Science

Grade Two
Science Grade Two

Topics A, B, and C
Science
Grade Two
Outcomes

SKILLS

These skills apply to the five topics of study identified for Grade 2. The organization of these skills reflects a general pattern of science inquiry, not a fixed instructional sequence. At Grade 2, students normally will show independence in exploratory activities but require teacher direction in developing a structured approach to investigating questions and problems.

<table>
<thead>
<tr>
<th>Science Inquiry</th>
<th>Problem Solving Through Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Learner Expectations</strong></td>
<td><strong>General Learner Expectations</strong></td>
</tr>
<tr>
<td>Students will:</td>
<td>Students will:</td>
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<tr>
<td>2-1 Investigate, with guidance, the nature of things, demonstrating an understanding of the procedures followed.</td>
<td>2-3 Construct, with guidance, an object that achieves a given purpose, using materials that are provided.</td>
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<tr>
<td>2-2 Recognize pattern and order in objects and events studied; and, with guidance, record procedures and observations, using pictures and words; and make predictions and generalizations, based on observations.</td>
<td>Note: Construction tasks will involve building objects that float and are stable in water.</td>
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<table>
<thead>
<tr>
<th>Specific Learner Expectations</th>
<th>Specific Learner Expectations</th>
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<tbody>
<tr>
<td>Students will:</td>
<td>Students will:</td>
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<tr>
<td><strong>Focus</strong></td>
<td><strong>Focus</strong></td>
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<tr>
<td>• ask questions that lead to exploration and investigation</td>
<td>• identify the purpose of the object to be constructed. What structure do we need to make? What does it need to do?</td>
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<tr>
<td>• identify one or more possible answers to questions asked by themselves and others. Ideas may take the form of predictions and hypotheses</td>
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<tr>
<td><strong>Explore and Investigate</strong></td>
<td><strong>Explore and Investigate</strong></td>
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<tr>
<td>• manipulate materials and make observations that are relevant to questions asked</td>
<td>• attempt, with guidance, a variety of strategies to complete tasks</td>
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<tr>
<td>• carry out simple procedures identified by others</td>
<td>• identify steps followed in constructing the object and in testing it to see if it works</td>
</tr>
<tr>
<td>• identify materials used and how they were used</td>
<td>• engage in all parts of the task and allow others to make their contributions</td>
</tr>
<tr>
<td>• use, with guidance, print and other sources of information provided. Sources may include library, classroom, and community resources</td>
<td>• identify materials used and how they were used</td>
</tr>
</tbody>
</table>
Reflect and Interpret
- describe what was observed, using captioned pictures and oral language
- describe and explain results; explanations may reflect an early stage of concept development
- identify applications of what was learned
- identify new questions that arise from the investigation

Reflect and Interpret
- use, with guidance, print and other sources of information provided. Sources may include library, classroom and community resources.
- communicate results of construction activities, using oral language, captioned pictures and simple graphs (pictographs and bar graphs)
- describe the product and describe and explain the processes by which it was made
- identify applications for the product that was made

ATTITUDES

These attitudes apply across the five topics of study identified for Grade 2.

General Learner Expectations

Students will:

2-4 Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.

Specific Learner Expectations

Students will show growth in acquiring and applying the following traits:
- curiosity
- confidence in personal ability to explore materials and learn by direct study
- inventiveness
- perseverance: staying with an investigation over a sustained period of time
- appreciation of the value of experience and careful observation
- a willingness to work with others and to consider their ideas
- a sense of responsibility for actions taken
- a respect for living things and environments, and commitment for their care.
UNDERSTANDINGS

Topic A: Exploring Liquids

Overview

Students will learn about the nature of liquids, and the interactions of liquids with other materials. They explore liquids by examining droplets, by watching liquids trickle down slopes, by investigating flow rates and by observing liquid interactions with a variety of materials. They learn that some materials are impervious to liquids, while others are absorbent, and that some liquids mix readily while others do not. They observe that liquid water can be changed to ice or to steam, and back again, if heated and cooled, and that wet materials dry out when left open to the air. Through this topic, students learn that water is our most important liquid, that we use water in many ways, and that water is essential to life.

General Learner Expectations

Students will:

2-5 Describe some properties of water and other liquids, and recognize the importance of water to living and nonliving things.

2-6 Describe the interaction of water with different materials, and apply that knowledge to practical problems of drying, liquid absorption and liquid containment.

Specific Learner Expectations

Students will:

1. Recognize and describe characteristics of liquids:
   - recognize and describe liquid flow
   - describe the shape of drops
   - describe the surface of calm water
2. Compare water with one or more other liquids, such as cooking oil, glycerine or water mixed with liquid detergent. Comparisons may be based on characteristics, such as colour, ease of flow, tendency of drops to form a ball shape (bead), interactions with other liquids and interactions with solid materials.
3. Compare the amount of liquid absorbed by different materials: e.g., students should recognize that some forms of paper are very absorbent but other forms of paper are not.
4. Evaluate the suitability of different materials for containing liquids. Students should recognize that materials such as writing paper would not be suitable as containers; but that waxed paper and glazed pottery are waterproof and, thus, could be used in constructing or lining a liquid container.
5. Demonstrate an understanding that liquid water can be changed to other states:
   - recognize that on cooling, liquid water freezes into ice and that on heating, it melts back into liquid water with properties the same as before
   - recognize that on heating, liquid water may be changed into steam or water vapour and that this change can be reversed on cooling
   - identify examples in which water is changed from one form to another
6. Predict that the water level in open containers will decrease due to evaporation, but the water level in closed containers will not decrease.

7. Predict that a wet surface will dry more quickly when exposed to wind or heating and apply this understanding to practical situations, such as drying of paints, clothes and hair.

8. Recognize that water is a component of many materials and of living things.

9. Recognize human responsibilities for maintaining clean supplied of water, and identify actions that are taken to ensure that water supplied are safe.

**Topic B: Buoyancy and Boats**

**Overview**

Students explore what sinks and what floats, and what makes an effective watercraft. Through building and testing a variety of floating objects, students learn the importance of selecting appropriate materials and the importance of workmanship in shaping, positioning, fitting and waterproofing their constructions, so they will do the intended job. Along the way, students learn about balance and stability and about different methods that can be used in propelling a watercraft. The concept of density is informally developed in this topic.

**General Learner Expectations**

_Students will:_

2-7 **Construct objects that will float on and move through water, and evaluate various designs for watercraft.**

**Specific Learner Expectations**

_Students will:_

1. Describe, classify and order materials on the basis of their buoyancy. Students who have achieved this expectation will distinguish between materials that sink in water and those that float. They will also be aware that some “floaters” sit mostly above water, while others sit mostly below water. The terms buoyancy and density may be introduced but are not required as part of this learning expectation.

2. Alter or add to a floating object so that it will sink, and alter or add to a nonfloating object so that it will float.

3. Assemble materials so they will float, carry a load and be stable in water.

4. Modify a watercraft to increase the load it will carry.

5. Modify a watercraft to increase its stability in water.

6. Evaluate the appropriateness of various materials to the construction of watercraft, in particular
   - the degree to which the material is waterproof (not porous)
   - the ability to form waterproof joints between parts
   - the stiffness or rigidity of the material
   - the buoyancy of the material

7. Develop or adapt methods of construction that are appropriate to the design task.

8. Adapt the design of a watercraft so it can be propelled through water.

9. Explain why a given material, design or component is appropriate to the design task.
Topic C: Magnetism

Overview

Students explore the interactions of magnets with a variety of materials found within our own environment. By testing the effects of one magnet on another, they learn that magnets show polarity and that strength of magnetic effects diminishes with distance. They learn to distinguish materials that are affected by magnets from those that are not and learn how magnets can be used in sorting objects, moving things and holding things together.

General Learner Expectations

Students will:

2-8 Describe the interactions of magnets with other magnets and with common materials

Specific Learner Expectations

Students will:

1. Identify where magnets are used in the environment and why they are used.
2. Distinguish materials that are attracted by a magnet from those that are not.
3. Recognize that magnets attract materials with iron or steel in them; and given a variety of metallic and non-metallic objects, predict those that will be attracted by a magnet.
4. Recognize that magnets have polarity, demonstrate that poles may either repel or attract each other, and state a rule for when poles will repel or attract each other.
5. Design and produce a device that uses a magnet.
6. Demonstrate that most materials are transparent to the effects of a magnet. A magnetic field will pass through such materials, whereas other materials interact with a magnet.
7. Compare and measure the strength of magnets.
Topic D: Hot and Cold Temperature

Overview

Students learn that materials are sometimes changed by heating or cooling and that by observing such changes, they can infer how hot or cold an object is. They learn that thermometers provide a helpful way to measure and describe the hotness or coldness of things—a more reliable way than provided by their own senses. Students observe that temperatures can go up and down, including the temperature of their surroundings and the temperatures of particular objects within it. They also learn about methods that are used to control temperature in buildings and how insulation is used to keep things hot or cold.

General Learner Expectations

Students will:

2-9 Recognize the effects of heating and cooling, and identify methods for heating and cooling.

Specific Learner Expectations

Students will:

1. Describe temperature in relative terms, using expressions, such as hotter than, colder than.
2. Measure temperature in degrees Celsius (°C).
3. Describe how heating and cooling materials can often change them; e.g., melting and freezing, cooking, burning.
4. Identify safe practices for handling hot and cold materials and for avoiding potential dangers from heat sources.
5. Recognize that the human body temperature is relatively constant and that a change in body temperature often signals a change in health.
6. Identify ways in which the temperature in homes and buildings can be adjusted; e.g., by turning a thermostat up or down, by opening or closing windows, by using a space heater in a cold room.
7. Describe, in general terms, how local buildings are heated:
   • identify the energy source or fuel
   • recognize that most buildings are heated by circulating hot air or hot water
   • describe how heat is circulated through the school building and through their own homes.
8. Describe the role of insulation in keeping things hot or cold, and identify places where some form of insulation is used; e.g., clothing, refrigerator, coolers, homes.
9. Identify materials that insulate animals from the cold; e.g., wool, fur, and feathers; and identify materials that are used by humans for the same purpose.
10. Design and construct a device to keep something hot or cold.
11. Describe ways in which temperature changes affect us in our daily lives.
Science Grade Two
Outcomes

Topic E: Small Crawling and Flying Animals

Overview

Students learn about the structure and life habits of animals by studying small animals that live in their own community. By investigating outdoor spaces in and around the school and their homes, students discover a wide range of animals that find shelter and food within the local area. In studying these animals, they learn where animals live, what they eat, what they are eaten by and features of the animals that suit them to their particular environment.

General Learner Expectations

Students will:

2-10 Describe the general structure and life habits of small crawling and flying animals; e.g., insects, spiders, worms, slugs; and apply this knowledge to interpret local species that have been observed.

Specific Learner Expectations

Students will:

1. Recognize that there are many different kinds of small crawling and flying animals, and identify a range of examples that are found locally.
2. Compare and contrast small animals that are found in the local environment. These animals should include at least three invertebrates – that is, animals such as insects, spiders, centipedes, slugs, worms.
3. Recognize that small animals, like humans, have homes where they meet their basic needs of air, food, water, shelter and space; and describe any special characteristics that help the animal survive in its home.
4. Identify each animal’s role within the food chain. To meet this expectation, students should be able to identify the animals as plant eaters, animal eaters or decomposers and identify other animals that may use them as a food source.
5. Describe the relationship of these animals to other living and nonliving things in their habitat, and to people.
6. Identify and give examples of ways that small animal avoid predators, including camouflage, taking cover in burrows, use of keen senses and flight.
7. Describe conditions for the care of a small animal, and demonstrate responsible care in maintaining the animal for a few days or weeks.
8. Identify ways in which animals are considered helpful or harmful to humans and to the environment.
Topic A

Exploring Liquids
About the Lessons

This unit of study is, for the most part, is activity-based. It involves examining the characteristics of various types of liquids, including water. Teachers may choose the liquids they would like their students to study. It is recommended that when there is a choice, opt for the more “colourful” liquid, so that it is more easily distinguishable from water. For example, choose dark corn syrup over white corn syrup; choose coloured dish soap over clear dish soap.

Materials
If you are able, assemble all the equipment and materials needed prior to starting the unit. Keeping them in a large tub with lid will save time and help keep things organized. All the materials, including the liquids, can be found around your school, at home, or at local retail outlets. The only exception is eyedroppers. Although they are relatively inexpensive, you will most likely have to order them from a science education supply company. Buy lots of them. They are used extensively at many grade levels. Eye droppers can be reused if carefully washed with soap and hot water and air-dried. The only exception is when they are used to drop oil. You can try washing these with a Q-Tip, but even then, a residue remains in the eyedropper’s tip. To overcome this, you might want to designate certain eyedroppers as “for oil only”.

