest with human activity. Note that human introduce many more abiotic factors into a forest ecosystem, such as cars, engine exhaust, and litter. Discuss how this might affect a forest ecosystem.

4. With students make notes to be copied into notebooks, such as Ecosystem – a community of biotic and abiotic things that interact with each other.
   Biotic – living
   Abiotic – nonliving

5. Have students read Mini Textbook, page 10 and 11 independently.

6. Distribute Worksheet #6E.3a. Allow students to use the poster to give them ideas. Go over the directions, if necessary.

7. ALTERNATELY. Have students compare “natural” forest ecosystems with “human-use” forest ecosystems, using the Venn diagram on Worksheet #6E.3b.

Assignments:
1. Make notes.
2. Read Mini Textbook, pages 10 and 11.
3. Do Worksheet #6E.3a.
4. ALTERNATELY. Compare natural and human-use forest ecosystems on Worksheet #6E.3b.
**The Forest Ecosystem**

**Directions:** Write down as many biotic and abiotic things, as you can think of, that you would find in a natural forest ecosystem.

<table>
<thead>
<tr>
<th>Biotic</th>
<th>Abiotic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Natural and Human-Use of Forest Ecosystems
Science Grade 6 Topic E Trees and Forests – Part I
Worksheets
Natural and Human-Use of Forest Ecosystems

Natural

- home for wildlife
- control soil erosion
- enrich soil

Human

- food
- shade
- protection
- shelter
- use oxygen produced

- furniture
- buildings
- paper/paper products
- recreation
- beauty
Lesson Four

Concept: Forest Ecosystem: Biotic Factors

Resources/Materials: Mini Textbook, page 12
Poster: “Between the Stands”
Worksheet #6E.4 (student copies)

Introduction: Review the terms biotic, abiotic, and ecosystem. Explain that today’s lesson has to do with the biotic factors in natural forest ecosystems. Refer to poster, if necessary.

Procedure:

1. Explain that the biotic factors in a forest ecosystem can be classified into three main categories: producers, consumers, and decomposers. Each has a different function. All affect each other and the health of the forest.


3. Discuss that in any ecosystem you must have producers, consumers, and decomposers for it to be healthy. If, for some reason, there is a sudden decline in one, all the others are affected. For example, if you cut down all the trees and bushes, the animals that feed off the trees and bushes have no food. If you kill the consumers, the trees and bushes become overgrown and begin to die because they cannot get enough sunlight. If you kill the decomposers, there is nothing to break down dead and decaying organisms so producers cannot get nutrients from the soil.

4. Have students use the information from Mini Textbook, page 12 to make notes about the roles of Producers, Consumers, and Decomposers.


Assignments:

1. Read Mini Textbook, page 12.

2. Make notes about the Biotic Factors in an ecosystem: Producers, Consumers, and Decomposers.

3. Do Worksheet #6E.4.
Directions: Classify the biotic things in the box.

mushrooms  bacteria  aspen tree  millipede  caribou  butterfly
pine tree  earthworm  grass  squirrel  fox  lodgepole pine
deer  eagle  bush  ant  balsam fir  birch tree
black bear  spruce tree  shrub  poplar tree  moose  woodpecker

Producers

Forest Ecosystem
Biotic Factors

Consumers

Decomposers
Directions: Classify the biotic things in the box.

### Producers
- Pine tree
- Lodgepole pine
- Birch tree
- Spruce tree
- Aspen tree
- Grass
- Bush
- Shrub
- Poplar tree
- Balsam fir

### Consumers
- Deer
- Black bear
- Eagle
- Squirrel
- Caribou
- Fox
- Mouse
- Butterfly
- Woodpecker

### Decomposers
- Mushroom
- Earthworm
- Ant
- Millipede
Lesson Five

Concept: The Interaction Between Biotic and Abiotic Factors

Resources/Materials: Mini Textbook, pages 13 and 14
Poster: “Between the Stands”
Worksheet #6E.5 (student copies)

Introduction: Briefly discuss how the colony uses the natural resources in its area. (For example, use the soil, rain, and sunlight to grow crops.) Then discuss how the colony affects the soil. (For example, growing crops takes nutrients and water from the soil.)

Explain that today’s lesson is about one particular type of forest ecosystem producer – the tree and how it affects other biotic factors and how it affects abiotic factors.

Procedure:

1. Display the “Between the Stands” poster. Using the poster to generate ideas, discuss how trees affect might be affected by an abiotic factor like moisture:

   Example: **Moisture** – trees actually add moisture to the air through a process called transpiration. The tree draws moisture from the soil through its roots, through the trunk and branches and then to the leaves where it evaporates into the air. A tree’s shade helps keep moisture levels near the ground to stay higher.

2. Explain that biotic factors can affect the health of a tree.

   Example: **Mountain Pine Beetle** – the adult bores through the bark of pine trees to lay its eggs. The adults often carry a fungus, which infects the tree. Eventually, the tree dies.

   Stress that although biotic factors can be harmful, they can also be beneficial. For example, the mountain pine beetle can be viewed as nature’s way of ensuring too many trees do not try to grow in one spot. Many other insects and animals can harm trees, yet when these insects and animals die, their decaying bodies become like a fertilizer for tree growth.


4. Distribute Worksheets #6E.5. Go over the directions, if necessary.

Assignment:


2. Do Worksheet #6E.5.
Directions: Use the information from Worksheets #6E.5a and #6E.5b to help you with the questions.

1. How do trees affect each of the following factors in the forest?

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>Effect Trees Have on the Factor</th>
<th>What Trees Do to Affect This Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. What effect does each organism have on trees?

<table>
<thead>
<tr>
<th>Organism Living in the Forest</th>
<th>Affect Organism Has on Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tent caterpillar</td>
<td></td>
</tr>
<tr>
<td>Leaf miner</td>
<td></td>
</tr>
<tr>
<td>Yellow-bellied sapsucker</td>
<td></td>
</tr>
<tr>
<td>Blight</td>
<td></td>
</tr>
<tr>
<td>Deer</td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #6E.5
**The Forest Ecosystem**

**Directions:** Use the information from Worksheets #6E.5a and #6E.5b to help you with the questions.

1. How do trees affect each of the following factors in the forest?

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>Effect Trees Have on the Factor</th>
<th>What Trees Do to Affect This Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>decrease</td>
<td>provides shade</td>
</tr>
<tr>
<td>Soil</td>
<td>prevent erosion</td>
<td>roots hold soil in place</td>
</tr>
<tr>
<td></td>
<td>enrich</td>
<td>decaying leaves, branches</td>
</tr>
<tr>
<td>Wind</td>
<td>decrease</td>
<td>break force of wind</td>
</tr>
<tr>
<td>Moisture</td>
<td>increase</td>
<td>shade reduces evaporation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>transpiration releases water</td>
</tr>
</tbody>
</table>

2. What effect does each organism have on trees?

<table>
<thead>
<tr>
<th>Organism Living in the Forest</th>
<th>Affect Organism Has on Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tent caterpillar</td>
<td>eat leaves; could kill tree</td>
</tr>
<tr>
<td>Leaf miner</td>
<td>eat leaves; could kill tree</td>
</tr>
<tr>
<td>Yellow-bellied sapsucker</td>
<td>eat sap</td>
</tr>
<tr>
<td></td>
<td>holes it makes could eventually kill tree</td>
</tr>
<tr>
<td>Blight</td>
<td>brown leaves, preventing tree from making own food through photosynthesis</td>
</tr>
<tr>
<td>Deer</td>
<td>eat leaves and bark; could kill tree</td>
</tr>
</tbody>
</table>
Lesson Six

Concept: The Forest Levels

Resources/Materials: Mini Textbook, page 15
Worksheet #6E.6a (transparency and student copies)
Worksheet #6E.6b (optional, transparency or copied onto chart)
Worksheet #6E.6c (student copies)

Introduction: Tell student that various organisms live at different levels in the forest, depending on their particular needs.

Procedure:

1. Put up the transparency of Worksheet #6E.6a and distribute copies to students. With students examine the picture. Note the different organisms living at various levels of the forest.

2. With students, label the four different levels starting from the top: upper canopy, understory, underbrush, and forest floor.


4. Have students make notes on the four forest levels notes or copy the notes from the transparency or chart of Worksheet #6E.6b.

5. Distribute Worksheet #6E.6c. Tell students to read the information about the forest levels from the Mini Textbook to provide examples of plants and animals living in the forest levels on Worksheet #6E.6a. Then have them complete Worksheet #6E.6c.

6. OPTIONAL. Have students make a forest diorama. They can use a shallow box like the lid from a case of paper and stand it up on its side. Make a background with construction paper cutouts of trees pasted onto a blue construction paper. Then have students draw and cut out trees with folds on the bottom so that the fold can be glued to the “floor”.

Assignments:

1. Make notes about the forest levels from the information on Mini Textbook, page 15 OR Copy the notes from a transparency or chart of Worksheet #6E.6b.
2. Do Worksheet #6E.6c.
3. OPTIONAL. Make a forest diorama.
In a forest ecosystem, there are four forest levels. Different plants and animals live in each of the levels. Label the four levels of this forest and name one plant and one animal found in each level.

Level plant animal

Level plant animal

Level plant animal
Levels of the Forest

1. **Upper Canopy** – top level of the forest, formed by leaves and branches of the tallest trees.

2. **Understory** (middle level) – home to the smaller trees and larger shrubs. It provides a sheltered space for birds and small mammals to travel.

3. **Underbrush** (shrubbery level) – area of densest plant growth

4. **Forest Floor** – includes the ground cover and the soil.
**The Forest Levels**

**Directions:** Classify the biotic things in the box according to the level of the forest where they live.

<table>
<thead>
<tr>
<th>Upper Canopy</th>
<th>Understory</th>
</tr>
</thead>
<tbody>
<tr>
<td>owl</td>
<td>butterfly</td>
</tr>
<tr>
<td>bacteria</td>
<td>wildflowers</td>
</tr>
<tr>
<td>deer</td>
<td>mouse</td>
</tr>
<tr>
<td>spider</td>
<td>tree seedling</td>
</tr>
<tr>
<td>fox</td>
<td>sow bug</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underbrush</th>
<th>Forest Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #6E.6c
In a forest ecosystem, there are four forest levels. Different plants and animals live in each of the levels. Label the four levels of this forest and name one plant and one animal found in each level.

Answers may vary.

Level canopy
plant tall trees
animal owl

Level understory
plant larger shrubs
animal squirrel

Level underbrush
plant ferns
animal porcupine

Level forest floor
plant moss
animal salamander
Directions: Classify the biotic things in the box according to the level of the forest where they live.

<table>
<thead>
<tr>
<th>Upper Canopy</th>
<th>Understory</th>
</tr>
</thead>
<tbody>
<tr>
<td>owl</td>
<td>squirrel</td>
</tr>
<tr>
<td>bacteria</td>
<td>butterfly</td>
</tr>
<tr>
<td>deer</td>
<td>wildflowers</td>
</tr>
<tr>
<td>spider</td>
<td>mouse</td>
</tr>
<tr>
<td>fox</td>
<td>tree seedling</td>
</tr>
<tr>
<td></td>
<td>sow bug</td>
</tr>
<tr>
<td>tent caterpillar</td>
<td>millipede</td>
</tr>
<tr>
<td>aphid</td>
<td>woodpecker</td>
</tr>
<tr>
<td></td>
<td>skunk</td>
</tr>
<tr>
<td></td>
<td>aphid</td>
</tr>
<tr>
<td></td>
<td>rabbit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Underbrush</th>
<th>Forest Floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>butterfly</td>
<td>millipede</td>
</tr>
<tr>
<td>wildflowers</td>
<td>bacteria</td>
</tr>
<tr>
<td>deer</td>
<td>toad</td>
</tr>
<tr>
<td>mouse</td>
<td>spider</td>
</tr>
<tr>
<td>skunk</td>
<td>earthworm</td>
</tr>
<tr>
<td>tree seedling</td>
<td>sow bug</td>
</tr>
<tr>
<td>fox</td>
<td></td>
</tr>
<tr>
<td>rabbit</td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #6E.6c
Lesson Seven

Concept: Food Chains

Resources/Materials: Mini Textbook, pages 16 and 17
Worksheets #6E.7a (optional transparency or copied onto chart paper)
Worksheets #6E.7b, #6E.7c and #6E.7d (student copies)

Introduction: Review the terms: producer, consumer, decomposer.
Have students speculate as to how they are connected.
Explain that today’s lesson is about how they are connected in an ecosystem.

Procedure:

1. Ask students these questions and write down the answers as they are given in a row with space between the words. (The answers may vary, but accept any valid response.)
   • In a forest what can deer eat? (grass, leaves, etc.)
   • What eats a deer? (cougar)

2. Show students how to connect grass, deer, and cougar using a food chain:

   grass ——> deer ——> cougar

   Explain that the arrow ——> is read “is eaten by”. So the food chain on the board is read, “The grass is eaten by the deer; the deer is eaten by the cougar.”

3. Explain that there are many different food chains in a forest ecosystem. A producer is always at the beginning of every food chain.

4. Explain also that there may be more than one consumer in a food chain. For example:

   grass ——> mouse ——> fox ——> lynx

   In this case the mouse is called a primary consumer, the fox is the secondary consumer, and the lynx is the tertiary consumer.

5. Have students turn to Mini Textbook, page 16. Explain that they can refer to pages 16 and 17, if necessary when doing the independent work.

6. Have students make notes on Food Chains on the board OR have them copied from a transparency or chart of Worksheet #6E.7a:

   Food Chains
   A food chain show “what eats what” in an ecosystem. It always begins with a producer. Consumers can be divided into other categories:
   primary consumer – eats a producer
   secondary consumer – eats a primary producer
   tertiary consumer – eats a secondary consumer

(continued)
Lesson Seven (continued)

7. Distribute Worksheets #6E.7b, #6E.7c and #6E.7d. Explain that the pictures on Worksheet #6E.7b show some of the organisms in two different ecosystems. The arrows show “what is eaten by what”. **What is not shown on the pictures is the producers.**

8. In order to complete the activity, students will have to take an “educated guess” about what each primary consumer eats.

9. Go over the directions on Worksheet #6E.7c, if necessary.

Assignments:


2. Make notes about food chains OR copy notes from a transparency or chart of Worksheet #6E.7a.

3. Do Worksheets #6E.7b, #6E.7c and #6E.7d.
Food Chains

A food chain shows “what eats what” in an ecosystem. It always begins with a producer. Consumers can be divided into categories:

**primary consumer** - eats a producer

**secondary consumer** – eats a primary producer

**tertiary consumer** – eats a secondary consumer
Forest Ecosystem 1

wolf

bird
owl

moose
elk
insects

lynx
weasel
fox
mouse
squirrel

Forest Ecosystem 2

cougar

fox

deer
rodent

bear (omnivore)

owl

birds

skunk

insects

opossum
1. Study the illustration of the food chain below. In your own words, explain the meaning of this food chain.

2. Use the illustrations of the forest ecosystems to write seven more food chains.

a.

b.
1. Study the illustration of the food chain below. In your own words, explain the meaning of this food chain.

Grass is eaten by the grasshopper. Grasshopper is eaten by the robin. Robin is eaten by the hawk.

2. Use the illustrations of the forest ecosystems to write seven more food chains. 

   **Answers will vary. All food chains must begin with a producer.**

   [NOTE: The ecosystems show do not show a specific producer.]

   b.
Lesson Eight

Concept: Food Pyramids

Resources/Materials: Mini Textbook, pages 18 and 19
- Worksheets #6E.8a and #6E.8b (transparencies)
- Geometric solid of a pyramid
- Worksheets #6E.8c and #6E.8d (student copies)

Introduction: Review food chains and how they should be interpreted. Explain that the information in a food chain can be organized into a food pyramid.

Procedure:
1. Put up the transparency of Worksheet #6E.8a and have them find the same graphic on Mini Textbook, page 18.

2. Explain that a food pyramid not only shows what eats what. **Try to get students to see that a food pyramid should be viewed as three-dimensional like the geometric solid, and not two-dimensional like the picture.** It also shows the relative number of organisms at each level. Using the food pyramid on Worksheet #6E.8a, show students that to support one tertiary consumer like a grizzly bear, it takes many secondary consumers. Similarly, to support one secondary consumer, it takes several primary consumers. And to support one primary consumer, it takes several producers. **In the end it takes thousands of producers to support one tertiary consumer.**

3. Explain that ecosystems always try to maintain a balance somehow. If something happens to one part of a food chain, the other parts of the food chain are affected.

(Continued)
Lesson Eight (continued)

4. Put up the transparency of Worksheet #6E.8b and refer them to Mini Textbook, page 18. Guide them carefully through each step. The information is reproduced here for your convenience.

<table>
<thead>
<tr>
<th>Food Chain:</th>
<th>grass ➔ rabbit ➔ coyote</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A farmer sets out poison to kill all the coyotes.</td>
</tr>
<tr>
<td></td>
<td>There are only a few coyotes left to eat rabbits.</td>
</tr>
<tr>
<td></td>
<td>The rabbit population grows rapidly.</td>
</tr>
<tr>
<td></td>
<td>There are so many rabbits that they eat all grass and the rabbits become weak.</td>
</tr>
<tr>
<td></td>
<td>The weakened rabbits are easier for the coyotes to hunt.</td>
</tr>
<tr>
<td></td>
<td>Soon the coyotes grow stronger and the coyote population increases.</td>
</tr>
<tr>
<td></td>
<td>There are soon so many coyotes that they hunt the rabbits and the rabbit population goes down.</td>
</tr>
</tbody>
</table>

5. Distribute Worksheets #6E.8c and #6E.8d. Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, pages 18 and 19.

2. Do Worksheets #6E.8c and #6E.8d.
Organisms in a Food Chain Affect Each Other

Food Chain: grass → rabbit → coyote

A farmer sets out poison to kill all the coyotes.

There are only a few coyotes left to eat rabbits.

The rabbit population grows rapidly.

There are so many rabbits that they eat all grass and the rabbits become weak.

The weakened rabbits are easier for the coyotes to hunt.

Soon the coyotes grow stronger and the coyote population increases.

There are soon so many coyotes that they hunt the rabbits and the rabbit population goes down.
Food Pyramid
(Ecological Pyramid)

Primary Producers: Trees, shrubs, ferns, grasses, flowers
9000 Kilocalories per square meter per year available for Primary Consumers

90 Kilocalories per square meter per year available in bodies of Secondary Consumers

Secondary Consumers Predators

9 Kilocalories per square meter per year
Tertiary Consumers Predators
1. The graph below shows the relationship between populations of hawks and gophers over a twelve-year period. What pattern do you notice in this graph? Explain your answer.

![Graph showing populations of hawks and gophers from 1980 to 1994.

2. Woodland caribou like to eat the lichens on the side of forests. Extensive logging has destroyed the trees where these lichens grows. Explain how this would affect the caribou population and the population of the cougars that feed on the caribou.
3. One year the deer in a forest were overhunted. This left only a few deer. What effect would this have on the deer and the lynx that hunt them for food?

4. On the lines below, write a paragraph that explains the relationship between the populations of the organisms in a food chain.
1. The graph below shows the relationship between populations of hawks and gophers over a twelve-year period. What pattern do you notice in this graph? Explain your answer.

**Populations of Hawks and Gophers**

![Graph showing population changes over time]

When populations of hawks decreased, gopher population increased.

When population of hawks increased, gopher population decreased.

2. Woodland caribou like to eat the lichens on the side of forests. Extensive logging has destroyed the trees where these lichens grows. Explain how this would affect the caribou population and the population of the cougars that feed on the caribou.

Caribou population would decrease; cougar population would then also decrease.
3. One year the deer in a forest were overhunted. This left only a few deer. What effect would this have on the deer and the lynx that hunt them for food?

   The lynx population would decrease. Eventually, the deer population would begin to increase, leading to an increase in the lynx population.

4. On the lines below, write a paragraph that explains the relationship between the populations of the organisms in a food chain.

   - Generally, the population of one organism changes, it causes changes in other populations.
   - An increased population of one species causes an increase in the population of the organism that consumes it.
   - An increase in the population of a consumer can lead to a decrease in the population of what it consumes.
Lesson Nine

Concept: Decomposers

Resources/Materials: Mini Textbook, pages 20 and 21
Worksheet #6E.9a (transparency and student copies)
Worksheet #6E.9b (student copies)

Introduction: Review the roles of producers and consumers. Explain that today we will examine decomposers more closely. Decomposers have an extremely important role in an ecosystem.

Procedure:

1. Review with students that decomposer break down dead and decaying organisms to the point where plants can use the nutrients again.

2. Tell students that we will be looking at three types of decomposers, but there are many more.

3. Ask students if they have ever eaten mushrooms. Bread. Wine. An important part of these is a type of decomposer. Mushrooms are a type of decomposer called a fungus. Bread and wine rely on a type of fungus called yeast.

4. Put up the overhead of Worksheet #6E.9a. Discuss the picture.

5. Then have students turn to Mini Textbook, page 20. Have them read pages 20 and 21 independently.

6. Distribute copies of Worksheets #6E.9a and #6E.9b. They are to use the information to label the decomposers on the picture on Worksheet #6E.9a and also to answer the riddles on Worksheet #6E.9c.

Assignments:


2. Do Worksheets #6E.9a and #6E.9b.
There are many different types of decomposers in a forest ecosystem. One of the most important is fungi.
1. I grow on the roots of trees and use some of the sugar in the roots to grow. In return, I help the roots to take in food from the soil. I also help to enrich the soil. What am I?

2. I grow very, very slowly and may live for a very long time. What am I?

3. I have growth rings like a tree, but I am not a tree. What am I?

4. I live on the forest floor. What am I?

5. I can be found in the understory and herb or shrub levels of the forest. What am I?

6. You know the air in the forest is quite clean and free of pollution if you see me on the trees. What am I?

7. I look soft, but I am really quite hard. What am I?

8. I am made up of two plants. I am formed by one plant that collects water and minerals and another plant that contains chlorophyll. What am I?

9. Sometimes I am poisonous. Other times, I can be eaten by animals and/or people. **BE CAREFUL! YOU MAY NOT KNOW IF I AM SAFE TO EAT!** What am I?
There are many different types of decomposers in a forest ecosystem. One of the most important is fungi.
1. I grow on the roots of trees and use some of the sugar in the roots to grow. In return, I help the roots to take in food from the soil. I also help to enrich the soil. What am I?

   mycorrhizal fungus

2. I grow very, very slowly and may live for a very long time. What am I?

   lichen

3. I have growth rings like a tree, but I am not a tree. What am I?

   conk

4. I live on the forest floor. What am I?

   lichen or mushroom

5. I can be found in the understory and herb or shrub levels of the forest. What am I?

   lichen

6. You know the air in the forest is quite clean and free of pollution if you see me on the trees. What am I?

   lichen

7. I look soft, but I am really quite hard. What am I?

   conk

8. I am made up of two plants. I am formed by one plant that collects water and minerals and another plant that contains chlorophyll. What am I?

   lichen

9. Sometimes I am poisonous. Other times, I can be eaten by animals and/or people. **BE CAREFUL! YOU MAY NOT KNOW IF I AM SAFE TO EAT!** What am I?

   mushroom
Lesson Ten

Concept: The Nutrient Cycle

Resources/Materials: Mini Textbook, page 22
   Worksheet #6E.10a (optional, transparency)
   Worksheet #6E.10b (student copies)

Introduction: Ask the question “Why do we eat?” Conclude that we eat to get the things from food that help us to grow and strong stay strong and healthy. We call those things our body needs nutrients.

Procedure:

1. Explain that all organisms need nutrients in order to live.

2. People get the nutrients they need from eating plants and animals.

3. Discuss:
   - Where do plants get their nutrients? (soil)
   - Where do animals get their nutrients? (from the plants)

4. Explain that nutrients are passed on to us from the food we eat. When plants and animals die, decomposers break down the dead matter and the nutrients go back into the soil.

5. Explain that the words cycle means circle. The nutrient cycle explains how nutrients are passed in a food chain when producer (green plant) is eaten by a first order consumer. When that first order consumer is eaten by a second order consumer, the nutrients are passed along. When any organism dies, decomposers break down the organism, which releases the nutrients into the soil – and the whole process begins again.

6. Put up the transparency of Worksheet #6E.10 OR have students turn to Mini Textbook, page. Go through the nutrient cycle with students.

7. Distribute Worksheet #6E.10b. Go over the directions, if necessary.

Assignment:

1. Read Mini Textbook, page 22.

2. Do Worksheet #6E.10b.
1. Nutrients are dissolved in the water found in the soil. Plants absorb the dissolved nutrients through their roots. The nutrients make their way to the branches and leaves.

2. A first order consumer such as a deer eats the grass and leaves to get the nutrients. When a wolf hunts, kills, and eat the deer, it will get those nutrients.

3. When plants and animals die they decay. Decomposers break down the organic matter.

4. Once the decomposers break down the plant and animals, the nutrients are released back into the soil. Now the nutrients can once again be absorbed by the plants.
Below is a nutrient cycle:

1. Which component in this nutrient cycle is a producer? _________________________

2. From which part of the cycle does it get its nutrients? _________________________

3. Which animal is the primary consumer? _________________________

4. Which animal is the secondary consumer? _________________________

5. What happens to the plants and animals when they die?
   _____________________________________________________________________
   _____________________________________________________________________

6. Why are decomposers so important in the nutrient cycle? _________________________
   _____________________________________________________________________

7. In the space below draw a diagram of another nutrient cycle.
The Nutrient Cycle

Below is a nutrient cycle:

1. Which component in this nutrient cycle is a producer? grass
2. From which part of the cycle does it get its nutrients? soil
3. Which animal is the primary consumer? rabbit
4. Which animal is the secondary consumer? wolf
5. What happens to the plants and animals when they die? bacteria breaks them down
6. Why are decomposers so important in the nutrient cycle? breaks down organisms so that nutrients can be released into soil and absorbed by producers
7. In the space below draw a diagram of another nutrient cycle. Answers may vary.
Lesson Eleven

Concept: The Oxygen Cycle

Resources/Materials: Mini Textbook, page 23
Worksheet #6E.11a (optional, transparency and student copies)
Worksheet #6E.11b (student copies)
Worksheet #6E.11c (optional, transparency or copied onto a chart)

Introduction: Ask students “What do we need in order to live?” Write responses on the board. Lead the discussion to the point where students realize that we need oxygen. When we breathe, we take in oxygen and produce carbon dioxide.

Procedure:

1. If humans and animals use oxygen and then exhale carbon dioxide, will we eventually run out of oxygen?

2. Discuss how green plants (including trees) take in carbon dioxide and give off oxygen. Because of this, we have a continual supply of oxygen.

3. The process where green plants take in carbon dioxide and produce oxygen is called photosynthesis. The process where animals take in oxygen is called respiration. These two processes together comprise the oxygen cycle.

4. Put up the transparency of Worksheet #6E.11a OR have students turn to Mini Textbook, page 23. Go over the “Oxygen Cycle”.

5. Conclude that we need trees to produce oxygen for us to survive. If we cut down or burn too many trees, it will affect the survival of some animals. Add also that factories, home heating, and factories all use oxygen.

6. Discuss the process of photosynthesis further, and then have make notes on Photosynthesis and Respiration OR alternately, put up the transparency/chart of Worksheet #6E.11c for them to copy.

7. Distribute Worksheet #6E.11b. Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, page 23.
2. Make notes on photosynthesis and respiration OR copy notes from transparency/chart of Worksheet #6E.11c.
3. Do Worksheet #6E.11b.
1. During **photosynthesis** green plants use sunlight, carbon dioxide, and water to produce sugars and oxygen.

2. During **respiration** animals take in oxygen and give off carbon dioxide and water vapour.
Directions: In the space below draw a picture that illustrates the oxygen cycle. Be sure to include trees, grasses, people, and animals. Label the picture. Do not forget to include oxygen and carbon dioxide as two of the labels.

What do you predict would happen if the majority of our trees was destroyed?
Photosynthesis

Photosynthesis is the process by which plants make sugars. Plants use a green substance called chlorophyll to trap solar energy. This energy is then used to combine carbon dioxide and water to form sugar and oxygen. The sugar is food for the plant. The oxygen is given off into the air along with water.

\[ \text{Carbon dioxide} + \text{water} + \text{chlorophyll} = \text{sugar} + \text{oxygen} \]

Respiration

In respiration plants and animals take in oxygen and give off carbon dioxide.
Lesson Twelve

Concept: The Water Cycle

Resources/Materials: Mini Textbook, page 24  
Worksheet #6E.12a optional, transparency  
Worksheet #6E.12b (student copies)  
Worksheet #6E.12c (optional, transparency or copied onto chart paper)  
two clear plastic bags with twist ties  
a coniferous tree and a deciduous tree

Introduction: Discuss with students how greenhouses are usually hot and humid. Where does the humidity come from? (from the leaves of the plants) Trees belong the plant kingdom and give off water through a process called transpiration.

Procedure:

| Note the activity described below will work best on a hotter day. |

1. Tell students that today we will try to find evidence that trees give of moisture.  
   - Select a branch from a deciduous tree. Place the plastic bag over one end of it. Tie the bag closed with a twist tie.  
   - Repeat for a coniferous tree.  
   - Leave the bags for 3 or more hours.  
   - Observe. There should be water droplets in the bags.

2. Discuss that for a forest to be healthy it needs water. Just like forests are part of the nutrient cycle and water cycle, they are part of a water cycle.

3. Put up the transparency of Worksheet #6E.12a and have students turn to Mini Textbook, page 24.

4. Explain that water gets from the Earth’s surface to the atmosphere in two ways: evaporation from the ground and from bodies of water and transpiration from trees and other plants.

5. Explain that in transpiration trees take up water through their roots and then give it off through their leaves. Trees with leaves lose more water through transpiration than do trees with needles.

6. Moisture from transpiration and evaporation form clouds. The clouds produce precipitation in the form of rain and snow. Some water runs into lakes, rivers, and oceans. Some soaks into the ground and eventually makes it way into plants where transpiration begins again.

7. If you like, with students, make notes about transpiration for them to copy. Alternately, they can copy them from a transparency or chart of Worksheet #6E.12c.

8. Distribute Worksheet #6E.12b. Have students label the diagram.

Assignments:

2. Make notes about transpirations OR Copy notes from transparency of Worksheet #6E.12c.
3. Do Worksheet #6E.12b.
1. Water enters the air through **transpiration**. Transpiration is the process where trees take in water through the roots and release it into the air through the stomata on the underside of their leaves. Leaves release this water in the form of water vapour.

2. Water also enters the air through **evaporation**. In evaporation it changes from a liquid to water vapour.

3. The water vapour in the air forms clouds.

4. The clouds produce precipitation in the form of rain and snow.

5. Much of the precipitation runs off into lakes, rivers, and oceans.

6. Much of the precipitation is absorbed by the soil where it is used by the plants once more.
**The Water Cycle**

**Directions:** Label and colour this picture of the water cycle.
Transpiration

Transpiration is the evaporation of water into the air through the stomata on the underside of a leaf. The top part of the leaf is covered with a waxy material called the cuticle, which tends to waterproof the leaf. Water in the tree is replaced with water absorbed by the roots from the soil.
Directions: Label and colour this picture of the water cycle.
Lesson Thirteen

Concept: What is a Tree?

Resources/Materials: Mini Textbook, pages 25 and 26
Worksheets #6E.13a and #6E.13b (student copies)

Introduction: With students review the characteristics that make a plant a tree:
  • Perennial
  • Self-supporting trunk
  • Trunk is woody
Explain that today’s lesson explores more about what makes a plant a tree.

Procedure:

1. Explain that plants can be divided into two main types: *herbaceous plants* and *trees*. Everyone knows a tree when they see one. The term herbaceous plant may sound difficult, but it is simply the name for the green plants that are not trees.

2. Have students turn to *Mini Textbook*, page 26. Direct attention to the tree diagram and the basic parts.

3. Then have them turn to *Mini Textbook*, page 25. Guide the reading to determine the differences and similarities between *herbaceous plants and trees*.

4. Distribute Worksheets #6E.13a and #6E.13b. Then make notes on the basic parts of a tree on Worksheet #6E.13a. Direct students to compare and contrast trees and herbaceous plants on the Venn diagram on Worksheet 6E.13b.

Assignment:

2. Do Worksheets #6E.13a and 6E.13b.
Directions: Label the three main parts of a tree. Briefly explain the function of each part.
Directions: Label the three main parts of a tree. Briefly explain the function of each part.

Leaves
- make food for tree

Trunk
- supports tree
- contains tree’s plumbing
- place where other tree parts are attached

Roots
- anchor the tree
- take up water and minerals to feed tree
Trees
- trunk is self-supporting
- hard, woody trunk
- larger
- bigger leaves
- larger roots
- bark
- branches

Herbaceous Plants
- soft stem
- no bark
- may have branches
- smaller
- smaller leaves
- smaller roots

Trees Versus Herbaceous Plants
Lesson Fourteen

Concept: Parts of a Tree

Resources/Materials: Mini Textbook, pages 26 and 27
Worksheet #6E.14a (transparency and student copies)
Worksheets #6E.14b, #6E.14c, and #6E.14d (student copies)

Introduction: Review from last day the major differences between trees and herbaceous plants. Also review the three main parts of a tree.

Explain that today we will find out more about the parts of a tree.

Procedure:

1. Put up the transparency of Worksheet #6#.14a and distribute copies to the students. With students label the tree diagram. Note that the section of leaves and branches is referred to as the crown.


3. Distribute Worksheets #6E.14b, #6E.14c, and 6E.14d. Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, pages 26 and 27.
2. Do Worksheets #6E.14b, #6E.14c, and #6E.14d.
Directions: Label the parts of the tree using the following terms:

- sapwood
- inner bark (phloem)
- heartwood
- outer bark (cork)
- cambium
- roots
- crown
Directions: Use the information above to label the diagrams using the following terms:

- heartwood
- sapwood
- inner bark
- outer bark
- cambium
### Parts of a Tree

**Directions:** Match the parts of a tree with their descriptions.

<table>
<thead>
<tr>
<th>roots</th>
<th>trunk</th>
<th>outer bark</th>
<th>branches</th>
</tr>
</thead>
<tbody>
<tr>
<td>cones</td>
<td>crown</td>
<td>xylem</td>
<td>needles or leaves</td>
</tr>
<tr>
<td>phloem</td>
<td>cambium</td>
<td>heartwood</td>
<td>sapwood</td>
</tr>
</tbody>
</table>

1. small woody structures that produce the seeds on coniferous trees.

   ________________________

2. anchor the tree in the ground and absorb water and minerals from the soil.

   ________________________

3. non-living core of the tree stem, giving the stem strength. It makes up most of the stem.

   ________________________

4. upper part of a tree made up of branches, twigs, leaves, needles, buds, and cones

   ________________________

5. thin yellowish-white layer found between the sapwood and the inner bark which produces new xylem cells each year, allowing the tree to grow

   ________________________

6. outer part of the trunk. It is made up of dead tissue. It protects the living parts underneath

   ________________________

7. thin layer of active xylem or wood that surrounds the heartwood. This is where the water and dissolved materials are transported through cells called the xylem, from the roots to the leaves.

   ________________________
8. strongest part of the tree providing support for the rest of the tree. It contains four parts.

9. tissue that moves sap up and down a tree. It makes up the inner bark or layer next to the outer bark. It transports nutrients made in the tree leaves down to the roots. The tree will die if this layer is damaged.

10. flat or needle-like structures containing most of the chlorophyll and are the places where photosynthesis occurs. They use sunlight, water, and carbon dioxide to produce food for the trees and oxygen.

11. They grow out from the trunk and grow leaves, flowers, fruits, and seeds.

12. consists of sapwood on the outside and heartwood on the inside.
Directions: Label the parts of the tree using the following terms:

- sapwood
- inner bark (phloem)
- heartwood
- outer bark (cork)
- cambium
- roots
- crown
Directions: Use the information above to label the diagrams using the following terms:

- heartwood
- sapwood
- inner bark
- outer bark
- cambium
**Directions:** Match the parts of a tree with their descriptions.