The lesson plans for Exploring Liquids have been designed for use with a multi-graded instructional group, typically composed of students in grades one, two, and three. However, because of the sophistication of concepts and the language needed to communicate these concepts, it will be necessary for older students in the group to assist younger students who have little or no English language skills.

Mini Textbook
A Mini Textbook is provided for those who prefer to base lessons on a prepared text. The use of the Mini Textbook should be considered OPTIONAL, however.

Language Development
As English is a second language for Hutterite children, language development activities are incorporated into the lesson plans themselves. This is especially important for grade one students, who must acquire oral language and literacy skills simultaneously. It is expected that teachers will adjust the language development aspects of the lessons to suit their particular students and circumstances.
Science Grade Two
Topic A: Exploring Liquids

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Lesson One

NOTE: Lesson One has several purposes. First, to introduce working with liquids; second, to establish behavioural rules for any activity-based lesson; third, to teach students how to carry out particular procedures correctly and safely; fourth to introduce some of the vocabulary pertaining to the unit.

Concept: Introduction

Resources/Materials: Mini Textbook, pages 4 and 5
Worksheet #2A.1a (teacher copy)
Worksheet #2A.1b (student copies)
clear plastic cups (or beakers) cake pan(s) plastic containers
eye droppers water waxed paper

Introduction: Ask students to tell you how water is important in their lives. (Write their ideas on the board. Add to any ideas students did not offer.)

Explain that water is a liquid. Dish soap, gasoline, vinegar, and milk are also liquids. Explain that this unit is all about getting to know more about liquids. Today, we are going to work with water.

Procedure:

1. Distribute the Mini Textbooks. Allow students a minute or two flip through the pages. Then with students locate the Introduction in the Contents page. Have students locate page 4. Guide the reading of pages 4 and 5.
2. Explain that in today’s activities involving water, you are going to do something with water. Then each of them is going to do the same. (That is, you are going to demonstrate a simple procedure. Then students should try to do exactly as you did.)
3. Demonstrate and then have students do each of the actions described on Worksheet #2A.1a.
   a. Demonstrate each action followed immediately by students doing the same action.
   b. Describe, in simple terms, what you are doing as you do it.
   c. Give students any tips you can think of (some are listed in the chart on Worksheet #2A.1a).
   d. Emphasize the importance of proceeding methodically and carefully. (These activities are always fun for children; however, they must understand that activities in science have a specific purpose and are to be taken seriously.)
4. ALTERNATELY. If you like, give students all the equipment and materials. Encourage them to “explore” for 10 – 15 minutes. Then discuss the characteristics of water as a class.
5. As a class come up with the characteristics of liquids. Write simple sentences about these characteristics on chart paper. Once finished, have the class read the list of sentences two or three times. Keep the chart for future reference.
6. Distribute Worksheet #2A.1b. Go over the directions. Have older students help younger students, if necessary. You may want older students to copy the sentences into their notebooks. You may want younger students to do Worksheet #2A.1c.

Assignments:
1. Do Worksheet #2A.1b.
2. OPTIONAL. (Older students) Copy the characteristics of liquids into notebooks.
3. OPTIONAL. (Younger students). Do Worksheet #2A.1c.
<table>
<thead>
<tr>
<th>Action</th>
<th>Characteristic of Water</th>
<th>Tips</th>
</tr>
</thead>
</table>
| a      | Water can be poured     | • Pour slowly, especially at first  
|        |                         | • Tilt the receiving container slightly toward the pouring container  
|        |                         | • Resting the pouring container on the rim of the receiving container will help to keep the pouring container steady |
| b      | Water flows             | • Hold the pouring container as close to the cake pan as possible to prevent splashing.  
|        |                         | • Pour slowly |
| c      | Water has no shape      | • See “a” above. |
| d      | Water can form a bead   | • Squeeze the rubber bulb between the thumb and forefinger before putting the tip into the water.  
|        |                         | • Once the tip is in the water, release the pressure on the bulb so that the liquid goes up into the eyedropper.  
|        |                         | • Put the tip of the eyedropper over the desired spot on the waxed paper; then **squeeze very slowly** so that only one drop comes out.  
|        |                         | • Avoid holding the eyedropper upside down. You do not want the liquid to go up into the bulb.  
|        |                         | • An eyedropper used for one type liquid cannot be used for another type of liquid. |
| e      | Water has no smell      | • Stand/squat so that you are at eye level with the rim of the container.  
|        |                         | • **NEVER sniff** directly into a container, unless you are absolutely sure of what it is. |
| f      | Water has no colour     | • If the container is very full, do not lift it up; instead squat down a little |
**Characteristics of Water**

**Directions:** Draw pictures to show how you demonstrated each of the characteristics of liquids.

<table>
<thead>
<tr>
<th>Water can be poured.</th>
<th>Water flows.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water has no shape.</td>
<td>Water can form beads.</td>
</tr>
<tr>
<td>Water has no smell.</td>
<td>Water has no colour.</td>
</tr>
</tbody>
</table>
Characteristics of Water

Directions: Fill in the missing letters.

- water
  - _ ater
- cup
  - _ up
- pan
  - _ an
- drop
  - _ rop
- table
  - _ able
- bead
  - _ ead
Lesson Two

Concept: Liquids Have Different Flow Rates

Resources/Materials: Mini Textbook, pages 6 - 8
  - Worksheet #2A.2a (younger students)
  - Worksheet #2A.2b (older students)
  - five different kinds of liquids (water, dish soap, cooking oil, dark corn syrup, rubbing alcohol tinted with food colouring, glycerine, etc.)
  - five eye droppers
  - cookie sheet (with sides, preferably not non-stick)

Introduction: Review some of the characteristics of water. Explain that these characteristics are shared by all liquids. One by one, hold up the other liquids and name them. Have students repeat the names. If you think it is necessary, review the term flow (moving from one place to another). Tell students that today the class will find out if all liquids flow at the same rate. Ask students to help you make up a question having to do with flow and liquids? (Do all liquids flow equally fast? OR Do some liquids flow faster than others? OR Do liquids flow at the same rate?) Write the question on the board.

Procedure:

2. Then write the names of the five liquids (from the Introduction) on the board.
3. Explain what you are going to do.
   a. Place three drops of each liquid at the top of a cookie sheet so that they form a large bead.
   b. The beads must be in a row.
   c. Tilt the cookie sheet up at a slight slant, until the beads of liquid start to flow down the cookie sheet.
4. Explain that the students’ role is to decide which liquid flowed the fastest, second fastest, and so on. Distribute Worksheet #2A.2b to older students so they can write their predictions.
5. As a class decide the order of finish. Number names of the liquids written on the board according to how quickly the liquid flowed.
6. If you have enough cookie sheets and eyedroppers, allow students to try to replicate the activity. Remind students there is no fooling around. Be ready to troubleshoot.
7. Distribute Worksheet #2A.2a to younger students. Go over the directions. Have older students complete the second part of Worksheet #2A.2b. If you like, instead of Worksheet #2A.2, you can have older students write the question from the board and then sentences that tell what was observed into the notebooks. Illustrate.

Assignment:

Do Worksheet #2A.2a (younger students) or Worksheet #2A.2b (older students). You may want older students to write the activity question as well as sentences that describe what they observed.
How Fast Do Liquids Flow?

Directions: Write the names of the liquids in the spaces across the top. Under each name draw the liquids as they flowed down the cookie sheet.

Number the liquids from fastest to slowest.
1. **Before** doing this activity, predict the order in which you think the five liquid drops will finish the race.

**Prediction:**
- First: 
- Second: 
- Third: 
- Fourth: 
- Fifth: 

2. **After** doing the activity, tell the order in which the liquids finished the race.

**Observation:**
- First: 
- Second: 
- Third: 
- Fourth: 
- Fifth: 

3. Tell why you think some liquids flowed more quickly than others.
Lesson Three

Concept: Surface Tension: Beading

Resources/Materials: Mini Textbook, pages 9 and 10
Worksheet #2A.3 (student copies)
small containers of water  eyedroppers
waxed paper  plastic knives (or Popsicle sticks)
towels (paper or cloth for clean up of accidental spills)

Introduction: Briefly review that water can be poured and that liquids flow at different rates. Have students recall that water formed a bead when dropped from an eyedropper.

Explain that today, students will find out more about how water behaves when it forms beads.

Procedure:


Depending on your particular group and your instructional situation, you can give all the directions at once, leaving older students in charge. At this level, it is preferable, however, for you to guide each of the activities.

2. Give each student a square of waxed paper, a container of water, and an eyedropper.
3. Tell students they will be doing some things, observing what happened, and then drawing and/or writing about what they observed.
4. Have them do each of the following. You can have students draw/write what they observed after each on Worksheet #2A.3 OR have a big review of what they observed after all the activities have been completed. Then have them tell and/or draw what they did.

Activities
   a. Drop one bead of water on the waxed paper. Look at it at eye level. What does it look like? **Do not disturb it.**
   b. Drop another bead of water right next to, but not quite touching the first bead. What happens? (the two beads should join to make one) **Do not disturb it.**
   c. Drop a third bead of water right next the large bead. What happens?
   d. Try to cut the bead of water with a plastic knife. What happens?
   e. Try to move the bead of water with a plastic knife. What happens
   f. Blow gently on the bead of water. What happens?
5. Once the activities have been completed, explain that water forms beads because of something called **surface tension**. Surface tension is strong. That is why you can’t cut a bead of water or even blow it over.
6. Distribute Worksheet #2A.3. Younger students can simply draw the pictures. Expect older students to write sentences that tell what happened as well.

Assignment:

Do Worksheet #2A.3.
**Directions:** Tell what happened or draw a picture of what happened for each of the following:

<table>
<thead>
<tr>
<th>What You Did</th>
<th>What Happened?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) You put one drop of water on the waxed paper.</td>
<td></td>
</tr>
<tr>
<td>b) You put a drop of water next to the first drop.</td>
<td></td>
</tr>
<tr>
<td>c) You put another drop of water next to the first two drops.</td>
<td></td>
</tr>
<tr>
<td>d) You tried to cut the bead of water with a knife.</td>
<td></td>
</tr>
<tr>
<td>e) You tried to move the bead of water with a knife.</td>
<td></td>
</tr>
<tr>
<td>f) You blew gently on the bead of water.</td>
<td></td>
</tr>
</tbody>
</table>
Lesson Four

Concept: Surface Tension: In Containers

Resources/Materials: Worksheet #2A.4 (student copies)  
clear plastic cups  eyedroppers  
pitchers of water (or any container with a pouring lip)  
towels (paper or cloth)  containers large enough to hold any spill over from full plastic cups

Introduction: Briefly recall what happened during the last class. Explain that water, like other liquids, has surface tension. It is like a film that forms on the surface. It is because of surface tension that water forms a bead and that it is difficult to split a bead of water. Explain that today students will do an activity in which they will again look at surface tension.

Procedure:

1. First, demonstrate how students can fill a plastic cup with water. Pour the water from the pitcher. Be sure to point out that you must pour slowly as the water reaches the rim. Fill with water until it overflows slightly. Let the cup of water come to a rest. If the surface is not “bulging” a little, carefully add more water.

2. Tell students they are going to do what you just did. Then they are going to use the eyedroppers to add drops of water. Have them predict the number of drops of water they can add before the water overflows. **This is a good time to remind students how to use an eyedropper and how to ensure they drop only one drop at a time.**

3. Distribute Worksheet #2A.4. Help students to formulate an appropriate question (e.g., How drops of water can I add before the glass overflows?). Then have them write their prediction. **Have older students help younger students.**

4. Then pair the students. One can tally the number of drops while the other does the dropping. (Switch roles after 5 drops.) **Warn students to be careful not to disturb the water surface. They should hold the eyedropper above the water’s surface, just so the eyedropper itself does not touch the water, but so a drop that comes out of the eyedropper will.**

5. Once overflowing has been reached, have students record the number of drops it took to overflow the water.

6. Conclude that it was because of surface tension that students were able to add more water to the already full cup.

7. Have students complete Worksheet #2A.4. Nonreaders/writers can draw a picture. Writers should explain what they did in sentences.

Assignment:

Do Worksheet #2A.4.
I'm Already Full!

1. Fill a cup with water until it overflows slightly.

2. You will now add more water using an eyedropper.

3. **Make up a question** that asks what you want to know.

4. **Predict** what you think the answer to your question will be.

5. Tell how many drops you added to the cup.

6. In the space below, draw a picture of what you did or write sentences that tell what you did.
Lesson Five

Concept: Surface Tension: Comparing Liquids

Resources/Materials:  Worksheet #2A.5 (student copies)
                      four different liquids, one of which is water (dark corn syrup, rubbing alcohol,
                      olive oil, glycerine, dish soap, etc)
                      small containers           waxed paper (4 small squares per group)
                      eyedroppers (4 for each group)
                      strips of masking tape or self-adhesive labels with the names of the liquids
                      magnifying glasses (optional)

Introduction: Recall with students the shape of a bead of water. Explain that today we want to find out
of all liquids have the same shape of bead. With students formulate a question that will guide the
investigation (Do all liquids have the same shape of bead?). Write the question on the board.

Procedure:

1. If you feel it is necessary, quickly review how to use an eyedropper to form a bead. Model the
   procedure if you like.

2. Caution students that an eyedropper used to drop a bead of one liquid must only be used for that
   liquid.

3. Put the appropriate labels on the squares of waxed paper. With students go over the names of the
   liquids you will be using.

4. Give each group a set of waxed papers, containers of liquids, and eyedroppers. Have them make
   a one-bead drop of each liquid. Observe the shape. Discuss the differences.

5. Then have each group add another drop of each liquid to the existing drop. Observe and discuss
   the differences. For each liquid write a couple of descriptive words (round, flat, ball, etc.)

6. If you have the time, write a sentence about the shape of each bead of liquid on the board along
   with a picture of the shape.

7. Distribute Worksheet #2A.5. Have younger students draw a picture and write one or two
   descriptive words under each picture. Have older students draw a picture and write a descriptive
   sentence under each picture.

Assignment:

Do Worksheet #2A.5. Younger students draw pictures and write one or two descriptive words. Older
students draw pictures and write descriptive sentences.
**Comparing Liquids**

**Directions:** In the spaces above the boxes, write the names of the liquids. Draw pictures of the beads. Describe the beads.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Worksheet #2A.5
Lesson Six

Concept: Liquids Have No Definite Shape

Resources/Materials: Mini Textbook, pages 11 and 12
Worksheet #2A.6a and #2A.6b (student copies)
water    food colouring
measuring cup    pitcher
4 clear containers of different shape

Introduction: Explain that students will learn more about water.

Procedure:

2. Display the four containers. Ask students which one they think will hold the most.
3. Add few drops of food colouring to the water. Explain that adding the food colouring will help students to see the water better.
4. Pour water into the measuring cup. If your containers are smaller, pour about 250 mL; if they are large 500 mL or more. (Be sure to keep track of the amount.)
5. Pour the water in the measuring cup into the first container. With students observe that the shape of the water is the same shape as the inside of the container.
6. Have students speculate about the shape of the water if it is poured from the first container into the second container. Then pour the water from the first container into the second container. Observe the shape of the water. Discuss whether this will be the case for all liquids (yes). Conclude that liquids have no definite shape. They take the shapes of their containers.
7. Use the measuring cup to measure out an equal amount of water, and pour that amount into each of the empty containers. (All four containers should have equal amounts of water in them.)
8. Allow the containers to settle so that the water is calm. Have students observe and describe the water’s surface. On the board, write descriptive sentences:
   Examples: The water is flat.
   The water is shiny.
   The water is still.
9. Tilt one of the jars. Have students observe and describe. (angle of the water’s surface stays the same; i.e., parallel to the table)
10. Then jiggle one of the jars. Have students observe and describe the water’s surface (wavy, splashy, etc.).
11. Distribute Worksheets #2A.6a and #2A.6b. Go over the directions. Have older students help younger students.

Assignment:

Do Worksheets #2A.6a and #2A.6b.
1. Draw each container. Draw in and colour the water in each container.

2. Write a sentence that tells about the shape a liquid has. ____________________________

3. Write a sentence that describes the surface of a liquid when it is calm.

______________________________
Directions: Andy and Willie filled some containers with coloured water. Then they tilted each of the containers. Draw in and colour the water to show what they observed.
Lesson Seven

Concept: Liquids Vary in Density

Resources/Materials: Mini Textbook, pages 13 and 14
Worksheet #2A.7a (student copies)
Worksheet #2A.7b (optional, student copies)
4 or 5 liquids (try to avoid all liquids of the same colour)
signs or labels that name each of the liquids
taller container with straight sides (or a graduated cylinder)
stirring rod of some kind (large spoon, stirring rod, etc.)

Introduction: Explain that some liquids are heavier than others. Today we will find out which liquids are heavy and which one are not.

Procedure:

2. Present each of the liquids. As you present each, place a sign or label in front of the liquid.
3. Tell students that each of the liquids has a different weight.
4. Distribute Worksheet #2A.7a. Have students predict the order of their weights and write them in that order on the left side of the worksheet. (lightest on top; heaviest on the bottom)
5. Then, carefully pour approximately the same amount of each of the liquids into the container with the straight sides. Pouring down the side of the container will minimize the liquids mixing. Wait for a few minutes.
6. Then have students observe. Explain that the heavier a liquid, the lower it will settle in the container. On the board write the names of the liquids in a column with lightest on top and heaviest at the bottom.
7. If you like, use the stirring rod to mix the liquids together. Wait several minutes. (The liquids should separate out again.)
8. Have students help you compose simple sentences to describe their observations, such as:
   ___________ is lighter than ___________.
   ___________ is heavier than ___________.
   ___________ is the lightest.

9. Have students draw and label the layers of liquids in the correct order on Worksheet #2A.7a. Have older students write sentences in their notebooks to describe what they observed.
10. OPTIONAL. Distribute Worksheet #2A.7b. Go over the directions.

Assignments:

1. Do Worksheet #2A.7a.
2. OPTIONAL. Do Worksheet #2A.7b.
3. Older students write sentences about what they observed.
1. Predict which liquids will be lightest and which will be heaviest. Write them in order.

**Prediction:**

lightest

heaviest

2. From the activity in class draw what you observed in the box above.

3. Are all liquids equally heavy? Tell how you know.
Directions: Amanda and Shelley wanted to know how heavy some liquids were. They poured some liquids into a tall glass jar. Then they waited to see how the liquids settled in the jar. They numbered the liquids in order from heaviest to lightest.

In the picture, draw in and label the layers.

<table>
<thead>
<tr>
<th>Liquid</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetone</td>
<td>6</td>
</tr>
<tr>
<td>alcohol</td>
<td>5</td>
</tr>
<tr>
<td>gasoline</td>
<td>7</td>
</tr>
<tr>
<td>glycerine</td>
<td>1</td>
</tr>
<tr>
<td>sea water</td>
<td>2</td>
</tr>
<tr>
<td>cooking oil</td>
<td>4</td>
</tr>
<tr>
<td>tap water</td>
<td>3</td>
</tr>
</tbody>
</table>
Lesson Eight

Concept:  Mixing Solids with Liquids

Resources/Materials:  Mini Textbook, pages 15 - 17
Worksheets #2A.8a and #2A.8b (student copies)
- water
- clear plastic cups
- stir sticks
- plastic spoons
- Popsicle sticks
- 6 different kinds of powdered solids, such as cocoa powder, cornstarch, sugar, salt, flour, drink crystals, instant coffee crystals, coffee grounds
  Try to use a mixture of solids that will dissolve and those that won’t
- labels or tags with the names of the solid printed on them
- Newspapers
- paper/cloth towels

Introduction:  Recall with students that when drinking a cup of hot chocolate or cocoa, the chocolate or cocoa powder tends to settle to the bottom after awhile. This is because it is difficult for the chocolate to dissolve in the water.
Explain that powders, like hot chocolate or cocoa mix are really solids that have been ground into tiny bits. But some powders dissolve in water better than others. (The same would go for other liquids.)

Procedure:


You can do this activity as a demonstration; have the students help you; or, if you’re in a particularly adventuresome mood, allow students to do the activity on their own.

2. Prepare the table’s surface by putting down a layer of newspapers. Have paper or cloth towels ready, just in case you need them.
3. Fill each plastic cup about two-thirds full of room temperature water.
4. Go over the names of the powders with the students. As you name each, place the label in front of its container.
5. Show students how to take a heaping spoonful of powder and then use a Popsicle stick to level off the surface, so that the excess falls back into the container.
6. Add a level plastic spoonful of each powder into the cups of water. Stir for a minute. (If students are doing the stirring, you might want to have them “stir 100 times”.)
7. Let the water-powder mixtures rest for about ten minutes. Then observe.
   Note: While you are waiting, you might want to do activities that will foster language development for the younger students, such as review the English names for the solids; mixing up the tags and having students put them back in front of the correct containers; review the sounds of the initial consonants for each solid; making up sentences about each of the solids and writing them on the board for all to read.
8. Distribute Worksheets #2A.8a and #2A.8b. Go over the directions. (NOTE: For questions #3 and #4 on Worksheet #2A.8b, adjust the expectation to fit the grade level of students.)

Assignment:

Do Worksheets #2A.8a and #2A.8b.
Question: Do all powders dissolve in water?

**Directions:** At the top of each box, write the name of the powder. Draw a picture to show what each mixture looked like after it had rested. Then tell what you observed.

<p>| | | |</p>
<table>
<thead>
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</tbody>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #2A 8a
Question: Do all powders dissolve in water?

1. In a sentence, answer the question.

   


2. Write the names of the powders in the chart.

<table>
<thead>
<tr>
<th>Dissolve in Water</th>
<th>Do Not Dissolve in Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Write a sentence about a powder that dissolves in water.

   


4. Write a sentence about a powder that does not dissolve in water.

   

Lesson Nine

Concept: Exploring Liquids, Part I Test

Resources/Materials: Exploring Liquids, Part I Test (student copies)

Introduction: Explain that the first part of the unit on liquids is complete. Now it is time for a test.

Procedure:

1. If you like, do a brief review of the topics covered so far in the unit, prior to giving students the test.
   - Liquids flow, but a different rates
   - Liquids can be poured
   - Liquids take the shape of their container
   - Liquids form beads
   - Pure water has no smell
   - Water has no colour
   - Some liquids are heavier than others
   - The surface of liquids is parallel to the surface of the earth. The surface is flat
   - Some solids mix with liquids; others do not

2. Distribute the Exploring Liquids, Part I tests.

3. Depending on the make-up of your class, you may want to go through the test with students, question by question.
Exploring Liquids, Part I
Test

1. For each question, circle the best answer.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>If you pour water into the corner of a cake pan, what will happen?</td>
<td>• The water will stay in the corner.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The water will spread out.</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>If you put a drop of water onto a piece of waxed paper, what will happen?</td>
<td>• The water will spread out.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The water will form a bead.</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>If you put a drop of water right next to another drop of water, what will happen?</td>
<td>• The two drops will join together.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The two drops will push apart.</td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>What will happen if you try to cut a bead of water with a Popsicle stick?</td>
<td>• The bead of water will divide into two beads.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The bead will not divide.</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>What will happen if you blow <em>gently</em> on a bead of water?</td>
<td>• The whole bead will move.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The bead will divide into many smaller beads.</td>
<td></td>
</tr>
</tbody>
</table>
2. Circle **yes** or **no**.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>You can pour water.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>b</td>
<td>All liquids form the same shaped beads.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>c</td>
<td>No liquid has a smell.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>d</td>
<td>Pure water has no colour.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>e</td>
<td>When water is calm, it is smooth and flat.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>f</td>
<td>Some liquids flow faster than others.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
<tr>
<td>g</td>
<td>All powders will dissolve in water.</td>
</tr>
<tr>
<td></td>
<td><strong>yes</strong>  <strong>no</strong></td>
</tr>
</tbody>
</table>
3. Bob drew a picture of three bottles with water in them. Only one is correct. Circle the correct bottle.

4. Mr. Hill poured some liquids into a tall glass container. The liquids formed layers. Put a 1 beside the name of the heaviest liquid, a 2 beside the second heaviest liquid, a 3 beside the third heaviest liquid, and a 4 beside the lightest liquid.

____ gasoline

____ water

____ alcohol

____ cooking oil

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>gasoline</td>
<td></td>
</tr>
<tr>
<td>alcohol</td>
<td></td>
</tr>
<tr>
<td>cooking oil</td>
<td></td>
</tr>
<tr>
<td>water</td>
<td></td>
</tr>
</tbody>
</table>
5. Judy tried to dissolve some powders in water. After she added the powders to water, she stirred. Then she waited for 15 minutes. She then made a chart to show what she observed.