<table>
<thead>
<tr>
<th>roots</th>
<th>trunk</th>
<th>outer bark</th>
<th>branches</th>
</tr>
</thead>
<tbody>
<tr>
<td>cones</td>
<td>crown</td>
<td>xylem</td>
<td>needles or leaves</td>
</tr>
<tr>
<td>phloem</td>
<td>cambium</td>
<td>heartwood</td>
<td>sapwood</td>
</tr>
</tbody>
</table>

1. small woody structures that produce the seeds on coniferous trees.  
   - cones

2. anchor the tree in the ground and absorb water and minerals from the soil.  
   - roots

3. non-living core of the tree stem, giving the stem strength. It makes up most of the stem.  
   - heartwood

4. upper part of a tree made up of branches, twigs, leaves, needles, buds, and cones  
   - crown

5. thin yellowish-white layer found between the sapwood and the inner bark which produces new xylem cells each year, allowing the tree to grow  
   - cambium

6. outer part of the trunk. It is made up of dead tissue. It protects the living parts underneath  
   - outer bark

7. thin layer of active xylem or wood that surrounds the heartwood. This is where the water and dissolved materials are transported through cells called the xylem, from the roots to the leaves.  
   - sapwood
8. strongest part of the tree providing support for the rest of the tree. It contains four parts.

   trunk

9. tissue that moves sap up and down a tree. It makes up the inner bark or layer next to the outer bark. It transports nutrients made in the tree leaves down to the roots. The tree will die if this layer is damaged.

   phloem

10. flat or needle-like structures containing most of the chlorophyll and are the places where photosynthesis occurs. They use sunlight, water, and carbon dioxide to produce food for the trees and oxygen.

   needles or leaves

11. They grow out from the trunk and grow leaves, flowers, fruits, and seeds.

   branches

12. consists of sapwood on the outside and heartwood on the inside

   xylem
Lesson Fifteen

Concept: Deciduous Versus Coniferous Trees

Resources/Materials: Mini Textbook, page 28
- Poster: “Between the Stands”
- Worksheet #6E.15a (student copies)
- Worksheet #6E.15b (optional, student copies)

Samples of coniferous and deciduous tree branches

Encyclopedias and other reference books

Introduction: Explain that trees can be divided into two main categories: coniferous and deciduous. Coniferous trees have leaves shaped more like needles while deciduous tree leaves are flat and broad. Explain that coniferous trees are often called evergreens because they appear green all year long.

Procedure:

1. If you have tree branch samples, display them and allow students to examine them; otherwise, display the “Between the Stands” poster showing “8 Common Alberta Trees”.

2. Discuss any differences students notice.

3. Have students turn to Mini Textbook, page 28. With students go over the information. Relate the information to the branch samples or pictures, when at all possible.

4. Distribute Worksheet #6E.15a. Have students compare and contrast coniferous and deciduous trees using the Venn diagram.

5. OPTIONAL. If you have access to encyclopedias or books on trees, have students do Worksheet #6E.15b. On this activity, students have to classify various types of trees as coniferous or deciduous.

6. OPTIONAL. Have students use encyclopedia articles to write reports about a species of tree. If your class is large and the students are sharing one set of encyclopedias, you may have to photocopy the necessary articles ahead of time.

Discuss ahead of time with students the content you expect, such as
- Appearance – leaves, bark, overall shape
- Habitat
- Geographic location
- Uses

Assignments:
2. Do Worksheet #6E.15b.
3. OPTIONAL. Do Worksheet #6E15c.
4. OPTIONAL. Research and write a report on a species of tree.
Directions: Tell whether each of these species of tree is deciduous or coniferous. Write D for deciduous and C for coniferous.

_____ douglas fir

_____ black spruce

_____ cherry

_____ lodgepole pine

_____ cottonwood

_____ sumac

_____ juniper

_____ ash

_____ birch

_____ redwood

_____ chestnut

_____ hemlock

_____ larch

_____ apple

_____ maple

_____ cedar

_____ poplar

_____ aspen

_____ oak

_____ hickory

_____ alder

_____ willow

_____ yew

_____ walnut

_____ jack pine

_____ elm
Deciduous
- shed leaves in fall
- broad-shaped leaves
- lose moisture through underside of leaves
- cannot withstand temperature extremes
- produce flowers

Coniferous
- shed leaves continually
- needle-shaped leaves
- thick waxy coating on leaves
- can withstand extremes in temperature
- cone-bearing
Directions: Tell whether each of these species of tree is deciduous or coniferous. Write D for deciduous and C for coniferous.

C  douglas fir
D  black spruce
D  cherry
D  lodgepole pine
D  cottonwood
D  sumac
C  juniper
D  ash
D  birch
C  redwood
D  chestnut
C  hemlock
C/D larch
D  apple
D  maple
C  cedar
D  poplar
D  aspen
D  oak
D  hickory
D  alder
D  willow
C  yew
D  walnut
C  jack pine
D  elm
Lesson Sixteen

Concept: Trees and Forests, Part I Review

Resources/Materials: Trees and Forests, Part I Review Sheets (student copies)

Introduction: Explain that the first half of the Trees and Forests unit is now completed and it is time to prepare for the test.

Procedure:

1. Go over the major concept covered in the unit.
   - What is an ecosystem?
   - Importance of trees and forests
   - Biotic and abiotic factors in a forest ecosystem
   - The forest levels
   - Food chains
   - Food pyramids
   - The nutrient cycle
   - The oxygen cycle
   - The water cycle
   - Parts of a tree
   - Deciduous and coniferous trees

2. Distribute the Trees and Forests, Part I Review Sheets. Have students do them and then, if possible, check them as a class.

Assignment:

Do the Trees and Forests, Part I Review Sheets.
1. Explain how a tree is different from a herbaceous plant.

2. Define forest.

3. What are eight ways that trees and forests are important.
   a. 
   b. 
   c. 
   d. 
   e. 
   f. 
   g. 
   h. 

4. What is an ecosystem?
5. Write B if it is a biotic factor and A if it is an abiotic factor.

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>Effect Trees Have on the Factor</th>
<th>What Trees Do to Affect this Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Fill in the chart that tells how trees affect abiotic factors in a forest.

7. Fill in the chart that tells the effect biotic factors have on trees.

<table>
<thead>
<tr>
<th>Organism Living in the Forest</th>
<th>Effect Organism Has on Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squirrel</td>
<td></td>
</tr>
<tr>
<td>Woodpecker</td>
<td></td>
</tr>
<tr>
<td>Earthworm</td>
<td></td>
</tr>
<tr>
<td>Leaf miner</td>
<td></td>
</tr>
</tbody>
</table>

8. Fill in the following chart that tells about the forest levels.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Organism That Lives in the Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Area of densest plant growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Home to smaller trees and shrubs. It provides a sheltered space for birds and small mammals to travel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Includes the ground cover and the soil. The ground cover includes leaf litter, mushrooms, animals living on the ground, flowers, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Top level of the forest formed by the leaves and branches of the tallest trees.</td>
<td></td>
</tr>
</tbody>
</table>
9. Examine the food chain below. In your own words explain the meaning of this food chain.

apple tree leaf → tent caterpillar → robin → falcon

In the food chain above, what is
the first order consumer? __________________________
the producer? __________________________
the third order consumer? __________________________
the second order consumer? __________________________

10. What would happen if suddenly most of the falcons were killed?

_________________________________________________________

_________________________________________________________

_________________________________________________________

_________________________________________________________

11. What is the role of decomposers?

_________________________________________________________

Name four decomposers you would find in a forest ecosystem.

_________________________________________________________
12. Draw a diagram of a nutrient cycle. Explain how it works.

13. Examine the diagram of the oxygen cycle.

During which process is oxygen produced? ____________________________

During which process is carbon dioxide produced? ____________________
14. Think about the water cycle. During which two processes is water released into the air?

15. Label the cross section cut of a tree stem.

16. Fill in the chart telling about the parts of a tree.

<table>
<thead>
<tr>
<th>Part of a Tree</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• also called the xylem. It surrounds the heartwood. It transports water and dissolved minerals from the roots to the rest of the tree.</td>
</tr>
<tr>
<td></td>
<td>• also called the phloem. It is next to the outer bark and transports sugars made in the tree leaves down to the roots.</td>
</tr>
<tr>
<td></td>
<td>• the upper part of the tree that is made of branches, twigs, leaves, needles, buds, and cones.</td>
</tr>
<tr>
<td></td>
<td>• the non-living core of the tree stem. It gives the tree its strength.</td>
</tr>
<tr>
<td></td>
<td>• They anchor the tree to the ground and absorb water and minerals from the soil.</td>
</tr>
<tr>
<td></td>
<td>• also called the cork. It is the outer part of the trunk. It is made up of dead tissue and protects the living parts underneath.</td>
</tr>
<tr>
<td></td>
<td>• the thin yellowish-white layer found between the sapwood and the inner bark. It produces new xylem cells every year.</td>
</tr>
</tbody>
</table>
17. Write **C** if the word or phrase tells about a coniferous tree and **D** if it tells about a deciduous tree.

_____ needles
_____ can withstand extreme temperatures
_____ bears cones
_____ shed leaves continuously
_____ broad-leafed
_____ leaves are waxy on top, but have large surface on the bottom, causing moisture loss
_____ cannot withstand extreme temperatures
_____ shed leaves in fall
_____ bear flowers and seeds
_____ spruce
_____ maple
_____ poplar
_____ pine
_____ crab apple
_____ birch
_____ cedar
1. Explain how a tree is different from a herbaceous plant.
   - woody stem
   - self-supporting trunk
   - larger

2. Define forest.
   - large area of land covered with trees and brush growing thickly

3. What are eight ways that trees and forests are important.
   a. produce oxygen
   b. make buildings/furniture
   c. paper/paper products
   d. control soil erosion
   e. control wind
   f. provide food, home, shelter for wildlife
   g. protect us from Sun’s heat
   h. act as sound barrier
   - recreation areas  - add beauty/enjoyment  - food

4. What is an ecosystem?
   - community of biotic and abiotic factors that interact
5. Write B if it is a biotic factor and A if it is an abiotic factor.

- B fox
- B deer
- B balsam fir
- A rain
- A soil
- A sunlight
- A temperature
- B fungus
- B bacteria
- B squirrel
- B wind
- B eagle

6. Fill in the chart that tells how trees affect abiotic factors in a forest.

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>Effect Trees Have on the Factor</th>
<th>What Trees Do to Affect this Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>enrich it</td>
<td>decaying leaves release nutrients into soil</td>
</tr>
<tr>
<td>Moisture</td>
<td>increase or maintain</td>
<td>shade lessens evaporation, transpiration</td>
</tr>
<tr>
<td>Wind</td>
<td>lessens</td>
<td>act as wind break</td>
</tr>
<tr>
<td>Temperature</td>
<td>lowers</td>
<td>provides shade</td>
</tr>
</tbody>
</table>

7. Fill in the chart that tells the effect biotic factors have on trees.

<table>
<thead>
<tr>
<th>Organism Living in the Forest</th>
<th>Effect Organism Has on Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squirrel</td>
<td>droppings enrich soil, nests in tree</td>
</tr>
<tr>
<td>Woodpecker</td>
<td>drill holes in tree → can kill tree</td>
</tr>
<tr>
<td>Earthworm</td>
<td>decomposes decaying organic matter which become nutrients for tree</td>
</tr>
<tr>
<td>Leaf miner</td>
<td>eats leaves, could kill tree</td>
</tr>
</tbody>
</table>

8. Fill in the following chart that tells about the forest levels.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Organism That Lives in the Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>underbrush</td>
<td>• Area of densest plant growth</td>
<td></td>
</tr>
<tr>
<td>understory</td>
<td>• Home to smaller trees and shrubs. It provides a sheltered space for birds and small mammals to travel</td>
<td></td>
</tr>
<tr>
<td>forest floor</td>
<td>• Includes the ground cover and the soil. The ground cover includes leaf litter, mushrooms, animals living on the ground, flowers, etc.</td>
<td></td>
</tr>
<tr>
<td>canopy</td>
<td>• Top level of the forest formed by the leaves and branches of the tallest trees.</td>
<td></td>
</tr>
</tbody>
</table>
9. Examine the food chain below. In your own words explain the meaning of this food chain.

apple tree leaf → tent caterpillar → robin → falcon

Apple tree leaf is eaten by tent caterpillar. Tent caterpillar is eaten by robin. Robin is eaten by falcon.

In the food chain above, what is
the first order consumer? tent caterpillar
the producer? apple tree
the third order consumer? falcon
the second order consumer? robin

10. What would happen if suddenly most of the falcons were killed?
Robin population would increase and tent caterpillar population would decrease

11. What is the role of decomposers?
breakdown organisms to release nutrients absorbable by plants

Name four decomposers you would find in a forest ecosystem.
Answer may vary
mushrooms, bacteria, ants, millipedes, corks
12. Draw a diagram of a nutrient cycle. Explain how it works.

Answers may vary.

*must have producer, at least one consumer, decomposer*

13. Examine the diagram of the oxygen cycle.

During which process is oxygen produced? **photosynthesis**

During which process is carbon dioxide produced? **respiration**
14. Think about the water cycle. During which two processes is water released into the air?

_ evaporation and transpiration _

15. Label the cross section cut of a tree stem.

16. Fill in the chart telling about the parts of a tree.

<table>
<thead>
<tr>
<th>Part of a Tree</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>sapwood</td>
<td>- also called the xylem. It surrounds the heartwood. It transports water and dissolved minerals from the roots to the rest of the tree.</td>
</tr>
<tr>
<td>inner bark</td>
<td>- also called the phloem. It is next to the outer bark and transports sugars made in the tree leaves down to the roots.</td>
</tr>
<tr>
<td>crown</td>
<td>- the upper part of the tree that is made of branches, twigs, leaves, needles, buds, and cones.</td>
</tr>
<tr>
<td>heartwood</td>
<td>- the non-living core of the tree stem. It gives the tree its strength.</td>
</tr>
<tr>
<td>roots</td>
<td>- They anchor the tree to the ground and absorb water and minerals from the soil.</td>
</tr>
<tr>
<td>outer bark</td>
<td>- also called the cork. It is the outer part of the trunk. It is made up of dead tissue and protects the living parts underneath.</td>
</tr>
<tr>
<td>cambium</td>
<td>- the thin yellowish-white layer found between the sapwood and the inner bark. It produces new xylem cells every year.</td>
</tr>
</tbody>
</table>
17. Write C if the word or phrase tells about a coniferous tree and D if it tells about a deciduous tree.

C needles
C can withstand extreme temperatures
C bear cones
C shed leaves continuously
D broad-leaved
D leaves are waxy on top, but have large surface on the bottom, causing moisture loss
D cannot withstand extreme temperatures
D shed leaves in fall
D bear flowers and seeds
C spruce
D maple
D poplar
C pine
D crab apple
D birch
C cedar
Lesson Seventeen

**Concept:** Trees and Forests, Part I Test

**Resources/Materials:** Trees and Forests, Part I Test (student copies)
Test

Directions: Choose the best answer for each question. Write the letter of the answer on the answer sheet. Do not write in this booklet.

1. Which of the following is not a characteristic of a tree?
   a. perennial
   b. self-supporting trunk
   c. trunk is woody
   d. dies down to the soil each fall.

Use the information below to answer question 2.

- houses
- furniture
- paper
- tools
- toys
- recreation
- prevent soil erosion
- wind break
- home for birds and animals

2. Which of the following would be the best heading for the above?
   a. How People Use Trees and Forests
   b. Human and Natural Uses of Trees and Forests
   c. Conserving Our Forests
   d. The Oxygen Cycle

3. Why is a forest considered to be an ecosystem?
   a. It has several different levels.
   b. It is home to both birds and animals.
   c. It is a community of biotic and abiotic things that interact with each other.
   d. People cannot affect it.

4. Which of the following lists only abiotic factors?
   a. temperature, wind, sunlight, soil, rocks
   b. squirrels, hawks, fungi, deer
   c. moisture, wind, chipmunk, tent caterpillar
   d. leaf miner, yellow-bellied sapsucker, tent caterpillar, deer
Sandra took the temperature of the air just outside the edge of a forest, just inside the edge of a forest, and well inside the forest. The table below shows what she found.

<table>
<thead>
<tr>
<th>Location</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Just outside the edge of the forest</td>
<td>32°C</td>
</tr>
<tr>
<td>Just inside the edge of the forest</td>
<td>30°C</td>
</tr>
<tr>
<td>Well inside the forest</td>
<td>26°C</td>
</tr>
</tbody>
</table>

5. A conclusion that Sandra can make based on the above is that

a. forests can become extremely warm in summer.
b. forests can affect temperature.
c. it is more comfortable inside a forest.
d. the humidity is always higher inside a forest than outside.

6. What do the above have in common?

a. They all affect the health of forests.
b. They are abiotic factors in a forest ecosystem.
c. They are all found in the canopy.
d. They are found in ocean, desert, and forest ecosystems.

7. Producers, consumers, and decomposers are

a. all biotic factors in a forest ecosystem.
b. found only in forest ecosystems.
c. biotic and abiotic.
d. found only on the forest floor.
8. Which of the following correctly labels the levels of a forest?

a. 1 – canopy  
   2 – understory  
   3 – underbrush  
   4 – forest floor  

b. 1 – forest floor  
   2 – underbrush  
   3 – understory  
   4 – canopy  

9. At level 4 you would most likely find

a. mice, weasels, rabbits, and butterflies.

b. owls, orioles, and eagles.

c. insects, chipmunks, and yellow-bellied sapsuckers.

d. spiders, millipedes, worms, and bacteria.

10. Which of the following is **not true** of earthworms, millipedes, ants, fungi, and bacteria alike?

a. They are decomposers.

b. They serve to break down decaying matter that then becomes part of the soil.

c. They are an important part of a forest ecosystem.

d. Because they are so small, little is known about them.
11. The above is an example of a
   a. food pyramid.
   b. nutrient cycle.
   c. food chain.
   d. flow chart.

12. Which of the organisms would be a producer?
   a. poplar tree
   b. tent caterpillar
   c. robin
   d. hawk

13. If the number of hawks in the area were to suddenly greatly decrease, what would be the most likely effect?
   a. The population of robins would decrease.
   b. The population of robins would increase.
   c. The number of poplar trees would increase.
   d. The number of tent caterpillars would increase.

14. The diagram best illustrates
   a. the nutrient cycle.
   b. water cycle.
   c. the forest cycle.
   d. the oxygen cycle
15. Photosynthesis and respiration are the two most important processes in

a. the nutrient cycle.
b. the water cycle.
c. the forest cycle.
d. the oxygen cycle.

Use the following information to answer question 16.

16. In the diagram of the water cycle, at which step is transpiration occurring?

a. 1  
b. 2  
c. 3  
d. 4
Use the information below to answer questions 17 – 19.

<table>
<thead>
<tr>
<th>PARTS OF A TREE</th>
<th>Description</th>
</tr>
</thead>
</table>
| phloem          | • transports food may by the leaves to other parts of the tree.  
|                 | • next to the outer bark |
| cambium         | • produces new xylem cells every year  
|                 | • thin yellowish-white layer found between the sapwood and the phloem |
| sapwood         | • surrounds the heartwood  
|                 | • water and dissolved materials are transported from the roots to the leaves |
| heartwood       | • non-living core of the tree stem, giving the stem strength |
| cork            | • outer part of the trunk  
|                 | • made up of dead tissue  
|                 | • protects living parts underneath |

17. According to the information above, on the tree diagram the **phloem** is marked  
   a. 3.  
   b. 4.  
   c. 5.  
   d. 7.  

18. According to the information a difference between the phloem and the sapwood is  
   a. the thickness of the layer.  
   b. the amount of materials each transports.  
   c. the direction each transports materials.  
   d. the importance each has to the tree’s health.
19. From the information you can conclude that another name for the cork is the

a. crown.
b. understory.
c. canopy.
d. bark.

Use the information below to answer questions #20 and 21.

Sylvia made a Venn diagram to show the differences and similarities between deciduous and coniferous trees.

20. Jack spotted a tree that had cones. According to Sylvia’s chart,

a. the tree was deciduous.
b. the tree was a pine tree.
c. the tree would change colour.
d. the tree was coniferous.

21. According to Sylvia’s chart, both coniferous and deciduous trees

a. shed their leaves.
b. bear fruit.
c. have broad leaves.
d. have scaly trunks.
Name: ________________________________

Trees and Forests, Part I
Test

Answer Sheet

1. ________

2. ________

3. ________

4. ________

5. ________

6. ________

7. ________

8. ________

9. ________

10. ________

11. ________

12. ________

13. ________

14. ________

15. ________

16. ________

17. ________

18. ________

19. ________

20. ________

21. ________
Science Grade 6 Topic E Trees and Forests, Part I Test

Name: ________________________________

Trees and Forests, Part I Test

Answer Sheet

1. d
2. b
3. c
4. a
5. b
6. a
7. a
8. a
9. d
10. d
11. c
12. a
13. b
14. a
15. d
16. d
17. b
18. c
19. d
20. d
21. a
### About Part II

Whereas Part I of *Trees and Forests* dealt with the forest as part of an ecosystem, Part II deals more with the trees as unique species in the plant kingdom. Students learn about different ways to classify trees, including tree shape, leaf shape, leaf arrangement, leaf margins, branch shape, branch arrangement, and bark colour, texture, and shape. They also learn the differences between deciduous and coniferous trees. Finally, students learn how to make inferences about a tree’s history by examining its twig and by studying tree cookies.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Concept</th>
<th>Mini Textbook Pages</th>
<th>Hands On?</th>
<th>Non Hands On Option?</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>Leaf Classification</td>
<td>29 – 31</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>19</td>
<td>Leaf Shapes, Margins, and Arrangements</td>
<td>32 – 34</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>20</td>
<td>Leaf Classifications: Using a Dichotomous Key</td>
<td>35 – 36</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>21</td>
<td>Tree Bark Patterns</td>
<td>37</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>22</td>
<td>Tree Shapes</td>
<td>38</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>23</td>
<td>Branching Patterns</td>
<td>39 – 41</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>24</td>
<td>Buds and Growth Rings</td>
<td>42</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>25</td>
<td>Determining the History of a Tree</td>
<td>43 – 45</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Lesson Eighteen

Concept: Leaf Classifications

Resources/Materials: Mini Textbook, pages 29 – 31
Worksheet #6E.18 (student copies)
leaves of various types and shapes, if possible

Introduction: Explain that trees can be classified according to their appearance. The next few days will be spent examining the differences and similarities in the appearance of trees. The first is leaves.

Procedure:

1. Explain that the first thing we will do is to examine a broad leaf, like one that you would find on a deciduous tree.

2. If you brought leaf samples into class, show them to students, pointing out their differences.


4. Then have students turn to Mini Textbook, page 30. Guide the reading.

5. If you have any actual samples of leaves, examine them and try to identify the parts.


7. Direct students to make notes on the following using information from the Mini Textbook:
   - Ways to Classify Leaves
   - Parts of a Leaf
   - Types of Leaves (Describe and illustrate.)

8. Distribute Worksheet #6E18. Go over the directions, if necessary.

Assignments:


2. Make notes on
   - Ways to Classify Leaves
   - Parts of a Leaf
   - Types of Leaves (Describe and illustrate.)

3. Do Worksheet #6E.18.
Directions: Use Mini Textbook, pages 29 – 31 to help you with the questions.

1. On the diagram below label the parts of a leaf.

2. Write the name of the type of leaf.
Directions: Use *Mini Textbook*, pages 29 – 31 to help you with the questions.

1. On the diagram below label the parts of a leaf.

![Diagram of a leaf with labeled parts: apex, margin, midvein (midrib), veins, blade, petiole, base]

2. Write the name of the type of leaf.

<table>
<thead>
<tr>
<th>Scaly</th>
<th>Compound</th>
<th>Simple</th>
<th>Double Compound</th>
<th>Needle</th>
</tr>
</thead>
</table>
Lesson Nineteen

Concept: Leaf Shapes, Margins, and Arrangements

Resources/Materials: Mini Textbook, pages 32 - 34

- Samples of deciduous and coniferous tree leaves (optional)

Introduction: Review the parts of a leaf and also the different types of tree leaves.

Explain that today we will be examining leaf shapes, the different types of leaf margins, and leaf arrangements.

Procedure:

1. Discuss with students the different types of leaf shapes they may have noticed. Have students turn to Mini Textbook, page 32. Guide the reading. Note subtle differences between leaves such as cordate and deltoid.

2. Then bring attention to the leaf margins on Mini Textbook, page 33. Leaf margins have to do with the shapes of the edges of the leaves. Again, note any subtle differences the students might miss.

3. Finally, have students turn to Mini Textbook, page 34. Discuss. (Note in the basal arrangement, several leaves come out from the same bud directly on the branch. In the whorl arrangement, several leaves come out, but not directly on the branch. The difference is quite technical, so probably not worth making too much of it.)

4. Distribute Worksheets #6E.19a and #6E.19b. Go over the directions, if necessary.

5. OPTIONAL. If you have samples of deciduous and coniferous tree leaves at your own home or at the colony, have students classify them according to the descriptors on Worksheets #6E.19a.

Assignments:

1. Read Mini Textbook, pages 32 – 34.
2. Do Worksheets #6E.19a and #6E.19b.
3. OPTIONAL. Analyze leaves from local trees according to criteria listed at top of Worksheet #6E.19a.
Directions: Examine each picture of a leaf. Below each picture tell

1. type of leaf
2. shape of leaf or needle
3. margin type (deciduous) or arrangement of needles (coniferous)

a. Willow

1. 
2. 
3. 

b. Cottonwood

1. 
2. 
3. 

c. Western Red Cedar

1. 
2. 
3. 

d. Wild Rose

1. 
2. 
3. 

Worksheet #6E.19a
Science Grade 6 Topic E Trees and Forests – Part II
Worksheets

e. Box Elder
1. 
2. 
3. 

f. Aspen Poplar
1. 
2. 
3. 

g. Balsam Poplar
1. 
2. 
3. 

h. Lodgepole Pine
1. 
2. 
3. 

i. Saskatoon
1. 
2. 
3. 

j. Tamarack (Larch)
1. 
2. 
3. 

Worksheet #6E.19b
Directions: Examine each picture of a leaf. Below each picture tell
1. type of leaf
2. shape of leaf or needle
3. margin type (deciduous) or arrangement of needles (coniferous)

a. Willow
   1. simple
   2. linear
   3. smooth

b. Cottonwood
   1. simple
   2. deltoid
   3. serrated

c. Western Red Cedar
   1. needle/double compound
   2. scaly
   3. opposite

d. Wild Rose
   1. compound
   2. oval
   3. serrated/opposite
e. Box Elder
1. simple
2. ovate
3. scalloped or serrated

f. Aspen Poplar
1. simple
2. deltoid
3. smooth

g. Balsam Poplar
1. simple
2. deltoid or cordate
3. fine-toothed

h. Lodgepole Pine
1. needle
2. flat
3. bundles of two

i. Saskatoon
1. simple
2. orbicular
3. fine-toothed

j. Tamarack (Larch)
1. needle
2. flat
3. bundles of more than five
Lesson Twenty

Concept: Leaf Classifications: Using a Dichotomous Key

Resources/Materials: Mini Textbook, pages 35 and 36

Poster: “Between the Stands”
Worksheets #6E.20a, #6E.20b, and #6E.20c (student copies)
Worksheet #6E.20d (optional)

Introduction: Review the different criteria we can use to classify tree leaves. Explain that today we will use a graphic organizer called a **dichotomous key** to retrieve information about trees and their leaves.

Procedure:

1. Explain that a **dichotomous key is a way of classifying and identifying organisms. The prefix “di” means two. In a dichotomous key a group is broken down into two branches; then each of those branches is broken into two branches, and so on.**

2. Have students turn to *Mini Textbook*, page 35. Guide the reading of page 35. (Students can study the dichotomous key on page 36 independently.

3. Display the dichotomous key on the “Between the Stands” poster. Show students how it works. Ask questions to help students learn how to identify tree types, such as
   - Which tree has single needles with rounded tips? (black spruce)
   - Which tree has flat leaves that have fine margins? (aspen poplar)
   - Describe the leaf arrangement of the tamarack. (clusters of 10 – 40 needles)

4. Distribute Worksheets #6E.20a, #6E.20b, and #6E.20c. Go over the directions, if necessary.

5. **OPTIONAL.** Have students make their own dichotomous key using the information they have on leaf classification. They can do this on Worksheet #6E.20d. As this is a generic dichotomous key, they may not need to use all the boxes.

6. **OPTIONAL.** Have students make up five questions about the dichotomous key on *Mini Textbook*, page 36. They can exchange them with classmates.

Assignment:

2. Do Worksheets #6E.20a, #6E.20b and #6E.20c.
3. **OPTIONAL.** Make your own dichotomous key using Worksheet #6E.20d.
4. **OPTIONAL.** Make up questions that can be answered using the dichotomous key on *Mini Textbook*, page 36. Exchange questions with classmates.
Directions: Examine each of the dichotomous keys. Then answer the questions.

Dichotomous Key 1:

1. Which tree has leaves that are large round and flat, with fine-toothed edges and a round stem?

2. The tree has needles that grow in twins. When it matures, the branches are short and curve upward.
1. You find a twig on the ground and you would like to know the kind of tree it is from. You examine the twig and note that it has needles that are two cm long, square, pointed, and singly attached to the branch. What kind of tree is the twig from?

2. Daniel was hiking in the forest and spotted a tree he had never seen before. When he looked at it closely, he noticed that the needles were attached to the branches in large clusters – probably about ten. Which type of tree did Daniel mostly likely see?

3. Margarita moved to a new house. In the front yard was a coniferous tree and it was beautiful. Each twig was like a feather with needles coming off both sides. The needles were short and flat with a very nice smell. Name the tree in Margarita's front yard.

4. There was another tree in the backyard that Margarita did not like as much. It was also an evergreen with long needles that came off the branches in bundles of 2. Which tree was in Margarita's back yard?
Dichotomous Key 3:

1. Here is a silhouette of a spruce tree. According to the dichotomous key above, to which group does the spruce tree belong?

   Spruce tree

2. Barbara has a tree in her yard. It is a deciduous tree that grows upright and produces the most beautiful white flowers in the spring. To which group does it belong?

3. Karl went on a vacation to the mountains. He visited many places, but at one hotel he saw the most amazing tree. It was not tall. Instead it grew horizontally. It had scaly flat needles. To which group does it belong?
Directions: Examine each of the dichotomous keys. Then answer the questions.

Dichotomous Key 1:

1. Which tree has leaves that are large round and flat, with fine-toothed edges and a round stem?  
   - balsam poplar

2. The tree has needles that grow in twins. When it matures, the branches are short and curve upward.  
   - lodgepole pine
Dichotomous Key 2:

1. You find a twig on the ground and you would like to know the kind of tree it is from. You examine the twig and note that it has needles that are two cm long, square, pointed, and singly attached to the branch. What kind of tree is the twig from?

   white spruce

2. Daniel was hiking in the forest and spotted a tree he had never seen before. When he looked at it closely, he noticed that the needles were attached to the branches in large clusters – probably about ten. Which type of tree did Daniel mostly likely see?

   tamarack

3. Margarita moved to a new house. In the front yard was a coniferous tree and it was beautiful. Each twig was like a feather with needles coming off both sides. The needles were short and flat with a very nice smell. Name the tree in Margarita’s front yard.

   balsam fir

4. There was another tree in the backyard that Margarita did not like as much. It was also an evergreen with long needles that came off the branches in bundles of 2. Which tree was in Margarita’s back yard?

   jack pine
Dichotomous Key 3:

1. Here is a silhouette of a spruce tree. According to the dichotomous key above, to which group does the spruce tree belong?

   Group 3

2. Barbara has a tree in her yard. It is a deciduous tree that grows upright and produces the most beautiful white flowers in the spring. To which group does it belong?

   Group 4

3. Karl went on a vacation to the mountains. He visited many places, but at one hotel he saw the most amazing tree. It was not tall. Instead it grew horizontally. It had scaly flat needles. To which group does it belong?

   Group 4
Lesson Twenty-one

Concept: Tree Bark Patterns

Resources/Materials: Mini Textbook, page 37
Worksheet #6E.21a (transparency)
Worksheets #6E.21b, #6E.21c and #6E.21d (student copies)
Pictures of various trees with bark showing (optional)

Introduction: Explain that our study of trees is now switching from leaves to branches and bark. Today we will examine different kinds of tree bark.

Procedure:

1. Review with students that the bark of a tree is also called the cork.

2. If you have any pictures of trees, share them with students, examining the appearance of the bark. If there are trees in the yard, you might want to go out and examine them. Otherwise, have students describe the bark they have seen on trees – colour, texture, patterns.


4. Start notes for students to copy. (If you do not have time to create notes with students, you can also have them copy notes from Worksheet #6E.21a.
Example:
Bark
As a tree grows, the inner layers become too large for the outer bark to cover them. There is always new bark being produced in the phloem to replace the outer bark. When this occurs, the outer bark cracks and splits, creating interesting patterns and lines.

5. Distribute Worksheets #6E.21b, #6E.21c and Worksheets #6E.21d. Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, page 37.
2. Copy notes from the board or from a transparency or chart of Worksheet #6E.21a.
3. Do Worksheets #6E.21b, #6E.21c and #6E.21d.
Bark

As a tree grows, the inner layers become too large for the outer bark to cover them. There is always new bark being produced in the phloem to replace the outer bark. When this occurs, the outer bark cracks and splits, creating interesting patterns and lines.
**Tree Bark Patterns**

**Directions:** Examine each of the tree bark patterns. Then write the words that describe the patterns.

- **A:** horizontal and scaly
- **B:** vertical and wavy
- **C:** scaly patches

---

Worksheet #6E.21b
Science Grade 6 Topic E Trees and Forests - Part II
Worksheets
Bark Characteristics Chart

TEXTURE
- smooth
- rough

COLOUR
- reddish brown
- grey
- white

PATTERN
- scaly
- vertical
- combination
- horizontal
Bark Characteristics Chart

Directions: Read the descriptions of four trees. Write the names of these trees in the correct places on the Bark Characteristics Chart. You will have to put more than one tree name in some of the boxes.

Lodgepole Pine

The lodgepole pine is commonly found in the central and northern parts of Alberta. It is a coniferous tree with bark that is rough. Lodgepole pine bark is usually grey in colour and forms in scales.

Aspen

Another tree that is common in many parts of Alberta’s forests is the aspen. Unlike the lodgepole pine the aspen is a deciduous tree. It has horizontal white bark that has horizontal markings much like a birch. Like the birch the aspen’s texture is smooth.

Poplar

Poplar trees are commonly found in southern Alberta, although some are found in other parts of the province as well. Most southern Alberta poplars have been planted as few trees grown naturally in the grasslands. The poplar’s bark is thick and rough. When young poplars can have a brown colour, but as they mature they take on a grey colour.

Western Hemlock

The western hemlock is grows in the mountainous areas of Alberta. It is a large tree, growing to be 30 – 50 metres in height. It has a narrow crown with drooping branches. Older western hemlocks have rough vertical grooves. They are reddish-brown in colour.

On Your Own

Look in an encyclopedia to find two different trees. Tell about each of their bark characteristics.

a. 

b. 
Directions: Examine each of the tree bark patterns. Then write the words that describe the patterns.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Scaly patches</td>
</tr>
<tr>
<td>B</td>
<td>Horizontal</td>
</tr>
<tr>
<td>C</td>
<td>Vertical</td>
</tr>
<tr>
<td>D</td>
<td>Horizontal and wavy</td>
</tr>
<tr>
<td>E</td>
<td>Vertical and scaly</td>
</tr>
</tbody>
</table>
Bark Characteristics Chart

TEXTURE

- smooth
  - aspen

- rough
  - lodgepole pine, poplar, western hemlock

COLOUR

- reddish brown
  - western hemlock

- grey
  - lodgepole pine, poplar

- white
  - aspen

PATTERN

- scaly
  - lodgepole pine

- vertical
  - western hemlock

- combination

- horizontal
  - aspen
Lesson Twenty-two

Concept: Tree Shapes

Resources/Materials: Mini Textbook, page 38
Worksheets #6E.22a and #6E.22b (transparency and student copies)
Photos of various types of trees, optional

Introduction: Review that we have classified trees according to their leaves and their bark. Today we will look at tree shapes.

Procedure:

1. Explain that there are five basic types of tree shapes: triangle or cone, oval, circle, spreading, and rectangle.


3. Give students a copy of Worksheet #6E.22a. Tell students to decide on the basic shape of each of the tree silhouettes.

4. Instruct students to then make notes on tree shapes. For each shape they should give an example from Worksheet #6E.22a and draw a sample silhouette:

Example:

Tree Shapes

- triangle or cone
  Examples: balsam fir, white spruce, black spruce
  (diagram)

- oval
  Example: lodgepole pine
  (diagram)

and so on.

5. Distribute Worksheet #6E.22b. Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, page 38.
2. Do Worksheets #6E.22a and #6E.22b.
3. Make notes on tree shapes, with examples and diagrams.
**Directions:** Examine each tree silhouette. Tell what shape it has.