<table>
<thead>
<tr>
<th>Powder</th>
<th>Did it dissolve?</th>
</tr>
</thead>
<tbody>
<tr>
<td>flour</td>
<td>no</td>
</tr>
<tr>
<td>salt</td>
<td>yes</td>
</tr>
<tr>
<td>sugar</td>
<td>yes</td>
</tr>
<tr>
<td>cocoa</td>
<td>no</td>
</tr>
<tr>
<td>cornstarch</td>
<td>no</td>
</tr>
<tr>
<td>coffee grounds</td>
<td>no</td>
</tr>
</tbody>
</table>

Circle **yes** or **no**.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>yes</th>
<th>no</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>You can dissolve cocoa in water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>Three of the powders dissolved in water.</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>c</td>
<td>You can dissolve sugar in water.</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>
Lesson Ten

ADVANCE PREPARATION: Write the names of the liquids in the chart on Worksheet #2A.10a. before photocopying for students.

Concept: Absorption of Liquids

Resources/Materials: Mini Textbook, pages 18 - 20
Worksheets #2A.10a and #2A.10b (student copies)
Water
Ten samples of materials with varying degrees of absorbancy:
• several different types of paper, such as paper towel, bond paper, construction, paper, shiny paper, like from a catalogue, coffee filter
• several types of cloth, such as terry towel, cotton broadcloth, polyester, wool, nylon
• other materials, such as sponge, plastic grocery bag, plastic wrap,

Introduction: Discuss with students instances when they or someone in their family has spilled something. Talk about how the liquid was cleaned up. Discuss why you would clean up a spill with a cloth as opposed to a plastic bag. Introduce the word absorb as meaning to soak up. Write it on the board.

Procedure:

2. Explain that today students will be an activity that will show them what kinds of materials absorb liquids well and what types do not.
3. Make a chart on the board or on chart paper, such as

<table>
<thead>
<tr>
<th>Good Absorption</th>
<th>Medium Absorption</th>
<th>Poor Absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Distribute Worksheet #2A.10a. One at a time, hold up each sample of material. Have students write their prediction beside the name of the material. (good, medium, poor)
5. For each material, spill a small amount of water on a level table. Then have a student try to wipe it up. Have the class decide whether the material had good, medium, or poor absorption. Once this is decided, then have students note this on the Observations section of Worksheet #2A.10a.
6. Distribute Worksheet #2A.10b. Go over the directions. Younger students will need some help with this. Perhaps older students in the group can help.

Assignment:

Do Worksheet #2A.10b.
**How Well Materials Absorb**

**Directions:** In the first column, circle the word that tells how well you think each material will absorb water. In the second column, circle the word that tells how well each material absorbed water.

<table>
<thead>
<tr>
<th>Material</th>
<th>Prediction (How well I think the material will absorb water.)</th>
<th>Observation (How well the material absorbed water.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
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<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
<tr>
<td>good</td>
<td>medium</td>
<td>poor</td>
</tr>
</tbody>
</table>

Worksheet #2A.10a
**How Well Materials Absorb**

**Directions:** Fill in the chart to show how well the materials you tested absorbed water. Then make a bar graph that shows this information.

<table>
<thead>
<tr>
<th>Good Absorption</th>
<th>Medium Absorption</th>
<th>Poor Absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Number of Materials**

<table>
<thead>
<tr>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

**Absorption**

Worksheet #2A.10b
Lesson Eleven

ADVANCE PREPARATION: Write the names of the containers/materials you will be testing on the chart on Worksheet #2A.11a.

Concept: Containing Liquids.

Resources/Materials:  Mini Textbook, pages 21 and 22
Worksheet #2A.11a (student copies run off on bond paper)
Worksheet #2A.11a (student copies run off on Manila tag or card stock)
Worksheets #2A.11b and #2A.11c (student copies)
Mixture of containers/materials of varying suitability for holding liquids, such as plastic cup, egg carton cup (paper), unglazed pot (terra cotta), metal container, glazed pot (coffee mug), Styrofoam cup, glass bowl or cup, paper cup (waxed paper coated), foil container, milk carton square of cloth (approx. 30 cm X 30 cm) pitcher of water plastic dishpan

Introduction: Review the activity from the last Science class where students determined how well materials absorbed liquids. Ask students which types of materials they think would be most suitable for holding liquids.

Procedure:

2. One by one hold up the containers/materials students will be testing. Name each.
3. Discuss with students how they could test to see if the containers/materials are suitable for holding liquids. (Pour water into them and see if they leak or not.) Explain that you will be testing them with water because water is inexpensive and easy to clean up.
4. Distribute the bond paper and Manila tag copies of Worksheet #2A.11a. Show students how to cut out, shape, and glue into a cone-shaped cup. Then have them make their cups.
5. Distribute Worksheet #2A.11b. Have students circle either yes or no in the Prediction column.
6. Then allow each student to test out his paper and Manila tag cups. Discuss their effectiveness for holding water.
7. Demonstrate the testing of the other containers. For the cloth, nest the square of cloth in a small shallow container so that the edges of the cloth spill over the sides of the container. Pour water into the cloth; then pull the edges together and pull the cloth out of the container. After each, have students complete the Observations section.
8. Distribute Worksheet #2A.11c. Go over the directions. Younger students will most likely need some help.

Assignment:

Do Worksheet #2A.11c.
Directions: Carefully cut out the shape. Form it into a cone. Glue on the tab it to make it stay together.
1. Make up a question that has to do with finding out which materials are best for holding liquids.

2. For each material, predict if you think it will be good for holding liquids. Then tell what you observed.

<table>
<thead>
<tr>
<th>Material</th>
<th>Prediction</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>yes</td>
<td>no</td>
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<tr>
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Worksheet #2A.11b
Materials That Hold Liquids

Directions: Fill in the chart to show which materials you tested were good for holding liquids. Then make a bar graph that shows this information.

<table>
<thead>
<tr>
<th>Materials That Held Liquids Well</th>
<th>Materials That Did Not Hold Liquids Well</th>
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Number of Materials

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<th>Good</th>
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How Well It Held Liquids
Lesson Twelve

Concept: Making a Material Water Resistant

Resources/Materials: Mini Textbook, page 23
Worksheet #2A.12 (optional, student copies)
half sheets of bond paper (2 per student)
wax crayons
eyedroppers
towelling (for clean up)
small containers with water

Introduction: Review the observations students made in the last class about how some materials are better suited for holding liquids than others. Explain that some materials do not hold water well, but if you coat them with a certain material, they are more suitable for holding water.

Procedure:

1. Review that some materials that absorb water are not suited to holding water. Then have students turn to Mini Textbook, page 23. Guide the reading.

2. Give students each a square of paper. Then have them use an eyedropper to place a few drops of water in the centre. Discuss what was observed. Have students help you compose a sentence or two about the observations and then write them on the board.

3. Next give students each another square of paper. Have them coat the surface entirely with wax crayon. They must coat the paper thoroughly with a good thick layer of crayon.

4. Have students use the eyedropper to place a few drops of water in the centre. Again discuss what was observed. Then once more have students help you compose a sentence or two about the observations and write them on the board.

5. Explain that waxed paper is made up of a thin layer of paper coated with wax, so that the paper becomes more water resistant. If you have a milk carton handy, show students how you can actually scratch off some of the wax coating. Many paper cups and plates are coated with wax or plastic to make them more water resistant.

6. Distribute Worksheet #2A.12. Go over the directions. Instead of doing the worksheet, have students tell what they did and what they observed in their notebooks. Make illustrations to support the observations.

Assignment:

Do Worksheet #2A.12 OR write and illustrate what was done and what was observed in notebook.
Making Materials Water Resistant

1. Fill in the chart to show what you observed. Make a picture to show what you observed.

<table>
<thead>
<tr>
<th>What I Did</th>
<th>What I Observed</th>
<th>Picture</th>
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<tbody>
<tr>
<td>I put a few drops of water in the middle of a piece of paper.</td>
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<tr>
<td>I coloured a square of paper with wax crayon. Then I put a few drops of</td>
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<tr>
<td>water in the middle of the paper.</td>
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2. Why are milk cartons coated with wax?

________________________________________________________________________
________________________________________________________________________

3. Why do we put paint on houses and wood furniture?

________________________________________________________________________
________________________________________________________________________
NOTE: Both Lessons Thirteen and Fifteen can be started on one day in the same class period.

Lesson Thirteen (done over a period of two or three days)

Concept: Freezing and Melting

Resources/Materials: Mini Textbook, pages 24 and 25
Worksheet #2A.13a (student copies)
Worksheet #2A.13b (older students) and Worksheet #2A.13c (younger students)
plastic container with lid, such as a cottage cheese or margarine container
water

Introduction: Discuss the differences between rain and snow. (Snow is colder than rain. Snow falls in flakes, while rain falls in drops. Snow is a solid and rain is a liquid.) Explain that rain and snow are two forms of the same substance. Rain is a liquid while snow is really made up of flakes that are made up of tiny pieces of ice.

Procedure:

2. Pour water into the container. Emphasize that water is a liquid and has the characteristics of liquid. Ask students how you can make it into a solid. (Students will be able to tell you to put the liquid into the freezer.)
3. Discuss what happens when you put something into a refrigerator or a freezer. (Heat is removed from a substance.)
4. Explain that you will put the container of water into the freezer overnight. Explain also that you will put a lid on the container to prevent it from spilling. If you are using a freezer in the colony’s kitchen or in one of the student’s houses, consider putting a label on it indicating it is a school project. (DO NOT OPEN. SCHOOL PROJECT)
5. The next class, bring back the container of frozen water. Allow students to feel it for temperature and texture. Contrast ice with water. (colder, cannot be poured, does not flow, has a definite shape) Explain that when a liquid changes to a solid, it is called freezing.
6. Explain that, in general, all liquids can be made into solids by cooling them. However, some must be cooled more than others before they become solids.
7. Ask students to predict what will happen to the ice if you leave in the classroom for a few hours, and what will happen if you leave the ice on a table (or shelf) without the plastic container. Leave the plastic container out overnight. Then observe. Conclude that the ice melted and became a liquid because the temperature rose. Explain that when a solid changes to a liquid, it is called melting.
9. If you like, have students do Worksheet #2a.13b (older) or Worksheet #2A.13c (younger) OR they can do something similar in their notebooks.

Assignments:

1. Do Worksheet #2A.13a.
2. OPTIONAL. Do Worksheet #2A.13b (older) or #2A.13c (younger) OR do something similar in notebooks. Younger students will need some help.
Science Grade Two Topic A: Exploring Liquids, Part II
Worksheets

Changing from a Liquid to a Solid

Directions: Choose words from the boxes to fill the spaces.

1. What happens when a liquid freezes?
   The temperature of the liquid goes ____________.
   The liquid becomes a ________________.
   It now has a ________________ of its own.
   It does not ________________.
   You cannot ________________ it.

2. What happens when a solid melts?
   The temperature of the solid goes ________________.
   It becomes a ________________.
   It does not have a ________________ of its own.
   It ________________.
   You can ________________ it.

3. Answer yes or no.
   Is ice a liquid? ______
   Does ice have a shape? ______
   Can you make ice into a liquid by cooling it? ______
   Can you pour a liquid? ______
Liquids and Solids

Directions: To answer each question write a sentence that tells how liquids and solids are different. Use the following sentence frame:

Liquids ____________________, but solids ____________________.

1. Which have a shape?

2. Which can be poured?

3. Which can flow?

4. Which can form a drop?
1. Circle all the sentences that tell about liquids.

- A liquid can pour.
- A liquid can flow.
- A liquid has a shape.
- A liquid has no shape.
- A liquid can make a drop.
- A liquid can melt.
- A liquid can freeze.

2. Circle all the sentences that tell about a solid.

- A solid has a shape.
- A solid can pour.
- A solid can flow.
- A solid can melt.
- A solid has no shape.
- Ice is a solid.
- Ice is a liquid.
Lesson Fourteen

Concept: Evaporation and Condensation

Resources/Materials: Mini Textbook, pages 26 and 27
Worksheet #2A.14a and #2A.14b (student copies)
beaker of water (or glass Pyrex measuring cup)
electric kettle OR hotplate and saucepan
tin can or metal pie plate (foil will do)
oven mitts (optional)

Introduction: Review how water turned from a liquid to a solid by cooling it. Review also how the characteristics of a liquid were different than that of solids. Explain that today, instead of cooling the water, we will be heating it.

Procedure:


2. Show students the beaker or measuring cup of water. Note that it is a liquid. Note also how much water is in the beaker (give actual number of mL).

3. Pour the water into the kettle or into a saucepan. Boil the water. Most colony children know about the potential dangers of being around kettles and hotplates, but it doesn’t hurt to remind them to observe only and not to get too close.

4. While the water is starting to heat up, have students predict what will happen.

5. Once steam starts to escape, discuss where the steam is coming from. Note that the steam eventually seems to disappear into the air. Explain that steam is formed from water. Steam is a gas. (You may have to clarify that this is different from gas you put in a car.) When you heat a liquid, it eventually turns into a gas. The gas is thick close to the surface of the water, but then it mixes with other gases in the air and seems to disappear. Explain that when a liquid turns to a gas, it is called evaporation.