<table>
<thead>
<tr>
<th>Lodgepole Pine</th>
<th>Balsam Fir</th>
<th>White Poplar</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Spruce</td>
<td>Black Spruce</td>
<td>Apple Tree</td>
</tr>
<tr>
<td>White Birch</td>
<td>Acacia (not found in Alberta)</td>
<td>Red Oak (not found in Alberta)</td>
</tr>
</tbody>
</table>
Directions: Describe each tree shape. Then tell about how environmental conditions affected the tree shapes.
**Tree Silhouettes**

**Directions:** Examine each tree silhouette. Tell what shape it has.

<table>
<thead>
<tr>
<th>Tree Silhouette</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodgepole Pine</td>
<td>Oval</td>
</tr>
<tr>
<td>Balsam Fir</td>
<td>Triangle or cone</td>
</tr>
<tr>
<td>White Poplar</td>
<td>Circle</td>
</tr>
<tr>
<td>White Spruce</td>
<td>Triangle or cone</td>
</tr>
<tr>
<td>Black Spruce</td>
<td>Triangle or cone</td>
</tr>
<tr>
<td>Apple Tree</td>
<td>Circle</td>
</tr>
<tr>
<td>White Birch</td>
<td>Circle</td>
</tr>
<tr>
<td>Acacia</td>
<td>Spreading</td>
</tr>
<tr>
<td>Red Oak</td>
<td>Rectangular</td>
</tr>
</tbody>
</table>

*Note: Acacia and Red Oak are not found in Alberta.*
**Tree Shapes and the Environment**

**Directions:** Describe each tree shape. Then tell about how environmental conditions affected the tree shapes.

- **Triangular, symmetrical:** good growing conditions
- **Leaning:** strong prevailing wind
- **Oval:** close to other trees, but not so close as to alter growth significantly
- **Some branches dying:** could be lack of moisture, soil nutrients, disease, or insects

Worksheet #6E.22b
Lesson Twenty-three

Concept: Branching Patterns

Resources/Materials: Mini Textbook, pages 39 - 41
                  Worksheets #6E.23a and #6E.23b (student copies)
Branches showing different branching patterns.

Introduction: Explain that today’s lesson is all about tree branches. Ask students what differences they have seen in the way that branches grow on trees.

Procedure:

1. Explain that when we talk about branching patterns, we talk about three main things:
   - The direction the branches point – up, down, straight out
   - Growth patterns – how the branches grow on the main trunk
   - Where on the trunk branches grow.

2. Direction. Have a student use his arms to show branches point up, pointing down, and sticking straight out.

3. Location. Explain that trees vary as to where on their trunks branches grow. Trees like apple trees are good for climbing because the main trunk often splits in several directions. On other trees like spruce trees, branches grow on either side of the main trunk on a regular basis.

4. Growth Patterns. Recall how leaves grew opposite each other, alternating, basal, and whorled. Explain that branches grow much in the same way.


6. Distribute Worksheet #6E.23c and #6E.23d. Go over the directions, if necessary.

Assignments:

2. Do Worksheets #6E.23a and #6E.23b.
Directions: Use Mini Textbook, pages 39 – 41 to help you with the questions.

1. Read each of the scenarios. Then draw a picture to illustrate the branching patterns.

<table>
<thead>
<tr>
<th>In locations where there is a lot of wind, trees will actually grow, leaning away from the prevailing wind.</th>
<th>More branches grow on the north side of a tree’s trunk than on any other side.</th>
<th>If a tree grows too closely to other trees, its branches will be shorter next to its close neighbours.</th>
</tr>
</thead>
</table>

| If a tree is planted closely to a building or a fence, then the branches facing the house will be shorter than those on the opposite side. | If a tree is not getting enough nutrients, then some of its bottom branches may lose their leaves. Those bottom branches may become brittle and break off. | If a tree is growing on a hill, the branches on the upper slope will not grow as those on the downward part of the hill. |
2. Make a sketch of each of these branching patterns to show the directions the branches point.

| downward | upward | outward |

3. Make a sketch of each of these branching patterns to show the locations of the branches.

| excurrent | decurrent | columnar |

4. Make a sketch of each of these branching patterns to show growth patterns.

| opposite | alternate | whorled | spiral |
**Branching Patterns**

**Directions:** Use Mini Textbook, pages 39 – 41 to help you with the questions.

1. Read each of the scenarios. Then draw a picture to illustrate the branching patterns.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>In locations where there is a lot of wind, trees will actually grow, leaning away from the prevailing wind.</td>
<td><img src="image" alt="leaning tree" /></td>
</tr>
<tr>
<td>More branches grow on the north side of a tree’s trunk than on any other side.</td>
<td><img src="image" alt="more branches on north side" /></td>
</tr>
<tr>
<td>If a tree grows too closely to other trees, its branches will be shorter next to its close neighbours.</td>
<td><img src="image" alt="tree in amongst others; short branches facing closest neighbours" /></td>
</tr>
<tr>
<td>If a tree is planted closely to a building or a fence, then the branches facing the house will be shorter than those on the opposite side.</td>
<td><img src="image" alt="tree next to building; branches shorter on building/fence side" /></td>
</tr>
<tr>
<td>If a tree is not getting enough nutrients, then some of its bottom branches may lose their leaves. Those bottom branches may become brittle and break off.</td>
<td><img src="image" alt="dead bottom branches" /></td>
</tr>
<tr>
<td>If a tree is growing on a hill, the branches on the upper slope will not grow as those on the downward part of the hill.</td>
<td><img src="image" alt="tree on hill; shorter branches up slope" /></td>
</tr>
</tbody>
</table>
2. Make a sketch of each of these branching patterns to show the directions the branches point.

- downward
- upward
- outward

3. Make a sketch of each of these branching patterns to show the locations of the branches.

- excurrent
- decurrent
- columnar

4. Make a sketch of each of these branching patterns to show growth patterns.

- opposite
- alternate
- whorled
- spiral
Lesson Twenty-four

Concept: Buds and Growth Rings

Resources/Materials: Mini Textbook, page 42
Poster: “Between the Stands”
  Worksheets #6E.24a (student copies)
  Worksheets #6E.24b and #6E.24c (optional, student copies)
Twig from a deciduous tree (optional)
encyclopedia

Introduction: Tell students we can often tell about the life of a tree by examining one of its branches.

Procedure:

1. If you have a tree twig, try to show various parts of the twig to enhance the information on Mini Textbook, page 42

2. Have students turn to Mini Textbook, page 42. Guide the reading of the page.

3. Distribute Worksheet #6E.24a. Go over the directions, if necessary.

4. If you feel your students need review on the characteristics of trees, have them do Worksheets #6E.24b and #6E.24c.

5. Have students research two deciduous and two coniferous trees. You can have them use encyclopedias or other reference books. ALTERNATELY. Have them use the brief information from the “8 Common Alberta Trees” section of the “Between the Stands” poster. Have them use that information to write four short reports (of one paragraph each).

Assignments:

1. Do Worksheet #6E.24a.
2. OPTIONAL. Do Worksheets #6E.24b and #6E.24c.
3. Research and report on two deciduous and two coniferous trees of Alberta. Use encyclopedias and other reference books. ALTERNATELY. Have them use the brief information from the “8 Common Alberta Trees” section of the “Between the Stands” poster. Have them use that information to write four short reports (of one paragraph each).
1. Label the diagrams below.

2. What can you tell by looking at each of the following?
   
a. leaf scar ____________________________

   b. growth ring _________________________

   c. many buds on a branch ________________

   d. lenticel _____________________________

   e. short distance between growth rings _______________________

   f. great distance between growth rings _________________________
1. Brenda found a twig with needles that were two 2 cm long, square, pointed, and singly attached to the branch. From which tree did the twig come?

2. Gordon found a twig as well. It had needles that were four-sided, and attached to the branch in bundles of two. From which tree did the twig come?

3. Mr. Hofer found another twig. It had needles that had two-sided cross-sections. They were six cm long, pointed, and singly attached. From which tree did his twig come?

4. Betty found a twig too. It had several needles all attached to the branch in bundles. The needles were pointed and about 10 cm long. From which tree did her twig come?
<table>
<thead>
<tr>
<th>Tree</th>
<th>Leaf Description</th>
<th>Tree Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balsam poplar</td>
<td>- egg-shaped with a sharp point</td>
<td>- long, narrow shape with large thick, short branches</td>
</tr>
<tr>
<td>Red willow</td>
<td>- pointed tip</td>
<td>- smooth, slim twigs</td>
</tr>
<tr>
<td></td>
<td>- attached in alternating pattern</td>
<td>- straight, unbranched trunk</td>
</tr>
<tr>
<td></td>
<td>- long and skinny</td>
<td>- can be found near water</td>
</tr>
<tr>
<td>Red alder</td>
<td>- 6 to 12 cm long with pointed tip</td>
<td>- can be shrub-like</td>
</tr>
<tr>
<td></td>
<td>- serrated edge</td>
<td>- grows on stream banks and marshes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- produces catkins (cone-like structures)</td>
</tr>
<tr>
<td>Trembling aspen</td>
<td>- stem of leaf is longer than leaf</td>
<td>- long trunk and short, roundish crown</td>
</tr>
<tr>
<td></td>
<td>- nearly circular with abrupt, short, sharp tip</td>
<td></td>
</tr>
<tr>
<td>White spruce</td>
<td>- single needle joins twig</td>
<td>- cones found only at the top</td>
</tr>
<tr>
<td></td>
<td>- needles are four-sided and have tiny, brown stem</td>
<td></td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>- two needles per bunch</td>
<td>- small, hard cones</td>
</tr>
<tr>
<td></td>
<td>- spiralled or twisted</td>
<td>- tall, straight tree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- older trees in groups normally have not living</td>
</tr>
<tr>
<td></td>
<td></td>
<td>branches near the bottom</td>
</tr>
</tbody>
</table>

1. According to the chart, which tree has a shape like this?  

[Image of a tree]  

2. Which tree has long slender leaves and that you would probably find near a river?  

[Image of leaves]  

3. Which tree has short branches that are thick? Its silhouette is long and narrow while the leaves are oval and pointed at one end.  

[Image of leaves]  

4. Which tree produces catkins and has leaves that look like this?  

[Image of leaves]
Directions: Use Mini Textbook, page 42 to help you answer the questions.

1. Label the diagrams below.

2. What can you tell by looking at each of the following?
   a. leaf scar shows where a leaf was once attached to branch
   b. growth ring shows where terminal bud from previous year dropped off
   c. many buds on a branch number of new leaves
   d. lenticel where gas exchange occurs
   e. short distance between growth rings poor growing conditions
   f. great distance between growth rings good growing conditions
Use the dichotomous key to answer the question.

1. Brenda found a twig with needles that were two 2 cm long, square, pointed, and singly attached to the branch. From which tree did the twig come?

   - white spruce

2. Gordon found a twig as well. It had needles that were four-sided, and attached to the branch in bundles of two. From which tree did the twig come?

   - jack pine

3. Mr. Hofer found another twig. It had needles that had two-sided cross-sections. They were six cm long, pointed, and singly attached. From which tree did his twig come?

   - balsam fir

4. Betty found a twig too. It had several needles all attached to the branch in bundles. The needles were pointed and about 10 cm long. From which tree did her twig come?

   - tamarack
<table>
<thead>
<tr>
<th>Tree</th>
<th>Leaf Description</th>
<th>Tree Description</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>• smooth, slim twigs</td>
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<td></td>
<td>• attached in alternating pattern</td>
<td>• straight, unbranched trunk</td>
</tr>
<tr>
<td></td>
<td>• long and skinny</td>
<td>• can be found near water</td>
</tr>
<tr>
<td>Red alder</td>
<td>• 6 to 12 cm long with pointed tip</td>
<td>• can be shrub-like</td>
</tr>
<tr>
<td></td>
<td>• serrated edge</td>
<td>• grows on stream banks and marshes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• produces catkins (cone-like structures)</td>
</tr>
<tr>
<td>Trembling aspen</td>
<td>• stem of leaf is longer than leaf</td>
<td>• long trunk and short, roundish crown</td>
</tr>
<tr>
<td></td>
<td>• nearly circular with abrupt, short, sharp tip</td>
<td></td>
</tr>
<tr>
<td>White spruce</td>
<td>• single needle joins twig</td>
<td>• cones found only at the top</td>
</tr>
<tr>
<td></td>
<td>• needles are four-sided and have tiny,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>brown stem</td>
<td></td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>• two needles per bunch</td>
<td>• small, hard cones</td>
</tr>
<tr>
<td></td>
<td>• spiralled or twisted</td>
<td>• tall, straight tree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• older trees in groups normally have not living</td>
</tr>
<tr>
<td></td>
<td></td>
<td>branches near the bottom</td>
</tr>
</tbody>
</table>

1. According to the chart, which tree has a shape like this?  
   ![trembling aspen]  
   **trembling aspen**

2. Which tree has long slender leaves and that you would probably find near a river?  
   ![red willow]  
   **red willow**

3. Which tree has short branches that are thick? Its silhouette is long and narrow while the leaves are oval and pointed at one end.  
   ![balsam poplar]  
   **balsam poplar**

4. Which tree produces catkins and has leaves that look like this?  
   ![red alder]  
   **red alder**
Lesson Twenty-five

Concept: Determining the History of a Tree

Resources/Materials: Mini Textbook, pages 43 - 45
- tree cookies, if you have them
- Worksheet #6E.25a (transparency)
- Worksheets #6E.25b, #6E.25c, and #6E.25d (student copies)

Introduction: Review how the distance between growth rings on a tree branch can tell you how much that branch grew in a year. Explain that today we will find out how to find out more about a tree’s life by looking at some cookies!

Procedure:

1. Explain that we will be looking at tree cookies. These are cross section slices of a tree trunk, so you cannot eat tree cookies. They are very interesting though. Tree cookies are also called dendrodiscs and the scientific study of growth patterns using dendrodiscs is called dendrochronology.

2. If you have any tree cookies, allow students to examine them.

3. Explain that dendrodiscs can tell you much about the life of a tree. Put up the transparency of Worksheet #6E.25a. Explain that the numbers point to certain “areas of interest” that can help dendrochronologists make inferences about the environment as a tree grew.

4. Have students turn to Mini Textbook, page 44. Guide the reading of pages 43 and 44.

5. Then with students, try to make inferences about the environment as indicated by the numbers on Worksheet #6E.25a. **NOTE: Mini Textbook, page 45 provides the possible explanations**

6. Distribute Worksheets #6E.25b, #6E.25c, and #6E.25d. Go over the directions, if necessary.

Assignments:

2. Do Worksheets #6E.25b, #6E.25c, and #6E.25d.

NOTE: There are not separate tests for Part II and Part III. The content for both parts is covered in a single test, found at the end of Part III.
Reading a Tree's Life in a Dendrodisc

Worksheet #6E.25a
Determining the Life of a Tree

Directions: Examine the illustrations below. Then look at the tree cookies. List two possible incidents that may have caused each of the variations in the tree rings.

- Construction
- Dead Branch
- Insect Attack
- Growing On A Slope
- Drought
- Fire

following variations in tree rings.

A. 

B. 

C. 

D. 

Worksheet #6E.25b
Directions: Examine the tree cookie. Then on Worksheet #6E.25c, tell what you think happened at each of the numbers.
<table>
<thead>
<tr>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
</tbody>
</table>
Directions: Examine the illustrations below. Then look at the tree cookies. List two possible incidents that may have caused each of the variations in the tree rings.

A. construction
   another tree
   growing on slope

B. dead branch
   insect attack

C. fire
   insect attack

D. drought
   fire
<table>
<thead>
<tr>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ring at centre</td>
<td>tree is born</td>
</tr>
<tr>
<td>2. wide ring</td>
<td>good growing conditions</td>
</tr>
<tr>
<td>3. ring is narrow on one side,</td>
<td>obstruction on one side, such as another tree,</td>
</tr>
<tr>
<td>wide on the other</td>
<td>fence, building, hill</td>
</tr>
<tr>
<td>4. narrow ring</td>
<td>poor growing conditions</td>
</tr>
<tr>
<td>5. narrow ring</td>
<td></td>
</tr>
<tr>
<td>6. scar</td>
<td>fire/insect damage</td>
</tr>
<tr>
<td>7. scar</td>
<td>fire/insect damage</td>
</tr>
<tr>
<td>8. last ring</td>
<td>tree was cut down</td>
</tr>
</tbody>
</table>
Part III of *Trees and Forests* focuses on the responsible use of trees and forests and natural resources. Students first examine how trees and forests were used historically in Alberta by investigating how First Nations peoples used trees in a sustainable way. They contrast this with how trees and forests are used in modern times. Then students study human practices that enhance and threaten forests, including harvesting methods and the influences of external factors, such as water and air pollution.

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Concept</th>
<th>Mini Textbook Pages</th>
<th>Hands On?</th>
<th>Non Hands On Option?</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Past and Present Uses of Forests</td>
<td>46 – 48</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>27</td>
<td>Identifying Household Items Derived from Trees</td>
<td>-----------</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>28</td>
<td>How Human Activity Impacts Forest Ecosystems</td>
<td>49 – 54</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>29</td>
<td>Trees and Forests – Parts II and III Review</td>
<td>-----------</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>30</td>
<td>Trees and Forests – Parts II and III Test</td>
<td>-----------</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Lesson Twenty-six

Concept:  Past and Present Uses of Forests

Resources/Materials:  Mini Textbook, pages 46 - 48  
Worksheets #6E.26a and #6E.26b  (student copies)

Introduction:  Recall with students the differences between nature’s uses of trees and forests and human uses.  Explain that today students will compare past and present day uses of the forests.

Procedure:

1.  Explain that the First Nations peoples were the first to use the forests as a resource.  They used forest in some of the ways we do today.  First Nations traditionally used forest resource with the attitude that they must conserve and not waste.  They used the forest only for what they needed.

2.  Explain that our attitudes towards using the forests have changed.  We often forget that the forest is an ecosystem and that when human disrupt the ecosystem too much, the whole ecosystem is affected.

3.  Have students turn to Mini Textbook, page 46.  Explain that pages 46 – 48 outline some of the traditional uses of the forests by First Nations and then how we use forests today.  Have students read pages 46 – 48 independently.

4.  With students speculate how we will use trees and forests in the future.

5.  Distribute Worksheets #6E.26a and #6E.26b.  Have them complete the charts using information from Mini Textbook, pages 46 – 48.

Assignments:

2.  Do Worksheets #6E.26a and #6E.26b.
**Human Use of Forest Products**

**Directions:** In each chart, tell how people of the past used the forest, how people presently use forests, and how you think people will use forests in the future.

<table>
<thead>
<tr>
<th>How First Nations Used Forests (the past)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Needs</td>
</tr>
<tr>
<td>Recreation/Leisure</td>
</tr>
<tr>
<td>Attitude About Using Forest Products</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How Forests Are Used Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Needs</td>
</tr>
<tr>
<td>Recreation/Leisure</td>
</tr>
<tr>
<td>Attitude About Using Forest Products</td>
</tr>
</tbody>
</table>
How is the way humans use forests different now that it was in the past?

<table>
<thead>
<tr>
<th>Basic Needs</th>
<th>Recreation/Leisure</th>
<th>Attitude About Using Forest Products</th>
</tr>
</thead>
</table>

Worksheet #6E.26b
**Human Use of Forest Products**

**Directions:** In each chart, tell how people of the past used the forest, how people presently use forests, and how you think people will use forests in the future.

<table>
<thead>
<tr>
<th>How First Nations Used Forests</th>
<th>Recreation/Leisure</th>
<th>Attitude About Using Forest Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(the past)</strong></td>
<td>medicines</td>
<td>toys</td>
</tr>
<tr>
<td></td>
<td>homes</td>
<td>jewellery</td>
</tr>
<tr>
<td></td>
<td>food</td>
<td>game pieces</td>
</tr>
<tr>
<td></td>
<td>transportation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>tools</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How Forests Are Used Today</th>
<th>Recreation/Leisure</th>
<th>Attitude About Using Forest Products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic Needs</strong></td>
<td>homes/buildings</td>
<td>picnicning</td>
</tr>
<tr>
<td></td>
<td>food</td>
<td>hiking</td>
</tr>
<tr>
<td></td>
<td>furniture</td>
<td>skiing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>lodging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>snowmobiling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>horseback riding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>golfing</td>
</tr>
</tbody>
</table>

Worksheet #6E.26a
How is the way humans use forests different now that it was in the past?

- More emphasis on recreational uses
- More emphasis on using forests for economic gain than maintaining balance in ecosystem

*Answers will vary.*

<table>
<thead>
<tr>
<th>Basic Needs</th>
<th>Recreation/Leisure</th>
<th>Attitude About Using Forest Products</th>
</tr>
</thead>
</table>

Lesson Twenty-seven

Concept: Identifying household items derived from trees

Resources/Materials:

Introduction: Review from last day’s lesson that we use forests and forest products in much of our lives. Ask “How do we use forest products in our home?”

Procedure:

1. Remind students that it is not only wood products that we use, but products made from chopping up, boiling and treating wood like paper and cardboard that are forest products.

2. Tell students to make a list of all things they have in their home that use wood or a wood product. Don’t forget to include the building itself. (Mini Textbook, page 48 might give students some ideas.) Discuss ways that they might organize this information.
   Example:
   - the structure itself
   - living room
   - kitchen
   - bedrooms

Assignment:

Make a list of all the things in your home that are made from wood or a wood product.
Lesson Twenty-eight

Concept: How human activity impacts a forest ecosystem

Resources/Materials: Mini Textbook, pages 49 - 54
   Poster: “Between the Stands”
   Worksheets #6E.28a and #6E.28b (optional, transparencies or copied onto charts)
   Worksheets #6E.28c, #6E.28d, #6E.28e, and #6E.28f (student copies)

Introduction: Review with students some of the activities involved with human use of forests. Then discuss that some activities threaten the forest ecosystem while others enhance it. If necessary, go over these terms.

Procedure:

1. Display the “Between the Stands” poster, the human activity side. Have student observe some of the ways that humans are threatening the forest and enhancing it.

2. Focus attention some of the activities involved with forestry:
   - Clear cutting
   - Selective cutting
   - Natural regeneration
   - Direct seeding
   - Planting seedlings

3. Have students turn to Mini Textbook, page 49. With students scan pages 49 – 54 so that they can get an idea of the content covered and how it is organized.

4. Have students read Mini Textbook, pages 49 – 54 independently.

5. Then have them use the Mini Textbook pages to make notes on:
   - Tree Harvesting Methods
   - Reforestation and Regeneration Methods
   ALTERNATELY. Put up the transparencies of Worksheets #6E.28a and #6E.28b for students to copy into their notebooks.

6. Distribute Worksheets #6E.28c, #6E.28d, #6E.28e, and #6E.28f. Go over the directions, if necessary.

Assignments:
1. Make notes or copy them from Worksheets #6E.28a and #6E.28b OR use Mini Textbook, pages 50 – 53.
2. Do Worksheets #6e.28c, #6E.28d, #6E.28e, and #6E.28f.
Tree Harvesting Methods

a. Clear Cutting
- All trees in a particular area are cut down
- Leads to immediate loss of habitat for animals and birds
- Causes soil erosion

b. Selective Cutting
- The taller trees are cut down on a regular basis.
- Allows shorter trees to get more sunlight and allows them to grow more naturally.
- Habitat for animals and birds is not changed drastically
Reforestation and Regeneration Methods

a. **Natural Regeneration** – seeds fall to the forest floor, germinate, and grow

b. **Direct Seeding** – cones and seeds are gathered and sown from tractors and airplanes

c. **Planting Seedlings** – small trees that are grown in nurseries are taken out and planted
Directions: Think of activities that humans do to enhance or threaten the forest.

<table>
<thead>
<tr>
<th>Enhance the Forest</th>
<th>Threaten the Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Selective Cutting

What are the advantages of using selective cutting when harvesting trees?

________________________________________________________________________

________________________________________________________________________

What are the disadvantages of selective cutting to the forestry company?

________________________________________________________________________
2. Clear Cutting

What is the advantage to the forestry company of using clear cutting?

_________________________________________________________________

Assuming both owls and mice live in the wooded area, predict what will happen to each population and why after clear cutting.

Owls _____________________________________________________________

_________________________________________________________________

_________________________________________________________________

Mice _____________________________________________________________

_________________________________________________________________

_________________________________________________________________

What might be other disadvantages of using clear cutting to harvest trees?

_________________________________________________________________

_________________________________________________________________
1. Below is a graph showing the area of trees that were harvested and replanted in a forest near Sandbar Camp. Use the graph to answer the questions.

![Area of Trees Harvested and Replanted](image)

According to the information in the graph, between 1980 and 1995

a. the area of trees replanted decreased.
b. the area of trees harvested decreased.
c. a greater area of trees was harvested than was replanted.
d. a greater area of trees was replanted than was harvested.

2. If the same trend is allowed to continue, what do you think might eventually happen?
**Enhance or Threaten?**

**Directions:** Think of activities that humans do to enhance or threaten the forest.

<table>
<thead>
<tr>
<th>Enhance the Forest</th>
<th>Threaten the Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>create provincial/national park</td>
<td>clear cutting</td>
</tr>
<tr>
<td>reseeding/reforestation</td>
<td>factories pollute</td>
</tr>
<tr>
<td>selective cutting</td>
<td>strip mining</td>
</tr>
<tr>
<td></td>
<td>building cities/roads/farms</td>
</tr>
<tr>
<td></td>
<td>clear forests for recreational facilities</td>
</tr>
<tr>
<td></td>
<td>off-roading</td>
</tr>
<tr>
<td></td>
<td>start fires because of carelessness</td>
</tr>
</tbody>
</table>
1. Selective Cutting

What are the advantages of using selective cutting when harvesting trees?

- Only taller trees are cut
- Allows shorter trees to get more sunlight, allowing them to grow normally
- Habitat for animals/birds not changed as dramatically

What are the disadvantages of selective cutting to the forestry company?

- Higher cost
- Inconvenient
2. Clear Cutting

Before clear-cutting  After clear-cutting

What is the advantage to the forestry company of using clear cutting?

less expensive

Assuming both owls and mice live in the wooded area, predict what will happen to each population and why after clear cutting.

Owls ______ homes lost →________ have to move elsewhere population will decrease

Mice population will increase because owl population will decrease

What might be other disadvantages of using clear cutting to harvest trees?

increased soil erosion windy
1. Below is a graph showing the area of trees that were harvested and replanted in a forest near Sandbar Camp. Use the graph to answer the questions.

![Area of Trees Harvested and Replanted](image)

According to the information in the graph, between 1980 and 1995

- the area of trees replanted decreased.
- the area of trees harvested decreased.
- a greater area of trees was harvested than was replanted.
- a greater area of trees was replanted than was harvested.

2. If the same trend is allowed to continue, what do you think might eventually happen?
Lesson Twenty-nine

Concept: Trees and Forests, Parts II and III Review

Resources/Materials: Trees and Forests, Parts II and III Review Sheets (student copies)

Introduction: Explain that the second half of Trees and Forests is now at and end and it is time to review for a test.

Procedure:

1. Oral go over the topics covered in this half of the unit:
   - Classifying leaves according to type (single, compound)
   - Classifying leaves according to shape, margins, and arrangements
   - Tree bark patterns
   - Tree shapes
   - Branching patterns
   - Buds and growth rings
   - Tree cookies
   - Past and present uses of forests
   - Household items derived from trees
   - How human activity impacts a forest ecosystem

2. Distribute the Trees and Forests, Parts II and III Review Sheets. Have students work on them independently or in pairs. If possible, check them as a class.

Assignment:

Do the Trees and Forests, Parts II and III Review Sheets.
1. Read the sentences below. Write D if the sentence tells about **deciduous** trees, C if the sentence tells about **coniferous** trees, or B if the sentence tells about both deciduous and coniferous trees.

_____ self-supporting trunk

_____ have needle-shaped leaves

_____ produce seeds inside fruits and nuts

_____ woody material

_____ lose leaves annually

_____ produce seeds inside cones

_____ used as shelter for wildlife

_____ leaves change colour in autumn

_____ stay green all year round

_____ can survive in areas of extreme drought and extreme temperatures

_____ shed leaves continually

_____ can be cut down and used for lumber

2. Label the parts of a leaf.

![Diagram of a leaf with labeled parts]
3. Write the leaf type under the correct picture.

<table>
<thead>
<tr>
<th>simple</th>
<th>compound</th>
<th>double compound</th>
<th>needle</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="simple leaf" /></td>
<td><img src="image2.png" alt="compound leaf" /></td>
<td><img src="image3.png" alt="double compound leaf" /></td>
<td><img src="image4.png" alt="needle leaf" /></td>
</tr>
</tbody>
</table>

4. Write the leaf shapes under the correct pictures.

<table>
<thead>
<tr>
<th>linear</th>
<th>oblong</th>
<th>oval</th>
<th>ovate</th>
<th>cordate</th>
</tr>
</thead>
<tbody>
<tr>
<td>lobed</td>
<td>deltid</td>
<td>orbicular</td>
<td>4-sided needle</td>
<td>flattened needle</td>
</tr>
</tbody>
</table>

| ![leaf](image5.png) | ![leaf](image6.png) | ![leaf](image7.png) | ![leaf](image8.png) | ![leaf](image9.png) |
5. Write the names of the types of leaf margins under the correct pictures.

<table>
<thead>
<tr>
<th>smooth</th>
<th>fine-toothed</th>
<th>serrated</th>
<th>scalloped</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
</tr>
</tbody>
</table>

6. Write the names of the leaf arrangements under the correct pictures.

<table>
<thead>
<tr>
<th>opposite</th>
<th>alternate</th>
<th>whorled</th>
<th>basal</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
<td><img src="image_url" alt="Leaf" /></td>
</tr>
</tbody>
</table>
7. Write the names of the needles arrangements under the correct pictures.

<table>
<thead>
<tr>
<th>bunches of 2</th>
<th>bunches of 5</th>
<th>singly on a twig</th>
</tr>
</thead>
<tbody>
<tr>
<td>scale-like</td>
<td>in clusters of more than 5</td>
<td></td>
</tr>
</tbody>
</table>

8. Use the dichotomous key below to answer the questions.

```
   Needle-shaped leaf
      /         \
     /           \
    Bundles of 2  
      \            
       Jack pine

Singly attached
   /      \
  /        \  
/          \ 
/           \ 
White spruce Balsam fir

4-sided cross section

Attached clusters of 10

Flat cross section

Tamarack
```

a. Which tree has a twig with needles that are two cm long, square, pointed, and singly-attached to the branch?

b. Which tree has a twig with needles that are always green and attached in clusters of 10?
9. Use the dichotomous key to answer the questions.

```
Trees

Shed leaves annually

Grow by spreading on the ground
  Flower
  Group 1

Grow upright
  Do not flower
  Group 2

Do not shed leaves annually

Grow upright
  Group 3

Grow by spreading on the ground
  Group 4

```

a. The apple tree belongs in Group _____.

b. The balsam fir belongs in Group _____.

10. Tell why the bark on a tree has cracks and splits on it.

```

11. Examine the bark patterns below. Then read the descriptions. Write the correct letter of the bark diagrams.

```

a. _____ The birch tree loses its leaves annually and has smooth white bark. It has a horizontal pattern.

b. _____ The lodgepole pine is the provincial tree of Alberta. It is a coniferous tree with bark that is rough. It is usually grey in colour and with a pattern that is vertical and scaly.
```
12. Write the names of the tree shapes under the correct pictures.

<table>
<thead>
<tr>
<th>triangle</th>
<th>oval</th>
<th>circle</th>
<th>spreading</th>
<th>rectangle</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Triangle Tree" /></td>
<td><img src="image2" alt="Oval Tree" /></td>
<td><img src="image3" alt="Circle Tree" /></td>
<td><img src="image4" alt="Spreading Tree" /></td>
<td><img src="image5" alt="Rectangle Tree" /></td>
</tr>
</tbody>
</table>

13. Tell how you think the branching patterns and tree shapes have been affected by their environment.
14. Write T for true and F for false.

____ The natives of North America used trees mainly for survival.

____ The First Nations of North America wasted many of the trees they harvested.

____ The First Nations of North America used trees for medicines, homes, food, tools, fuel, transportation, and recreation.

____ Today we use trees more for buildings, furniture, and recreation.

____ There is no need to limit how we use trees and forests because there is such a huge supply.

15. On the lines below list eight things in your home or in our classroom that are made of wood.

________________________________________

________________________________________

________________________________________

________________________________________

16. Humans can either enhance or threaten the existence of forests. In the chart below tell about these activities.

<table>
<thead>
<tr>
<th>Activities That Enhance Forests</th>
<th>Activities That Threaten Forests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Read the sentences below. Write D if the sentence tells about **deciduous** trees, C if the sentence tells about **coniferous** trees, or B if the sentence tells about **both** deciduous and coniferous trees.

   - **B** self-supporting trunk
   - **C** have needle-shaped leaves
   - **D** produce seeds inside fruits and nuts
   - **B** woody material
   - **D** lose leaves annually
   - **C** produce seeds inside cones
   - **B** used as shelter for wildlife
   - **D** leaves change colour in autumn
   - **C** stay green all year round
   - **C** can survive in areas of extreme drought and extreme temperatures
   - **B** shed leaves continually
   - **B** can be cut down and used for lumber

2. Label the parts of a leaf.

   ![Diagram of a leaf with labeled parts: apex, margin, midrib/midvein, veins, blade, petiole, base.](Diagram_of_a_leaf_with_labeled_parts.png)
3. Write the leaf type under the correct picture.

<table>
<thead>
<tr>
<th>simple</th>
<th>compound</th>
<th>double compound</th>
<th>needle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>double compound</td>
<td>needle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>simple</td>
<td>compound</td>
</tr>
</tbody>
</table>

4. Write the leaf shapes under the correct pictures.

<table>
<thead>
<tr>
<th>linear</th>
<th>oblong</th>
<th>oval</th>
<th>ovate</th>
<th>cordate</th>
<th>4-sided needle</th>
<th>flattened needle</th>
<th>deltoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>lobe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Write the names of the types of leaf margins under the correct pictures.

<table>
<thead>
<tr>
<th>smooth</th>
<th>fine-toothed</th>
<th>serrated</th>
<th>scalloped</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="leaf" /></td>
<td><img src="Image" alt="leaf" /></td>
<td><img src="Image" alt="leaf" /></td>
<td><img src="Image" alt="leaf" /></td>
</tr>
</tbody>
</table>

6. Write the names of the leaf arrangements under the correct pictures.

<table>
<thead>
<tr>
<th>opposite</th>
<th>alternate</th>
<th>whorled</th>
<th>basal</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="Image" alt="leaf arrangement" /></td>
<td><img src="Image" alt="leaf arrangement" /></td>
<td><img src="Image" alt="leaf arrangement" /></td>
<td><img src="Image" alt="leaf arrangement" /></td>
</tr>
</tbody>
</table>
7. Write the names of the needles arrangements under the correct pictures.

<table>
<thead>
<tr>
<th>bunches of 2</th>
<th>bunches of 5</th>
<th>singly on a twig</th>
</tr>
</thead>
<tbody>
<tr>
<td>scale-like</td>
<td>in clusters of more than 5</td>
<td></td>
</tr>
</tbody>
</table>

| singly on a twig | bundles of 2 | clusters of 5 or more | bundles of 5 | scale-like |

8. Use the dichotomous key below to answer the questions.