6. With students discuss how a gas is different/similar from a liquid. (lighter, no definite size (i.e., volume), can flow)

7. Have students predict what will happen if you place the can/pie plate above the kettle/pan. Then do it. With students observe what happens. Explain that when the steam touches the can, it immediately cools down. When it cools down, it changes back from a gas to a liquid. Explain that when a gas turns to a liquid, it is called condensation.

8. Finally measure out the water remaining in the kettle or pan. Note that the amount is now less.


Assignment:
Do Worksheets #2A.14a and #2A.14b.
Chaching from a Liquid to a Gas

1. Draw a picture for each step.

Put water into a cup.

Put the water into a kettle.

Heat the water until steam forms.

Hold a tin can where the steam comes out.
2. Answer the questions.

   How do you turn a liquid into a gas?

   How do you turn a gas into a liquid?

3. Put a check mark (✓) under liquid, solid, or gas.

<table>
<thead>
<tr>
<th></th>
<th>Liquid</th>
<th>Solid</th>
<th>Gas</th>
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<tbody>
<tr>
<td>It flows.</td>
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<td></td>
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<tr>
<td>It has a shape.</td>
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<tr>
<td>It will turn to a gas if you heat it.</td>
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<tr>
<td>It can form a bead.</td>
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<tr>
<td>It will turn to a liquid if you cool it.</td>
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<td></td>
<td></td>
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<tr>
<td>It will turn to a solid if you cool it.</td>
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Lesson Fifteen

Concept: Controlling Evaporation: The Effect of Covering

Resources/Materials: Mini Textbook, pages 28 - 30
Worksheet #2A.15a (older students)
Worksheet #2A.15b (younger students)
two identical plastic containers with tight-fitting lids.
water
ruler

Introduction: Pose questions having to do with evaporation, such as “Why does a garden dry out?”, Why do clothes get dry when you hang them outside?”

Explain that if it is warm enough, water turns from a liquid to an invisible gas called **water vapour**. The water vapour escapes into the air.

Procedure:


2. Ask students what they think would happen if you put wet clothes into a plastic bag and then hung the plastic bag on the clothesline.

3. Explain that today, you are going to start an activity and finish it in a few days.

4. Put an equal amount of water in each of the two containers (a centimetre or two). Use the ruler to measure the depth of water in the containers to make sure that both containers have the same amount of water. Put a lid on one container and leave the lid off the other. Set the containers in a warm spot where they will not be disturbed. (If you can find a spot where the containers won’t accidentally be jostled, but where students can still check on the water levels, that would be ideal.)

5. After a few days, check the water levels in the two containers. Note how more water from the lidless container has evaporated than from the container with the lid. Be sure students have the chance to examine the water levels; then verify their observation by measuring them with the ruler.

6. Discuss applications of this activity in real life.
   a. We put lids on containers of food in the refrigerator to prevent moisture loss.
   b. We put produce and meat in plastic bags before we put them in the refrigerator.
   c. Putting straw or wood chips on the ground around strawberry plants prevents moisture loss (and also helps to control weeds).
   d. We keep lids on jars of liquids, especially those that contain a lot of water.
   e. If we want water to evaporate from items quickly, we do not cover it. (Covered hair will dry less quickly than uncovered hair.)

7. Distribute either Worksheet #2A.15a (older) or Worksheet #2A.15b (younger). Go over the directions.

Assignment:
Do either Worksheet #2A.15a (older) or Worksheet #2A.15b (younger).
Open and Closed Containers

Directions: Think about the activity you did. Then fill in the spaces.

Question: Which will lose water faster, a container with a lid or one without a lid?

Materials: ____________________________________________________________

Observations (Draw pictures and write sentences.):

Container Without a Lid

Container With a Lid

______________________________

______________________________
Open and Closed Containers

Directions: In each picture label the picture. Use the words from the box.

- table
- water
- lid
- container

Side View

Top View
Lesson Sixteen

Concept: Controlling Evaporation: The Effect of Opening Size

Resources/Materials: Mini Textbook, pages 31 and 32
Workheets #2A.16a and #2A.16b (younger students)
two containers (one wide-mouthed, one narrow-mouthed)
measuring cup
chart paper and marker

Introduction: Review that water in a container with a lid lost less water due to evaporation than a container without a lid. Explain that putting a lid on a container of water is a way we can control how much water evaporates.

Explain that today’s lesson investigates whether the size of the container’s opening affect how much water evaporates.

Procedure:


2. As a class come up with an investigative question to guide the activity, such as “Will more water evaporate from a container with a large opening than from a container with a small opening?” Write the question on a chart.

3. Have students give you ideas about an activity that could be done to answer the question. Write down the materials needed and steps as they are agreed upon.

4. Then follow the steps as determined by the class. An example would be:
   a. Take two containers, one with a large opening and one with a small opening.
   b. Add the same amount of water to both containers.
   c. Put the containers in a warm spot for five days.
   d. Measure the water left in each of the containers.

5. At this point, have older students copy the question, materials, and steps into their notebooks.
   Distribute Worksheet #2A.16 to younger students. Go over the directions.

6. Once the activity is complete, discuss what was observed and decide upon a statement that tells what was learned. Write them on a chart. Have older students copy these into their notebooks, making sure they include a picture with their observations. Have younger students complete Worksheet #2A.16b.

Assignments:
1. Older students. Copy the question, materials, and steps into notebooks on the first day. Copy the observations, make a picture, and tell what was learned on the follow-up day.
2. Younger students. Do Worksheet #2A.16a on the first day. Do Worksheet #2A.16b on the follow-up day.
Directions: For each set of containers tell which one is big and which one is little. Colour the big containers red. Colour the little containers blue.
Big and Little Openings

1. Draw the containers. Draw in the water levels.

   Before

   After

2. Write each word two times.

   water _______________________________________

   liquid _______________________________________

   gas _________________________________________

   solid _______________________________________
Lesson Seventeen

Concept: Controlling Evaporation: The Effects of Heat and Wind

Resources/Materials: Mini Textbook, pages 33 - 36
Worksheets #2A.17a, #2A.17b, and #2A.17c (student copies)
paper towels    water
electric fan    hair dryer (hand held type)

Introduction: Recall from the last science class how students learned that you could control evaporation of a liquid by covering or not covering. Explain that today’s lesson involves looking at two more ways we can control how much evaporation takes place.

Procedure:

2. Display the electric fan and the hair dryer. Turn each of them on and discuss what each does and how each works. With the hair dryer be sure to demonstrate that it can be used with and without heat.
3. Explain that you are going to wet three paper towels and squeeze the water out, so that they are just damp.
   • You will spread each of the wet towels out flat.
   • You will set one of the wet towels out for the air to dry.
   • You will set the second in front of the fan so that the wind created by the fan will blow across the wet towel.
   • You will aim the hair dryer, with the heat turned on, toward the third towel.
   **You want to see which towel will dry out most quickly.**
4. Distribute Worksheet #2A.17b. Explain how the sheet is set up. Then have students complete the Predict section.
5. Proceed with the activity. Try to ensure that there is enough space between the towels so that, for example, the wind created from the fan doesn’t also dry out the towel that is to be air-dried only.
6. Check for degree of wetness after 2 minutes, after 5 minutes, and longer if possible. (Note: Most hair dryers have a thermostat that will not allow you to continue using it on high past about 5 minutes. You will just have to continue blowing hot air from the hair dryer until its thermostat shuts it off.) After each amount of time has passed, allow student to feel the towels to check to see which is driest and which is wettest.
7. Once this is done, discuss practical applications of the effects of wind and heat on evaporation. Distribute Worksheet #2A.17a to help you in this discussion.
   • Clothes hanging on the line dry faster when it is windy.
   • The garden dries out faster on hot days than on cool days.
   • A clothes dryer speeds up drying by blowing hot air into the dryer.
   • Wheat in the field dries faster on when it is windy.
   • Grain dryers dry grain by blowing warm air into a container of grain.
8. Have students complete the rest of Worksheet #2A.17b. Then distribute Worksheet #2A.17c.

Assignment: Do Worksheets #2A.17b and #2A.17c.
Wind and Heat
Wind and Heat

Prediction: Which towel do you think will dry most quickly? Number the following order from quickest to slowest.

_____ fan  _____ air only  _____ hair dryer

Observation: Which towel dried most quickly? Number the following in order from quickest to slowest.

_____ fan  _____ air only  _____ hair dryer

1. For each of the following write a sentence and draw a picture to show how quickly the towel dried.

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<th>air only</th>
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<td>hair dryer</td>
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2. Tell about an example of where wind makes something dry out faster.

3. Tell about an example where heat makes something dry out faster.

4. Tell about an example where wind and heat together make something dry out faster.
Lesson Eighteen

Concept: Water Is Part of Living Things

Resources/Materials: Mini Textbook, pages 37 - 39
Worksheets #2A.18a and #2A.18b (student copies)
small plant
popcorn and popper (or microwave)

Introduction: Discuss how things that are living grow and change. Nonliving things might change a little, but they do not grow. Go over a few examples of living things and then a few nonliving things to ensure that students understand the difference.

Ask students what they do if they are thirsty. Explain that thirst is our body’s way of telling us we need water.

Procedure:


2. Explain that all living things need water. If a living thing does not have enough water, it can no longer live; it will die.

3. Discuss how humans get water. (Most will say by drinking water.) Remind students that humans get a lot of the water their bodies need in the foods they eat. Some foods, like watermelon have a lot of water in them; others like crackers have very little water in them. A human’s body is mostly water!

4. Animals, such as birds, horses, fish, and insects get their water in much the same way as humans. A few creatures like earthworms also soak water in through their skin.

5. Explain that plants get water through their roots. Pull the plant out of the pot and shake away some of the soil to expose the roots. Explain that plants take water from the soil and soak it up through the roots. From there, the water makes its way up to the stem and leaves.

6. Explain that the popcorn we pop is really a seed. A seed is living thing. The popcorn seed has a tiny drop of water inside it. When the popcorn seed is heated up, the water gets so hot that actually makes the seed explode from the inside out. That’s how we get the popcorn we eat.

7. Pop some popcorn for all to enjoy.

8. Distribute Worksheets #2A.18a and #2A.18b. Go over the directions.

Assignment:

Do Worksheets #2A.18a and #2A.18b.
Living Things Need Water

1. Tell how each of the following gets water. You may tell about more than one way.

   a. human

   b. cow

   c. robin

   d. plant

   e. fish

   f. tree
2. Why do we need to water the plants in a garden?

3. What happens to a crop if it does not get enough rain?

4. Why do you think many animals try to stay out of the hot sun?
Lesson Nineteen (Optional)

Concept: Water is a Component of Living Things

Resources/Materials: oranges  seedless grapes
                  raisins      knife
                  paper towels  small bowls (or any container: See #3 below.)
                  measuring cup

Introduction: Review that all living things need water to live. Review also that the foods we eat contain water. Explain that today we will be looking more closely at two foods.

Procedure:

1. Show students the grapes and raisins. Ask them how these two foods are related. Explain that a raisin is a dried grape. The people who make raisins, take grapes and then put them in an oven. They blow warm air onto the grapes. (If necessary, review that wind and heat speed up drying.)

2. Have students taste the grapes; then the raisins. Which has more water in it?

3. Explain that oranges have a lot of water in them. Give each student an orange half, a spoon, a small bowl, and a paper towel. Have students use the spoons to try to get as much water as possible out of the oranges. Then have all students pour their juice into a measuring cup to determine how much they were able to squeeze out of the oranges. Emphasize that there is still plenty of water in the orange rind and in the remaining pulp.

4. After clean up and wash up, you can have students write about what they did and what they found in their notebooks.

Assignment:

Optional. If you like, have students write about what they did and what they found in their notebooks.
Lesson Twenty

ADVANCE PREPARATION: Talk to the German teacher to find out specifically how the colony treats its water for human consumption.

Concept: Maintaining Clean Water Supplies

Resources/Materials: Mini Textbook, pages 40 - 42
Worksheet #2A.20 (student copies)

Introduction: Review that humans, like all living things, must have water to survive. Discuss that it is not a good idea to drink water from a lagoon, dugout, or ditch.

Procedure:


2. Explain that if we drink water from lagoons, ponds, lakes, and dugout, we might get sick. Some animals can drink that same water and not get sick at all.

3. Explain that most water found in nature have tiny living things in them that can make us ill or even kill us. For this reason we do things to it to make the water safer. **Note:** Most colonies have a system of treating their water to make it safe to drink. If yours does, then explain what it is. Some colonies may be able to use well water, which is naturally purified as surface moisture makes its way to underground water sources.

4. Point out that one way that we can keep water safe is to not put things into the water that can harm us. With the class, come up with a list of things people can do to make their water supply safe. Write them on a chart. Examples:
   a. Do not throw litter into ponds, streams, and lakes.
   b. Do not throw poisons down the drain.
   c. Take old paint to a paint recycling centre.
   d. Do not throw sprays into ponds, streams, and lakes.

   Once your list is complete. Read the list over a few times, making sure to point to the individual words as they are being read.

5. Distribute Worksheet #2A.20. Go over the directions. (Younger students will most likely need help.)

Assignment:

Do Worksheet #2A.20.
Lesson Twenty

ADVANCE PREPARATION: Talk to the German teacher to find out specifically how the colony treats its water for human consumption.

Concept: Maintaining Clean Water Supplies

Resources/Materials: Worksheet #2A.20 (student copies)

Introduction: Review that humans, like all livings things, must have water to survive. Discuss that it is not a good idea to drink water from a lagoon, dugout, or ditch.

Procedure:

1. Explain that if we drink water from lagoons, ponds, lakes, and dugout, we might get sick. Some animals can drink that same water and not get sick at all.

2. Explain that most water found in nature have tiny living things in them that can make us ill or even kill us. For this reason we do things to it to make the water safer. **Note: Most colonies have a system of treating their water to make it safe to drink. If yours does, then explain what it is. Some colonies may be able to use well water, which is naturally purified as surface moisture makes its way to underground water sources.**

3. Point out that one way that we can keep water safe is to not put things into the water that can harm us. With the class, come up with a list of things people can do to make their water supply safe. Write them on a chart.
   Examples:
   - Do not throw litter into ponds, streams, and lakes.
   - Do not throw poisons down the drain.
   - Take old paint to a paint recycling centre.
   - Do not throw sprays into ponds, streams, and lakes.

   Once your list is complete. Read the list over a few times, making sure point to the individual words as they are being read.

4. Distribute Worksheet #2A.20. Go over the directions. (Younger students will most likely need help.)

Assignment:

Do Worksheet #2A.20.
Science Grade Two Topic A: Exploring Liquids, Part II
Worksheets

Our Water Supply

1. Tell where your colony gets its water.

________________________________________________________________________

________________________________________________________________________

2. Tell what the colony does to make the water safe to drink.

________________________________________________________________________

________________________________________________________________________

3. What are some things people can do to keep water safe?

a. ________________________________________________________________

b. ________________________________________________________________

c. ________________________________________________________________

d. ________________________________________________________________

e. ________________________________________________________________

f. ________________________________________________________________

g. ________________________________________________________________

Worksheet #2A.20
Lesson Twenty-one

Concept: Exploring Liquids, Part II Test

Resources/Materials: Exploring Liquids, Part II Test (student copies)

Introduction: Explain that the unit on Exploring Liquids is now complete. It is time for a test.

Procedure:

1. Distribute the tests.

2. If you have grade one students in the group, it is probably best to go through the test question by question.
Exploring Liquids, Part II
Test

1. Circle the material that will soak up the most water.

<table>
<thead>
<tr>
<th></th>
<th>plastic bag</th>
<th>sponge</th>
<th>shiny paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>paper towel</th>
<th>grocery bag</th>
<th>newspaper</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>shiny paper</th>
<th>construction paper</th>
<th>cloth towel</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>coffee filter</th>
<th>writing paper</th>
<th>catalogue</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Circle the material that will hold water the best.

<table>
<thead>
<tr>
<th></th>
<th>plastic cup</th>
<th>cloth</th>
<th>writing paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>milk carton</th>
<th>sweater</th>
<th>paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Paul wants to make a piece of paper hold water better. Circle the sentence that tells what he could do.

- Colour the piece of paper with wax crayon.
- Cut the paper into two pieces.

4. Amanda wants to make water into ice. Circle the sentence that tells what she should do.

- Put the water into the freezer.
- Put the water on the stove.

5. June wants to change ice from a solid to a liquid. Circle the sentence that tells what she should do.

- Put the water into the freezer.
- Leave the ice on a table for a while.

6. Ben wants to change water to a gas. Circle the sentence that tells what he should do.

- Heat the water in a kettle.
- Put the water in the freezer.
7. John wants to change water vapour back to water. Circle the sentence that tells what he should do.

- Heat the water vapour.
- Cool the water vapour.

8. For each question, circle the sentence that tells about water evaporating more quickly.

<table>
<thead>
<tr>
<th>a</th>
<th>A container of water has a lid on it.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A container of water does not have a lid on it.</td>
</tr>
<tr>
<td>b</td>
<td>Clothes are hanging on the clothesline on windy day.</td>
</tr>
<tr>
<td></td>
<td>Clothes are hanging on the clothesline on a calm day.</td>
</tr>
<tr>
<td>c</td>
<td>It is a cool day in the garden.</td>
</tr>
<tr>
<td></td>
<td>It is a hot day in the garden.</td>
</tr>
<tr>
<td>d</td>
<td>It is hot and windy in the wheat field.</td>
</tr>
<tr>
<td></td>
<td>It is hot and calm in the wheat field.</td>
</tr>
</tbody>
</table>
9. Circle **yes** or **no**.

<table>
<thead>
<tr>
<th></th>
<th>Birds do not need to drink water.</th>
<th>yes</th>
<th>no</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>Plants get water through their roots.</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>c</td>
<td>Most foods do not have any water in them.</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>d</td>
<td>Humans can get water by eating food.</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>e</td>
<td>All living things have water in them.</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>f</td>
<td>Most animals get some water by eating food.</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>
10. Circle all the sentences that tell how humans can keep water safe to drink.

- Do not throw junk into pond.
- Throw leftover paint into a lake.
- Keep sprays away from streams and lakes.
- Get rid of poisons by throwing it down the drain.
- Make sure that manure stays out of streams and lakes.

11. Tell how your colony makes its water safe to drink.
Topic A

Exploring Liquids

Mini Textbook
Exploring Liquids

Contents

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The Amount of Wind 33
The Amount of Heat 35

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We Need to Keep Our Water Clean 40

Introduction 3
Introduction

We use liquids everyday.

We drink liquids.

We use liquids to keep things clean.
Liquids help plants and animals to grow.

Cars, trucks, airplanes, and trains use liquids to make them go.

Liquids are important.
Properties of Liquids

Introduction

The properties of liquids tell what liquids are like.

All liquids have the same properties.

If something does not have all these properties, it is not a liquid.

On the following pages you will find out about some of the properties of liquids.
A. Liquids Can Flow

A liquid moves from one place to another by flowing.

When a liquid flows, it moves in one steady stream.

Water is a liquid. It flows in tiny creeks and large rivers.

When you pour milk from a jug to a cup, it flows.
Some liquids flow quickly.

Some liquids flow slowly.
B. Liquids Form Beads

A drop of a liquid will form into a round bead.

The surface of the liquid is like a skin that you cannot see.

The skin keeps the water that is inside of the bead from spilling out.

Some liquids make beads that are round.

Some liquids make beads that are domed.

Some liquids make beads that look like a pancake.
The liquid at the top of a cup also forms a skin.

A bug called a water strider can stand on top of water.

This skin is strong.

It is so strong that you can float a paper clip on the surface of a cup of water.
C. Liquids Do Not Have a Shape

When it is still, the top of a liquid is flat and smooth.

The top part of a liquid never slants, even if you tilt the container that it is in.
A liquid has no shape of its own.

It takes on the shape of the container it is in.

These bottles all have different shapes. When you pour a liquid into them, the liquid will take the shape of the container.
D. Liquids Have Different Weights

Some liquids are heavier than other liquids.

It is not always easy to tell which liquids are heavy and which liquids are light.

A cup filled with water will be heavier than a cup filled with oil.

A jar filled with gasoline will be lighter than a jar filled with water.
Here is a way for you to decide which liquids are heavy and which liquids are light:

- Get a tall jar.
- Pour the same amounts of several liquids into the jar.
- Stir the liquids together.
- Wait for a few minutes.

You will see that the heavier liquids will be at the bottom of the jar. The lighter liquids will be at the top of the jar.
E. Solids Can Be Mixed with Some Liquids

Some solids do not mix with liquids at all.

The sand, gravel, and rocks in this fish aquarium will not mix with the water.
You can mix some solids with liquids, but later these solids will settle to the bottom.

**Picture A.** When you mix flour and water you get a cloudy mixture.

**Picture B.** If you let the mixture sit for a while, the flour settles to the bottom.

If you this cup of hot chocolate sit for a while, the chocolate will settle to the bottom of the cup.
You can mix some solids with liquids.

These solids will **dissolve** in the liquid. This means they seem to disappear in the liquid. You can’t see them any more. They will stay mixed with the liquid.

If you add salt to water and then stir, the salt and water will stay mixed.

If you add drink crystals to water and then stir, the drink crystals will stay mixed with the water.

You make coffee by mixing coffee grounds with hot water. Little bits of coffee grounds stay mixed with the hot water.
Part II: Using and Controlling Water

Introduction

Water is a liquid. It is an important liquid in our lives.

Here are some facts about water:

- Pure water is clear. It is transparent.
- Pure water has no smell.
- Water is the most important liquid on Earth.
- There is more water on Earth than any other liquid.
- All living things need water.

In this part of the unit, you will learn more about water.
A. Absorbing Water

Some materials absorb water better than others.

When a material absorbs water, it lets it soak in.

These materials absorb water very well.

newspaper

paper towel

cardboard

sponge
These materials absorb water, but not very well.

- unglazed pottery
- nylon fabric

These materials do not absorb water at all.

- glass
- plastic
- metal
B. Holding Water

Materials that do not absorb water are good for making containers to hold water.

Containers made of plastic make good holders of water. The plastic does not absorb water.

Glass is another material that is good for making containers to hold water. Glass does not absorb water.

Metals do not absorb water. They make good containers for holding water.
Materials that absorb water are not good for making containers for holding water.

A paper cup will absorb water. After a while, the paper cup gets soft and the water will leak out.

A sponge also absorbs water. The water will soak into the sponge and then leak out. A sponge will not make a good container for holding water.

A cardboard box will not hold water. The cardboard will absorb the water and become soft.
Some materials are not good for making containers for holding water.

You can change these materials so that they will not absorb water. Then you can make them into good containers for holding water.

A milk carton is cardboard coated with a layer of wax. It then makes a good container for holding water and other liquids.

Some pots absorb water. If you coat them with a special paint, they will not absorb water.
C. Changing Water

You can change water by heating it. You can also change water by cooling it.

Freezing

If you cool water a lot, it will freeze. **Freezing** means changing from a liquid to a solid. Frozen water is called ice.

The ice you put in punch or juice is frozen water.

Snow is really small bits of frozen water.
Melting

If you heat up ice, it will melt.

Melting means changing from a solid to a liquid.

When ice melts, it turns to water.

An ice cube gets smaller when you put it in water. It is melting. It is a solid that is melting into a liquid.

Snow melts when it gets warm outside. It changes from ice to water.
Evaporation

If you heat water, it turns to steam. Steam is a gas. **Evaporation** means changing from a liquid to a gas. Water can evaporate into the air and become water vapour. You can't see water vapour. Water vapour is a gas too.

![Image of boiling water](image1)

You can see water turn to steam when a pot of water boils.

![Image of clothesline](image2)

Clothes on a clothesline dry because water from the wet clothes evaporate into the air.
Condensation

When a gas is cooled it changes back to a liquid.

Condensation happens when a gas changes to a liquid.

When water vapour or steam in the air touches something cold, it changes to a liquid.

In the winter, water droplets form on a cold window. The water vapour in the air is cooled by the cold window. It changes to a liquid.

Water droplets form on the inside of a pot of boiling water. The steam inside the pot is cooled by the lid. This makes the steam turn to water.
D. Controlling Evaporation

Water evaporates when it changes to steam or water vapour.

Sometimes we want water to evaporate. Sometimes we do not want water to evaporate.

We can do things to speed up evaporation. We can do other things to slow down evaporation.

Here are some things that affect how much evaporation takes place:

1. Putting a cover on a container.

Putting a cover on a container helps to prevent evaporation. When you prevent something, you keep it from happening.

The cap on a bottle of water or a can or pop prevents the water from evaporating.
When bread dries out, water evaporates from it. We cover a loaf of bread with a plastic bag. This way the bread does not dry out.

The glue in a bottle will dry out if you do not screw down the cap. The cap prevents the water in the glue from evaporating.
Sometimes we want water to evaporate. We don't use a cover then.

The noodles are sitting out without a cover. This way they will dry a little.

A wet dish will dry faster if you do not cover it. The water will evaporate into the air. After a while, the dish is dry.
2. The size of the opening of a container.

A lot of water will evaporate from a container with a big wide opening.