```
Needle-shaped leaf
 /    \
|      |
Bundles of 2
 /      \      
|      |      Jack pine 

Singly attached
 /        \
|        |
4-sided cross section
 /          \          
|          |         White spruce

Attatched clusters of 10
 /      \      
|      |      
Flat cross section
 /          \          
|          |         Balsam fir

Tamarack
```

a. Which tree has a twig with needles that are two cm long, square, pointed, and singly-attached to the branch?

**White spruce**

b. Which tree has a twig with needles that are always green and attached in clusters of 10?

**Tamarack**
9. Use the dichotomous key to answer the questions.

   Trees
   
   Shed leaves annually
   
   Grow by spreading on the ground
   
   Flower
   Group 1
   
   Do not flower
   Group 2
   
   Grow upright
   
   Do not shed leaves annually
   
   Grow by spreading on the ground
   Group 3
   
   Grow upright
   Group 4

a. The apple tree belongs in Group 1.

b. The balsam fir belongs in Group 3.

10. Tell why the bark on a tree has cracks and splits on it.

   bark is growing under outer bark, causing outer bark to crack and split

11. Examine the bark patterns below. Then read the descriptions. Write the correct letter of the bark diagrams.

   a. C The birch tree loses its leaves annually and has smooth white bark. It has a horizontal pattern.

   b. E The lodgepole pine is the provincial tree of Alberta. It is a coniferous tree with bark that is rough. It is usually grey in colour and with a pattern that is vertical and scaly.
12. Write the names of the tree shapes under the correct pictures.

<table>
<thead>
<tr>
<th>triangle</th>
<th>oval</th>
<th>circle</th>
<th>spreading</th>
<th>rectangle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>circle</td>
<td>spreading</td>
<td>rectangle</td>
</tr>
<tr>
<td>circle</td>
<td></td>
<td>spreading</td>
<td>triangle</td>
<td>rectangle</td>
</tr>
<tr>
<td>oval</td>
<td></td>
<td>circle</td>
<td>spreading</td>
<td>rectangle</td>
</tr>
</tbody>
</table>

13. Tell how you think the branching patterns and tree shapes have been affected by their environment.

<table>
<thead>
<tr>
<th>Wind</th>
<th>growing closely together</th>
<th>drought</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>poor soil</td>
</tr>
</tbody>
</table>
14. Write T for true and F for false.

T  The natives of North America used trees mainly for survival.

F  The First Nations of North America wasted many of the trees they harvested.

T  The First Nations of North America used trees for medicines, homes, food, tools, fuel, transportation, and recreation.

F  Today we use trees more for buildings, furniture, and recreation.

F  There is no need to limit how we use trees and forests because there is such a huge supply.

15. On the lines below list eight things in your home or in our classroom that are made of wood. Answers will vary.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

16. Humans can either enhance or threaten the existence of forests. In the chart below tell about these activities. Answers may vary

<table>
<thead>
<tr>
<th>Activities That Enhance Forests</th>
<th>Activities That Threaten Forests</th>
</tr>
</thead>
<tbody>
<tr>
<td>selective cutting</td>
<td>clear cutting</td>
</tr>
<tr>
<td>direct seeding/planting seedlings</td>
<td>accidental fires</td>
</tr>
<tr>
<td>fertilizing, spraying for pests, watering</td>
<td>littering</td>
</tr>
<tr>
<td>creating provincial/national parks</td>
<td>construction</td>
</tr>
</tbody>
</table>
Lesson Thirty

Concept: Trees and Forests, Parts II and III Test

Resources/Materials: Trees and Forests, Parts II and III Test (student copies)
Directions: Write the letter of the best answer to each question on the answer sheet. Do not write in this booklet.

Use the following information to answer question 1.

1. Which of the following correctly identifies the parts of the leaf?
   a. 1 – petiole
   2 – apex
   3 – margin
   4 – midrib

   b. 1 – base
   2 – margin
   3 – petiole
   4 – apex

   c. 1 – blade
   2 – veins
   3 – apex
   4 – margin

   d. 1 – blade
   2 – apex
   3 – midrib
   4 – margin

Use the information below to answer question 2.

2. Which of the following correctly describes the leaf.
   a. compound, serrated, ovate
   b. simple, smooth, orbicular
   c. compound, scalloped, ovate
   d. simple, serrated, oval
While going for walk, Sarah found a twig lying on the sidewalk. She took it to her teacher who described it as a small branch with smooth-margined, cordate leaves arranged in an opposite arrangement.

3. Which of the following is most like the twig that Sarah found?

a.  

b.  

c.  

d.  

4. The bark pattern shown can best be described as

a. horizontal.
b. vertical.
c. scaly.
d. horizontal and wavy.

5. Bark splits and cracks because

a. the inner layers become too large for the bark to cover them.
b. the inner layers dry out causing the outer layers to crack as well.
c. diseases cause damage to the bark.
d. the older the outer bark becomes, the more elasticity it has.
Use the following information to answer question 6.

Jennifer made a poster of several tree silhouettes.

She describes one of the trees as
- tall and thin
- having drooping branches that sweep up at the ends
- having branches that are close together at the top of the tree
- having branches that grow close to the ground

6. The tree silhouette that matches Jennifer’s description is labelled
   a. W
   b. X
   c. Y
   d. Z

Use the information below to answer question 7.

The white spruce is a tree commonly found in Alberta. It has these characteristics:
- large size, up to 45 m
- rough, scaly bark, brownish to silver grey
- needles 4-sided, stiff, sharp, bright green
- seed cones usually at end of young twigs, brown

7. From the information above, you can tell that the white spruce is
   a. a deciduous tree.
   b. will shed its leaves in the fall.
   c. can also be found in other parts of Canada.
8. Which of the following best describes branches that grow in a spiral pattern?

a. Branches grow from the opposite sides of the trunk, across from each other.
b. Branches grow on opposite sides from each other, but one will be farther up the trunk than the first.
c. Branches are attached in groups of two or three from the same location on the trunk.
d. Branches grow alternately along the trunk, but like a corkscrew or circular staircase, moving up the trunk.

9. On a twig, the distance between growth rings shows

a. how much the twig grew in a year.
b. the number of buds the tree produced.
c. how lenticels help the gas exchange.
d. if the tree is deciduous or coniferous.

Use the information below to answer question 10.

10. According to the dichotomous key, the branch most likely shown at the right is from which kind of tree?

a. jack pine
b. white spruce
c. balsam fir
d. tamarack
11. Which of the following is not correct about a tree cookie?

a. The number of rings tells you how old the tree is.
b. The dark wood is summer growth and the light wood is winter growth.
c. You can make inferences about the tree’s history by examining it.
d. Each tree cookie is unique.

Use the following information to answer questions 12 – 14.

12. Which tree cookie’s pattern is most likely due to the tree growing closely to another tree?

a. 1  
b. 2  
c. 3  
d. 4

13. Which tree cookie shows that the tree was most likely damaged by fire?

a. 1  
b. 2  
c. 3  
d. 4

14. Which tree cookie shows that the tree has mostly likely lived through both periods of drought and good growing conditions?

a. 1  
b. 2  
c. 3  
d. 4
Barney’s father cut down a tree in their yard. Barney noticed that in the rings toward the centre of the tree trunk, the rings were farther apart on one side than on the other. When he examined the outer rings, he noticed that the rings were more evenly spaced all around.

15. Which of the following most likely tells why the ring pattern changed?

a. When the tree was younger, there were severe drought conditions. When tree was older, there were good growing conditions.

b. When the tree was younger, there was fire near the tree.

c. When the tree was first planted, it was located near a garden shed. A few years later, the garden shed was torn down.

d. Barney’s yard is on a slope.

Use the following information to answer question 16.

16. Which dendrodisc indicates the tree may have lived through insect damage?

a. 

b. 

c. 

d.
Use the following information to answer questions 17 – 19.

**USES OF FORESTS**

<table>
<thead>
<tr>
<th>Traditional First Nations</th>
<th>Present Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>• teepee poles</td>
<td>• fuel</td>
</tr>
<tr>
<td>• fuel</td>
<td>• buildings</td>
</tr>
<tr>
<td>• spruce bark tea used to cure scurvy</td>
<td>• chewing gum</td>
</tr>
<tr>
<td>• gathered berries for food</td>
<td>• furniture</td>
</tr>
<tr>
<td>• travois poles</td>
<td>• camping</td>
</tr>
<tr>
<td>• canoes and boats</td>
<td>• hiking</td>
</tr>
<tr>
<td>• snowshoes</td>
<td>• skiing</td>
</tr>
<tr>
<td>• syrup</td>
<td>• birdwatching</td>
</tr>
<tr>
<td>• mountain ash bark used to stop stomach pain</td>
<td>• maple syrup</td>
</tr>
<tr>
<td>• toys</td>
<td>• tannin used in leather making</td>
</tr>
<tr>
<td>• arrows</td>
<td>• musical instruments</td>
</tr>
</tbody>
</table>

17. From the above information you can infer that

a. First Nations people used forests for entirely different things that we use them in present day use.
b. First Nations did not use forests wisely.
c. We do not use forests wisely today.
d. First Nations people used forests more for survival than we do today.

18. From the above information what can you conclude about the use of forests long ago and today?

a. Forests are used to provide both food and shelter.
b. First Nations people knew more about conserving natural resources.
c. First Nations people were good hunters.
d. People today use forests less than people long ago.

19. From the information in the chart you can conclude that

a. people today use forests more for recreation than people long ago.
b. people today are more likely to litter the forest than people long ago.
c. forests will soon no longer be able to provide us with the resources we need.
d. camping, hiking, and fishing are a waste of time.
Use the following information to answer questions 20 – 22.

Gordie and his family were on a car trip through northern Alberta. The family was driving through thick forests, when all of a sudden they came upon a large area where there was not one tree standing. Gordie’s father said that this area had most likely been harvested using clear cutting.

20. Gordie’s father would explain that in clear cutting
   a. only the taller trees are cut down.
   b. only the shorter trees are cut down.
   c. all trees in a particular area are cut down.
   d. trees are only harvested on cloudless days.

21. Gordie could infer that a disadvantage of using clear cutting is
   a. that it is a more expensive way for forestry companies to harvest trees.
   b. there is an immediate loss of habitat for birds and animals.
   c. soil erosion will not occur.
   d. the speed of the winds will decrease.

22. Gordie’s father explained that the area that was clear cut would most likely not be reforested through natural regeneration. By natural regeneration he means that
   a. seeds that fall to the forest floor, germinate and grow.
   b. cones and seeds are sown from tractors and airplanes.
   c. small trees that are grown in nurseries are taken out and planted.
   d. the forestry company will be responsible for making sure the forest came back to life.
Name: ____________________________

Trees and Forests – Parts II and III
Test

Answer Sheet

1. ________ 12. ________

2. ________ 13. ________

3. ________ 14. ________

4. ________ 15. ________

5. ________ 16. ________

6. ________ 17. ________

7. ________ 18. ________

8. ________ 19. ________

9. ________ 20. ________

10. ________ 21. ________

11. ________ 22. ________
Science Grade 6 Topic E Trees and Forest – Parts II and III
Test

Trees and Forests – Parts II and III
Test

Answer Sheet

1. a
2. a
3. a
4. b
5. a
6. b
7. d
8. d
9. a
10. d
11. b
12. d
13. a
14. b
15. c
16. d
17. d
18. a
19. a
20. c
21. b
22. a
Comprehensive Review I

Directions: For each question write the letter of the best answer on the answer sheet. DO NOT WRITE IN THIS BOOKLET.

1. Mr. Donaldson asked each student to make a list of the characteristics of air. Which student has a correct list?

   - **Katie**
     - tasteless
     - can be compressed
     - exerts a force on surfaces
     - visible

   - **Brent**
     - invisible
     - does not take up space
     - can only be felt when it moves
     - has no mass

   - **Karla**
     - exerts force on surfaces
     - invisible
     - takes up space
     - can be compressed

   - **Michael**
     - has mass
     - can be seen
     - takes up space
     - can hold things up

Use the following information to answer questions 2 and 3.

Jake stuffed a paper towel into the bottom of a jar. He then turned the jar over and pushed it into a tub of water.

2. Which of the following most likely tells what Jake observed?

   - a. The jar filled with water.
   - b. The paper towel stayed dry.
   - c. The paper towel became soaked with water.
   - d. The water made the jar overturn.
3. Jake's experiment showed that
   a. air takes up space.
   b. air is heavier than water.
   c. water exerts pressure.
   d. air cannot be mixed with water.

*Use the following information to answer question 4.*

Miss Carnie laid a metre stick on her desk so that half of the stick was on the desk and the other half stuck out. She then laid an unfolded sheet of newspaper on the part of the metre stick that was on her desk. When she pushed sharply down on the free end of the metre stick, she noticed that the sheet of newspaper barely moved.

4. In this activity Miss Carnie demonstrated that
   a. air has no mass.
   b. air presses sideways.
   c. air presses down.
   d. air presses up.

*Use the following information to answer question 6.*

Sandra taped two identical balloons to either end of a rod. She then tied a string to the centre of the rod so that the balloons balanced when she held the rod up by the string. Finally, she took a pin and popped one of the balloons. She observed that the side of the rod with the inflated balloon went down.

5. What is air pressure?
   a. The force that air exerts on surfaces.
   b. The direction that the wind blows.
   c. The force that air exerts in the water.
   d. The amount of mass that an object has.

6. Sandra's activity showed that
   a. balloons have mass.
   b. air exerts pressure on surfaces.
   c. air has mass.
   d. air is invisible.
Kelly built a device that could measure how much air it took to blow up a balloon. She made a table showing what she found.

<table>
<thead>
<tr>
<th>Volume of Air Pumped into the Balloon</th>
<th>Volume of the Air Inside the Balloon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000 cm³</td>
<td>900 cm³</td>
</tr>
<tr>
<td>1500 cm³</td>
<td>1300 cm³</td>
</tr>
<tr>
<td>2000 cm³</td>
<td>1500 cm³</td>
</tr>
<tr>
<td>2500 cm³</td>
<td>1650 cm³</td>
</tr>
<tr>
<td>3000 cm³</td>
<td>1750 cm³</td>
</tr>
</tbody>
</table>

7. Kelly’s activity showed that
   a. air can be compressed.
   b. air has mass.
   c. balloons cannot expand.
   d. air exerts pressure.

8. Which of the following scientists discovered that faster moving air has less air pressure than slower moving air?
   a. Niels Bohr
   b. Isaac Newton
   c. Marie Curie
   d. Daniel Bernoulli

Use the following information to answer question 9.

Victor wanted to demonstrate the effects of air movement. He blew air through a paper tent.
9. When he blew air through the paper tent, what did he most likely notice?

   a. Both sides bent inward.
   b. Both sides bent outward.
   c. Neither side would bend.
   d. One side bent inward and the other side bent outward.

*Use the following information to answer question 10.*

![Diagram](image)

10. The top of the wing is curved in order to create

   a. low pressure in area A.
   b. low pressure in area B.
   c. fast-moving air in area B.
   d. slow-moving air in area A.

11. In order for a bird, insect, or aircraft to ascend

   a. gravity must be greater than lift.
   b. lift must be greater than gravity.
   c. lift must be equal to gravity.
   d. lift must be less than gravity.

12. One adaptation that birds have that enable them to fly is

   a. hollow bones.
   b. shiny feathers.
   c. webbed feet.
   d. sharp eyes.

13. An adaptation that enables insects to fly is

   a. a large mass.
   b. compound eyes.
   c. hairy legs.
   d. wings that take on the curved shaped of an airfoil once they beat against
      the air.
14. In order for an airplane to accelerate,
   a. drag must be greater than thrust.
   b. lift must be greater than drag.
   c. thrust must be greater than drag.
   d. thrust must be greater than weight.

Use the following information to answer question 15.

15. On the airplane above the part of the airplane that provides thrust is
   a. the propeller.
   b. the jet engines.
   c. the fuselage.
   d. the nose.

16. The action of a bird that corresponds to the turning of the propeller on an aircraft is
   a. the folding of the wings.
   b. the spreading out of the tail feathers.
   c. the curving of the wing feathers.
   d. the flapping of the wings.
Use the following information to answer question 17.

Nick taped an inflated balloon to a string. Then he untied the balloon’s neck so the air could escape. He noticed that the balloon travelled along the string in the opposite direction from the air escaping from the balloon.

17. The balloon moving in the opposite direction from the air escaping from the balloon is based on the same principle that propels

   a. a rocket.
   b. a paper airplane.
   c. a glider.
   d. an insect.

Use the following information to answer question 18.

Elizabeth wanted to know if the amount of air in an inverted jar affected how long a candle would burn. To do this she took three jars of different sizes. She took a candle and lit it. She inverted the smallest jar over the lit candle and timed the number of seconds the candle stayed lit. She did the same for the other two jars. She noticed that the candle under the largest jar burned longest, followed by the medium-sized jar and the smallest-sized jar.

18. In Elizabeth’s activity, what would be the manipulated variable?

   a. the length of time the candles burned.
   b. the candle.
   c. the location.
   d. the size of the jar.

19. Elizabeth’s activity showed evidence of which gas in the air?

   a. nitrogen
   b. carbon dioxide
   c. oxygen
   d. helium
20. The most important gas in the atmosphere for humans and animals to breathe is
   a. oxygen.
   b. carbon dioxide.
   c. nitrogen.
   d. hydrogen.

Use the information below to answer questions 21 and 22.

Walter found a labelled diagram of a parachute. He wondered about the function of some of the parts of the parachute. He went to his teacher for answers. His teacher told him to “go look it up!” So he did.

21. Walter would have found out that the purpose of the canopy was
   a. to increase drag in order to decrease the rate of descent.
   b. to increase drag in order to increase the rate of descent.
   c. to decrease drag in order to decrease the rate of descent.
   d. to increase drag in order to increase the rate of descent.

22. Walter also found out that the vent
   a. increased the amount of air resistance.
   b. allowed for a more controlled descent.
   c. opened the pilot chute.
   d. increased the mass of the canopy.
Walter was out one day watching parachutists. The parachutists were having a contest to see who could land most closely to a metal disc on the ground. He noticed that those who used parachutes with rectangular-shaped canopies were able to land more closely to the disc compared to those who used circular canopies.

23. An inference that Walter could make from what he observed is that the parachutists using the rectangular parachutes

a. were more experienced than those using the circular ones.
b. were older than those using the circular ones.
c. were lighter weight compared to those using the circular ones.
d. had more control over their parachutes compared to those using circular ones.

Use the following diagram to help you answer questions 24 and 25.

24. Which of the following correctly identifies the parts of the hot air balloon?

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Alternative Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>canopy</td>
<td>1 - envelope</td>
</tr>
<tr>
<td>2</td>
<td>skirt</td>
<td>2 - skirt</td>
</tr>
<tr>
<td>3</td>
<td>payload</td>
<td>3 - pilot</td>
</tr>
<tr>
<td>4</td>
<td>envelope</td>
<td>4 - basket</td>
</tr>
</tbody>
</table>

2 - bag
3 - envelope
4 - skirt
1 - pilot
2 - payload
25. A hot air balloon pilot would open the hole marked with the question mark (?) when he or she wants to
   a. ascend.
   b. move forward.
   c. lift off.
   d. descend.

26. A hot air balloon will rise when the air inside the balloon is warmer than the air outside the balloon. This is because
   a. cooler air is denser and heavier than warm air.
   b. warmer air has more molecules than cooler air.
   c. warmer air is denser than cooler air.
   d. in cooler air the molecules are more active compared to those in warmer air.

Use the following information to answer questions 27 and 28.

Donna made a paper airplane. She noticed that when she threw it, the plane went straight out for a short distance and then dove straight to the floor.

27. Donna’s airplane most likely did not fly straight because
   a. the nose was too heavy.
   b. the tail was too heavy.
   c. one wing was higher than the other.
   d. the paper she used to make the paper airplane was too heavy.

28. In order to make the airplane fly straighter and further her teacher would suggest she add paper clips to
   a. the nose.
   b. each wing.
   c. the tail.
   d. the fuselage.
29. Helicopters must be able to hover during rescue operations. In order to do this
   a. thrust and lift must equal drag.
   b. lift must equal weight and thrust be greater than drag.
   c. thrust must equal drag and lift must be greater than weight.
   d. lift must equal weight and thrust must equal drag.

Use the information below to answer questions 30 and 31.

![Diagram of an airplane with labeled parts.

30. Which of the following correctly labels the airplane's control surfaces?

   a. 1 – aileron
      2 – vertical stabilizer
      3 – rudder
      6 – fuselage

   b. 1 – horizontal stabilizer
      2 – aileron
      5 – vertical stabilizer
      6 – rudder

   c. 2 – horizontal stabilizer
      4 – rudder
      5 – vertical stabilizer
      6 – aileron

   d. 3 – elevator
      5 – vertical stabilizer
      6 – fuselage
      1 – aileron

31. If a pilot wants to control yaw, which control surface would he use?

   a. 1
   b. 5
   c. 4
   d. 2
32. The part of the airplane that causes it to descend is labelled
   a. 1.
   b. 2.
   c. 3.
   d. 4.

33. In which of the following diagrams of the rear view of an airplane are the control surfaces set in a position that would allow the plane to roll to the left?
   a. 
   b. 
   c. 
   d. 

34. A pilot wants to make his airplane bank right. In order to do this he must put
   a. the right aileron up, the left aileron down, the rudder to the right.
   b. the left aileron up, the right aileron down, the rudder to the left.
   c. the right aileron down, the left aileron up, the rudder to the right.
   d. the left aileron down, the right aileron up, the rudder to the left.
35. Which of the following is not a purpose of the fuselage?

a. to hold the wings in place.
b. to enable the airplane to create lift.
c. to increase gravity.
d. to hold the tail in place.

Use the following information to answer question 36.

A

B

36. Which of the following statements is true?

a. Airplane A is more streamlined than airplane B.
b. Airplane B is more streamlined than airplane A.
c. Airplane A will encounter less drag because its nose is flat.
d. Airplane B will encounter more drag because its nose is wider than its tail.

Use the following information to answer question 37.

37. In order to increase thrust on this airplane, you would have to

a. put up the elevators.
b. change to a smaller propeller.
c. lift the ailerons.
d. put more turns on the elastic.
Paul and David did an experiment. They filled a bottle half full with a vinegar and water mixture. Then they added baking soda and quickly placed a cork in the bottle’s neck. They lay the bottle down on row of round pencils. The baking soda reacted with the vinegar to produce a gas. The cork blew out!

Use the information below to answer question 38.

38. Which statement most likely tells what happened next?
   a. The bottle moved sideways.
   b. The bottle moved in the direction of its neck.
   c. The bottle did not move.
   d. The bottle moved in the direction of its base.

Use the information below to answer questions 39 and 40.

Clara and Ida did some research on the Earth’s atmosphere. They found out that the atmosphere has layers. The closer to the Earth, the denser the air. They put some of their findings in a chart.

<table>
<thead>
<tr>
<th>Layer</th>
<th>How Far It Extends from Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>troposphere</td>
<td>10 km</td>
</tr>
<tr>
<td>stratosphere</td>
<td>50 km</td>
</tr>
<tr>
<td>mesosphere</td>
<td>85 km</td>
</tr>
<tr>
<td>thermosphere</td>
<td>500 km</td>
</tr>
</tbody>
</table>

39. From the information above, Clara and Ida can infer that
   a. the farther a spacecraft is from Earth, the less air resistance it will encounter.
   b. the farther a spacecraft is from Earth, the more air resistance it will encounter.
   c. once a spacecraft leaves the stratosphere, it will not encounter air resistance.
   d. once a spacecraft leaves the thermosphere, air resistance will be the greatest.
40. Clara and Ida inferred that once a spacecraft has travelled more than 500 from the Earth’s surface
   a. the Moon’s pull will be greater than the Earth’s pull.
   b. there will no longer be drag on the spacecraft.
   c. the spacecraft must increase its lift in order to move forward.
   d. the spacecraft can only hover.

41. The planet Venus is visible in the night sky because it
   a. it emits light.
   b. reflects light.
   c. refracts light.
   d. is a source of light.

42. Which of the following is not true of the Sun and the stars?
   a. The Sun is a star.
   b. The Sun and stars are sources of light.
   c. The Sun and stars are composed of gases.
   d. Some stars are made up of solids while others, like the Sun, are made of gases.

43. Winter constellations are those that
   a. are not visible during winter.
   b. show winter scenes.
   c. are visible only in winter.
   d. can only be seen in colder climates.

Use the following information to answer questions 44 and 45.

The Big Dipper is a visible all year round. Its position at midnight in March is shown below.
44. Which of the following diagrams illustrates the position of the Big Dipper at midnight in September?

a.  

b.  

c.  

d.  

45. As the days of the year go by, the constellations appear to

a. rotate in a clockwise direction.
b. rotate in a counterclockwise direction.
c. move from east to west.
d. move from west to east.

46. The Sun appears to rise in the east and set in the west because of

a. the rotation of the Earth on its axis.
b. the revolving of the Earth around the Sun.
c. the movement of the Sun around the Earth.
d. the rotation of the Sun on its axis.

47. The Ancient Egyptians and Chinese used these devices to tell time. These devices are called

a. sticks.
b. discs.
c. dials.
d. Ports
Use the following information to answer question 48.

The teacher told her students that it was unsafe to view the Sun without special protection or without using special devices. She showed them how to make one such device where the light passes through a very tiny hole in a box and then projects an inverted image on the opposite side of the box.

48. The device the teacher showed the students how to make was

a. a pinhole camera.
b. number 13 welding goggles.
c. a Polaroid camera.
d. a sun camera.

Use the following information to answer questions 49 and 50.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Length of Shadow</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>500 cm</td>
</tr>
<tr>
<td>09:00</td>
<td>410 cm</td>
</tr>
<tr>
<td>10:00</td>
<td>330 cm</td>
</tr>
<tr>
<td>11:00</td>
<td>260 cm</td>
</tr>
<tr>
<td>12:00</td>
<td>200 cm</td>
</tr>
<tr>
<td>13:00</td>
<td>150 cm</td>
</tr>
<tr>
<td>14:00</td>
<td>200 cm</td>
</tr>
<tr>
<td>15:00</td>
<td>260 cm</td>
</tr>
<tr>
<td>16:00</td>
<td>330 cm</td>
</tr>
<tr>
<td>?</td>
<td>500 cm</td>
</tr>
</tbody>
</table>

49. From the information in the table, at what time will the shadow be 500 cm long?

a. 16:00  
b. 17:00  
c. 18:00  
d. 19:00

50. Shadows change length throughout the course of a day mainly because

a. the Earth revolves around the Sun.  
b. the Moon revolves around the Earth.  
c. the Earth rotates on its axis.  
d. the Sun revolves around the Earth.
Use the following information to answer questions 51 – 53.

The diagrams below illustrate the apparent path of the Sun in the daytime sky in Alberta at four different times of the year. The angle above the horizon that is noted in each diagram represents the approximate angle of the Sun at its highest point in the sky for that time of year.

51. Which of the diagrams shows the apparent path of the Sun in the middle of June?
   a. I
   b. II
   c. III
   d. IV

52. The angle of the Sun above the horizon changes from season to season partly because of the fact that
   a. Earth is tilted on its axis.
   b. Earth is rotating on its axis.
   c. the Sun is rotating on its axis.
   d. the Sun is revolving around Earth.

53. In Alberta, summer is hotter than winter because in summer
   a. the Sun’s rays are shining at a greater slant in Alberta in summer.
   b. the Earth is closer to the Sun in summer than in winter.
   c. the Sun’s rays are shining more directly on Alberta in summer.
   d. the Earth is farther from the Sun in summer than in winter.
The diagram below can be used to explain the phases of the Moon over the period of one month.

54. During the new moon phase the side of the Moon we can see from Earth is

a. in complete shadow.
b. is one half lit.
c. is one quarter lit.
d. is fully lit.

55. The phase marked 6 would be which phase of the moon?

a. waxing crescent
b. waxing gibbous
c. waning crescent
d. waning gibbous
Use the information below to answer question 56.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Distance from the Sun (million kilometres)</th>
<th>Time for Planet to Circle the Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>58</td>
<td>88 days</td>
</tr>
<tr>
<td>Venus</td>
<td>108</td>
<td>225 days</td>
</tr>
<tr>
<td>Earth</td>
<td>150</td>
<td>1 year</td>
</tr>
<tr>
<td>Jupiter</td>
<td>780</td>
<td>12 years</td>
</tr>
<tr>
<td>Uranus</td>
<td>2870</td>
<td>84 years</td>
</tr>
<tr>
<td>Neptune</td>
<td>4500</td>
<td>165 years</td>
</tr>
</tbody>
</table>

56. Mars is 230 000 000 kilometres from the Sun. Which of the following can you conclude would be Mars’ period of revolution?

a. 687 hours  
b. 687 days  
c. 687 years  
d. 687 cm

Use the following information to answer questions 57 and 58.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Approximate Distance from the Sun (million km)</th>
<th>Length of Day (Earth units)</th>
<th>Length of Year (Earth Units)</th>
<th>Diameter (km)</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>58.0 km</td>
<td>58.0 days</td>
<td>88 days</td>
<td>4 878 km</td>
<td>0</td>
</tr>
<tr>
<td>Venus</td>
<td>108.0 km</td>
<td>243.0 days</td>
<td>225 days</td>
<td>12 104 km</td>
<td>0</td>
</tr>
<tr>
<td>Earth</td>
<td>152.0 km</td>
<td>1.0 day</td>
<td>365 days</td>
<td>12 756 km</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>228.0 km</td>
<td>1.0 day</td>
<td>687 days</td>
<td>6 787 km</td>
<td>2</td>
</tr>
<tr>
<td>Jupiter</td>
<td>778.0 km</td>
<td>10.0 hours</td>
<td>12 years</td>
<td>142 800 km</td>
<td>63</td>
</tr>
<tr>
<td>Saturn</td>
<td>1 507.0 km</td>
<td>10.0 hours</td>
<td>30 years</td>
<td>120 000 km</td>
<td>61</td>
</tr>
<tr>
<td>Uranus</td>
<td>2 871.0 km</td>
<td>16.0 hours</td>
<td>84 years</td>
<td>51 118 km</td>
<td>27</td>
</tr>
<tr>
<td>Neptune</td>
<td>5 913.0 km</td>
<td>18.0 hours</td>
<td>248 years</td>
<td>49 528 km</td>
<td>13</td>
</tr>
</tbody>
</table>

57. Which planets have more natural satellites than Neptune?

a. Venus, Jupiter, Uranus.  
b. Mercury, Earth, Mars.  
c. Saturn, Jupiter, Mars.  
d. Uranus, Jupiter, Saturn
58. From the table you can tell that the period of rotation

a. on Venus is greater than on Mars.
b. on Earth is greater than on Mars.
c. on Mars is greater than on Neptune.
d. on Mars is less than on Mercury.

59. What do rockets, space stations, telescopes and space probes have in common?

a. They are all ways that we have gathered information about outer space.
b. They are all Canadian inventions.
c. They are all used to gather rock samples from the planets.
d. They have only been used for the last 100 years.

60. Which of the following are correctly ordered from largest to smallest?

a. Milky Way, universe, solar system, Sun
b. solar system Milky Way, universe, Sun
c. universe, Milky Way, solar system, Sun
d. Sun, solar system, Milky Way, universe

Use the following information to answer questions 61 and 62

The police officer took a picture of the crime scene immediately after the break-in. However, the police officer was suddenly called away from the crime scene to assist with the investigation of a serious accident.

Later that day, the police officer returns to the scene to gather more evidence. On your way home from school, you meet the police officer. This is the scene that you and the officer see.
61. The police officer explains that the footprints will be difficult to use as evidence because
   a. the original footprints have been disturbed too much.
   b. Many of the footprints are not deep enough.
   c. there are too few footprints.
   d. the new footprints are not clear enough.

62. As you look at the evidence, the police officer tells you that the tire tracks can be used to
   a. determine the number of people involved in the break-in.
   b. identify the tires of a suspect's vehicle.
   c. identify the make and model of the vehicle.
   d. pinpoint the exact time of the crime.

Use the information below to answer question 63.

It is a nice warm summer day. You decide to go for a hike. You come across two sets of tracks next to each other going in the same direction. One set looked like it was made by shoes, but the other set resembled those of a coyote. You notice that the length of the stride on both sets of tracks was short.

63. Which of the following could you infer from what you observed?
   a. A man shot and killed a coyote.
   b. A man was running after a coyote.
   c. A man was walking with his dog.
   d. A coyote was chasing a man.

Use the following information to answer question 64.

![weasel tracks]

64. From examining the tracks above, you can infer that the weasel
   a. was walking, then started running.
   b. was jumping, the started running.
   c. was trotting, then started jumping.
   d. was jumping, then started hopping.
The police were called to investigate a break-in at the school. Here is a picture of what they found when they arrived.

65. Which of the following would the police most likely conclude?

a. Two people approached the school from different directions.
b. One person entered the school through the window, but a different person left the school.
c. A person entered the school through the window, then jumped out of the window and walked off.
d. A person entered the school through the window, then jumped out of the window and ran off.

66. The police found a piece of torn cloth at the scene. At which two places would they most likely to find the torn cloth?

a. W and X
b. X and Y
c. Y and Z
d. W and Z
John spotted a set of fresh footprints in the snow. One pair of footprints was much bigger than the other. The length of the stride was also much longer on the larger set. All of a sudden the smaller set of footprints disappeared, but the larger ones got deeper.

Use the following information to answer question 67.

67. From examining the footprints, John could infer that

a. A parent and child were walking. Then the parent started carrying the child.
b. Two friends were walking. Then one friend decided not to continue the walk.
c. A parent and child were walking. Then they began running.
d. A man and child were out walking with their pet dog.

Use the following information to answer question 68.

In Thompsonville, there had been a break in at a farm just outside town. The Thompsonville police had four different suspects. The police chief told one of the officers to take a soil sample from the shoes of each of the suspects.

68. How would the police chief use these soil samples to find out who committed the crime?

a. He would ask each suspect if he had been at the farm where the break-in had occurred.
b. He would take a sample of soil from the break-in site and see if it matched the soil taken from any of the suspects.
c. He would examine each soil sample to see if it matched the soil from each of their homes.
d. He would see if any of the suspects had dirty shoes.
Use the information below to answer question 69.

Joe told his friend Randy to write his name on four separate pieces of filter paper, each using a different black marker. While Joe was out of the room, he friend did as Joe had instructed. Then to Randy’s amazement Joe was able to match the black markers to the names on the different filter papers.

69. Joe told Randy that he was able to match the pens and the names using a method called

a. aromatherapy.
b. paper lithography.
c. paper chromatography.
d. dendrology.

Use the information below to answer question 70.

70. Which of the following correctly labels the fingerprint types?

a. 1 – whorl
   2 – composite
   3 – arch
   4 – loop

b. 1 – arch
   2 – loop
   3 – composite
   4 – whorl

c. 1 – composite
   2 – loop
   3 – arch
   4 – whorl

d. 1 – loop
   2 – arch
   3 – composite
   4 – whorl
Use the following information to answer questions 71 and 72.

Officer O'Reilly takes four fingerprints from each student who visits her display. She makes a graph of the different types of fingerprints and the number of students that have each type.

71. The type of fingerprint that is shared by exactly 18 of the students is the type that this student has on her

a. left thumb
b. left index finger
c. right thumb
d. right pinky finger

72. Officer Reilly could tell the students that a composite fingerprint pattern

a. is the same as the whorl.
b. is the same as the arch.
c. is the same as the loop.
d. is a combination of fingerprint patterns.
73. Fingerprints can help investigators to solve crimes because

a. people who commit crimes usually have certain types of fingerprint patterns.
b. everyone’s fingerprints are unique.
c. all people have the same fingerprint patterns on all their fingers.
d. most criminals wear gloves when committing crimes.

74. Which of the following is true about using fingerprints as evidence?

a. Everyone is fingerprinted when they are born.
b. People are fingerprinted when applying for a driver’s license.
c. Police usually only have fingerprints on file if a person has been arrested.
d. Suspects are not required to have their fingerprints taken.

Use the following information to answer questions 75 and 76.

Officer Dennison was sent to investigate the scene of a home robbery. He reported his findings as follows:

- There were tire tracks at the scene that were not from the homeowners’ vehicles.
- The tire tracks were approximately 10 mm deep.
- The tire tracks were approximately 25 cm wide.
- The road leading up to the home is made of a mixture of brown clay and sand.

Officer Dennison also analyzed the tires from the vehicles of four different suspects. His findings are recorded in the table below.

<table>
<thead>
<tr>
<th>Tires from Suspect 1’s Vehicle</th>
<th>Tread Depth</th>
<th>Tire Colour</th>
<th>Tire Width</th>
<th>Soil in Tread</th>
<th>Tire Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8 – 11 mm</td>
<td>black with white letters</td>
<td>18 cm</td>
<td>dark brown clay, sand, small stones</td>
<td>poor</td>
</tr>
<tr>
<td>Tires from Suspect 2’s Vehicle</td>
<td>7 – 8 mm</td>
<td>all black</td>
<td>28 cm</td>
<td>light brown clay, sand, small stones</td>
<td>good</td>
</tr>
<tr>
<td>Tires from Suspect 3’s Vehicle</td>
<td>8 – 11 mm</td>
<td>all black</td>
<td>25 cm</td>
<td>light brown clay, sand</td>
<td>excellent</td>
</tr>
<tr>
<td>Tires from Suspect 4’s Vehicle</td>
<td>9 – 11 mm</td>
<td>black with white letters</td>
<td>25 cm</td>
<td>dark brown clay, sand, dark soil</td>
<td>good</td>
</tr>
</tbody>
</table>
Science Grade 6 Comprehensive Review I

75. Officer Dennison concluded that the vehicle that was most likely at the crime scene was the one that belonged to

a. suspect 1.
b. suspect 2.
c. suspect 3.
d. suspect 4.

76. Officer Dennison decided he would also like to know more about the whereabouts of one of the other suspects, based on the tire tracks. Which suspect would it most likely be?

a. suspect 1.
b. suspect 2.
c. suspect 3.
d. suspect 4.

Use the following information to answer question 77.

A criminal kidnapped a man and left this ransom note.

I've got the boss. He's free for $6,000,000

The investigators of the crime had each of four suspects write the same sentences that was on the note.

Suspect 1

I've got the boss. He's free for $6,000,000

Suspect 2

I've got the boss. He's free for $6,000,000

Suspect 3

I've got the boss. He's free for $6,000,000

Suspect 4

I've got the boss. He's free for $0,000,000
77. From examining the ransom note and the writing of the four suspects, you can conclude that the person who most likely wrote the ransom note was

a. suspect 1.
b. suspect 2.
c. suspect 3.
d. suspect 4.

78. The study of analyzing handwriting is called

a. chromatography.
b. photography.
c. handology.
d. graphology.

79. Why is it difficult to forge someone else's handwriting?

a. We can never find the same writing instrument.
b. The way we make letters, the slant, and spacing are habits that we have difficulty changing.
c. We leave fingerprints on the paper and on the pen.
d. It is difficult to learn handwriting in the first place.

Use the following information to answer question 80.

A police officer in training went to the scene of a crime with his supervisor. They found a piece of cloth snagged on a nail that was sticking out of a railing. The supervisor instructed the officer in training to write down his observations:

1. Red materials with white dots
2. Stretches 2 – 3 cm
3. Coarse weave
4. Black soil on one section
5. Person needed a shower
6. Threads are very fine.

80. The supervisor said that one of notes the officer in training wrote was not an observation. What was the number of the note?

a. 2
b. 4
c. 6
d. 5
Use the following information to answer question 81.

Jake: In the summer my family and I like to go hiking in the woods. There is nothing like being out in nature where there is peace and quiet and fresh air.

Susie: I work at the local pulp mill. It’s hard work, but the pay is good. A lot of people do not think we should be cutting down trees, but if they stopped to think about how much we rely on trees in our daily lives, they would think differently.

Sam: Our forests should be left untouched. It seems that whenever people come into the picture, they wreck things. The forest ecosystem should be allowed to exist without people messing things up.

Adinna: I own a forestry company. We are a responsible business that employs hundreds of people. For every one tree we harvest, we replant three.

81. The people who most think about forests as a source of jobs are
   a. Jake and Susie.
   b. Susie and Sam.
   c. Sam and Adinna.
   d. Susie and Adinna.

82. Leaf miners, deer, tent caterpillars, and blight affect forests because
   a. they can kill trees.
   b. they improve the health of trees.
   c. they were introduced to forests by people.
   d. they are only found in forested areas.

Use the information below to answer question 83.

- Food
- Shelter
- Protection

83. A heading for the above list could be
   a. How Plants Use Forests
   b. Forests: A Natural Resource
   c. How Forest Animals Threaten Trees
   d. Jobs Forests Provide
84. In the nutrient cycle above, which of the following is missing?

   a. producer  
   b. consumer  
   c. human  
   d. decomposer  

85. In the oxygen cycle, carbon dioxide is produced by respiration and oxygen is produced by ________.

   a. transpiration  
   b. evaporation  
   c. photosynthesis  
   d. condensation  

86. In the water cycle, by which two ways is water released into the air?

   a. evaporation and transpiration  
   b. evaporation and condensation  
   c. condensation and transpiration  
   d. sublimation and condensation
### TYPES OF TREES

<table>
<thead>
<tr>
<th></th>
<th>Deciduous</th>
<th>Coniferous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shedding of leaves</td>
<td>• shed leaves in fall</td>
<td>• shed continuously (Most do not shed leaves in one season.)</td>
</tr>
<tr>
<td>Shape of leaves</td>
<td>• broad-leafed or needle shaped</td>
<td>• needle-shaped leaves</td>
</tr>
<tr>
<td>Water retention</td>
<td>• leaves waxy topside and large surface area on underside, causing moisture loss</td>
<td>• thick, waxy coating reduces water loss from transpiration</td>
</tr>
<tr>
<td>Temperature resistance</td>
<td>• do not withstand temperature extremes</td>
<td>• can withstand temperature extremes</td>
</tr>
<tr>
<td>Seed Production</td>
<td>• mostly flowers and fruit</td>
<td>• cones</td>
</tr>
</tbody>
</table>

87. According to the chart, coniferous trees are more suited than deciduous trees to growing in areas

- where it can be very cold or very hot with only small amounts of precipitation.
- where there is plenty of rain and temperatures are mild.
- there is little soil.
- there is little wildlife.

88. Which of the following does **not** describe a tree?

- a. self-supporting trunk
- b. woody
- c. perennial (grows year after year)
- d. dies down to the soil each year
Use the following information to answer questions 89 – 92.

<table>
<thead>
<tr>
<th>EIGHT COMMON ALBERTA TREES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Aspen poplar</td>
</tr>
<tr>
<td>Black spruce</td>
</tr>
<tr>
<td>Jack pine</td>
</tr>
<tr>
<td>White spruce</td>
</tr>
<tr>
<td>Balsam poplar</td>
</tr>
<tr>
<td>Tamarck</td>
</tr>
<tr>
<td>Lodgepole pine</td>
</tr>
<tr>
<td>White birch</td>
</tr>
</tbody>
</table>

89. According to the chart, the white birch’s leaves are arranged like which of the following?

- [ ] a. balsam poplar
- [ ] b. white birch
- [ ] c. white spruce
- [ ] d. aspen poplar

90. According to the chart, which of the following is **not** a deciduous tree?

- a. balsam poplar
- b. white birch
- c. white spruce
- d. aspen poplar
91. Which of the following most resembles the leaves of the lodgepole pine?

a. 

b. 

c. 

d. 

92. The tree shape that is **not** represented in the trees in the chart is.

a. 

b. 

c. 

d. 

*Use the information in the box to answer questions 93 – 95.*

93. The tree cookie was taken from a tree that was

a. 20 years old.

b. 15 years old.

c. 12 years old.

d. 25 years old.

94. By examining the tree cookie, you can infer that

a. it has been damaged by fire.

b. it was growing near a fence.

c. it was growing very closely to other trees.

d. at one time it grew in period of drought.
95. On the tree ring the

a. lighter coloured wood is the spring and summer growth and the darker coloured wood is the fall and winter growth.
b. lighter coloured wood is the fall and winter growth and the darker coloured wood is the spring and summer growth.
c. lighter coloured wood represents one year’s growth and the darker coloured wood represents another year’s growth.
d. lighter and darker coloured rings tell you that this tree has finished growing.

Examine the tree cookie; then answer question 96.

96. Which of the following could you not infer from the pattern of the rings?

a. The tree grew next to a building.
b. The tree grew on a slope.
c. The tree grew very closely to another tree.
d. The tree lived through a drought.

97. Which of the following tree cookies most likely came from a tree that was damaged by fire?
98. Which of the following is true about how First Nations people traditionally used forests compared with how we use forests today?

a. First Nations people tended to use forests to meet their basic needs more than we do today.
b. First Nations people tended to use forests for recreation more than we do today.
c. First Nations people were less concerned about forest conservation than we are today.
d. First Nations people used more trees than we do today.

Use the following information to answer question 99.

- Water pollution
- Expanding towns and cities
- Insect infestations
- Clearing land for agriculture
- Littering

99. An appropriate heading for the above list would be

a. How We Enhance Our Forests
b. How Nature Affects Forests
c. How Our Forests Are Being Threatened
d. Traditional Uses of Forests

Use the following information to answer question 100.

**Speaker 1:** If we didn’t use clear cutting, the prices of lumber and paper would too high.

**Speaker 2:** When we use clear cutting, animal and bird habitats are destroyed.

**Speaker 3:** Selective cutting allows younger trees to get more sunlight and grow.

**Speaker 4:** Companies that clear cut always plants three or four new trees for every one they harvest.

100. The speakers who are most against the use of harvesting trees through clear cutting are

a. Speakers 1 and 2.
b. Speakers 2 and 3.
c. Speakers 3 and 4.
d. Speakers 1 and 4.
Science Grade Six Comprehensive Review I

Answer Sheet

Name: ________________________________

1. _____  21. _____  41. _____  61. _____  81. _____
2. _____  22. _____  42. _____  62. _____  82. _____
3. _____  23. _____  43. _____  63. _____  83. _____
4. _____  24. _____  44. _____  64. _____  84. _____
5. _____  25. _____  45. _____  65. _____  85. _____
6. _____  26. _____  46. _____  66. _____  86. _____
7. _____  27. _____  47. _____  67. _____  87. _____
8. _____  28. _____  48. _____  68. _____  88. _____
9. _____  29. _____  49. _____  69. _____  89. _____
10. _____ 30. _____  50. _____  70. _____  90. _____
11. _____ 31. _____  51. _____  71. _____  91. _____
12. _____ 32. _____  52. _____  72. _____  92. _____
13. _____ 33. _____  53. _____  73. _____  93. _____
14. _____ 34. _____  54. _____  74. _____  94. _____
15. _____ 35. _____  55. _____  75. _____  95. _____
16. _____ 36. _____  56. _____  76. _____  96. _____
17. _____ 37. _____  57. _____  77. _____  97. _____
18. _____ 38. _____  58. _____  78. _____  98. _____
20. _____ 40. _____  60. _____  80. _____  100. _____
1. c 21. a 41. b 61. a 81. d
2. b 22. b 42. d 62. b 82. a
3. a 23. d 43. c 63. c 83. b
4. c 24. b 44. a 64. c 84. d
5. a 25. d 45. b 65. d 85. c
6. c 26. a 46. a 66. b 86. a
7. a 27. a 47. c 67. a 87. a
8. d 28. c 48. a 68. b 88. d
9. a 29. d 49. c 69. c 89. d
10. a 30. d 50. c 70. b 90. c
11. b 31. c 51. b 71. c 91. c
12. a 32. d 52. a 72. d 92. d
13. d 33. b 53. c 73. b 93. b
14. c 34. a 54. a 74. c 94. d
15. b 35. c 55. b 75. c 95. a
16. d 36. b 56. b 76. d 96. d
17. a 37. d 57. d 77. b 97. b
18. d 38. d 58. c 78. d 98. a
19. c 39. a 59. a 79. b 99. c
20. a 40. b 60. c 80. d 100. b
Comprehensive Review II

Directions: For each question write the letter of the best answer on the answer sheet. DO NOT WRITE IN THIS BOOKLET.

Use the information below to do questions 1 and 2.

Dorothy wanted to demonstrate to her class some of what she has learned about air. She stuffed some damp steel wool into the bottom of a test tube. Then she inverted the test tube into a container of water. She noticed that the water did not go up into the test tube.

After a week, Dorothy noticed that the steel wool had become rusty and that more water had gone up into the test tube.

1. When Dorothy first inverted the test tube into the container of water, the water did not go up into the test tube. This showed that

a. air is invisible.
b. moving air is called wind.
c. air has weight and takes up space.
d. air is composed of many different gases.

2. Later the steel wool became rusty and water went up into the test tube. Why did this happen?

a. The oxygen in the air combined with the iron in the steel wool to form rust. With the oxygen now part of the rust, it was removed from the air in the test tube. The test tube air now took up less room and now there was room for more water in the test tube.
b. The rust made the air in the test tube lighter, so there was less pressure from the air on the water.
c. The oxygen in the air combined with the iron in the steel wool to form rust. The molecules in the air could then become more compressed.
d. The air became heavier in the room, pushing down on the water in the container. This forced water up into the test tube.
3. Which of the following shows what would happen if you put an inflated and an uninflated balloon on a balance scale.

a. 

b. 

c. 

d. 

Use the following information to answer question 4.

Kevin wanted to demonstrate another characteristic of air. To do this, he filled a glass with water until it overflowed slightly. Then he placed a piece of heavy paper on the rim of the glass and pressed down gently to make sure the paper was sealed onto the glass. He firmly held the paper in place and turned the glass over. To the class’s surprise none of the water spilled out. The paper stayed in place.

4. The paper stayed in place because

a. it was actually glued to the rim of the glass.
b. the water was lighter than the air.
c. the paper was sticky.
d. air was pressing up on the paper.

5. When you open a can of pop, the sound you hear is caused by

a. air moving from the room into the can.
b. air moving from the can into the room.
c. the sugar in the pop interacting with the water vapour in the air.
d. the bubbles in the pop combining with the sugar.
6. A bicycle pump can be used to fill an inner tube because
   a. the air pressure inside the inner tube is greater than the air pressure in the pump.
   b. the air pressure created in the pump is greater than the air pressure in the inner tube.
   c. air cannot be compressed.
   d. air expands when it is compressed.

7. What will happen when the girl blows across the top of the paper strip?
   a. The paper strip will stayed down.
   b. The paper strip will fold.
   c. The paper strip will expand.
   d. The paper strip will straighten up.

---

Use the information below to answer question 8.

A Swiss scientist, Daniel Bernoulli, discovered that faster moving air has less air pressure than slower moving air.

---

8. The cross section picture of an airfoil shows how Bernoulli’s discovery gives an airplane
   a. drag.
   b. weight.
   c. lift.
   d. thrust.

---

9. Birds and insects create thrust by
   a. folding their wings.
   b. flapping their wings.
   c. making their wings into an airfoil.
   d. fluffing their feathers and hairs.
10. Which of the following drawings best illustrates streamlining?

a. 

b. 

c. 

d. 

11. Parachutes are designed to

a. increase lift in order to speed up ascent.

b. increase weight in order to decrease the rate of descent.

c. increase thrust in order to speed up ascent.

d. increase air resistance in order to decrease the rate of descent.

12. How are parachute canopies designed so that descent is more controlled?

a. Canopies are round.

b. Canopies are multi-coloured.

c. Canopies have a vent hole.

d. Some are made from canvas.

13. A hot air balloon rises when its envelope is filled with warm air because

a. the warm air inside the envelope is denser than the cooler air outside the envelope.

b. the warm air inside the envelope is less dense than the cooler air outside the envelope.

c. the molecules of the air inside the envelope are closer together than those outside.

d. the molecules outside the envelope are farther apart than those inside the envelope.
Use the information below to answer question 14.

Benjamin attached paper clips to his paper glider. After adding each paper clip, he threw the glider and measured its flight distance.

<table>
<thead>
<tr>
<th>Number of Paper Clips</th>
<th>Flight Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>156 cm</td>
</tr>
<tr>
<td>1</td>
<td>175 cm</td>
</tr>
<tr>
<td>2</td>
<td>200 cm</td>
</tr>
<tr>
<td>3</td>
<td>230 cm</td>
</tr>
<tr>
<td>4</td>
<td>240 cm</td>
</tr>
<tr>
<td>5</td>
<td>140 cm</td>
</tr>
<tr>
<td>6</td>
<td>120 cm</td>
</tr>
<tr>
<td>7</td>
<td>90 cm</td>
</tr>
</tbody>
</table>

14. By examining the information in the table, what can Benjamin conclude?

a. The more paper clips, the longer the flight.
b. The fewer paper clips, the longer the flight.
c. Paper clips do not affect the flight distance.
d. Paper clips affect flight distance.

Use the information below to answer questions 15 – 17.

15. Which of the following must happen before the airplane can accelerate and ascend?

a. Lift must be greater than weight. Thrust must be greater than drag.
b. Drag must be greater than thrust. Lift must be greater than weight.
c. Lift must be less than weight. Thrust must be greater than drag.
d. Thrust must be less than weight. Drag must be less than lift.
16. Which part of the aircraft would the pilot use to roll left or right?

a. 1  
b. 2  
c. 3  
d. 4

17. Which control surface would the pilot use if he wanted the nose to move upward?

a. 1  
b. 2  
c. 3  
d. 4

18. Which part of an airplane is used to keep the aircraft upright?

a. rudder.  
b. horizontal stabilizer  
c. vertical stabilizer  
d. aileron

19. What must a pilot do if he wants his airplane to bank left?

a. Put the right aileron up and the left aileron up  
b. Put the left aileron up, the right aileron down, turn the rudder right.  
c. Put the left aileron down, the right aileron up, and turn the rudder left.  
d. Put the left aileron up, the right aileron down, and turn the rudder left.

20. How are flapping wings, propellers, and jet engines alike?

a. All are used to create lift.  
b. All are used to create thrust.  
c. All are parts of an aircraft.  
d. All are used to keep the aircraft level.

21. The planets, their moons, dwarf planets, asteroids, and comets are alike because they all

a. reflect light.  
b. are sources of light.  
c. refract light.  
d. made of solids.
Use the information below to answer questions 22 and 23.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Distance from Sun (millions of kilometres)</th>
<th>Period of Rotation (Earth units)</th>
<th>Period of Revolution (Earth units)</th>
<th>Diameter (kilometres)</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>57.9</td>
<td>59 days</td>
<td>88 days</td>
<td>4 880</td>
<td>0</td>
</tr>
<tr>
<td>Venus</td>
<td>108.2</td>
<td>243 days</td>
<td>224.7 days</td>
<td>12 100</td>
<td>0</td>
</tr>
<tr>
<td>Earth</td>
<td>149.6</td>
<td>24 hours</td>
<td>365 days</td>
<td>12 756</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>227.9</td>
<td>24 hours</td>
<td>687 days</td>
<td>6 787</td>
<td>2</td>
</tr>
<tr>
<td>Jupiter</td>
<td>778.3</td>
<td>10 hours</td>
<td>12 years</td>
<td>143 200</td>
<td>63</td>
</tr>
<tr>
<td>Saturn</td>
<td>1 427</td>
<td>11 hours</td>
<td>29 years</td>
<td>120 000</td>
<td>61</td>
</tr>
<tr>
<td>Uranus</td>
<td>2 871</td>
<td>17 hours</td>
<td>84 years</td>
<td>51 800</td>
<td>27</td>
</tr>
<tr>
<td>Neptune</td>
<td>4 497</td>
<td>16 hours</td>
<td>165 years</td>
<td>49 528</td>
<td>13</td>
</tr>
</tbody>
</table>

22. Which planet has more natural satellites than Saturn?
   a. Neptune
   b. Earth
   c. Jupiter
   d. Mars

23. From the table above you can tell that
   a. the closer a planet is to the Sun, the shorter is its day.
   b. the farther a planet is from the Sun, the more moons it has.
   c. the closer a planet is to the Sun, the shorter is its year.
   d. the farther a planet is from the Sun, the shorter is its year.
Use the information below to answer questions 26 and 27.

<table>
<thead>
<tr>
<th>Time of Year</th>
<th>Length of Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 21</td>
<td>12 h</td>
</tr>
<tr>
<td>May 1</td>
<td>14 h</td>
</tr>
<tr>
<td>June 21</td>
<td>16 h</td>
</tr>
<tr>
<td>August 1</td>
<td>14 h</td>
</tr>
<tr>
<td>September 21</td>
<td>12 h</td>
</tr>
<tr>
<td>November 1</td>
<td>10 hours</td>
</tr>
<tr>
<td>December 21</td>
<td>8 hours</td>
</tr>
<tr>
<td>February 1</td>
<td>10 hours</td>
</tr>
</tbody>
</table>

26. One reason the length of day varies throughout the year is because
   a. Earth is tilted.
   b. Earth rotates.
   c. the Sun revolves.
   d. the Moon revolves around the Earth.

27. In Alberta the nights are longest when
   a. the North Pole is pointing away from the Sun.
   b. the North Pole is pointing toward the Sun.
   c. the Sun is shining directly on the equator.
   d. the South Pole is pointing away from the Sun.

28. In Alberta the seasons are due to
   a. the rotation of Earth on its axis.
   b. the revolving of Earth around the Sun.
   c. the tilting of Earth as it rotates.
   d. Both the revolving of the Earth around the Sun and the tilting of Earth as it rotates.
Use the information below to answer question 24.

Cassiopeia – December

24. Which of the following shows the constellation Cassiopeia in September?

   a. 
   b. 
   c. 
   d. 

25. The length of shadows varies depending on the time of day because

   a. Earth revolves around the Sun.
   b. Earth is tilted.
   c. Earth rotates on its axis.
   d. the Sun orbits Earth.
Use the information below to answer question 29.

The class at Huttervale Colony made a sundial. They recorded the length of the shadow cast by the sundial at various times of the day.

<table>
<thead>
<tr>
<th>Time</th>
<th>Length of Shadow</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 a.m.</td>
<td>100 cm</td>
</tr>
<tr>
<td>10:00 a.m.</td>
<td>120 cm</td>
</tr>
<tr>
<td>11:00 a.m.</td>
<td>140 cm</td>
</tr>
<tr>
<td>12:00 noon</td>
<td>160 cm</td>
</tr>
<tr>
<td>1:00 p.m.</td>
<td>170 cm</td>
</tr>
<tr>
<td>2:00 p.m.</td>
<td>160 cm</td>
</tr>
<tr>
<td>3:00 p.m.</td>
<td>140 cm</td>
</tr>
<tr>
<td>4:00 p.m.</td>
<td>?</td>
</tr>
</tbody>
</table>

29. The class did not take a measurement at 4:00 p.m. because they were out of English School. The teacher told them they could infer that the sundial’s shadow would be

a. 160 cm.
b. 100 cm.
c. 190 cm.
d. 120 cm.

30. Examine the diagram of the moon rotating around the Earth. At which position will people on Earth see the waning gibbous phase?

![Diagram of the moon rotating around the Earth]

a. A
b. B
c. C
d. D

MOON ROTATING AROUND THE EARTH
Use the information below to answer question 31.

31. You can infer that the animal that left the tracks

a. digs in the soil.
   b. is a good swimmer.
   c. can float.
   d. eats grass.

Use the information below to answer question 32.

The police were sent to investigate a robbery at a farm just south of town. They found fresh footprints in the dirt and the back door had been damaged. They determined that there were two sets of footprints – one leading to the back door of the house, but two leading away from the house through the back door. The footprints ended at some tire tracks.

32. What inference might the police be able to make from examining the footprints.

a. Two thieves broke into the house and stole the goods.
   b. One person broke into the house and stole the goods.
   c. A person broke into the house and kidnapped someone.
   d. The person who broke into the house lived in the house.

33. Which of the following can you not infer by measuring the length of a person's stride?

a. The longer the stride, the taller the person.
   b. The longer the stride, the faster the person is running.
   c. The longer the stride, the longer a person's feet will likely be.
   d. The longer the stride, the larger the person's waist.
A crime detective spent an afternoon investigating the scene of a kidnapping. Following is a list of evidence she found:

- Fingerprints on the kitchen table
- Pay a million and he’s yours 555-9160
- Note left on kitchen table, written with a felt marker
- Piece of torn cloth on bushes outside home:
  - yellow
  - nylon
  - black grease stain
- Dried mud on kitchen floor:
  - brown clay and small stones
  - does not match soil in the yard.

After 48 hours, the detective had four suspects in custody.

34. The detective noted that the two fingerprints were

a. an arch and a whorl.
b. a composite and an arch.
c. a loop and an arch.
d. a whorl and a loop.

35. The detective gathered a sample of the dirt on the kitchen floor. What will she do next?

a. sweep it up so that she does not leave a mess behind.
b. take samples of the dirt from each of the suspects’ shoes.
c. toss it out in the yard.
d. leave it at the house.
36. Which of the following suspects appears to have written the note?

a. Pay a million and he's yours 555-9160
b. Pay a million and he's yours 555-9160

c. Pay a million and he's yours! 555-9160

d. Pay a million and he's yours 555-9160

37. After trying to match the handwriting, the detective will send the note to get the ink analyzed. The person who will do the analysis will do this type of test.

a. chromatography
b. graphology
c. toxicology
d. biology

38. The detective searched each of the suspects' clothing. According to the lists of what she found, which suspect is most likely to be the one who tore his clothing on the bush?

a. Suspect A
   - yellow nylon jacket
   - good condition

b. Suspect B
   - red nylon pants
   - small tear
   - dirty

c. Suspect C
   - yellow nylon jacket
   - grease stain

d. Suspect D
   - yellow nylon pants
   - large tear
   - recently laundered
39. Although the detective is fairly certain as to which suspect did the kidnapping, she decides that a fingerprint match will give her the evidence she needs to make a conviction. Why does the detective want the fingerprint test done?

a. No two people have the same fingerprints.
b. Fingerprints are easy to lift.
c. Criminal have the same types of fingerprints.
d. People with loop patterns are more likely to kidnap than other people.

Use the following information to answer question 40.

The detective found that the tracks left at the scene of the kidnapping matched the tires of one of the suspects. The detective’s supervisor said that this alone was not enough evidence to arrest the person.

40. Why did the supervisor tell the detective that matching a suspect’s tires with the tire tracks at the crime scene was not enough evidence for an arrest?

a. Most vehicles do not leave tire tracks.
b. Many people would own the same type of tires.
c. Matching tire tracks is not evidence that the police use.
d. The supervisor probably had not heard of matching tire tracks as evidence.

Use the following information to answer question 41.

<table>
<thead>
<tr>
<th>Speaker A</th>
<th>I am a cabinet maker. I need trees to make furniture and kitchen cupboards.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker B</td>
<td>There is nothing a like nice long walk through the forest to make a good day into a fantastic day.</td>
</tr>
<tr>
<td>Speaker C</td>
<td>We should leave our forests to nature’s creatures. It’s their home.</td>
</tr>
<tr>
<td>Speaker D</td>
<td>I’m the publisher of a newspaper. We used tonnes of newsprint each and every day.</td>
</tr>
</tbody>
</table>

41. Which people see forests as valuable for the resources we take from them?

a. Speakers A and B
b. Speakers B and C
c. Speakers C and D
d. Speakers A and D
Use the following information to answer questions 42 and 43.

42. In the dichotomous key above what would go in the box numbered 4?

a. herbaceous plants  
b. Alberta  
c. forests  
d. coniferous

43. The name of an organism that could go in the box numbered 5 is

a. mushroom.  
b. woodpecker.  
c. tent caterpillar.  
d. deer.

44. The two main process involved in the oxygen cycle are

a. hydration and condensation.  
b. transpiration and evaporation.  
c. photosynthesis and respiration.  
d. evaporation and transpiration.
Use the following information to answer question 45.

Scaly yellowish-brown bark
Needle clusters of 2
Oval shape
Yellowish-brown cone
Sheds leaves continually

45. The tree described above is
   a. deciduous.
   b. coniferous.
   c. coniferous and deciduous.
   d. broad-leafed.

Use the information below to answer question 46.

46. Which of the following best describes the leaf?
   a. compound, oval, basal, smooth
   b. simple, cordate, alternate, smooth
   c. simple, ovate, opposite, fine-toothed
   d. compound, ovate, opposite, fine-toothed

Use the following information to answer questions 47 and 48.
47. Which of the following could you **not** infer from examining the tree cookie?

   a. It suffered from lack of nutrients for several years.
   b. It was damaged by fire.
   c. It suffered insect damage.
   d. One of its branches was broken off.

48. The tree cookie was cut from a tree that was how old?

   a. 12 years
   b. 24 years
   c. 15 years
   d. 17 years

*Use the following information to answer question 49.*

Annette and Simon wanted to conduct a fair test to see which type of tree seed would germinate more quickly, a balsam fir or white birch. They planted five seeds of each type in two identical pots filled with the same amount and type of soil. They were sure to put both pots in the same sunny location in their yard. They checked the seeds daily and recorded when each of the seed germinated.

49. In the fair test conducted by Annette and Simon, the responding variable was

   a. the type of tree.
   b. the amount of soil.
   c. the location.
   d. the germination time.

*Use the following information to answer question 50.*

Loss of habitat for birds and animals
Soil erosion
Loss of windbreak

50. Which of the following is true.

   a. The above lists advantages of clear cutting.
   b. The above lists advantages of selective cutting.
   c. The above lists disadvantages of clear cutting.
   d. The above lists disadvantages of selective cutting.
Science Grade Six Comprehensive Review II

Answer Sheet

1. c  18. c  35. b
2. d  19. d  36. d
3. a  20. b
4. c  21. a
5. d  22. c  37. a  38. d
6. b  23. c  39. a
7. a  24. a  40. b  41. d
8. a  25. a  42. a
9. b  26. d  27. c  43. c
10. c  28. c  44. b  45. b  46. d
11. b  29. d
12. d  30. d
13. a  31. a
14. a  32. c
15. d  33. d
16. c  34. c
17. d

18. c  35. b
19. d  36. d
20. b
21. a
22. c
23. c
24. a
25. a
26. d
27. c
28. c
29. d
30. d
31. a
32. c
33. d
34. c
35. b
36. d
37. a
38. d
39. a
40. b
41. d
42. a
43. c
44. b
45. b
46. d
47. a
48. a
49. d
50. c
Topic A
Air and Aerodynamics

Air is the mixture of gases that surrounds the Earth. Air is also referred to as atmosphere.

Aerodynamics is the study of air when it moves.

**Process Skills**

**Observation**
Observation involves getting information by using your senses. An expert observer must not only think about the whole picture, but all the little details. Although much observation uses your sense of sight, depending on the situation, your other senses can play an important role. Observation is an important skill in science because all the other thinking skills we use are based on observations.

**Inference**
Inferences are ideas or conclusions we make based on observations. For example, you might observe that someone has on a heavy coat and fleece-lined boots. You would infer that the person is cold. You could further infer that it is winter. Much of what we learn about air and aerodynamics is based on inference. This is because in its purest form, air is invisible, tasteless, and odourless, making it difficult to observe.

**Knowledge Skills**

Main Idea A: Air takes up space and exerts pressure.

1. **Air Takes Up Space.** Because air is invisible, we do not always think of it as taking up space. We can tell it does by observing and then inferring.

When you fill an empty plastic garbage bag with air, it bulges out. Air is trapped in the bag. It is taking up space.

If you stuff a paper towel into the bottom of a glass and then invert it into a container of water. The water does not rise up into the glass. That is because air is taking up space in the glass.
2. **Air Exerts Pressure.** Air presses on all sides of objects. It presses up, down, and sideways. Again, because air is invisible, we must observe and then infer that this is the case.

   ![Diagram of air pressure pushing together](image)

   *If you run water over the backs of two spoons, air presses the spoons together.*

**Main Idea B:** Air is fluid and capable of being compressed.

1. **Air Is Fluid.** This means that air can easily move from one place to another. It also takes the shape of the container it is filling. Wind is moving air — it is air moving from one place to another.

2. **Air Can Be Compressed.** When you compress something, you make it take up less space. When you blow up a balloon or pump air into a soccer ball, the air inside the balloon and soccer ball is compressed. The molecules of air are forced to take up less space when air is compressed. The air pressure increases when you compress it. Air pressure always wants to **equalize.** If you attach two containers with different air pressure, some of the air molecules in the container with the higher pressure will always move to the container with lower pressure until the pressure in both containers is equal.

   ![Diagram of air pressure](image)

   *Air molecules will continue to move from the inflated soccer ball to the plastic bag until the air pressure in the soccer ball and bag are equal.*

**Main Idea C:** Faster moving air exerts less air pressure than slower moving air.

Daniel Bernoulli was a Swiss scientist who made this discovery. We use this principle to explain many things in our lives and to make devices that will help us in our lives.

During tornadoes and hurricanes, the winds blow extremely hard. If a building is equipped with regular windows, the windows will break, blowing out. That is because the air pressure during high winds drops drastically, making the air pressure outside the building so much lower than the air pressure inside the building that the windows break.

(continued)
Main Idea C (continued)

Engineers discovered that a shape called an airfoil can make air going over one side travel faster than on the other side. An airfoil has a curved leading edge. They found that the air going over the rounded side travels faster than the air travelling over the flat side. This made the air travelling over the flat side have greater air pressure than that travelling over the rounded side.

Race cars are designed with a rear spoiler. The idea of the spoiler is to get air to press down on the spoiler so that the car can get more traction.

Airplane wings are designed so that they can help the airplane get off the ground and ascend. The rounded part is on the top and the flat part is on the bottom. This means that the faster moving air travels over the top, resulting in greater air pressure pushing up from the bottom.

Main Idea D: In order for aircraft to fly, lift must be greater than weight (gravity).

All aircraft are designed so that they can ascend or go higher. Most do this with some kind of airfoil. The force that makes an object go higher is called lift. In order to fly, the lift created by the airfoil must be greater than the weight of the aircraft itself.

For an airplane to fly, lift must be greater than gravity.

Rockets get lift by forcing air downward. This makes the rocket go upward. The force created by the downward air must be greater than the weight of the rocket or the rocket will not take off.

Assignment:

Do Worksheets #6A.Review.1a, #6A.Review.1b, #6A.Review.1c, and #6A.Review.1d.
Main Idea E: Birds and insects have adaptations that enable them to fly.

In nature adaptations refer to the way parts of an animal or plant designed so that they can do certain things to survive. Birds and insects that can fly can do things or have body parts that enable them to take flight.

Birds
- Streamlined body
- Wings curved on top and flat on the bottom
- Powerful chest muscles flap the wings up and down
- Tail can be used for steering
- Bones have many hollow spaces, making the bird lighter.

Insects
- Small and lightweight
- Wings are thin and take on a curved shape once they beat them in the air.
- Have specialized flight muscles to power their wings
- Some insects have two sets of wings. This enables them to make a bigger surface to push against the air.

Main Idea F: There are several different ways for flying animals and aircraft to propel themselves forward.

When flying animals and aircraft propel themselves forward, it means they push themselves forward. Thrust is the force that enables flying animals and aircraft to go forward.

Flying Animals. Basically it is the flapping of the wings that provide thrust for birds and insects.

Aircraft. Humans have invented several ways for aircraft to get thrust:

1. **propellers** – Propellers are long thin blades that are curved in such as way as to provide thrust. Propellers are turned by engines. Helicopters have two sets of propellers. One set helps to provide lift and the other set helps to provide thrust. Propellered airplanes have one or more sets of propellers.

2. **jet engines** – Jet engines provide thrust by pushing air out their rear end. The air pushing backward propels the jet forward. This works much like attaching an inflated balloon to a string and letting the air out. The air speeds out the back, making the balloon move forward along the string.
3. **rocket thrusters** — During the blast off phase, rocket fuel is ignited causing a sudden increase in the temperature of the air. This causes the air to expand quickly and is blast down toward the ground. The result is the rocket pushes up in the opposite direction. The blast of downward air gives the rocket enough lift to launch right through the atmosphere.

4. **elastic bands** — some toy airplanes use an elastic band to propel themselves forward. The elastic band is attached to a propeller. The elastic is twisted many times. When it untwists, it turns the propeller, which gives the airplane thrust.

![Image of airplane with elastic band](image)

**Main Idea G:** Streamlining reduces drag.

**Streamlining** refers to designing the body of an aircraft or vehicle so that the amount of air resistance is reduced. Air resistance is also referred to as **drag**. If you have ever run into the wind, you know that it is much more difficult than when there is no wind. The force you feel going against you is air resistance or drag.

Designers of motor vehicles and airplanes try to design the bodies so that the amount of drag they face is reduced as much as possible. To get ideas, they examined the bodies of birds. They noticed that the heads are smaller and rounder, then got a little bigger and finally tapered off to almost a point. They used many of these ideas when designing cars and airplanes. Streamlining helps vehicles to go faster and be more fuel efficient.

![Image of streamlined train and streamlined car](images)

This jet can carry close to 600 passengers. The fuselage is two storeys high. Notice it streamlined design.

This two-passenger car was built for speed. It was built many decades ago.
Main Idea H: Air is composed of different gases.

Air is composed of many different gases, but two of them make up more than 98%. They are nitrogen and oxygen. Other gases in the air include argon, carbon dioxide, neon, and helium.

1. Gases in the Air. The following table and circle graph show air’s composition.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>78.09%</td>
</tr>
<tr>
<td>Oxygen</td>
<td>20.9%</td>
</tr>
<tr>
<td>Argon</td>
<td>0.93%</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.04%</td>
</tr>
<tr>
<td>Neon</td>
<td>0.0018%</td>
</tr>
<tr>
<td>Helium</td>
<td>0.0005%</td>
</tr>
<tr>
<td>Krypton</td>
<td>0.0001%</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>0.00005%</td>
</tr>
<tr>
<td>Xenon</td>
<td>0.000008%</td>
</tr>
</tbody>
</table>

A circle graph (also called pie chart) is a good way to show the components of a whole thing because you can easily see how big a particular component is compared to the other components.
2. **Identifying Evidence of Different Gases.** The gases that make air are invisible. For this reason we must infer they are present by looking for evidence.

*Oxygen.* Oxygen is the most important gas for all animals, including humans. Oxygen is the gas that our body takes from the air we breathe in. We know that oxygen combines easily with other elements. One of them is iron. When it does, it forms iron oxide or rust.

If you stuff some moistened steel wool into a test tube and then invert it over a container of water, you will notice that the water does not go up the test tube. This is because the air in the test tube is occupying the space. But if you leave the test tube for a while, you will see that the oxygen from test tube air has combined with the iron in the steel wool to form rust. Not only that, but the water level in the test tube has gone up. This is because there is now less oxygen in the test tube air, leaving room for more water to go up into the test tube.

![Diagram of test tube experiment](image)

**Carbon Dioxide.** Scientists tell us that carbon dioxide does not support burning. It is also a heavy gas and will settle to the bottom if air in a room is still. You can make carbon dioxide by combining vinegar and baking soda. To show that carbon dioxide does not support burning, place a jar with a vinegar and baking soda mixture at one end of a shallow box. Place a short lit candle at the other end. The carbon dioxide produced by the vinegar-baking soda mixture will drift over the candle. (The sides of the box will keep the carbon dioxide from drifting out of the box.) The candle will go out. You will not be able to see the carbon dioxide, but you can infer that it is there because it puts the candle out.

![Diagram of carbon dioxide experiment](image)

**Assignment:**

Do Worksheets #6A.Review1e, #6A.Review1f, #6A.Review1g, and #6A.Review1h.
Process Skills

Tables and Charts

Tables and charts are used to record information. They are most valuable when you want to show facts in an organized fashion. They are important when you want to get information “at a glance”.

Charts can be used to display a wide variety of information. They usually involve words and phrases and often graphics and pictures.

In science we use tables and charts a lot. They save space and are much less work than writing out sentences.

Fair Tests

When we want to find out if changing one thing will make a difference in how things turn out, we use a fair test. In a fair test, you can change only one factor at a time, while keeping all the other conditions the same.

Let’s say you wanted to find out which of two different toy cars goes down a ramp the fastest. If you gave one of the cars a push and not the other, the test wouldn’t be fair; or if you tested one car on a steeper slope than the other, it wouldn’t be fair either. There can only be one difference between the two – in this case, it is the type of car. How will you know which is faster? Simple, the one that made it down the ramp first.