Paint will dry out fast if it is in a can with a wide opening.

The water from a pot of boiling water will evaporate quickly because the pot has a big opening.
Some containers have small openings. Water will evaporate more slowly from these containers.

Water will evaporate from this container. It will evaporate slowly.

From which container will water evaporate more quickly?
3. The amount of wind.

Wind is air that is moving. The more wind there is, the quicker evaporation takes place.

A fan will make water evaporate from a dish more quickly.

Clothes on a clothes line will dry out more quickly on a windy day. This is because the wind helps to speed up evaporation.
Wind can dry things out when we don't want it to.

We must water the garden more often if it is windy. The wind makes the water in the soil evaporate more quickly.
4. The amount of heat.

The more heat there is, the more quickly evaporation takes place.

Clothes dry out more quickly on a hot day. The heat speeds up the evaporation of water in the wet clothes.

A toaster heats up the outside of a slice of bread. It makes the water on the outside of the bread evaporate and become dry.
We can speed up evaporation by using both wind and heat together.

A clothes dryer blows hot air onto the clothes. This makes the water evaporate from the clothes more quickly.

A hair dryer can make your hair dry faster. It does this by blowing hot air onto your hair.
E. Water is Part of All Living Things

When you look in a mirror, you do not see water.

But believe it or not, your body is mostly water.

Plants are mostly water too.
Plants need water to live and grow.
Without water, plants would die.

Plants get water by absorbing it through their roots.
Water is part of animals and birds too. They need water to live and grow.

Most animals and birds get water by drinking it.

Fish get lots of water because they live in it.

Earthworms absorb water through their skin.
Humans get water by drinking it. They also get water from the foods they eat.

Drinking liquids such as water, pop, and milk are a few ways that humans get water.

Many foods that people eat are made up mostly of water.
F. We Need to Keep Our Water Clean

It is important that we keep our water clean. Water that is not clean can make us sick. It can also make plants and animals sick too.

Nature has a way of cleaning most water.

You can do an activity like the one shown above. It shows how dirty water goes through many different types of materials. This helps to make dirty water into clean water.
Here are some things we can do to keep our water clean.

1. Do not throw litter into ponds, streams, and lakes.

   The water that we drink comes from ponds, streams, and lakes. Litter can make the water bad for drinking by animals and humans. It is also not good for plants.

2. Take old paint to a paint recycling centre.

3. Take used motor oil to an oil recycling centre.

4. Do not throw sprays into ponds, lakes, and rivers.

5. Do not use too much fertilizer.

   The fertilizer from fields drains into rivers and lakes. It is not good for the water.

6. Do not throw medicines down the drain or flush it down the toilet.

7. Do not throw old farm chemicals into the water.
Water is important to all living things.

We must try not to waste it.

Can you think of ways we can use less water?
Topic B
Buoyancy and Boats
About the Lessons

*Buoyancy and Boats* provides students with a great opportunity to engage in several hands-on activities. It can get messy, so it is a good idea to have plenty of newspapers, paper towels, and rags handy.

If you have a mixture of younger and older primary grade students in your instructional group, you most likely will have to have the older students help the younger ones, especially if you are not free to provide guidance yourself. For some lessons, there are alternate independent activities for younger and older students.

Materials

Almost all of the materials you will need are readily available around your school and your home. It may be a good idea to flip through the unit to see what kinds of things you will need so that you can start to save them. There may be a few things, such as ping pong balls that you will have to get from a department store.

I recommend that you purchase corks from Edmonton Public Schools. The corks you can buy in wine shops are too dense, so they are too hard for students to pierce with paper clips or toothpicks. (See the address below.)

Mini Textbook

A Mini Textbook is provided for you to use as you see fit. It is provided if you would like to give your students a knowledge base before you start the actual hands-on portion of a particular lesson. However, with the exception of Lesson Eighteen, it should be possible for you to complete the unit without the Mini Textbook.

To order corks:

Stock No. 88-01240
(pkg. of 100)

Edmonton Public Schools
Distribution Centre
18004 – 116 Avenue
Edmonton, Alberta T5S 1L5

Telephone: 888-997-9098
Science Grade Two
Topic B: Buoyancy and Boats

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### Part II: Controlling Floatation

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<thead>
<tr>
<th>Lesson</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Twelve</td>
<td>Stability – Part I</td>
<td>16</td>
</tr>
<tr>
<td>Lesson Thirteen</td>
<td>Stability – Part II</td>
<td>17</td>
</tr>
<tr>
<td>Lesson Fourteen</td>
<td>Carrying a Load – Part I</td>
<td>18</td>
</tr>
<tr>
<td>Lesson Fifteen</td>
<td>Carrying a Load – Part II</td>
<td>19</td>
</tr>
<tr>
<td>Lesson Sixteen</td>
<td>Keeping Cargo Ships Stable</td>
<td>20</td>
</tr>
<tr>
<td>Lesson Seventeen</td>
<td>Evaluating Watercraft</td>
<td>21</td>
</tr>
<tr>
<td>Lesson Eighteen</td>
<td>Matching the Watercraft to the Use</td>
<td>22</td>
</tr>
<tr>
<td>Lesson Nineteen</td>
<td>Using Wind to Propel Watercraft</td>
<td>23</td>
</tr>
<tr>
<td>Lesson Twenty</td>
<td>Balloon-Powered Watercraft</td>
<td>24</td>
</tr>
<tr>
<td>Lesson Twenty-one</td>
<td>Buoyancy and Boats, Part II Test</td>
<td>25</td>
</tr>
</tbody>
</table>

![Image of a person floating in a tube](image-url)
Lesson One

Concept: Introduction

Resources/Materials: Worksheets #2B.1a, #2B.1c, and #2B.1d (transparencies OR student copies)  
Worksheet #2B.1b (teacher copy)

Introduction: Put up the transparency of Worksheet #2B.1a or show a copy to the students. With students discuss that pictures are of a ship that move by using sails to catch the wind. Explain that these pictures are not photographs. They are drawings. Then ask if any of the students know why this particular ship is important.

Explain that this is a drawing of the ship that transported the first Hutterites to North America from Europe almost 140 years ago (1874). It was called the Hammonia. It was considered to be a large ship in those days, but by today’s standards it is very small. (Note: There were actually several ships named Hammonia. Their design was essentially the same, but there were slight differences.)

Procedure:

1. Explain that just as ships were important to people many years ago, things that float like boats and ships are important today.

2. Explain that things that float that are used to carry people and loads are called watercraft. Ships are designed mainly for ocean travel, while boats are meant mainly for travel on lakes and rivers and ocean waters close to shore.

3. Put up the transparencies of Worksheets #2B.1c and #2B.1d or distribute the copies. Briefly give students a little bit of information on each. (Worksheet #2B.1b offers some ideas.)

4. Have students draw and colour a picture of their favourite watercraft. Then have them write a sentence or two telling why it is their favourite.

5. OPTIONAL. With students make two lists on the board: boats and ships. If you like, have younger students use the lists to make sentences, using the sentence frame

   A ____________ is a ______________ . (e.g. A junk is a boat.)

   Adjust the number of sentences expected according to the grade of the students.

Assignment:

Make a picture of your favourite watercraft. Tell why it is your favourite.
A Ship of Long Ago
Watercraft – Notes

1. **Surf Board** – one-person watercraft; used for fun
   - uses the power of ocean waves to move toward the shore

2. **Sea-Doo** – one-person watercraft powered by a motor, used for fun

3. **Raft** – made of logs tied together with boards on top, used for fun
   - use a pole to steer it

4. **Raft** – made of a strong rubber; filled with air so it will float

5. **Sailboat** – uses wind to make it move along the water; used for fun

6. **Fishing Boat** – used to catch fish; used for work
   - uses a motor to make it go through the water

7. **Motor Boat** – holds only a few people; used for fun
   - uses a motor to make it go through the water

8. **Junk** – usually home to a single family
   - uses wind to move it through the water

9. **Canoe** – made for one or two people
   - First Nations people used it a lot for getting from place to place
   - paddle used to move it through the water

10. **Tall Ship** – big ship used for ocean travel; used by companies whose business it was to move people and loads
    - no longer used today.
    - used the wind to move it through the water

11. **Yacht** – medium-sized ship used by rich people
    - powered by a motor
    - has all the comforts of home and more!

12. **Submarine** – made to move under the water’s surface
    - powered by a motor

13. **Cruise Ship** – designed for people who want to take a vacation on a ship
    - smaller ones hold about 300 people; larger ones hold up to 7500 people
    - have restaurants, theatres, and places to have fun
    - powered by motors

14. **Cargo Ship** (not pictured) – used mainly to haul loads. The grain produced on the colony would make its way to many other countries on a cargo ship.
Watercraft – Page 2

9. [Image of a man rowing a canoe]

10. [Image of a tall ship with multiple masts]

11. [Image of a cruise ship]

12. [Image of a submarine]

13. [Image of a large ship with a mountain in the background]
Lesson Two

ADVANCE PREPARATION: Write the names of the materials students will be testing on Worksheet #2B.2a.

Concept: Floaters and Sinkers

Resources/Materials: Worksheet #2B.2a and #2B.2b (student copies)

<table>
<thead>
<tr>
<th>Items to Test (ten)</th>
<th>Styrofoam</th>
<th>table tennis ball</th>
</tr>
</thead>
<tbody>
<tr>
<td>square of paper</td>
<td>pencil</td>
<td>small pop bottle</td>
</tr>
<tr>
<td>marble</td>
<td>block of wood</td>
<td>rock</td>
</tr>
<tr>
<td>piece of sponge</td>
<td>coin</td>
<td>nail</td>
</tr>
<tr>
<td>waxed paper</td>
<td>paper clip</td>
<td>piece of cloth</td>
</tr>
<tr>
<td>eraser</td>
<td>pumice</td>
<td>elastic band</td>
</tr>
<tr>
<td>tubs of water</td>
<td>cork</td>
<td></td>
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</tbody>
</table>

Introduction: Ask students to recall the watercraft from the last lesson. One thing they have in common is that they all float. Have students speculate about why they float. Conclude that the design and the materials used both help a watercraft to float.

Explain that today students will test some materials to decide if they will sink or float when placed in water.

Procedure:

1. With students come up with a question that will guide the activity, such as “Do all objects float?”, “Which object float and which objects sink?”

2. Distribute Worksheet #2B.2. Show students how the sheet is set up. Then hold up the objects in the order you have them listed on the sheet. As you hold each up, have students circle either float or sink in the Prediction column.

3. Have students test each object. Then have them circle either float or sink in the Observation column.

4. Distribute Worksheet #2B.2b. Have students complete the chart and then make a bar graph.

5. If you like, have younger students write sentences using the sentence frames

   A _____________ floats.
   A _____________ sinks.

   Have older students write a paragraph telling what they wanted to find out, what they did, and what they observed.

Assignments:

1. Do Worksheets #2B.2a and #2B.2b.
2. Write sentences or paragraphs about the activity. (See #5 of the Procedure)
Floaters or Sinkers?

Question: ____________________________

<table>
<thead>
<tr>
<th>Predictions:</th>
<th>Observations:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 float</td>
<td>1 float</td>
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<tr>
<td>2 float</td>
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<td>3 float</td>
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<td>9 float</td>
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<tr>
<td>10 float</td>
<td>10 float</td>
</tr>
</tbody>
</table>
Floaters or Sinkers?

**Directions:** Complete the chart. Then make a bar graph.

<table>
<thead>
<tr>
<th>Floaters</th>
<th>Sinkers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
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</tr>
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<tbody>
<tr>
<td>Floaters</td>
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<tr>
<td>Sinkers</td>
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</tr>
</tbody>
</table>

Think about where the floaters sat in the water. Fill in the chart.

<table>
<thead>
<tr>
<th>Floated Mostly Above the Water</th>
<th>Floated Mostly Below the Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

Worksheet #2B.2b
Lesson Three

ADVANCE PREPARATION: Write the names of the fruits and vegetable to be tested on Worksheet #2B.3.

Concept: Floaters and Sinker: Fruits and Vegetables

Resources/Materials: Worksheet #2B.3 (student copies)

variety of fruits and vegetables (ensure that there are some floaters and some sinkers – as many as ten: apple, pear, lemon, orange, plum, cranberry, broccoli, turnip, celery, potato, carrot, etc.

tubs of water

Introduction: Review that some objects are floaters and some are sinkers. What about fruits and vegetables? Explain that today, students are going to test them.

Procedure:

1. Follow the same procedure as the day before, having students circle their predictions first on Worksheet #2B.3.

2. Then test the vegetables and fruits, recording their observations.

3. Following the testing, explain that the fruits and vegetables that float have a lot of air in them. This helps them to float.