In science we give all the factors a special name. They are called variables. Not only that, we give each of the variables special names too.

Parts of a Fair Test

Question: This is what we want to find out. Example: Which bean plant will grow taller, one in sunlight or one in complete darkness?

Hypothesis: This is a statement that tells what you think the answer to your question is. Example: I think the bean plant kept in sunlight will grow taller than one kept in the dark.
Materials: This is a list of all the things you will need to conduct your fair test.

Manipulated Variable: One factor you are going to change. (sunlight or darkness)

Constant Variables: Factors you will keep the same (original height of plant, type of plant, size of pot, type of soil, amount of water, temperature, and on)

Responding Variable: How you will measure the difference that changing the one factor (manipulated variable) made.

Observations: Sentences and charts, graphs, or tables that record what you observed.

Conclusion: A statement that answers the question.

**Knowledge Skills**

**Main Idea A:** Parachutes are devices that are designed to use air resistance to decrease the rate of descent.

Parachutes are floaters. This means that when in a parachute it is basically the force of gravity that determines where you will end up. That place is always at a lower height (elevation or altitude) than where you started out. Although modern parachutes allow the parachutist to have some control about the descent, the parachutist cannot significantly make the parachute ascend or go forward or backward. Most parachutes are designed to drop people, but some are used to drop parcels that contain food, medicines, and other items to people in isolated areas.

1. **Parts of a Parachute**

*Canopy* – The canopy is folded and stored on the parachutist’s back until he or she jumps out of the airplane. The parachutist then pulls a cord which allows the canopy to unfold.

*Payload* – This is the weight that brings the parachute down to the Earth’s surface. It is the parachutist or some other kind of load.

*Suspension Lines* – They connect the canopy to the payload.

*Steering Lines* – Steering lines help give the parachutist some control over the shape the canopy takes. The canopy’s shape can change the drop of the parachute a little. (Note: Parachutes used to drop parcels do not have steering lines.)

![Diagram of a parachute](image)
2. How Parachutes Work. The main purpose of a parachute is to slow the rate of
descent. A parachute works on the idea that the larger and flatter the surface area of a
falling object, the more air resistance or drag, it will encounter. Air resistance causes
an object to fall more slowly.

It is mostly the canopy that meets with the greatest air resistance. The canopy is most often made with
a lightweight nylon material. Nylon fabric is fairly thin and lightweight, but it is very strong. It can be
folded up into a small bundle and stored on the parachutist’s back until the parachutist pulls the
“rip cord”. This causes the canopy to unfold.

Some parachutes have a pilot chute which inflates
as soon as the pilot leaves the airplane. The force
of the pilot chute opening is enough to cause the
main canopy to open up. In this case, there is no
need for a rip cord to open up the main chute.

So it is the force of gravity that pulls the parachutist down toward the Earth. It is the
resistance of the air against the canopy that slows the parachutist’s descent.

3. Design Changes to Improve Control. Designers of parachutes have done several
things to make them more effective. Three of them are

Vent Holes. Vent holes are small openings in the centre of the canopy. With regular
canopies, the air tends to drift out one side of the parachute, then the other, causing the
payload to swing back and forth. The vent hole makes the parachute more stable,
dropping more vertically.

Rectangular Canopies. The first parachute canopies were round, fast, and could drift,
especially when there was a breeze. Rectangular parachutes have a greater forward
speed than round parachutes and so are not easily blown backward when they
encounter wind. They also descend more slowly.

Steering Lines. With steering lines, the parachutists can change slightly the shape of
the canopy. This enables the parachutists to turn right or left. He can also use the
steering lines to pull down the back edge of the canopy to slow the parachute’s motion
and allow for a soft landing.
Main Idea B: Hot air balloons are devices that enable their pilots to ascend or descend.

Hot air balloons are type of glider. They do not have a way to propel themselves forward. The wind basically determines the direction they travel. Hot air balloons can ascend or descend, however.

1. **Parts of a Hot Air Balloon**

   **Envelope** (or Bag) – This is the large ball-like part of the hot air balloon. It is what inflates and keeps the balloon in the air. It is usually made of nylon or polyester.

   **Payload** – consists of the pilot, the passengers, the basket, equipment and supplies.

   **Rigging Wires** – hold the basket to the balloon envelope.

   **Rip Panel** – This is a hole at the top of the bag. It is opened using the rip cord. The cooling vent is a slit near the top of the bag and is used when the pilot wants to make a quick descent.

2. **How a Hot Air Balloon Works**

   It is possible for hot air balloons to rise because the air inside the envelope is less dense and therefore lighter than the air outside the envelope. This difference in density gives the balloon lift and lets the balloon float in the air. Propane gas burners, mounted under the envelope, heat the air. To keep the balloon aloft, a blast from the burners is given every thirty seconds.
HOW HOT-AIR BALLOONS WORK

Air that has been heated by the hot flames of a gas burner rises and collects in the balloon.

1. When the air inside the balloon is hot, it gives enough lift to overcome the balloon's weight. The balloon rises from the ground and soars into the sky.

2. As it rises, the hot air in the balloon begins to cool and the lift gets weaker. When the lift equals the balloon's weight, the balloon stops rising and floats at the same height in the air.

3. As the hot air cools further, the lift becomes less than the balloon's weight. The balloon begins to sink.

4. To keep the balloon flying, the pilot turns the burner on again. Short bursts of flame keep the air inside hot. The lift stays strong enough to keep the balloon from sinking.

5. To descend, a valve at the top of the balloon opens to release the hot air. Cold air replaces the hot air. The balloon becomes heavier and is able to descend and land.
Main Idea C: Gliders can be modified to improve their flight.

A glider is an airplane that has no means of its own to get thrust. The person who throws the plane provides the thrust. They always end up at a lower altitude than the altitude from where they were launched. In grade six science we use paper airplanes to try out different ways to control flight.

Make the “Super Flyer” below. Test it out. Then try to modify the way it flies by making changes to the nose, the tail, the wings and the wing flaps.

Assignment:
Do Worksheets #6B.Review.2a, #6B.Review.2b, and #6B.Review.2c, and #6A.Review.2d
Main Idea D: Four forces act on aircraft.

Airplanes and helicopters are flyers. A flyer’s pilot can make an aircraft go up, go down, speed up, and slow down. The four forces that act on an aircraft are

*lift* – makes it **ascend** or rise up

*weight* – makes it **descend** or go down. It is the pull of gravity that gives an object weight.

*thrust* – makes it **accelerate** or speed up

*drag* – makes it **decelerate** or slow down.

If lift is greater than weight, the aircraft will ascend.

If weight is greater than lift, the aircraft will descend.

If thrust is greater than drag, the aircraft will accelerate.

If drag is greater than thrust, the aircraft will decelerate.

If lift is equal to weight, and thrust is equal to drag, the aircraft will **hover**. Some birds like hummingbirds can hover. Of the aircraft invented by humans only helicopters can hover.

Creating Lift and Thrust

Airplanes use **wings** in the shape of an **airfoil** to create lift. Helicopters use **propellers** to create lift. Birds and insects make their **wings** into the shape of an **airfoil** to create lift.

Airplanes use **propellers** or **jet engines** to create thrust. Helicopters use **propellers** to create thrust.
Main Idea E: Airplanes are designed so that its movements can be controlled.

1. Parts of an Airplane

**fuselage** – This is the main body of the airplane.

**wings** – Wings are in the shape of an airfoil.

**ailerons** – flaps on the trailing edge of the wings

**horizontal stabilizers** – the little “wings” on the tail

**elevators** – flaps on the trailing edges of the horizontal stabilizers

**rudder** – flap on the trailing edge of the vertical stabilizer

**propeller(s)** – can be found on the airplane’s nose, under its wings, or by the tail

**jet engines** – usually attached to the bottom of the wings or on either side of the tail
2. **Basic Movements of an Airplane**

An airplane can perform three basic movements.

**yaw** – moving the nose of the airplane left or right. This move helps to make an airplane turn.

**pitch** – pointing the nose up or down. This move helps to make an airplane ascend or descend.

**roll** – dipping the left or right wing. This move helps the airplane to turn as well.

**bank** – turn an airplane. It involves **yawing** and **rolling** at the same time.
3. Functions of an Airplane’s Fixed Parts

An airplane’s fixed parts are the parts that the pilot cannot move. Even though they cannot be moved, they perform important functions.

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>fuselage</td>
<td>• holds the pilot, passengers, and cargo</td>
</tr>
<tr>
<td></td>
<td>• wings, tail, and sometimes engines are attached to it</td>
</tr>
<tr>
<td>horizontal stabilizers</td>
<td>• keep the airplane flying level</td>
</tr>
<tr>
<td>vertical stabilizer</td>
<td>• keep the airplane flying upright</td>
</tr>
<tr>
<td>wings</td>
<td>• airfoil design helps give the airplane lift</td>
</tr>
<tr>
<td>cockpit</td>
<td>• part of the fuselage where the pilot(s) sit</td>
</tr>
</tbody>
</table>
4. **Functions of the Movable Parts.**

Movable parts are those parts that the pilot can adjust to make the airplane move the way he or she wants it to move. They are often referred to as **control surfaces.**

![Diagram of an airplane showing parts labeled: rudder, elevator, horizontal stabilizer, and ailerons.]

<table>
<thead>
<tr>
<th>Part(s)</th>
<th>Function when it is used</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>ailerons</td>
<td>• used to roll the airplane</td>
<td>• to roll left, put the left aileron up and the right one down</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• to roll right, put the right aileron up and the left one down</td>
</tr>
<tr>
<td>elevators</td>
<td>• used to pitch the airplane</td>
<td>• to pitch up, raise the elevators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• to pitch down, put the elevators down</td>
</tr>
<tr>
<td>rudder</td>
<td>• used to yaw the airplane</td>
<td>• to yaw left, turn the rudder left</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• to yaw right, turn the rudder right</td>
</tr>
<tr>
<td>propellers and jets</td>
<td>• used to give the airplane thrust</td>
<td>• to accelerate, make them turn faster</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• to decelerate, make them turn more slowly</td>
</tr>
</tbody>
</table>

**How does a pilot turn an airplane?**

To turn an airplane, the pilot must do what is called **banking.** Banking involves two things: rolling and yawing.
- To bank right, the pilot must put the right aileron up, the left aileron down, and turn the rudder to the right.
- To bank left, the pilot must put the left aileron up, the right aileron down, and turn the rudder to the left.
How do flaps work?

The ailerons, elevators, and rudder are all flaps that are part of fixed parts of an airplane. When they are in their “at rest” positions, they are simply help the fixed parts do their jobs. When they are out of their at rest positions, they stick out from the fixed parts. Then they encounter more air resistance or drag. This creates a change in the movement of the airplane. For example when the elevators are in the “up” position, there is greater drag over the horizontal stabilizers compared to under the horizontal stabilizers. This causes the nose of the airplane to pitch upward because the air is meeting more resistance over the horizontal stabilizers than under the horizontal stabilizers.
How do propellers and jet engines provide thrust?

Propellers and jets both provide an airplane with thrust based on the idea that if air is forced out in one direction, the aircraft will move in the opposite direction. How the air is forced out is different for propellers and jets.

**Propellers.** Propellers are made up of two or more blades that are shaped in a special way. They are designed to speed up the flow of air and direct it behind the propellers. When this happens, it propels the aircraft forward.

This fan is designed to take air in from the back and force it out the front. In this illustration, the fan will move backward – the opposite direction from the exiting air. Airplane propellers take air in from the front and force it to exit behind the propellers. This thrusts the airplane forward.

**Jets.** Jet engines have blades called rotors. The job of the rotors is to speed up the airflow that comes into the engine. Inside the engine the air is compressed. The compressed air is then ignited, causing the gas to expand rapidly. This rapidly expanding gas is directed out the back of the jet, propelling the airplane forward.

Jet engines work like this balloon. Inside the balloon there is compressed air. When the compressed air tries to escape from the balloon out its neck, the balloon moves forward in the opposite direction.

**Assignment:** Do Worksheets #6B.Review.2e, #6B.Review.2f, #6B.Review.2g, and #6B.Review.2h
Celestial or Heavenly Bodies are any natural objects found in space. Our Earth and Moon, the Sun, the stars, and planets are amongst those objects we called celestial or heavenly bodies.

There are several objects now out in space that were placed there by humans. The Space Station and telecommunications satellites are examples of objects out in space that were made by humans. These are usually not considered to be heavenly bodies.

**GRAPHS**

We use graphs to record information. They are especially useful when we want a visual picture of the information. This enables us to make comparisons or notice any patterns. Almost any information from a table can be displayed as a graph.

**Bar Graphs, Line Graphs, and Circle Graphs**

Some students are not always sure whether it is better to display information on a bar graph, a line graph, or a circle graph. There are really no hard and fast rules, but following are some guidelines.

**Bar Graph.** Bar graphs are usually used when you want to compare things between different groups. For example, you could use a bar graph to compare the sizes of the families of the students in your grade or class. You could also use a bar graph to compare the sizes of the countries in North America.

**Line Graph.** Line graphs are most useful when you want to show how something changed over a period of time. For example, if you measured your height one a year for ten years, you could put that information on a line graph. Here is another example. Say you wanted to show the population of your colony over a ten or fifteen year period. You could organize that information on a line graph. You could then examine the line graph and notice that during a particular period of time, the population grew a lot or grew little.

**Circle Graph.** Sometimes circle graphs are called pie charts because they look like a pie cut into slices. Circle graphs are best to use when you are trying to compare parts of a whole. With circle graphs, you cannot show changes over time. Example: You could use a pie chart to show what percentage of time is spent on the various school subjects every week.

No matter what kind of graph you make, neatness counts! The more exactly you record your information, the more useful it is to anyone reading it, including yourself.
Main Idea A: Some celestial bodies are sources of light and others reflect light.

The universe includes everything that exists anywhere. In our universe we can divide celestial bodies into two categories: sources of light and reflectors of light.

Just because a heavenly body is lit does not mean it is a source of light. The fact is, of all the heavenly bodies, only the stars are sources of light (our Sun is really a star). All others reflect light. That includes the Earth, the planets, the Moon, and several other types of celestial bodies.

<table>
<thead>
<tr>
<th>Sources of Light</th>
<th>Reflectors of Light</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>planets (including Earth)</td>
</tr>
<tr>
<td>stars</td>
<td>moons</td>
</tr>
<tr>
<td></td>
<td>dwarf planets</td>
</tr>
<tr>
<td></td>
<td>asteroids</td>
</tr>
<tr>
<td></td>
<td>comets</td>
</tr>
</tbody>
</table>

Main Idea B: Galaxies and constellations are groups of stars.

1. Galaxies

A galaxy is a large cluster of stars. There are many galaxies in the universe. Our Sun is part of a galaxy called the **Milky Way**. The Milky Way is composed of 200,000,000,000 stars. It is in the shape of a spiral.

The Sun is one of the stars in the galaxy called the Milky Way. The Milky Way has a spiral shape. The Sun is located toward the outer edge.
2. **Constellations**

Constellations are small groups of stars that seem to form a pattern when we see them in the night sky. The Ancient Greeks had a particular fascination with stars and imagined that certain groups of stars formed images. They gave names to these constellations.

Would you have imagined these groups of stars to form these figures?

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**Constellations appear to move as the year goes by.**

The stars and constellations appear to change their positions from season to season. Actually the stars and constellations do not move at all. It is the Earth that moves. It spins or rotates and this is why the constellations appear to move. The locations of constellations in the night sky change in a counterclockwise position as the year goes by. In one year a constellation will appear to make one complete rotation.

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**Like all constellations, the Big Dipper appears to change its position in a counterclockwise manner throughout the year. The Earth’s rotation on its axis is the reason for this apparent movement.**

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**Summer and winter constellations**

Summer constellations are only visible from where we are, in summer. Winter constellations are those that are only visible from where we are, in winter.
Main Idea C: The Sun should never be viewed directly.

It is important to remember that a person should not stare at the Sun, even through a telescope or through light filters. The Sun’s rays can permanently damage the retina of your eye. The retina is the back part of the eye that catches all the light. The problem is that the retina cannot sense pain, so that it does not tell your brain when it is being burned. If the retina gets burned by the Sun’s rays, it cannot be repaired. This will result in partial or total blindness.

Certain types of welding goggles and devices used by astronomers (scientists who study celestial bodies) can prevent eye damage. Also using a pinhole can help because it does not require that you view the Sun directly.

Pinhole cameras project the Sun’s rays onto a screen.

Main Idea D: The slant of the Sun’s rays affects shadows, temperatures, and the seasons.

At different times of the day and at different times of the year, the Sun shines more directly on us than at other times. Slanted Sun rays are less intense than more direct Sun rays. More direct Sun rays provide more heat than slanted Sun rays.

1. The Length of Shadows. During the early morning hours and late evening hours, the Sun shines on us with the most slant. Therefore, at these times of the day, our shadows are the longest. During the midday hours the Sun shines on us most directly overhead. This results in shorter shadows.

Sundials. Sundials were devices used by many ancient cultures including the Ancient Egyptians. The sundial consisted of a triangular central piece called a gnomon which cast a shadow on a numbered scale of hours. The numbers were placed closer together towards noon, and farther apart towards morning and evening because the shadow moved more slowly over the sundial at midday when the sun was overhead.
2. **Temperature.** How directly the Sun shines on us affects the temperature. During the early morning and evening hours the Sun shines on more of a slant than it does towards noon. This is because Sun rays that shine more directly are more intense than those that shine of a greater slant. The result is the midday Sun shines more directly, resulting in higher temperatures.

3. **The Seasons.** In our part of the world the seasons are due to two main factors:

   - the Earth’s tilt
   - the Earth revolving around the Sun

   During the **summer**, the North Pole is tilted toward the Sun. This means the Sun is shining more directly on us. This results in higher temperatures.

   During the **winter**, the North Pole is tilted away from the Sun. This means the Sun is shining on us at more of a slant. This results in lower temperatures.

   ![Diagram of Earth's orbit around the Sun with seasons indicated]

   **In summer the North Pole is tilted toward the Sun. In winter it is tilted away from the Sun.**

   **The Length of the Day.** The Earth’s tilt also causes the days to be longer in summer than in winter. If the Earth was not tilted, but straight up and down, the lengths of our days and nights would stay the same all year long.

   In **summer** days are longer and nights are shorter because our part of the world is tilted toward the Sun.

   In **winter** days are shorter and nights are longer because our part of the world is tilted away from the Sun.
Summer and Winter

In Summer, with the sun high overhead, the sun's rays hit the earth more directly, warming the ground most effectively.

In Winter, with the sun always low in the sky, its rays are spread over a larger area of ground. Each patch of earth does not receive as much energy as it does in Summer.

Assignment: Do Worksheets #6C.Review.3a, #6C.Review.3b, #6C.Review.3c, and #6C.Review.3d.
Main Idea E: The Moon’s Phases Are Regular and Predictable

The Moon is the Earth’s only natural satellite. It is approximately 400,000 km from Earth and is about one quarter the size. It takes the Moon approximately 28 days to circle the Earth. The Moon’s gravitational pull is about one-sixth the gravitational pull of Earth’s. That means that if you weigh 60 kg on Earth, you would weigh 10 kg on the Moon.

As the Moon moves around the Earth, there are changes in its shape from night to night. These changes, which occur as we see more or less of the lit side of the Moon, are called the **phases of the moon**.

At any one time, half the Moon is lit by the Sun and the other half is in shadow. Depending on the night, the side of the Moon that is visible from our part of the Earth can be fully lit, in complete darkness, or somewhere in between. The Moon revolves around the Earth in a counterclockwise manner. As it does, more or less of the lit part of the Moon is visible.

**New Moon.** When the Moon is between the Sun and the Earth, the unlit side of the Moon faces the Earth. The Moon is not visible. This is called the new moon phase.

**Full Moon.** When the Moon is on the opposite side of the Earth than is the Sun, we can see all of the lit side of the Moon. It appears full and round. This is called the full moon phase.
As the Moon revolves around the Earth, the same side of the Moon is always facing the Sun. Starting with the new moon phase, we can see more and more of the Moon as it circles the Earth. This is called waxing. Waxing continues until the full moon phase is reached.

Once the full moon phase is reached, the amount of the lit side of the Moon we can see starts to decrease. This is called waning.

The Phases of the Moon
Main Idea F: The Solar System is made up of the Sun, the planets, dwarf planets, moons, comets, and asteroids.

The Sun is the centre of the solar system. Solar means sun. Eight planets, including Earth revolve around the Sun. Moons are natural satellites that revolve around the planets. Dwarf planets, asteroids, and comets are smaller celestial bodies in the solar system.

A satellite is an object in space that revolves around another object. In this way, the planets are satellites of the Sun and moons are satellites of the planets.

1. The Planets

There are eight planets. Each is unique. Some are mainly solids, like Earth and others are composed entirely of gases. The planets are all of different sizes, colours, and temperatures. Some planets like Saturn and Uranus have many rings around them.

Starting from the planet closest to the Sun, the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

Orbits. The planets travel around the Sun on a path called an orbit. Earth’s orbit is not a circle, like many people think. Instead it is elliptical – like a roundish-oval.

Period of Rotation. All planets rotate on their axes. The amount of time it takes a planet to rotate once on its axis is called its period of rotation. The period of rotation is one of that planet’s days. Earth’s period of rotation is 24 hours.

Period of Revolution. All the planets revolve around the Sun. The amount of time it takes for a planet to make one revolution is called its period of revolution. The period of revolution is that planet’s year. Earth’s period of revolution is 365.25 days.

2. Moons

Moons are the planets’ natural satellites. Moons are all unique as well. They also rotate as they revolve around the planets.

The number of moons that revolve around each planet varies from 0 to 63. As telescopes become more powerful and technology improves, astronomers may find yet undiscovered moons.

3. Asteroids are mini planets. They are found in the “asteroid belt” between Mars and Jupiter.

4. Dwarf Planets are small planets with their own gravities, but not large enough to have cleared their orbits of other celestial objects.

5. Comets are celestial bodies consisting of a fuzzy head and a long sweeping tail that points away from the Sun.
FACTS ABOUT THE PLANETS

<table>
<thead>
<tr>
<th>Planet</th>
<th>Distance from Sun (millions of kilometres)</th>
<th>Period of Rotation (Earth units)</th>
<th>Period of Revolution (Earth units)</th>
<th>Diameter (kilometres)</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>57.9</td>
<td>59 days</td>
<td>88 days</td>
<td>4 880</td>
<td>0</td>
</tr>
<tr>
<td>Venus</td>
<td>108.2</td>
<td>243 days</td>
<td>224.7 days</td>
<td>12 100</td>
<td>0</td>
</tr>
<tr>
<td>Earth</td>
<td>149.6</td>
<td>24 hours</td>
<td>365 days</td>
<td>12 756</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>227.9</td>
<td>24 hours</td>
<td>687 days</td>
<td>6 787</td>
<td>2</td>
</tr>
<tr>
<td>Jupiter</td>
<td>778.3</td>
<td>10 hours</td>
<td>12 years</td>
<td>143 200</td>
<td>63</td>
</tr>
<tr>
<td>Saturn</td>
<td>1 427</td>
<td>11 hours</td>
<td>29 years</td>
<td>120 000</td>
<td>61</td>
</tr>
<tr>
<td>Uranus</td>
<td>2 871</td>
<td>17 hours</td>
<td>84 years</td>
<td>51 800</td>
<td>27</td>
</tr>
<tr>
<td>Neptune</td>
<td>4 497</td>
<td>16 hours</td>
<td>165 years</td>
<td>49 528</td>
<td>13</td>
</tr>
</tbody>
</table>

Assignment: Do Worksheets #6CReview.3e, #6CReview.3f, #6CReview.3g, and #6CReview.3h.
Topic D
Evidence and Investigation

This unit gives you practice in making keen observations, reasonable inferences, thoughtful hypotheses, and drawing logical conclusions. You get to pretend you are a crime investigator looking for evidence, so that you can make an arrest.

**PROCESS SKILLS**

**Observation**

Observation involves gathering information using any or all of your five senses. This is especially important when conducting an investigation. A good detective will notice things that others do not.

**Inference**

Inferences are ideas based on observations. The inferences you make do not always turn out to be correct. Good investigators make good inferences.

**Hypothesis**

A hypothesis is your “best guess” as to who committed the crime, how the crime was committed, and/or why the crime was committed. In the crime solving world an investigator will make hypotheses based on his or her observations and inferences. After making a hypothesis, he or she then must set out to prove or disprove it. If the hypothesis turns out to be false, the investigator must re-examine the evidence and/or look for new evidence.

**Draw Conclusions**

You draw a conclusion when you come up with an idea based on all your observations and inferences.

**VOCABULARY**

**crime:** an act which breaks the law

**investigate:** to look for information in an organized way
client: the person who hires a detective

accuse: to blame or charge someone with a crime

condemn: to sentence a criminal who has been found guilty

stash: to hide something or someone

alibi: an excuse that tells others that a suspect was not at the scene of the crime

witness: someone who sees a crime happen

forensic science: the science that studies clues

evidence: in court, these facts are proof

clue: a small piece of evidence

perpetrator: person who committed the crime

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**Main Idea A:** The first step in solving a crime is gathering information from the scene of the crime.

The evidence found at the scene of a crime may give clues about the person or people who committed the crime and how they did it.

Some things to look for:

- Footprints and tire tracks
- Stained carpets and floors
- Hair samples
- Fingerprints
- Pieces of torn fabric
- Written messages
- Damage to buildings, furniture, and other items
- The condition of the room/building – items thrown on the floor, neat and tidy, and so on
- Items missing
- Blood
- Evidence of activity outside

**Suspect:**

A suspect is a person whom an investigator thinks may have committed a crime. Suspects are identified based on what was observed at the crime scene and the observations of any witnesses. A person can also become a suspect in a crime if they have committed similar crimes in the past.
Main Idea B: Footprints, animal tracks, and tire tracks can provide clues about who and how a crime was committed.

1. What Footprints Can Tell About the Person Who Made Them

*Height*
- The bigger the footprint, the taller the person
- The longer the stride, the taller the person (Stride is the distance between footprints.)

*Weight*
- The deeper the footprint, the heavier the person

*Tread*
- A worn tread means older shoes
- No tread means the person wore shoes with leather soles or smooth rubber soles
- Cuts or other marks means the person, at one time, stepped on something sharp

2. What Footprints Can Tell About How a Crime Was Committed

*Direction of Footprints*
- Gives ideas about where the person came from, what he or she did at the crime scene, and in which direction the person left

*Number of Sets*
- Tells how many people may have been involved

*Length of Stride*
- A shorter stride means the person was walking; a longer stride that the person was running

*Change in Depth of Footprints*
- If the depth of a particular set of footprints becomes greater, it usually means he or she started to carry something heavy or someone.
- If the depth of a particular set of footprints becomes shallower, it usually means he or she unloaded something heavy.

*Clarity*
- The clearer the footprints, the more recently they were made.
- Fresh snow, wind, and rain can make footprints less clear or disappear altogether
3. **Animal Tracks Leave Clues Too**

   **Type of Animal**
   - Most animal tracks are in groups of four paw prints
   - Bird tracks are in sets of two and most often three-toed
   - Different animals have distinct type of tracks
   - Tracks showing claw marks means the animal can dig. If there are toes and claw marks, it usually means the animal can climb trees.

   **Speed of Travel**
   - The farther apart the sets of tracks, the faster the animal was travelling
   - Hopping animals usually leave a “two front together” – “two back together” pattern

4. **What Tire Tracks Can Tell**

   **Make of the Tire**
   - Each tire manufacturer uses particular tread designs
   - Different types of tires have different tread widths

   **Age of Tires**
   - Clearer tread marks can mean the tires are newer or have been driven less distance.
   - Newer tires will usually make deeper tracks

   **Unusual Markings**
   - A detective will look for cuts and other marks on the tire tread

**Using Footprints and Tracks to Solve Crimes**

Observing footprints and tracks are valuable sources of evidence. They can tell investigators something about the people who committed the crime and how the crime was committed. This can help them to narrow the list of possible suspects. Once suspects have been identified, the investigators can try to match the footprints and tracks to the shoes and/or cars of the suspects. If there is a match, the investigators will know the suspect(s) was at the scene of the crime.

**Clarity of Footprints and Tracks**

Footprints and tracks are most useful in crime investigation when they have not been disturbed. For this reason it is important for people who come across the scene of a crime to be careful not to “spoil” the footprints by walking in amongst them. Crime investigators usually want to measure and photograph footprints and tracks as soon as they can after the start of an investigation.

**Assignment:** Do Worksheets #6D.Review.4a, #6D.Review.4b, #6D.Review.4c, #6D.Review.4d, and #6D.Review.4e.
Main Idea C: Everyone has a unique set of fingerprints.

Fingerprints left at the scene of a crime can be proof that a suspect was indeed present where the crime was committed. This is because everyone’s fingerprints are unique. If a person is arrested, he or she is fingerprinted, and these fingerprints are kept on file. Police departments all over the country, and most often all over the world can then access them.

Using fingerprints as evidence can be tricky because often only partial prints can be lifted or sometimes fingerprints are smudged. When fingerprints are taken from a crime scene, they can be matched using computer technology, to all the fingerprints that are already on file. If no match comes up, it means that the fingerprints belong to someone who has not been previously arrested. It does not mean that the fingerprints are useless to investigators. If police do find a suspect, they look to see if that person’s fingerprints match those found at the crime scene.

Types of Fingerprints

Fingerprints fall into four categories according to the patterns the ridges form. The loop is the most common type.

Almost all fingerprints have deltas, which are triangular patterns formed when ridges come together.

Arch is like a wave or a hill. The ridges enter on one side, rise in the middle, and exit on the opposite side.

Loop looks like a loop. The ridges enter one side, go up to form a loop, then exit the same side that they entered.
The **whorl** is like a spiral. The pattern circles around like a whirl pool. It has two deltas.

The **composite** pattern is a combination of patterns such as a whorl and arch, a loop and arch, or a whorl and loop.

**Main Idea D:** Notes left by perpetrators can be valuable clues to solving crimes.

Written notes are sometimes left to communicate with victims or even the police. At other times, police find notes and letters written by suspects that are unrelated to the crime itself, but end up being evidence.

1. **Paper Chromatography**

   Forensic experts can determine the type of ink used to write a note. Different types of ink require different tests. This is an important tool for investigators because they can try to match the ink used to write a crime-related note to a pen that a suspect owns. One test that can be used test ink used in felt markers is called chromatography.

   Paper chromatography works on the idea that any colour ink is actually a blend of other colours of ink. Black inks are usually mixtures of several different colours. Each pen company uses a different colour blend. You may have noticed that if the paper on which a note has been written gets wet, the ink bleeds and different colours appear. That is how chromatography works.

   ![Diagram of chromatography setup](image)

   To do a simple chromatography test, make a large dot toward the bottom of some filter paper or special chromatography paper. Suspend the end of the paper in water. Soon you will notice that as the water rises up the paper, the ink separates into different colours.
2. Graphology

Graphology is the study of handwriting. Just like all fingerprints are unique, so are people’s handwriting. Many people have similar handwriting, but an expert in graphology can identify little differences.

When a person tries to *forge* someone else’s handwriting, they try to copy it. This is usually unsuccessful. That is because we have handwriting habits that are very difficult to break, no matter how hard we try.

When examining handwriting, here are some things to look for.
- How individual letters are formed.
  - formation of loop letters such as l, o, f, p, b, and so on
  - crossing the letter t
  - formation of less common letters (x, z, v)
  - dotting of letters
  - formation of the down loop in letters like g, y
- Size of writing
- Slant
- Spacing between letters
- Spacing between words
- Combination of printing and writing
- Type of pen or pencil
- How hard the person presses when writing
- Doodle marks

**Main Idea E: Evidence from Things Unintentionally Left Behind**

Often criminals leave evidence at a crime scene without really meaning to. Things such as hair, soil, and pieces of fabric can be left behind.

1. **Hair**

All people lose hair. This happens everyday. If an investigator finds a hair sample that does not match the hair of the people who live or work in a particular building, he or she may be able to match it to the hair of suspect. An individual’s hair has a certain colour, texture, and length which can help identify a person. Hair also provides something called DNA. Everyone’s DNA is unique.
2. Soil

A perpetrator can leave soil behind or he or she can pick up soil in the treads of shoes or tires. An analysis of soil can place a suspect at the scene of a crime. When looking at soil samples, forensics experts look at thing such as

- Colour
- Texture
- Odour
- Content (clay, loam, sand, stones, or a combination)
- Particle size
- Particle shape

3. Fabrics

In their hurry to get away from the crime scene, criminals may accidentally snag clothing on a bush, nail, or other sharp object, leaving part of the article of clothing behind. The part can be as little as one or two threads. Forensics experts analyze the fabric sample, however big or little it is. They then try to match it to an article of clothing owned by a suspect. A match places the suspect at the scene of the crime.

When examining fabrics, forensics experts look for things like

- Colour
- Tendency to wrinkle
- Dye – how easily does the dye rinse out
- Appearance of the weave (coarse or fine; woven or knitted; loose or tight
- Texture (rough or smooth)
- Stretchiness
- Tendency to absorb or repel water
- How easily it burns
- What one thread looks like (hairy, smooth, even, wavy, and so on)

Assignment: Do Worksheets #6D.Review.4f, #6D.Review.4g, #6D.Review.4h, and #6D.Review.4i.
Topic E
Trees and Forests

A forest is an ecosystem. An ecosystem is a community of biotic and abiotic factors that interact.

Biotic – means living

Abiotic – means non-living

<table>
<thead>
<tr>
<th>Examples of Biotic Factors in a Forest</th>
<th>Examples of Abiotic Factors in a Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>Sunlight</td>
</tr>
<tr>
<td>Bush</td>
<td>Rain</td>
</tr>
<tr>
<td>Grass</td>
<td>Moisture</td>
</tr>
<tr>
<td>Deer</td>
<td>Temperature</td>
</tr>
<tr>
<td>Fox</td>
<td>Wind</td>
</tr>
<tr>
<td>Owl</td>
<td>Soil</td>
</tr>
<tr>
<td>ant</td>
<td>Rocks</td>
</tr>
<tr>
<td>earthworm</td>
<td>clouds</td>
</tr>
<tr>
<td>mushroom</td>
<td></td>
</tr>
<tr>
<td>squirrel</td>
<td></td>
</tr>
</tbody>
</table>

Main Idea A: Trees and Forests Are Not the Same Thing

A group of trees is a group of big plants. A forest is an ecosystem, so it includes all the things that are living in amongst the trees and all the abiotic factors as well.

1. Trees are Different from Other Plants

   In order for a plant to be a tree, it must have three characteristics:
   • Perennial (grows year after year)
   • Have a self-supporting trunk
   • Consist of woody material

2. Trees Can Be Classified as Coniferous or Deciduous

<table>
<thead>
<tr>
<th></th>
<th>Deciduous</th>
<th>Coniferous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shedding of leaves</td>
<td>Shed leaves in fall</td>
<td>Shed continuously</td>
</tr>
<tr>
<td>Shape of leaves</td>
<td>Broad-leaved</td>
<td>Needle-shaped leaves</td>
</tr>
<tr>
<td>Water retention</td>
<td>Leaves waxy topside and large underside, causing moisture loss</td>
<td>Thick, waxy coating reduces water loss from transpiration</td>
</tr>
<tr>
<td>Temperature resistance</td>
<td>Do not withstand temperature extremes</td>
<td>Do withstand temperature extremes</td>
</tr>
</tbody>
</table>
Main Idea B: Trees and Forests Are Important to Nature and to Humans

Much of the world’s land area is covered with trees and forests. They are necessary for the health of all living things.

1. Trees and Forest Are Necessary for Nature and for Humans

<table>
<thead>
<tr>
<th>Importance of Trees and Forests to Nature</th>
<th>Importance of Trees and Forests to People</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide homes to animals and birds</td>
<td>• Provide oxygen for people to breathe</td>
</tr>
<tr>
<td>• Provide food for animals and birds</td>
<td>• Provide us with useful products</td>
</tr>
<tr>
<td>• Produce oxygen for animals and birds to breathe</td>
<td>• Act as sound barriers</td>
</tr>
<tr>
<td>• Provide protection for many living things</td>
<td>• Provide people with food</td>
</tr>
<tr>
<td>• Enrich the soil</td>
<td>• Provide protection from wind and sun</td>
</tr>
<tr>
<td>• Control soil erosion</td>
<td>• Add beauty and enjoyment to our lives</td>
</tr>
<tr>
<td></td>
<td>• Provide good location for recreational activities</td>
</tr>
</tbody>
</table>

2. Trees and Forests Were Used Differently in the Past Than They Are Today

There are similarities between the ways that First Nations groups used trees and forests traditionally compared to how we use them today. However, there are important differences between how First Nations used trees and forests and their attitudes about trees and forests compared to our use and attitudes today.

<table>
<thead>
<tr>
<th>Attitudes</th>
<th>Traditional First Nations</th>
<th>Modern Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Trees and forests are part of nature and must be respected.</td>
<td>• There is a limitless supply of trees and forests.</td>
</tr>
<tr>
<td></td>
<td>• Must not take more from the forest than we need</td>
<td>• Trees and forests are there for us to use.</td>
</tr>
<tr>
<td></td>
<td>• Must try to conserve</td>
<td>• Should use forests to create jobs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use forests as a way to make money</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• We do not need to worry, trees and forests are renewable.</td>
</tr>
<tr>
<td>Uses</td>
<td>• Used mostly to provide basic necessities like food, shelter, transportation, medicines</td>
<td>• Used forest products to build houses, furniture, and other products</td>
</tr>
<tr>
<td></td>
<td>• Also used for leisure and recreation, but in a very limited way</td>
<td>• Used to make paper and paper products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Some ingredients used to make medicines, tires, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Used a lot for recreation and leisure</td>
</tr>
</tbody>
</table>
In the forest ecosystem there are four main levels of vegetation. Different plants and animals live in each level.

**Upper Canopy** – top level formed by leaves and branches of the tallest trees. Birds (owls, orioles) and insects (aphids, tent caterpillars) live here.

**Understory** – smaller trees and larger shrubs. Provides sheltered space for birds and small mammals to travel. Many insects, lichen, squirrels, woodpeckers, and many other birds live here.

**Underbrush (or herb or shrubbery) level** – ferns, wildflowers, and other soft-stemmed plants, as well as tree seedlings, butterflies, dragonflies, mice, weasels, deer, porcupine, skunks, and rabbits live here.

**Forest Floor** – includes the ground cover and the soil. The ground cover includes leaf litter, mushrooms, insects, salamanders, toads, moss, and flowers. The soil made up of thin layers of organic and mineral materials. F Worms, bacteria, soil insects, tree roots, spiders, millipedes and centipedes are found here.
Main Idea D: The Forest Ecosystem Involves Many Different Cycles

1. The Nutrient Cycle

Nutrients are those things an organism needs to live. Plants take nutrients from the soil. They are usually in the form of minerals that have been dissolved in water. Green plants have the ability to take sunlight, carbon dioxide to make food in the form of sugars. These nutrients are then passed on to animals that eat the plants. Those same nutrients are passed on again to organisms that eat these animals. This is called a food chain.

Here is an example of a food chain:

poplar tree leaf → deer → wolf

Organisms in a food chain have names according to what they do:

Producer – green plants; they can make their own food through photosynthesis

First Order Consumer – insects and animals that eat producers

Second Order Consumer – animals that eat first order consumers

The Nutrient Cycle involves another type of organism - the decomposer.

Decomposers – break down dead and decaying organism so that their nutrients can become part of the soil and so that plants can absorb them again. Without decomposers, the forest ecosystem could not survive. Bacteria, earthworms, millipedes, mushrooms, and ants are examples of decomposers.

The Nutrient Cycle traces nutrients as they progress from producers to consumers to decomposers and back to producers.

1. Plants absorb nutrients dissolved in the water through their roots.

2. Consumers, like deer, get the nutrients by eating the plant.

3. When the plants and animals die, they start to decay.

4. Decomposers break down the dead plants and animals, releasing the nutrients back into the soil.
2. The Oxygen Cycle

Without oxygen animals and people could not live. Without carbon dioxide plants, including trees, could not live. There are two main processes involved in the oxygen cycle.

**Respiration** – animals and people take in oxygen and give off carbon dioxide and water.

**Photosynthesis** – plants take in carbon dioxide and water to make sugars and oxygen.

![Oxygen Cycle Diagram]

During photosynthesis plants take in carbon dioxide and water and produce sugars and oxygen.

During respiration humans and animals take in oxygen and give off carbon dioxide and water.

3. The Water Cycle

Water is necessary for all forest organisms to survive. There are three main processes involved in the water cycle:

**Transpiration** – plants take up water through their roots are release it into the air through their leaves.

**Evaporation** – water changes from a liquid to water vapour which is also released into the air.

**Condensation** – when water vapour in the air cools, it forms a liquid or solid and falls to Earth as precipitation. The precipitation soaks into the soil or drains into bodies of water.

![Water Cycle Diagram]

**Assignment:** Do Worksheets #6E.Review.5a, #6E.Review.5b, #6E.Review.5c, and #6E.Review.5d.
Main Idea E: Trees Can Be Identified Using Many Different Characteristics

Trees are different in many ways. To identify a tree we can look at whether it is deciduous or coniferous, the type of leaves, the shape of leaves, the edge of the leaves, how the leaves are arranged on a branch, and the size and shape of the trees themselves.

1. Part of a Leaf

![Diagram of a leaf showing parts like blade, apex, midvein, and margin.]

2. Types of Leaves

*Simple* – one blade on a petiole

![Images of simple leaves.]

*Compound* – more than one blade on a petiole

![Images of compound leaves.]

*Double Compound* 

![Images of double compound leaves.]

*Needle Leaf* 

![Images of needle-like leaves.]

45
3. **Shape of Leaf**

<table>
<thead>
<tr>
<th>Linear</th>
<th>Oblong</th>
<th>Oval</th>
<th>Ovate</th>
<th>Cordate (heart)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deltoid (triangle)</th>
<th>Lobed</th>
<th>Orbicular (round)</th>
<th>4-sided needle</th>
<th>Flattened needle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **Type of Margin (edge)**

<table>
<thead>
<tr>
<th>Smooth</th>
<th>Fine-toothed</th>
<th>Coarse-toothed</th>
<th>Scallop or Wavy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. **Leaf Arrangements**

<table>
<thead>
<tr>
<th>Deciduous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opposite</td>
</tr>
<tr>
<td>Alternate</td>
</tr>
<tr>
<td>Whorled</td>
</tr>
</tbody>
</table>
6. **Type of Bark**

- **pattern**
  - scaly patches
  - horizontal
  - vertical
  - horizontal and wavy
  - vertical and scaly

- **texture** – what it feels like
  - rough
  - smooth

- **colour**
  - reddish brown
  - grey
  - white

7. **Tree Shape (silhouette)**

- triangle or cone
- oval
- circle
- spreading
- rectangle
8. Environment Can Affect Branching Patterns and Tree Shape

*Weather* – High winds and drought can affect how a tree grows.

*Insect Damage* – Insects can seriously damage or even kill a tree.

*Location* – Closeness to other trees or to buildings and fences can affect tree shape; so can growing on a hill

---

**Main Idea:** Growth Patterns Can Be Interpreted by Examining Branches and Tree Cookies

1. **Growth Patterns of Twigs and Branches**

   **Parts of a Twig**

   ![Diagram of a twig showing terminal bud, lenticel, leaf scar, and annual growth ring from terminal bud of previous year.](image)

   The distance between growth rings tells how much a twig grew in a year.
2. Parts of a Tree

**Roots** – anchor the tree to the ground and absorb water and minerals from the soil.

**Crown** – the upper part of the tree make up of branches, twigs, leaves, needles, buds, and cones.

**Cork (Outer Bark)** – outer part of the trunk. It is made up of dead tissue and protects the living parts underneath.

**Inner Bark** – contains the vascular bundles called **phloem** which transport sugars made in the leaves to other parts of the tree.

**Cambium** – thin yellowish-white layer which produces new xylem cells every year.

**Sapwood** – thin layer of active vascular bundles called **xylem** which transport water and dissolved minerals from the roots to the leaves.

**Heartwood** – non-living core of the tree stem, giving the stem strength.
3. **Tree Cookies**

Tree cookies (dendrodisces) are cross-sectional slices of a tree trunk. By examining tree cookies we can infer much about a tree’s growth history.

**Age** – the number of rings tells how old the tree is. A ring has two parts – a light part which is spring and summer growth, and a dark part which is fall and winter growth.

**Growing Conditions** – If the rings are far apart, it means that there was lots of light and water, nutrients, space, and the right amount of heat. Rings that are close together mean that there were poor growing conditions.

**Closeness to Other Objects** – Rings that are narrow on one side and wide on the other are an indication that a tree could grow more on one side compared to the other. This happens when a tree is growing very closely to another tree, a building, a fence, or even on a steep slope.

**Fire Damage** – A tree cookie with a wide scar usually indicates the tree survived a fire, but was still damaged by the fire.

**Insect Damage** – This also leaves a scar. Insect damage scars can look like fire damage scars or more narrow and deep. Many times insect damage is done to several parts of a tree, so there may be several scars.
Broken Branch – When a branch is broken, it usually dies. This can leave a scar as well and may look like insect damage.

Tissue Damage – can be caused by someone taking off the outer bark and damaging some of the inner layers. This can leave a broad or narrow scar, depending on the type of damage.

Main Idea G: There Are Many Issues Regarding the Use of Forests

There are many different perspectives on how our forests should be used. Environmental groups, industries, farmers, governments, and individual citizens all have their ideas about how best to use this valuable resource.

1. Human Activity Can Threaten or Enhance the Existence of Forests

Humans use forests for many purposes and in many ways. Some things that humans do help to preserve forests and keep them healthy. However, other things threaten forest ecosystems.

What kinds of activities enhance forests?

When people do things to maintain existing forests and keep them healthy, they are helping to enhance them. This involves treating forests with respect and understanding that their continued health is good for all living things on Earth.

Following are a few ways human activity enhances forests:
- Taking only what is necessary from forests.
- Reforestation by replanting what was harvested.
- Efforts to cut down on air, land, and water pollution

What kinds of activities threaten forests?

Many human activities threaten forests. Forests are an important user of carbon dioxide and producer of oxygen – things that are vital for humans and animals. People do rely heavily on forests and forest products in their lives. Because of this, they think more of how they can harvest more and more forest products and forget about conserving the forests we have. Following are a few ways that human activity threatens forests.
- Polluting air, waterways, and the land harms the forest ecosystem.
- Many hundreds of thousands hectares of forest land is burned each year for agricultural land, cities, factories, and roads.
- Tree harvesting methods, such as clear cutting, immediately take away homes for animals and birds. In addition, wind and soil erosion can become problems where entire forests have been cleared away.
2. There Are Many Issues Regarding Forest Use

**Clear Cutting or Selective Cutting?**

Clear cutting and selective cutting are both methods of harvesting trees. With clear cutting, all the trees in an area are bulldozed or cut down. Each of the different sizes of trees are used for different purposes.

With selective cutting, only the largest trees are harvested. A person goes through the forest and marks those trees to be cut down. Then other people cut the trees down and transport them to sawmills and pulp mills.

Following is a chart comparing clear cutting and selective cutting.

<table>
<thead>
<tr>
<th></th>
<th>Clear Cutting</th>
<th>Selective Cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Effects on Forest Ecosystem</strong></td>
<td>• Immediate loss of habitat for animals and birds</td>
<td>• Animals and birds keep their habitat</td>
</tr>
<tr>
<td><strong>Erosion</strong></td>
<td>• Can lead to wind and soil erosion</td>
<td>• Little, if any wind and soil erosion</td>
</tr>
<tr>
<td><strong>Business</strong></td>
<td>• Costs less to harvest trees</td>
<td>• Costs more, cutting down on profits</td>
</tr>
<tr>
<td><strong>Forest Regeneration</strong></td>
<td>• For every tree that is harvested at least three are planted</td>
<td>• Cutting down the large trees allows more light to get at the smaller trees, allowing them to grow faster. Forest regeneration can occur more naturally with seeds dropping from trees.</td>
</tr>
</tbody>
</table>

**Other Issues Regarding Forests**

There are several other issues regarding how we use our forests:

- What is the best way to regenerate growth in forests where harvesting has occurred?

- To what extent should governments be involved in how we use forests?

- Why should we be so concerned about starting forest fires when most are started by lightning?

**Assignment:** Do Worksheets #6E.Review.5e, #6E.Review.5f, #6E.Review.5g, #6E.Review.5h, and #6E.Review.5i
1. Define these terms:
   a. air
   b. aerodynamics

2. Write O if the statement tells about an observation. Write I if it tells about an inference.

   ____ It's a good day for going outside and playing.
   ____ Martha is such a wonderful person!
   ____ The man had on red pants, a blue shirt, and a brown baseball cap.
   ____ When I walked into the kitchen, all the school girls were doing the dishes.
   ____ Our new van had a flat tire.
   ____ Ben is a really good mechanic.
   ____ Betty has read hundred books so far this year.
   ____ When I put my hand in the box, I touched something that felt like peanut butter.
   ____ I couldn't see it, but when I put my hand in the box, I think I touched peanut butter.
   ____ When we turned the glass upside down, the card stayed in place.

3. For each observation, make an inference that tells about air.

   a. Observation: Rachel lined the rim of a jar with Plasticine. She set a funnel into the Plasticine so the sides around the funnel were sealed. When she poured water into the funnel, only the first bit of water dripped into the funnel. The rest stayed in the funnel.

   Inference:
b. **Observation:** Gordie filled a glass with water until it overflowed slightly. Then he place a large index card over the rim of the glass. He ran his finger around the rim to ensure that the index card was sealed to the rim. He held his hand firmly on the index card and then inverted the glass. To his surprise, the index card stayed in place. It did not fall off.

**Inference:**


c. **Observation:** Annie was in the bathroom. The smell was not so good so she decided to spray the bathroom using an air freshener. When she went into the living room, she could smell the air freshener in the living room.

**Inference:**


d. **Observation:** Ida used a special pump to blow up a large balloon. The pump could measure the volume of air that went into the balloon. When she compared the volume of air that was pumped into the balloon with the volume of the inflated balloon, she found that the volume of air was twice as great as the volume of the inflated balloon.

**Inference:**


e. **Observation:** Ida then attached the neck of her inflated balloon to the neck of an uninflated balloon, she found that inflated balloon started to deflate and the uninflated balloon started to inflate. This continued until both balloons were inflated equally.

**Inference:**
f. **Observation:** Jason hung two balloons from a rod so that there was 15 cm between them. He then blew air in the space between the balloons. To his surprise, the balloons moved together.

   Inference: __________________________
   __________________________
   __________________________

   g. **Observation.** Christina tied two inflated balloons to the ends of a rod. She then tied a string to the centre of the rod so that the rod hung suspended and balanced from the string. She took a pin and popped one of the balloons. The side of the rod where the balloon was still inflated went down and the side with the popped balloon went up.

   Inference: __________________________
   __________________________
   __________________________

4. Explain Bernoulli’s Principle.

   __________________________
   __________________________
   __________________________

5. Draw a diagram of an airfoil. Use arrows to show the direction the air moves when it comes against airfoil. Label
   - faster moving air
   - slower moving air
   - high pressure
   - low pressure
6. On each of the airfoils below, draw an arrow to show the direction of the greater force (up or down).

7. In an aircraft, the force that pulls the aircraft down is called _________________.
   The force that enables the aircraft to ascend is called _________________.

8. On the bird below label the forces of lift and weight.

9. Explain how a rocket gets lift.

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

10. Answer true (T) or false (F).

    ____ Air has mass.
    ____ Air only exerts pressure down and sideways.
    ____ Air is fluid (can move from place to place).
    ____ Air can be compressed.
    ____ Air takes up space.
    ____ Faster moving air has greater air pressure than slower moving air.
    ____ Compressed air will always try to equalize.
    ____ For an aircraft to fly, lift must be greater than gravity.
11. Birds and airplanes have many of the same parts. For each airplane part, name a corresponding bird part.

<table>
<thead>
<tr>
<th>Airplane</th>
<th>Bird</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuselage (body)</td>
<td></td>
</tr>
<tr>
<td>Wing</td>
<td></td>
</tr>
<tr>
<td>Tail</td>
<td></td>
</tr>
<tr>
<td>Landing gear and wheels</td>
<td></td>
</tr>
</tbody>
</table>

12. For each characteristic of an airplane, tell about a corresponding characteristic of a bird and/or an insect.

<table>
<thead>
<tr>
<th>Characteristic of Airplane</th>
<th>Characteristic of Bird or Insect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wings are in the shape of an airfoil.</td>
<td></td>
</tr>
<tr>
<td>Fuselage is hollow inside.</td>
<td></td>
</tr>
<tr>
<td>A flap on the tail can help it turn.</td>
<td></td>
</tr>
<tr>
<td>The wheels and landing gear fold up into the body to reduce drag during flight.</td>
<td></td>
</tr>
<tr>
<td>Powerful engines give it thrust.</td>
<td></td>
</tr>
</tbody>
</table>
13. What propels each of the following? Explain in a sentence or two.

a. a jet airplane

b. a battery-operated toy airplane

c. a rocket

d. a propellered airplane

e. a paper airplane

f. an elastic band toy airplane

14. Predict what will happen when the fan is turned on. Tell why.

15. What does it mean when something is streamlined?

16. Explain why designers of cars, trains, and airplanes make the bodies of their vehicles streamlined.

17. In the space below, draw a picture of a vehicle that is streamlined.
18. Examine the illustration of two cars coming down a ramp. Tell which car will come down faster and why.

19. What will happen if you light a candle and then put a jar over the top? Tell why.

20. What is the most common gas in our atmosphere?

21. Which gas is most important to humans? Why?
1. Define these terms:
   a. air **mixture of gases that surrounds the Earth**

   b. aerodynamics **study of moving air**

2. Write O if the statement tells about an observation. Write I if it tells about an inference.

   - [ ] It's a good day for going outside and playing.
   - [ ] Martha is such a wonderful person!
   - [ ] The man had on red pants, a blue shirt, and a brown baseball cap.
   - [ ] When I walked into the kitchen, all the school girls were doing the dishes.
   - [ ] Our new van had a flat tire.
   - [ ] Ben is a really good mechanic.
   - [ ] Betty has read hundred books so far this year.
   - [ ] When I put my hand in the box, I touched something that felt like peanut butter.
   - [ ] I couldn’t see it, but when I put my hand in the box, I think I touched peanut butter.
   - [ ] When we turned the glass upside down, the card stayed in place.

3. For each observation, make an inference that tells about air.

   a. Observation: Rachel lined the rim of a jar with Plasticine. She set a funnel into the Plasticine so the sides around the funnel were sealed. When she poured water into the funnel, only the first bit of water dripped into the funnel. The rest stayed in the funnel.

   Inference: **The water would not drain into the jar because air is in the jar and takes up space**

   ![Diagram of water dripping into a jar with Plasticine around a funnel]
Science Grade 6 Mini Review Worksheets

b. **Observation:** Gordie filled a glass with water until it overflowed slightly. Then he placed a large index card over the rim of the glass. He ran his finger around the rim to ensure that the index card was sealed to the rim. He held his hand firmly on the index card and then inverted the glass. To his surprise, the index card stayed in place. It did not fall off.

**Inference:** Air pressure is pushing up on the index card.

---

c. **Observation:** Annie was in the bathroom. The smell was not so good so she decided to spray the bathroom using an air freshener. When she went into the living room, she could smell the air freshener in the living room.

**Inference:** Air is fluid.

---

d. **Observation:** Ida used a special pump to blow up a large balloon. The pump could measure the volume of air that went into the balloon. When she compared the volume of air that was pumped into the balloon with the volume of the inflated balloon, she found that the volume of air was twice as great as the volume of the inflated balloon.

**Inference:** Air can be compressed.

---

e. **Observation:** Ida then attached the neck of her inflated balloon to the neck of an uninflated balloon, she found that inflated balloon started to deflate and the uninflated balloon started to inflate. This continued until both balloons were inflated equally.

**Inference:** Compressed air tries to equalize air pressure.
f. **Observation:** Jason hung two balloons from a rod so that there was 15 cm between them. He then blew air in the space between the balloons. To his surprise, the balloons moved together.

**Inference:** Moving air has less air pressure than still air.

---

g. **Observation:** Christina tied two inflated balloons to the ends of a rod. She then tied a string to the centre of the rod so that the rod hung suspended and balanced from the string. She took a pin and popped one of the balloons. The side of the rod where the balloon was still inflated went down and the side with the popped balloon went up.

**Inference:** Air has mass.

---

4. Explain Bernoulli’s Principle.

Moving air has less air pressure than still air.

---

5. Draw a diagram of an airfoil. Use arrows to show the direction the air moves when it comes against airfoil. Label

- faster moving air
- slower moving air
- high pressure
- low pressure

![Diagram of an airfoil with arrows indicating air flow and pressure areas]
6. On each of the airfoils below, draw an arrow to show the direction of the greater force (up or down).

7. In an aircraft, the force that pulls the aircraft down is called weight (gravity). The force that enables the aircraft to ascend is called lift.

8. On the bird below label the forces of lift and weight.

9. Explain how a rocket gets lift.

Air is forced downward, causing the rocket to lift upward.

10. Answer true (T) or false (F).

T Air has mass.
F Air only exerts pressure down and sideways.
T Air is fluid (can move from place to place).
T Air takes up space.
F Faster moving air has greater air pressure than slower moving air.
T Compressed air will always try to equalize.
T For an aircraft to fly, lift must be greater than gravity.
11. Birds and airplanes have many of the same parts. For each airplane part, name a corresponding bird part.

<table>
<thead>
<tr>
<th>Airplane</th>
<th>Bird</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuselage (body)</td>
<td>body</td>
</tr>
<tr>
<td>Wing</td>
<td>wing</td>
</tr>
<tr>
<td>Tail</td>
<td>tail</td>
</tr>
<tr>
<td>Landing gear and wheels</td>
<td>legs and feet</td>
</tr>
</tbody>
</table>

12. For each characteristic of an airplane, tell about a corresponding characteristic of a bird and/or an insect.

<table>
<thead>
<tr>
<th>Characteristic of Airplane</th>
<th>Characteristic of Bird or Insect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wings are in the shape of an airfoil.</td>
<td><em>Bird’s wing is curved on top, flat on bottom</em></td>
</tr>
<tr>
<td></td>
<td><em>Insect’s wings take on curved shape when it flaps</em></td>
</tr>
<tr>
<td>Fuselage is hollow inside.</td>
<td><em>Bird’s bones are hollow</em></td>
</tr>
<tr>
<td></td>
<td><em>Insects are light weight</em></td>
</tr>
<tr>
<td>A flap on the tail can help it turn.</td>
<td><em>Can use tail to steer</em></td>
</tr>
<tr>
<td>The wheels and landing gear fold up into the body to reduce drag during flight.</td>
<td><em>Legs fold up in flight</em></td>
</tr>
<tr>
<td>Powerful engines give it thrust.</td>
<td><em>Flapping of wings provide thrust</em></td>
</tr>
</tbody>
</table>
13. What propels each of the following? Explain in a sentence or two.

a. a jet airplane Air is pushed backward, causing the airplane ________
   to propel forward

b. a battery-operated toy airplane Battery turns a propeller which propels
   airplane forward

c. a rocket Blast of downward air propels rocket upward

d. a propellered airplane Engines turn propeller which provides
   thrust

e. a paper airplane Thrust is provided by the thrower

f. an elastic band toy airplane The unwinding elastic band turns
   the airplane’s propellers which provides thrust

14. Predict what will happen when the fan is turned on. Tell why.

Fan will travel backward. It forces
air out the front which has the
opposite effect on the fan itself
15. What does it mean when something is streamlined?

designed to minimize drag

16. Explain why designers of cars, trains, and airplanes make the bodies of their vehicles streamlined.

want to minimize drag in order to increase speed and fuel efficiency

17. In the space below, draw a picture of a vehicle that is streamlined.
18. Examine the illustration of two cars coming down a ramp. Tell which car will come down faster and why.

Round car will come down ramp more quickly → has less resistance to the moving air

19. What will happen if you light a candle and then put a jar over the top? Tell why.

Candle will soon go out → has used up all the oxygen in the jar

20. What is the most common gas in our atmosphere? nitrogen

21. Which gas is most important to humans? Why?

oxygen → need it to survive
1. Label the parts of the parachute. In boxes explain the functions of the parts.
2. Michelle and Joanne decided to conduct a fair test. They wanted to know if the size of the canopy affected the time it took for a parachute to land. They knew they had to keep the canopy material, canopy shape, length of the shroud lines and the mass of the payload constant. They also knew that they had to drop both parachutes from the same height and make these drops at the same time.

a. Think about Michelle and Joanne's fair test. What is your hypothesis?

b. In this fair test what are the manipulated variable? ____________________________

are the constant variables? ____________________________

is the responding variable? ____________________________

Here is a table showing the results of the girls' fair test.

<table>
<thead>
<tr>
<th>Diameter of Canopy</th>
<th>Descent Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 cm</td>
<td>5 s</td>
</tr>
<tr>
<td>30 cm</td>
<td>8 s</td>
</tr>
<tr>
<td>40 cm</td>
<td>12 s</td>
</tr>
<tr>
<td>50 cm</td>
<td>17 s</td>
</tr>
</tbody>
</table>

Based on their observations, what conclusion can the girls make?
3. Label the diagram of a hot-air balloon using the words from the box.

<table>
<thead>
<tr>
<th>basket</th>
<th>rip panel</th>
<th>cooling vent</th>
<th>skirt</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouth</td>
<td>rip cord</td>
<td>vent cord</td>
<td></td>
</tr>
</tbody>
</table>

4. Write **A** if it tells about a hot air balloon ascending and **D** if it tells about descending.

____  Air inside the bag is warmer than air outside the bag.
____  The pilot turns on the propane burner.
____  The pilot pulls the vent cord to release the hot air inside the envelope.
____  The air inside the bag is as dense as the air outside the bag.
____  The air inside the envelope is less dense than the air outside the envelope.
____  Gravity is greater than lift.
5. Patrick and Isaac were testing out paper gliders. They decided to make identical gliders from five different kinds of paper. They wanted to find out if the type of paper they used made a difference in how far a glider would fly.

The boys launched each of the five gliders ten times. Then they determined the average flight distance for each glider. They organized their results in a table, listing the papers from lightest weight to heaviest weight.

<table>
<thead>
<tr>
<th>Type of Paper</th>
<th>Tracing paper</th>
<th>Photocopy paper</th>
<th>Construction paper</th>
<th>Manila tag</th>
<th>Bristol board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Distance (average)</td>
<td>165 cm</td>
<td>352 cm</td>
<td>438 cm</td>
<td>614 cm</td>
<td>724 cm</td>
</tr>
</tbody>
</table>

Make a bar graph showing the results of Patrick and Isaac’s fair test. Give the graph a title and label the horizontal and vertical axes.

What can Patrick and Isaac conclude from the results of their fair test?
6. Label the diagram to show the four forces acting on an aircraft or a flying animal.

7. Fill the spaces with the words *lift*, *weight*, *thrust*, and *drag*.
   a. If ____________ is greater than ____________, the aircraft will decelerate.
   b. If ____________ is greater than ____________, the aircraft will ascend.
   c. If ____________ is greater than ____________, the aircraft will descend.
   d. If ____________ is greater than ____________, the aircraft will accelerate.
   e. If ____________ is equal to ____________ and ____________ is equal to ____________, the aircraft will hover.

8. Tell how each of these creates lift.
   a. insects and birds
   b. helicopters
   c. airplanes

9. Tell how each of these creates thrust.
   a. insects and birds
   b. helicopters
   c. airplanes
10. Label the parts of the airplane.

11. Describe each of these basic airplane movements.
12. Match the fixed parts of the airplane with their functions.
   a. fuselage  ____ keeps the airplane flying upright
   b. horizontal stabilizers  ____ part of the fuselage where the pilot sits
   c. vertical stabilizer  ____ holds people and cargo
   d. wing  ____ has airfoil design which helps give the airplane lift
   e. cockpit  ____ keeps the airplane flying level.

13. Tell how a pilot would move the control surfaces to perform each of these movements.
   a. yaw right ____________________________
   b. roll left ______________________________
   c. pitch up ______________________________
   d. roll right ______________________________
   e. yaw left ________________________________
   f. pitch down ______________________________
   g. accelerate ______________________________
   h. decelerate ______________________________
   i. bank right ______________________________
   j. bank left ________________________________
14. Examine each of the devices or parts of airplanes that provide thrust. For each image use arrows to show

- direction of the air going in
- direction of the air going out
- direction of movement of the balloon, aircraft, or fan
1. Label the parts of the parachute. In boxes explain the functions of the parts.

- Canopy: opens up to fill with air, causing drag

- Pilot Chute: causes main canopy to open

- Steering Lines: enable parachute to control shape of canopy

- Payload: provides weight, controls canopy

- Suspension Lining: connect canopy to payload
2. Michelle and Joanne decided to conduct a fair test. They wanted to know if the size of the canopy affected the time it took for a parachute to land. They knew they had to keep the canopy material, canopy shape, length of the shroud lines and the mass of the payload constant. They also knew that they had to drop both parachutes from the same height and make these drops at the same time.

a. Think about Michelle and Joanne's fair test. What is your hypothesis?
   Answers may vary
   - larger canopy = slower rate of descent

b. In this fair test what is the manipulated variable? size of canopy
   are the constant variables? canopy material, canopy shape, length of shroud lines, mass of payload, drop height, time of drop

   is the responding variable? rate of descent (or time it took to descend)

Here is a table showing the results of the girls' fair test.

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</tr>
</tbody>
</table>

Based on their observations, what conclusion can the girls make?

- the larger the canopy, the longer the descent time.
3. Label the diagram of a hot-air balloon using the words from the box.

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</table>

![Diagram of a hot-air balloon with labeled parts]

4. Write A if it tells about a hot air balloon ascending and D if it tells about descending.

A  Air inside the bag is warmer than air outside the bag.
A  The pilot turns on the propane burner.
D  The pilot pulls the vent cord to release the hot air inside the envelope.
D  The air inside the bag is as dense as the air outside the bag.
A  The air inside the envelope is less dense than the air outside the envelope.
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Make a bar graph showing the results of Patrick and Isaac’s fair test. Give the graph a title and label the horizontal and vertical axes.

![Bar Graph of Flight Distances for Different Types of Paper]

What can Patrick and Isaac conclude from the results of their fair test?
6. Label the diagram to show the four forces acting on an aircraft or a flying animal.

- **lift**
- **thrust**
- **drag**
- **weight**

7. Fill the spaces with the words *lift*, *weight*, *thrust*, and *drag*.
   a. If **drag** is greater than **thrust**, the aircraft will decelerate.
   b. If **lift** is greater than **weight**, the aircraft will ascend.
   c. If **weight** is greater than **lift**, the aircraft will descend.
   d. If **thrust** is greater than **drag**, the aircraft will accelerate.
   e. If **lift** is equal to **weight** and **thrust** is equal to **drag**, the aircraft will hover.

8. Tell how each of these creates lift.
   a. insects and birds: **flap wings**
   b. helicopters: **propellers**
   c. airplanes: **airfoil shaped wings**

9. Tell how each of these creates thrust.
   a. insects and birds: **flap wings**
   b. helicopters: **propellers**
   c. airplanes: **propellers**
   d. airplanes: **jets**
10. Label the parts of the airplane.

![Diagram of airplane showing parts: wing, fuselage, propeller, rudder, elevator, horizontal stabilizers, and vertical stabilizer.]

11. Describe each of these basic airplane movements.

<table>
<thead>
<tr>
<th>Roll Right</th>
<th>Pitch Up</th>
<th>Roll Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yaw Left</td>
<td>Roll Left</td>
<td>Pitch Down</td>
</tr>
</tbody>
</table>
12. Match the fixed parts of the airplane with their functions.

a. fuselage [ ] keeps the airplane flying upright
b. horizontal stabilizers [ ] part of the fuselage where the pilot sits
c. vertical stabilizer [ ] holds people and cargo
d. wing [ ] has airfoil design which helps give the airplane lift
e. cockpit [ ] keeps the airplane flying level.

13. Tell how a pilot would move the control services to perform each of these movements.

a. yaw right turn rudder right
b. roll left raise left aileron, lower right aileron
c. pitch up raise elevators
d. roll right raise right aileron, lower left aileron
e. yaw left turn rudder left
f. pitch down lower elevators
g. accelerate rotate engines more (increase engine speed)
h. decelerate decrease engine speed
i. bank right right aileron up, left aileron down, rudder right
j. bank left left aileron up, right aileron down, rudder left
14. Examine each of the devices or parts of airplanes that provide thrust. For each image use arrows to show

- direction of the air going in
- direction of the air going out
- direction of movement of the balloon, aircraft, or fan
1. Write S for source of light and R for reflector of light.
   
   ____ Earth   ____ planet   ____ moon
   ____ Sun    ____ comet    ____ star
   ____ Mars   ____ asteroid ____ dwarf planet

2. What is a galaxy? ________________________

   To which galaxy does our solar system belong? ________________________

3. Constellations make a one-quarter during each season. Below is a diagram of the constellation “Cepheus”. Draw Cepheus as it would appear in the other seasons.

   ![Diagram of constellation Cepheus]

   Summer   Autumn
   Winter   Spring
4. Why are some constellations referred to as summer constellations?

5. Explain why it is dangerous to look directly at the Sun.

6. The class made a sundial and recorded the lengths of the shadows that the gnomon cast. They recorded their findings in a table.

<table>
<thead>
<tr>
<th>Time of Day</th>
<th>Length of Sundial’s Shadow</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>90 cm</td>
</tr>
<tr>
<td>09:00</td>
<td>80 cm</td>
</tr>
<tr>
<td>10:00</td>
<td>70 cm</td>
</tr>
<tr>
<td>11:00</td>
<td>50 cm</td>
</tr>
<tr>
<td>12:00</td>
<td>40 cm</td>
</tr>
<tr>
<td>13:00</td>
<td>50 cm</td>
</tr>
<tr>
<td>14:00</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td></td>
</tr>
</tbody>
</table>

a. Complete the table with the missing shadow lengths.

b. Make a graph showing the information in the table. Be sure to include
   - a title
   - labels for the horizontal and vertical axes
7. Describe the relationship between the slant of the Sun's rays and the length of a shadow.

8. Describe the relationship between the slant of the Sun's rays and the temperature.
9. Fill in the blanks with words that make sense.

The seasons are caused by two main factors. First, the Earth is _______________. Second, the Earth _______________ around the Sun. In the summer, the North Pole is tilted _______________ the Sun. This means that the Sun is shining more _______________ on our part of the world. This makes the days _______________ and the temperatures _______________. In the winter, the North Pole is tilted _______________ from the Sun. This means that the Sun's rays are more _______________ as they shine on our part of the world. This makes the days _______________ and the temperatures _______________.

For the Science Fair, Suzanne created a display about the average amount of daylight in Alberta.

10. An observation that can be based on the data in Suzanne's graph is that in Alberta

a. shadows are longer in the winter than in the summer.
b. shadows are shorter in the winter than in the summer.
c. there are more hours of daylight in the fall and winter than in the spring and summer.
d. there are more hours of daylight in the spring and summer than in the fall and winter.
11. Answer T (true) or F (false) about these statements about the Moon.

__ The Moon is Earth's only natural satellite.
___ If you weigh 20 kg on the Moon, you will weigh 100 kg on Earth.
___ The Moon does not have gravity.
___ The Earth is about four times the size of the Moon.
___ When the Moon is waxing, we can see increasingly more of it.
___ All of the Moon is lit by the Sun at all times.
___ The Moon revolves around the Earth in a clockwise manner.
___ When the side of the Moon facing us is in complete shadow, we call that the new moon phase.
___ The waning gibbous phase comes just before the last quarter.
___ It takes 28 days for the Moon to travel around the Earth once.
___ The Moon is made of green cheese.

12. In the spaces below draw the eight phases of the moon in order starting with the new moon.
13. List the planets in order starting with the one closest to the Sun.


14. Complete the table.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Length of a Day (Earth Units)</th>
<th>Length of a Year (Earth Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uranus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neptune</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. What is an orbit? ________________________________

What is the shape of Earth's orbit? ________________________________

16. What is a satellite? ________________________________
Science Grade 6 Mini Review Worksheets

17. Make a table showing the number of moons each planet has. Put in your own headings.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

18. Make a graph showing the information from your table.
19. Why do you think the temperatures on Mercury, Venus, Earth, and Mars are greater than those of Jupiter, Saturn, Uranus, and Neptune?

20. What is the relationship between how close a planet is to the Sun and its period of revolution?

21. List the planets in order of size, starting with the smallest.

22. List these regions of space in order from smallest to largest: solar system, Earth, universe, galaxy.

23. Which two planets have the same number of natural satellites?

24. Which planet has a year that is seven times larger than Jupiter’s?
1. Write S for source of light and R for reflector of light:

   - R Earth
   - R planet
   - R moon
   - S Sun
   - R comet
   - S star
   - R Mars
   - R asteroid
   - R dwarf planet

2. What is a galaxy? **cluster of stars**

   To which galaxy does our solar system belong? **Milky Way**

3. Constellations make a one-quarter during each season. Below is a diagram of the constellation “Cepheus”. Draw Cepheus as it would appear in the other seasons.
4. Why are some constellations referred to as summer constellations?

Visible in our location only in summer.

5. Explain why it is dangerous to look directly at the Sun.

Sun’s rays can burn eye’s retina, causing vision impairment or blindness.

6. The class made a sundial and recorded the lengths of the shadows that the gnomon cast. They recorded their findings in a table.

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a. Complete the table with the missing shadow lengths.

b. Make a graph showing the information in the table. Be sure to include

- a title
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Science Grade 6 Mini Review Worksheets

Note: Line graph is best, but accept bar graph

Length of Sundial’s Shadow

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<td>80</td>
</tr>
<tr>
<td>11:00</td>
<td>60</td>
</tr>
<tr>
<td>12:00</td>
<td>40</td>
</tr>
<tr>
<td>13:00</td>
<td>20</td>
</tr>
<tr>
<td>14:00</td>
<td>40</td>
</tr>
<tr>
<td>15:00</td>
<td>60</td>
</tr>
<tr>
<td>16:00</td>
<td>80</td>
</tr>
</tbody>
</table>

7. Describe the relationship between the slant of the Sun’s rays and the length of a shadow.
   more slanted the Sun’s ray, the longer the shadow

8. Describe the relationship between the slant of the Sun’s rays and the temperature.
   more slanted the Sun’s rays, the cooler the temperature

Worksheet #6C.Review.3c
9. Fill in the blanks with words that make sense.

The seasons are caused by two main factors. First, the Earth is tilted. Second, the Earth revolves around the Sun. In the summer, the North Pole is tilted toward the Sun. This means that the Sun is shining more directly on our part of the world. This makes the days longer and the temperatures greater (hotter). In the winter, the North Pole is tilted away from the Sun. This means that the Sun's rays are more slanted, as they shine on our part of the world. This makes the days shorter and the temperatures cooler.

For the Science Fair, Suzanne created a display about the average amount of daylight in Alberta.

10. An observation that can be based on the data in Suzanne's graph is that in Alberta:
   a. shadows are longer in the winter than in the summer.
   b. shadows are shorter in the winter than in the summer.
   c. there are more hours of daylight in the fall and winter than in the spring and summer.
   d. there are more hours of daylight in the spring and summer than in the fall and winter.
11. Answer T (true) or F (false) about these statements about the Moon.

- T  The Moon is Earth’s only natural satellite.
- F  If you weigh 20 kg on the Moon, you will weigh 100 kg on Earth.
- F  The Moon does not have gravity.
- T  The Earth is about four times the size of the Moon.
- F  When the Moon is waxing, we can see increasingly more of it.
- F  All of the Moon is lit by the Sun at all times.
- T  The Moon revolves around the Earth in a clockwise manner.
- T  When the side of the Moon facing us is in complete shadow, we call that the new moon phase.
- T  The waning gibbous phase comes just before the last quarter.
- T  It takes 28 days for the Moon to travel around the Earth once.
- F  The Moon is made of green cheese.

12. In the spaces below draw the eight phases of the moon in order starting with the new moon.

<table>
<thead>
<tr>
<th>New moon</th>
<th>Waxing crescent</th>
<th>First quarter</th>
<th>Waxing gibbous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full moon</th>
<th>Waning gibbous</th>
<th>Last quarter</th>
<th>Waxing crescent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. List the planets in order starting with the one closest to the Sun.

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

14. Complete the table.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Length of a Day (Earth Units)</th>
<th>Length of a Year (Earth Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>59 days</td>
<td>88 days</td>
</tr>
<tr>
<td>Venus</td>
<td>243 days</td>
<td>224.7 days</td>
</tr>
<tr>
<td>Earth</td>
<td>24 hours</td>
<td>365 days</td>
</tr>
<tr>
<td>Mars</td>
<td>24 hours</td>
<td>687 days</td>
</tr>
<tr>
<td>Jupiter</td>
<td>10 hours</td>
<td>12 years</td>
</tr>
<tr>
<td>Saturn</td>
<td>11 hours</td>
<td>29 years</td>
</tr>
<tr>
<td>Uranus</td>
<td>17 hours</td>
<td>84 years</td>
</tr>
<tr>
<td>Neptune</td>
<td>16 hours</td>
<td>165 years</td>
</tr>
</tbody>
</table>

15. What is an orbit?  **path on which planet travels around Sun**

What is the shape of Earth's orbit? **ellipse**

16. What is a satellite? **body which travels around another**
17. Make a table showing the number of moons each planet has. Put in your own headings.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>0</td>
</tr>
<tr>
<td>Venus</td>
<td>0</td>
</tr>
<tr>
<td>Earth</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>2</td>
</tr>
<tr>
<td>Jupiter</td>
<td>63</td>
</tr>
<tr>
<td>Saturn</td>
<td>61</td>
</tr>
<tr>
<td>Uranus</td>
<td>27</td>
</tr>
<tr>
<td>Neptune</td>
<td>13</td>
</tr>
</tbody>
</table>

18. Make a graph showing the information from your table.

The Planets' Moons

Number of Moons

<table>
<thead>
<tr>
<th>Planet</th>
<th>Number of Moons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td></td>
</tr>
<tr>
<td>Earth</td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td></td>
</tr>
<tr>
<td>Uranus</td>
<td></td>
</tr>
<tr>
<td>Neptune</td>
<td></td>
</tr>
</tbody>
</table>
19. Why do you think the temperatures on Mercury, Venus, Earth, and Mars are greater than those of Jupiter, Saturn, Uranus, and Neptune?

closer to Sun

20. What is the relationship between how close a planet is to the Sun and its period of revolution?

closer a planet is to Sun, the shorter its period of revolution

21. List the planets in order of size, starting with the smallest.

Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn, Jupiter

22. List these regions of space in order from smallest to largest: solar system, Earth, universe, galaxy.

Earth, solar system, galaxy, universe

23. Which two planets have the same number of natural satellites?

Mercury, Venus

24. Which planet has a year that is seven times larger than Jupiter's?

Uranus
1. Write the words for each of the meanings.

_______________ to look for information in an organized way

_______________ a small piece of evidence

_______________ the person who hires a detective

_______________ person who committed the crime

_______________ someone who sees a crime happen

_______________ an act which breaks the law

_______________ to blame or charge someone with a crime

_______________ the science that studies clues

_______________ in court, these facts are proof

_______________ an excuse that tells others that a suspect was not at the scene of a crime

_______________ to hide something or someone

_______________ to sentence a criminal who has been found guilty

2. Detective Rick Peters is a police detective who has been called to the scene of a household robbery. The homeowners were not home when the robbery occurred. Four hundred dollars in cash was reported missing. Following are Detective Peters’ notes.

- Dresser drawers pulled out of dresser; contents of drawers dumped on floor
- Notepad on kitchen table, note was missing, but could see indentations made by pen
- Only bedroom appeared to have been searched
- Footprints on carpet in living room and in bedroom
- Lifted several sets of fingerprints from top of dresser
- Lamp in living room knocked over
- Hair samples found in bathroom
- Footprints in soil outside lead to and from tire tracks
- Tire tracks do not appear to be from homeowner’s vehicle
- Faint smell of cologne – maybe “Old Spice”???
- Torn piece of cloth on bush next to front steps
- Earring with small diamond found in bedroom, not owner’s
After examining his notes Detective Peters made some inferences and hypotheses. Tell which observations you think would have led him to make his inferences and hypotheses.

<table>
<thead>
<tr>
<th>Inferences and Hypotheses</th>
<th>Based on These Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The perpetrator was in a hurry to leave.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator knew where the money was kept.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator was in a hurry to get to the bedroom.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator came in a car.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator may have worn jewellery.</td>
<td></td>
</tr>
</tbody>
</table>

Detective Peters also decided that he needed to investigate some of the evidence further. Tell about at least five clues you think Detective Peters should look into and why.

a.  

b.  

c.  

d.  

e.  

3. For each of the observations about footprints, animal tracks, and tire tracks, tell about an inference you could make.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footprints are 10 cm long.</td>
<td></td>
</tr>
<tr>
<td>Footprints are deep (15 mm).</td>
<td></td>
</tr>
<tr>
<td>Stride is long (1.3 m).</td>
<td></td>
</tr>
<tr>
<td>Two sets of parallel footprints.</td>
<td></td>
</tr>
<tr>
<td>Length of stride started out short, but lengthened</td>
<td></td>
</tr>
<tr>
<td>Started out with two sets of parallel footprints. Then one set disappeared; the remaining set became deeper.</td>
<td></td>
</tr>
<tr>
<td>Toes and claw marks</td>
<td></td>
</tr>
<tr>
<td>Two prints per set; three-toed</td>
<td></td>
</tr>
<tr>
<td>Four prints per set</td>
<td></td>
</tr>
<tr>
<td>Tire treads were clear and deep.</td>
<td></td>
</tr>
<tr>
<td>Tire treads were unclear.</td>
<td></td>
</tr>
<tr>
<td>Tire treads clear. 6 cm line across tread</td>
<td></td>
</tr>
</tbody>
</table>
4. Examine each of the following. Tell what inference(s) you can make for each.

a. 

b. 

5. For each of the following, circle the one that matches.

a. 

b. The footprint...
6. Choose the best answer to each of these footprint questions.

The officer also made a diagram of some of the muddy footprints left inside the building.

By looking at the officer's diagram, you infer that the thief

A. stayed in the building only a few seconds
B. triggered an alarm in the secretary's office
C. ran out of the building carrying something heavy
D. found a second door leading to the camp director's office

When you return to your campsite, you find that the canoe is gone. There are some footprints on the beach near and around the rock where the canoe had been tied.

The RCMP officer infers that the canoe was **most likely** taken by someone who

A. walked to the canoe in shoes, took off his or her shoes, and met a friend
B. walked to the canoe in barefeet, untied the canoe, and hid the canoe
C. met another person and they both carried the canoe away
D. met another person and they both dragged the canoe away
7. Recently, someone broke into the community centre and vandalized one of the meeting rooms. An RCMP officer was assigned to the case. He went to the meeting room and gathered evidence. With the help of other officers he narrowed his suspect list down to four.

The chart below tells about information about each of the suspects and evidence found at the community centre.

<table>
<thead>
<tr>
<th>Type of Evidence</th>
<th>Suspect A</th>
<th>Suspect B</th>
<th>Suspect C</th>
<th>Suspect D</th>
<th>Evidence at Community Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoe print</td>
<td>Size 10 D</td>
<td>Size 10 C</td>
<td>Size 9 E</td>
<td>Size 10 E</td>
<td>Size 10</td>
</tr>
<tr>
<td>Fingerprint</td>
<td>loops</td>
<td>loops</td>
<td>arches</td>
<td>whorls</td>
<td>Loops</td>
</tr>
<tr>
<td>Ink</td>
<td>Black in pen</td>
<td>Black ink pen</td>
<td>Black ink pen</td>
<td>Blue ink pen</td>
<td>Black ink on envelope</td>
</tr>
<tr>
<td>Soil</td>
<td>Clay soil found on shoe</td>
<td>garden and loam found on tires</td>
<td>Garden soil found on tires</td>
<td>Sandy soil found on shoes</td>
<td>Clay and sandy soil in parking lot</td>
</tr>
</tbody>
</table>

a. Which suspects could have left the shoe prints at the community centre?

b. Which suspects had soil on their shoes or tires similar to that found at the community centre?

c. Which suspects could have written on the envelope?
d. Which of the suspects had each of the following fingerprint types?

- [Image of fingerprint types]

- [Image of fingerprint types]

- [Image of fingerprint types]

e. From the evidence the RCMP officer gathered, whom would he conclude is his prime suspect? Tell why.

- [Response to e]

8. Examine the double line graph showing break-in and property damage crimes in one week. Then answer the questions.

Number of Break-in and Property Damage Crimes in a One-Week Period

<table>
<thead>
<tr>
<th>Day</th>
<th>Mon</th>
<th>Tue</th>
<th>Wed</th>
<th>Thu</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>20</td>
<td>15</td>
<td>30</td>
<td>40</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The number of break-in and property damage crimes was highest on which two days?
Science Grade 6 Mini Review Worksheets

From the information in the graph, which of the following can you conclude?

a. Teenagers are most likely to commit break-ins and vandalize.
b. There are fewer break-ins than property damage crimes.
c. People should stay home on Saturdays.
d. There are more break-ins than property damage crimes.

9. Recently a very wealthy woman was kidnapped as she was walking to her car from the shopping mall.

This ransom note was written to a kidnap victim’s family.

_If you want the rich lady back, it’ll cost you big time. I’ll see you at six._

The investigating officer took handwriting samples from four suspects.

<table>
<thead>
<tr>
<th>Suspect 1</th>
<th>Put my things in a box.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspect 2</td>
<td>Put my things in a box.</td>
</tr>
<tr>
<td>Suspect 3</td>
<td>Put my things in a box.</td>
</tr>
<tr>
<td>Suspect 4</td>
<td>Put my things in a box.</td>
</tr>
</tbody>
</table>

Which suspect **most likely** wrote the note? Give reasons for your choice.
10. A fabric sample was found at a crime scene. The RCMP officer investigating the crime took samples from the clothing of four suspects. He recorded the data in the chart below to help identify the sample taken from the crime scene.

<table>
<thead>
<tr>
<th>Source of Fabric</th>
<th>Mass Per Square Centimetre</th>
<th>Length That a 10 cm Sample Stretches</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspect 1</td>
<td>4.0 g</td>
<td>3.0 cm</td>
<td>Rough</td>
</tr>
<tr>
<td>Suspect 2</td>
<td>3.0 g</td>
<td>1.0 cm</td>
<td>Rough</td>
</tr>
<tr>
<td>Suspect 3</td>
<td>2.0 g</td>
<td>4.0 cm</td>
<td>Smooth</td>
</tr>
<tr>
<td>Suspect 4</td>
<td>1.0 g</td>
<td>2.5 cm</td>
<td>Smooth</td>
</tr>
</tbody>
</table>

**Fabric sample taken from the crime scene:**
Mass – 3.5 g. per square cm
Stretches – 2.5 cm
Texture – rough

From the information in the chart, which suspect most likely left the fabric at the crime scene? Tell how you know.

11. A police officer shows you the notebook he uses to record evidence for an investigation.

With which of the following will he most likely label the final column? Tell why.

- Found by
- Size of evidence
- Location found
- Age of Evidence

---

Worksheet #6D.Review.4i
1. Write the words for each of the meanings.

- **investigate**: to look for information in an organized way
- **clue**: a small piece of evidence
- **client**: the person who hires a detective
- **perpetrator**: person who committed the crime
- **witness**: someone who sees a crime happen
- **crime**: an act which breaks the law
- **accuse**: to blame or charge someone with a crime
- **forensic science**: the science that studies clues
- **evidence**: in court, these facts are proof
- **alibi**: an excuse that tells others that a suspect was not at the scene of a crime
- **stash**: to hide something or someone
- **condemn**: to sentence a criminal who has been found guilty

2. Detective Rick Peters is a police detective who has been called to the scene of a household robbery. The homeowners were not home when the robbery occurred. Four hundred dollars in cash was reported missing. Following are Detective Peters’ notes.

- Dresser drawers pulled out of dresser; contents of drawers dumped on floor
- Notepad on kitchen table, note was missing, but could see indentations made by pen
- Only bedroom appeared to have been searched
- Footprints on carpet in living room and in bedroom
- Lifted several sets of fingerprints from top of dresser
- Lamp in living room knocked over
- Hair samples found in bathroom
- Footprints in soil outside lead to and from tire tracks
- Tire tracks do not appear to be from homeowner’s vehicle
- Faint smell of cologne – maybe “Old Spice”??
- Torn piece of cloth on bush next to front steps
- Earring with small diamond found in bedroom, not owner’s
After examining his notes Detective Peters made some inferences and hypotheses. Tell which observations you think would have led him to make his inferences and hypotheses.

<table>
<thead>
<tr>
<th>Inferences and Hypotheses</th>
<th>Based on These Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The perpetrator was in a hurry to</td>
<td>knocked over lamp OR</td>
</tr>
<tr>
<td>leave.</td>
<td>snagged clothing on bush</td>
</tr>
<tr>
<td>The perpetrator knew where the</td>
<td>only bedroom was searched</td>
</tr>
<tr>
<td>money was kept.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator was in a hurry to</td>
<td>knocked over lamp</td>
</tr>
<tr>
<td>get to the bedroom.</td>
<td></td>
</tr>
<tr>
<td>The perpetrator came in a car.</td>
<td>left tire tracks</td>
</tr>
<tr>
<td>The perpetrator may have worn</td>
<td>earring found</td>
</tr>
<tr>
<td>jewellery.</td>
<td></td>
</tr>
</tbody>
</table>

Detective Peters also decided that he needed to investigate some of the evidence further. Tell about at least five clues you think Detective Peters should look into and why.

a. **notebook**: Indentations from previous note might be useful

b. **footprints**: Might place a suspect at the scene

c. **tire tracks**: Might place a suspect's car at the scene

d. **torn cloth**: Might match cloth of a suspect

e. **earring**: Might match one owned by suspect

f. **hair sample**: DNA might match it to a suspect's DNA
3. For each of the observations about footprints, animal tracks, and tire tracks, tell about an inference you could make.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footprints are 10 cm long.</td>
<td>short person / young child</td>
</tr>
<tr>
<td>Footprints are deep (15 mm).</td>
<td>heavy person</td>
</tr>
<tr>
<td>Stride is long (1.3 m).</td>
<td>tall person / running</td>
</tr>
<tr>
<td>Two sets of parallel footprints.</td>
<td>two people walking together</td>
</tr>
<tr>
<td>Length of stride started out short, but lengthened.</td>
<td>started outwalking, changed to running</td>
</tr>
<tr>
<td>Started out with two sets of parallel footprints. Then one set disappeared; the remaining set became deeper.</td>
<td>two people were walking together; then one person started carrying the other</td>
</tr>
<tr>
<td>Toes and claw marks</td>
<td>animal can climb trees</td>
</tr>
<tr>
<td>Two prints per set; three-toed</td>
<td>bird</td>
</tr>
<tr>
<td>Four prints per set</td>
<td>4-legged animal</td>
</tr>
<tr>
<td>Tire treads were clear and deep.</td>
<td>new tires, recently made</td>
</tr>
<tr>
<td>Tire treads were unclear.</td>
<td>tracks made some time ago; worn tires</td>
</tr>
<tr>
<td>Tire treads clear 6 cm line across tread</td>
<td>at one time tire ran over something sharp</td>
</tr>
</tbody>
</table>
4. Examine each of the following. Tell what inference(s) you can make for each.

a. Running then walking

b. Walking then running

5. For each of the following, circle the one that matches.

a. 

b. The frogstomp stopped a short distance from the school. Megan looked closely on the ground and found a partial bike tire track in the mud.

She visited a local bike shop and obtained samples of four different bike tire tracks.

- A
- B
- C
- D

Worksheet #6D: Review 4d
6. Choose the best answer to each of these footprint questions.

By looking at the officer's diagram, you infer that the thief

A. stayed in the building only a few seconds
B. triggered an alarm in the secretary's office
C. ran out of the building carrying something heavy
D. found a second door leading to the camp director's office

The RCMP officer infers that the canoe was most likely taken by someone who

A. walked to the canoe in shoes, took off his or her shoes, and met a friend
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<th>Suspect C</th>
<th>Suspect D</th>
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<tbody>
<tr>
<td>Shoe print</td>
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<td>Size 10 C</td>
<td>Size 9 E</td>
<td>Size 10 E</td>
<td>Size 10</td>
</tr>
<tr>
<td>Fingerprint</td>
<td>loops</td>
<td>loops</td>
<td>arches</td>
<td>whorls</td>
<td>Loops</td>
</tr>
<tr>
<td>Ink</td>
<td>Black in pen</td>
<td>Black ink pen</td>
<td>Black ink pen</td>
<td>Blue ink pen</td>
<td>Black ink on envelope</td>
</tr>
<tr>
<td>cloth</td>
<td>White cotton shirt</td>
<td>White nylon shirt</td>
<td>White polyester shirt</td>
<td>White cotton shirt</td>
<td>White cotton on bush in parking lot</td>
</tr>
<tr>
<td>soil</td>
<td>Clay soil found on shoe</td>
<td>garden and loam found on tires</td>
<td>Garden soil found on tires</td>
<td>Sandy soil found on shoes</td>
<td>Clay and sandy soil in parking lot</td>
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</tbody>
</table>

a. Which suspects could have left the shoe prints at the community centre?  

A B D

b. Which suspects had soil on their shoes or tires similar to that found at the community centre? 

A D

c. Which suspects could have written on the envelope? 

A B C
d. Which of the suspects had each of the following fingerprint types?

L  D  A B

8. Examine the double line graph showing break-in and property damage crimes in one week. Then answer the questions.

The number of break-in and property damage crimes was highest on which two days?

Friday, Saturday
From the information in the graph, which of the following can you conclude?

- a. Teenagers are most likely to commit break-ins and vandalize.
- b. There are fewer break-ins than property damage crimes.
- c. People should stay home on Saturdays.
- d. There are more break-ins than property damage crimes.

9. Recently a very wealthy woman was kidnapped as she was walking to her car from the shopping mall.

This ransom note was written to a kidnap victim’s family.

If you want the rich lady back, it'll cost ya big time. I'll you at six.

The investigating officer took handwriting samples from four suspects.

- **Suspect 1**: Put my things in a box.
- **Suspect 2**: Put my things in a box.
- **Suspect 3**: Put my things in a box.
- **Suspect 4**: Put my things in a box.

Which suspect most likely wrote the note? Give reasons for your choice.

- **Suspect 4**: size of writing: letters y, b, q, 5, etc.
  - slant of writing
  - combination printing/writing
10. A fabric sample was found at a crime scene. The RCMP officer investigating the crime took samples from the clothing of four suspects. He recorded the data in the chart below to help identify the sample taken from the crime scene.

<table>
<thead>
<tr>
<th>Source of Fabric</th>
<th>Mass Per Square Centimetre</th>
<th>Length That a 10 cm Sample Stretches</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspect 1</td>
<td>4.0 g</td>
<td>3.0 cm</td>
<td>Rough</td>
</tr>
<tr>
<td>Suspect 2</td>
<td>3.0 g</td>
<td>1.0 cm</td>
<td>Rough</td>
</tr>
<tr>
<td>Suspect 3</td>
<td>2.0 g</td>
<td>4.0 cm</td>
<td>Smooth</td>
</tr>
<tr>
<td>Suspect 4</td>
<td>1.0 g</td>
<td>2.5 cm</td>
<td>Smooth</td>
</tr>
</tbody>
</table>

Fabric sample taken from the crime scene:
Mass – 3.5 g. per square cm
Stretches – 2.5 cm
Texture – rough

From the information in the chart, which suspect most likely left the fabric at the crime scene? Tell how you know.

Suspect 1: Mass and texture → came down to Suspect 1 or Suspect 2

Stretch → Suspect 1 was closer

11. A police officer shows you the notebook he uses to record evidence for an investigation.

With which of the following will he most likely label the final column? Tell why.

Found by:

- By elimination:
  Found by: we already know the police officer found the evidence

Size: can be measured and photographed

Age of Evidence: difficult to determine
1. What is an ecosystem?

Name ten biotic things you might find in a forest.

What are five abiotic factors in a forest?

Tell how these abiotic factors affect trees in a forest.

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>How the Abiotic Factor Affects Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunshine</td>
<td></td>
</tr>
<tr>
<td>Rain</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
</tbody>
</table>

Tell how these biotic factors affect the trees in a forest.

<table>
<thead>
<tr>
<th>Biotic Factor</th>
<th>How the Biotic Factor Affects Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tent caterpillar</td>
<td></td>
</tr>
<tr>
<td>Deer</td>
<td></td>
</tr>
<tr>
<td>Mushroom</td>
<td></td>
</tr>
</tbody>
</table>
2. How is a tree different from a forest?

Put a check mark (✓) in front of those things that describe trees.

- It dies down to the roots each fall.
- It has a woody stem.
- It has no bark.
- Its stem is soft.
- It has a self-supporting trunk.
- It produces flowers or cones.
- Its leaves are usually large.
- The roots are usually very tiny.

3. Write D if the statement tells about deciduous trees, C if it tells about coniferous trees, and B if it tells about both.

- They shed their leaves.
- Their leaves are usually broad and flat.
- They cannot withstand extreme temperatures.
- They shed their leaves continuously.
- Their leaves have a thick, waxy coating which reduces water loss.
- They can withstand temperature extremes.
- They shed their leaves in the autumn.
- The tops of the leaves are waxy, but the bottom sides are large and uncoated, causing moisture loss.
- Their leaves are needle-shaped.
4. Write N if the statement tells how trees and forests are important to nature, H if it tells how they are important to humans, and B if it tells how they are important to both.

____ They provide jobs.
____ They provide protection from the wind and sun.
____ They provide food.
____ They provide oxygen.
____ They provide carbon dioxide.
____ They help enrich the soil.
____ They are useful in making buildings and furniture.
____ They provide a place for recreation.
____ They provide homes.
____ They are used to make paper products.

5. Explain how the traditional attitudes of First Nations people helped to maintain balance in the forest ecosystem.

________________________________________________________________________

________________________________________________________________________

In what ways is our use of trees and forests similar to the ways that First Nations traditionally used them?

________________________________________________________________________

________________________________________________________________________

How is our use of trees and forests different from how First Nations traditionally used them?

________________________________________________________________________

________________________________________________________________________
6. Describe each of these forest levels.
   a. upper canopy
   b. understory
   c. underbrush
   d. forest floor

7. Write **N** if the statement tells about the nutrient cycle, **O** if it tells about the oxygen cycle, and **W** if it tells about the water cycle. You may put more than one letter in the space.

   ____ Water is given off into the air by plants.
   ____ In photosynthesis, plants take in water and carbon dioxide and produce sugars and oxygen.
   ____ Water evaporates into the air.
   ____ Nutrients are absorbed by the plants roots.
   ____ Water vapour in the air cools and condenses and falls to Earth as rain, snow, and hail.
   ____ A first order consumer eats the green plants.
   ____ Decomposers break down organic matters and releases the nutrients into the soil.
   ____ In respiration, animals and people breathe in oxygen and breathe out carbon dioxide.
   ____ In transpiration, plants release water into the air.
   ____ A cougar eats a rabbit.
   ____ It is a process that repeats itself over and over again.
   ____ The forest ecosystem depends on it.
   ____ In respiration, animals and plants breathe out carbon dioxide and water.
8. Label the parts of the leaf.

9. Examine the leaves below. Then fill in the spaces to describe them.

<table>
<thead>
<tr>
<th>Type of leaf</th>
<th>Shape of leaf</th>
<th>Type of margin</th>
<th>Leaf arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #6E Review 5c
10. Describe the bark shown in each of the pictures below.

12. Describe each of the tree shapes.

13. Draw pictures to illustrate trees growing in these conditions.

- growing closely to a wall
- growing in an area with a strong prevailing wind
- growing during a period of drought
15. Label the parts of this cross-section cut of a tree trunk. In the boxes describe each part.

16. Examine each tree cookie; then make one or more inferences about its growth.

a. 

b. 
17. Write E if the statement describes how human activity enhances forests. Write T if it tells how human activity threatens forests.

_____ After harvesting trees, planters sow seeds and plant seedlings.

_____ Governments make parks where forestry, hunting, and fishing are not allowed.

_____ Forestry companies use clear cutting to harvest trees.

_____ Factories dump their waste into rivers and lakes located in forests.

_____ Hundreds of thousands of hectares of forests are burned to make agricultural land each year.

_____ People visit forested areas, but take special care not to litter or damage the forest in any way.

_____ Governments pass laws to protect certain species of animals that live in forests.

_____ A large area of forest is cleared to make a golf course.

_____ Ecologists give people tours of forested areas to help them understand the forest ecosystem.

_____ A high watch tower is built so that fire rangers can spot forest fires.

_____ An area of forest is stripped so a company can mine the coal underneath.
18. Read the following facts about forest fires.

**About Forest Fires**
- Fire kills the low growth and cleanses the earth, providing opportunity for larger fire resistant trees to grow.
- Fire kills diseases and insects and can return nutrients to the earth.
- Consistent, on-going change is essential to a healthy ecosystem that will allow a sustainable forest to grow.
- Fire, in the right condition, can do good things. For example, some trees are fire-dependent and require heat to open their cones to release the seed.
- Homes in nature are beautiful but can become dangerous in an unintended forest as wild fires may occur.
- Trees compete for sunlight, water, and soil nutrients.
- We enjoy forests for: wood products, nature, beauty.

**Controlled Burns**
Controlled burns are intentionally set, but a close watch is kept on them to ensure that they do not spread wildly. They are called prescribed burns or cool burns. Cool burns kill undergrowth, diseases and insects. Sometimes a controlled burn can turn into a wild fire. This happens if the people in charge of the burn are not watching carefully or if a strong wind blow in unexpectedly. After a controlled burn, the ecosystem returns quickly to health.

**Wild Fires**
Wild fires are uncontrolled. They can be started by nature, usually or lightning strikes, or by careless humans. They burn hot. Unlike controlled burns, wild fires usually extend to burning the forest canopy. After the fire, soil and wind erosion become problems. It takes decades for a forest to return to health after a wild fire.

From what you read, what are the advantages and disadvantages of conducting controlled burns?

<table>
<thead>
<tr>
<th>Advantages of Controlled Burns</th>
<th>Disadvantages of Controlled Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #6E.Review.51
Science Grade 6 Mini Review Worksheets

Trees and Forests

1. What is an ecosystem? [community of biotic and abiotic things]

Name ten biotic things you might find in a forest.

What are five abiotic factors in a forest?

Tell how these abiotic factors affect trees in a forest.

<table>
<thead>
<tr>
<th>Abiotic Factor</th>
<th>How the Abiotic Factor Affects Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunshine</td>
<td>Trees need sunshine to grow/carry out photosynthesis</td>
</tr>
<tr>
<td>Rain</td>
<td>Trees need rain to grow</td>
</tr>
<tr>
<td>Temperature</td>
<td>Trees grow best when temperature is appropriate. E.g. deciduous trees do not like extreme temperatures</td>
</tr>
</tbody>
</table>

Tell how these biotic factors affect the trees in a forest.

<table>
<thead>
<tr>
<th>Biotic Factor</th>
<th>How the Biotic Factor Affects Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tent caterpillar</td>
<td>Eats leaves, can destroy leaves, may be kill tree</td>
</tr>
<tr>
<td>Deer</td>
<td>Eats leaves, droppings make soil more nutritious for trees</td>
</tr>
<tr>
<td>Mushroom</td>
<td>Decompose organic matter which makes soil richer for trees</td>
</tr>
</tbody>
</table>
2. How is a tree different from a forest?

Tree is a plant, but forest is an ecosystem

Put a check mark (✓) in front of those things that describe trees.

- [ ] It dies down to the roots each fall.
- [x] It has a woody stem.
- [ ] It has no bark.
- [ ] Its stem is soft.
- [x] It has a self-supporting trunk.
- [x] It produces flowers or cones.
- [x] Its leaves are usually large.
- [ ] The roots are usually very tiny.

3. Write D if the statement tells about deciduous trees, C if it tells about coniferous trees, and B if it tells about both.

B  They shed their leaves.
D  Their leaves are usually broad and flat.
D  They cannot withstand extreme temperatures.
C  They shed their leaves continuously.
C  Their leaves have a thick, waxy coating which reduces water loss.
D  They can withstand temperature extremes.
D  They shed their leaves in the autumn.
D  The tops of the leaves are waxy, but the bottom sides are large and uncoated, causing moisture loss.
C  Their leaves are needle-shaped.
4. Write N if the statement tells how trees and forests are important to nature, H if it tells how they are important to humans, and B if it tells how they are important to both.

H They provide jobs.
B They provide protection from the wind and sun.
B They provide food.
B They provide oxygen.
N They provide carbon dioxide.
N They help enrich the soil.
H They are useful in making buildings and furniture.
H They provide a place for recreation.
N They provide homes.
H They are used to make paper products.

5. Explain how the traditional attitudes of First Nations people helped to maintain balance in the forest ecosystem.

took only what they need
took care to conserve forests

In what ways is our use of trees and forests similar to the ways that First Nations traditionally used them?

use them to build homes, get food and materials

How is our use of trees and forests different from how First Nations traditionally used them?

First Nations relied on forests more to provide basic needs
We are not as concerned with conservation
We use forests more for recreation
6. Describe each of these forest levels.
   a. upper canopy formed by leaves and branches of tallest trees
   b. understory smaller trees and larger shrubs
   c. underbrush ferns, wildflowers, and other soft-stemmed plants
   d. forest floor ground cover and soil

7. Write N is the statement tells about the nutrient cycle, O if it tells about the oxygen cycle, and W if it tells about the water cycle. You may put more than one letter in the space.
   W  Water is given off into the air by plants.
   O  In photosynthesis, plants take in water and carbon dioxide and produce sugars and oxygen.
   W  Water evaporates into the air.
   N  Nutrients are absorbed by the plants roots.
   W  Water vapour in the air cools and condenses and falls to Earth as rain, snow, and hail.
   N  A first order consumer eats the green plants.
   N  Decomposers break down organic matters and releases the nutrients into the soil.
   O  In respiration, animals and people breathe in oxygen and breathe out carbon dioxide.
   W  In transpiration, plants release water into the air.
   N  A cougar eats a rabbit.
   N W O  It is a process that repeats itself over and over and over again.
   N W O  The forest ecosystem depends on it.
   N W O  In respiration, animals and plants breathe out carbon dioxide and water.
8. Label the parts of the leaf.

![Leaf Diagram]

9. Examine the leaves below. Then fill in the spaces to describe them.

<table>
<thead>
<tr>
<th>Type of leaf</th>
<th>Compound</th>
<th>Simple</th>
<th>Needle/Double Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape of leaf</td>
<td>linear</td>
<td>ovate</td>
<td></td>
</tr>
<tr>
<td>Type of margin</td>
<td>fine-toothed</td>
<td>smooth</td>
<td></td>
</tr>
<tr>
<td>Leaf arrangement</td>
<td>whorled</td>
<td>alternate</td>
<td>scale-like</td>
</tr>
</tbody>
</table>
10. Describe the bark shown in each of the pictures below.

<table>
<thead>
<tr>
<th>Scaly</th>
<th>Vertical</th>
<th>Vertical</th>
<th>Horizontal and Wavy</th>
<th>Horizontal</th>
</tr>
</thead>
</table>

12. Describe each of the tree shapes.

<table>
<thead>
<tr>
<th>Circle</th>
<th>Rectangle</th>
<th>Triangle</th>
<th>Spreading</th>
<th>Oval</th>
</tr>
</thead>
</table>

13. Draw pictures to illustrate trees growing in these conditions.

- One side more developed than the other
- Growing closely to a wall
- Leaning
- Growing in an area with a strong prevailing wind
- Some dying branches
- Growing during a period of drought
15. Label the parts of this cross-section cut of a tree trunk. In the boxes describe each part.

- **Outer Bark (Cork)**: protects tree
- **Sapwood**: xylem transports water and dissolved minerals from roots to the leaves
- **Heartwood**: gives the stem strength
- **Cambium**: produces new xylem
- **Phloem (Inner Bark)**: transport food from leaves to other parts of the tree

16. Examine each tree cookie; then make one or more inferences about its growth.

- **a.** growing close to an obstacle
- **b.** experienced period of drought

Answers may vary
17. Write E if the statement describes how human activity enhances forests. Write T if it tells how human activity threatens forests.

E  After harvesting trees, planters sow seeds and plant seedlings.
E  Governments make parks where forestry, hunting, and fishing are not allowed.
T  Forestry companies use clear cutting to harvest trees.
T  Factories dump their waste into rivers and lakes located in forests.
T  Hundreds of thousands of hectares of forests are burned to make agricultural land each year.
E  People visit forested areas, but take special care not to litter or damage the forest in any way.
E  Governments pass laws to protect certain species of animals that live in forests.
T  A large area of forest is cleared to make a golf course.
E  Ecologists give people tours of forested areas to help them understand the forest ecosystem.
E  A high watch tower is built so that fire rangers can spot forest fires.
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</tr>
</thead>
<tbody>
<tr>
<td>kill undergrowth and cleanses earth, enabling larger trees to become more fire resistant</td>
<td>can get out of control and become a wild fire. Damage from wild fire can take decades to overcome</td>
</tr>
<tr>
<td>kill diseases and insects</td>
<td></td>
</tr>
<tr>
<td>in the end makes for healthier ecosystem</td>
<td></td>
</tr>
<tr>
<td>after a controlled burn, ecosystem quickly returns to health</td>
<td></td>
</tr>
</tbody>
</table>