4. Explain that the peel of an orange (or lemon or lime) has many tiny air pockets. Peel the orange; then test it again. It should sink.

5. Cut an apple or similar fruit in half. Note the air pocket in seed cavity. This helps the apple float.

6. If you have the time, show students how to make a list that begins with an introductory sentence. Make two lists, one for foods that float and one for foods that sink.

   Example: These foods float in water:
   
   orange
   cranberry
   apple

Assignments:

1. Do Worksheet #2B.3.
2. OPTIONAL. In notebooks, make lists that are introduced with a sentence.
# Floaters or Sinkers: Fruits and Vegetables

### Predictions:

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<tr>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>float</td>
<td>sink</td>
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<tr>
<td>2</td>
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</table>

### Observations:

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<td>10</td>
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<td>float</td>
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</tbody>
</table>
Lesson Four

Concept: Floaters That Sink

Resources/Materials: Worksheet #2B.4a (student copies)
Worksheet #2A.2b (older students)
Worksheet #2A.2c (younger students)
pop bottle (clear) without cap or label
sponge (not man-made)
small terry towel (e.g. face cloth, dish cloth used by most colonics)
paper towel
tub of water

Introduction: Have students recall when they were testing objects to determine if they floated or sank. Ask them to think about any that floated at first, but then ended up floating further down in the water or sinking. Ask them to speculate about why this happens.

Procedure:

1. Explain that if an object has a lot of air trapped in it, it has a better chance of floating than if there is little or no air trapped.

2. Hold up the pop bottle. Note that there is a lot of air in the pop bottle. Place the pop bottle in the water so that the open end is up. It will mostly likely tilt in the water, but float.

3. The pop bottle may start to fill up with water on its own, but if it doesn’t, tip it so that water can start to enter. Have students observe that once the pop bottle has a certain amount of water in it, it will sink. Discuss that this happens because water has taken the place of the air. Water is heavier than air, so the pop bottle is now heavier.

4. Next, hold up the paper towel. Allow students to feel how “cushiony” it is. It is soft and cushiony because it has tiny air pockets. Float the paper towel on the water and then wait. It should begin to sink. (If you want to speed up the process, submerge the paper towel and squeeze it into a ball, forcing the air out. Students may notice air bubbles escaping as you squeeze.)

5. Repeat for the terry towel and the sponge. Typically the terry towel and sponge end up floating just below the surface.

6. Conclude that if an object has a lot of air in it, it will most likely float.

7. Distribute Worksheet #2B.4a. Go over the directions.

8. Distribute Worksheets #2B.4b (older students) or #2B.2c (younger students). Go over the directions.

Assignments:

1. Do Worksheet #2B.4a.
2. Do Worksheet #2B.4b (older students) or Worksheet #2B.4c (younger students).
Floaters That Sink

1. Follow these directions:

- In Box 1 draw a large tub of water.
- Draw a pop bottle floating in the water.

- In Box 2 draw a large tub of water.
- Draw a pop bottle that has some water in it, but is still floating.

- In Box 3 draw a large tub of water.
- Draw a pop bottle that has sunk.
2. Fill the spaces with words from the box.

| sink | air | float |

a. Things that stay at the top of the water ________________.
b. Things that go to the bottom of the water ________________.
c. ________________ helps to make things lighter.

3. Pretend you threw your winter coat into the dugout.

a. What would happen at first? Explain why.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

b. What would most likely happen after a while? Explain why.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
2. Write the missing letters. Use the words in the box to help you.

- cork
- pencil
- marble
- sponge
- rock
- paper clip
- coat
- nail
- wood
- bottle
- eraser
- penny

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Lesson Five

Concept: Making a Floater into a Sinker

Resources/Materials:  Worksheets #2B.5a and #2B.5b (student copies)
Floatable item, such as
- small square of cork (buy sheet of cork at building supply store)
- small square of Styrofoam (cut from a meat tray)
- small square of sponge
Variety of other small items (some light and floatable) – some of them must be heavy and dense, such as
- small rock
- heavy washers
- nut or bolt
variety of fasteners, such as
- Plasticine (be careful, some Plasticines are not waterproof)
- string
- electrical tape
tub of water

Introduction: Start the lesson by reviewing some vocabulary words, if necessary: sink, float, heavy, air, etc. Then tell students you have a challenge for them.

Procedure:

1. Hold up the floatable item. Explain that it does float. The challenge is that students are to figure out a way to make the floatable item sink.

2. Show students the other items they have to work with. Go over the names of the items.

3. Distribute Worksheet #2B.5a. Explain that students must first come up with a plan. Older students must write down their plan on the top part of Worksheet #2B.5a and show it to you. Younger students should tell you about their plan. (Write their plan down for them.) Once you have approved the plan, they can go ahead and try it out.

4. Once they have tried out their plan, they should write down how well it worked on the second half of Worksheet #2B.5a.

5. When all have had a chance to try out their plans and record their results, discuss:
   - In order to make a light floatable object sink, you must attach something that is heavy for its size to it to make the overall weight much greater.

6. Distribute Worksheet #2B.5b. Go over the directions. Have older students help younger students, if necessary.

Assignment:

Do Worksheet #2B.5b.
Science Grade Two Topic B: Buoyancy and Boats, Part I
Worksheets

Making a Floatable Object Sink

Challenge: You are to think of a way to make an item that floats sink.

Tell how you plan to do this.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Tell what happened.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

What did you learn?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Directions: Tell how you could make each of these floatable objects sink.

1. a pop bottle with a cap on it

2. a small row boat

3. a raft

4. a soccer ball
Lesson Six

Concept: Making a Sinker into a Floater – Part I

Resources/Materials: Worksheets #2B.6a and #2B.6b (student copies)
- sinkable item, such as
  - metal nut or bolt
  - stick of gum (unwrapped)
  - tightly folded piece of foil
- variety of other small items (some light and floatable) – some of them must be light and floatable, such as
  - Styrofoam
  - Popsicle sticks
  - sponge
- variety of fasteners, such as
  - Plasticine (be careful, some Plasticines are not waterproof)
  - string
  - electrical tape
- tub of water

Introduction: Review that during the last class students learned that if they wanted to make a floater into a sinker, they needed to make the floater a lot heavier. Review some of the things students did to accomplish this. Explain that today, you have another challenge for students – to make an object that usually sinks into a floater.

Procedure:

1. Show the student the object they must try to make into a floater. Place it in the water to show them that it actually does sink.

2. Distribute Worksheet #2B.6a. Explain that today’s activity will work much like that of the last day’s; that is, students must come up with a plan, write it down on the first part of Worksheet #2B.6a, and get it approved by you before they can begin. (Younger students can tell you what their plan is. You would most likely have to write it on the worksheet for them.)

3. Have students carry out their plan. Then on the bottom part of Worksheet #2B.6a, have them tell how it worked. If a student’s initial plan did not work out well, encourage him/her to alter it and try out the altered plan.

4. Once students have had a chance to try out their plans, discuss:
   - An object that usually sinks can be made to float by overall trying to make it lighter. You can do this by adding something much lighter or by thinking of a way to add air to the object.

5. Distribute Worksheet #2B.6b. Go over the directions. Older students can help younger students.

Assignment: Do Worksheet #2B.6b. Have older students help younger students.
Making a Sinker into a Floater

Challenge: You are to think of a way to make an item that sinks float.

Tell how you plan to do this.

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

Tell what happened.

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

What did you learn?

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________

_____________________________________________________________________
Making a Sinker into a Floater

Directions: Tell how you could make each of these sinkers into floaters.

1. a bottle full of water

2. a tightly folded piece of foil

3. an eraser

4. a balloon that is not blown up
Lesson Seven

Concept: Making a Sinker into a Floater – Part II

Resources/Materials: Worksheet #2B.7 (student copies)
metal washer or nut
string (about 30 cm)
balloon (uninflated)
tub of water

Introduction: Review that in order to make an object that usually sinks in water float, you needed to somehow make the object lighter overall. You can do this by adding an item that it much lighter for its size or by somehow adding air.

Explain that today you have another challenge. You may want students to work in pairs.

Procedure:

1. Drop a washer (or nut) into the water. Note that it sinks.

2. Challenge students to use the string and the balloon to make the washer or nut float.

3. Distribute Worksheet #2B.7.

4. Follow the same basic procedure as the last two days with students writing down their plan on Worksheet #2B.7, implementing it, then writing down their observations on Worksheet #2B.7.

For the Teacher: If the idea does not eventually come to the students, suggest that they blow up the balloon and tie the neck so that the air cannot escape. Then suggest they tie the balloon to the washer or nut. At this time you can introduce the term buoyancy as the force that water puts onto objects to hold them up. If buoyancy is greater than the weight of the object, then the object will float. If buoyancy is less than the weight of the object, then the object will sink. The addition of the inflated balloon actually helps to increase the area of the object that touches the water. This makes the buoyant force greater, making the washer or nut float.

Assignment:

Do Worksheet #2B.7.
Make It Float

Challenge: Make a washer or nut float using only a piece of string and a balloon.

Tell how you plan to do this.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________

Tell what happened. Draw a picture.

_________________________________________________________________________

_________________________________________________________________________

_________________________________________________________________________
Lesson Eight

Concept: Adjusting Floating Height and Position

Resources/Materials: Worksheet #2B.8a (transparency or teacher copy)  
Worksheets #2B.8b and #2B.8c (student copies)  
Worksheet #2B.8d (older students)  
Worksheet #2B.8e (younger students)  
plastic straws  
Plasticine  
tub of water

Introduction: Have students recall when they were testing objects to see if they would float or sink. They might recall that some of the floaters might have rolled or tipped over. Explain that people that build watercraft have to make them so that they will not easily tip or roll over. In today’s lesson, we will learn more about how this happens.

Procedure:

1. Put up the transparency of Worksheet #2B.8a or show students the teacher copy). Explain that this is a picture of a buoy. Buoys are placed in the water for many reasons. One of the most common reasons is to show where there may be rocks underneath the surface of the water. This is helpful because if a ship or boat sees one, it stays away.

2. How is it that a buoy does not tip over, even when the water is very rough? This is not easy because something thin and tall like a buoy can easily tip over. Today, students will find out.

3. Explain to students that they will be given a straw, some Plasticine, and a set of directions. They are to follow the directions carefully and then record their observations.

4. Distribute Worksheets #2B.8b and #2B.8c as well as the straws and Plasticine. Pair older students with younger students.

5. You might consider allowing the students to work through the activities independently.

6. At the end of the activity, conclude that
   - a thin tall object like a straw does not easily stay upright
   - a straw will float as long as it has some air in it
   - you can adjust how high the straw will float by adjusting the amount of water in it
   - a straw will stay upright if it is relatively heavy on the bottom
   - if an object does not tip over easily, we say that it is stable

7. Distribute Worksheet #2B.8d to older students. (Younger students can also do this sheet, but will need help.) Distribute Worksheet #2B.8e to younger students.

Assignments:
1. Do Worksheets #2B.8b and #2B.8c.
2. Do Worksheet #2B.8d (older) or Worksheet #2B.8e (younger).
# Making a Floater Stable

**Directions:** Follow each of the instructions. After each tell what you observed.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Put the straw into the water straight up and down.</td>
<td></td>
</tr>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td></td>
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</tr>
<tr>
<td><strong>2</strong></td>
<td>Put the straw into the water at a slant.</td>
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<tr>
<td><img src="image2.png" alt="Image" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Hold the straw under the water until it fills up with water. Then let it go.</td>
<td></td>
</tr>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td></td>
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<tr>
<td><strong>4</strong></td>
<td>Make sure the straw is empty. Put a little Plasticine in both ends. Place it in the water.</td>
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<tr>
<td><img src="image4.png" alt="Image" /></td>
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<tr>
<td><strong>5</strong></td>
<td>Plug one end with Plasticine. Fill the straw one-third with water. Plug the other end with Plasticine. Place it in the water.</td>
<td></td>
</tr>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. Plug one end with Plasticine. Fill the straw half with water. Plug the other end with Plasticine. Place it in the water.

7. Plug one end with Plasticine. Fill the straw two-thirds with water. Plug the other end with Plasticine. Place it in the water.

8. Plug one end with a **small** piece of Plasticine. Fill the straw one-third with water. Plug the other end with a **large** piece of Plasticine. Place it in the water.

9. Plug one end with a **small** piece of Plasticine. Fill the straw one-third with water. Plug the other end with a **large** piece of Plasticine. Place it in the water so that the large piece of Plasticine is on top.
Making a Floater Stable

1. How would you make a buoy so it stays upright?

2. Sam made a buoy. He set it in the water. It floated higher in the water than he wanted it to. What could Sam do to make his buoy float lower in the water?

3. Dorothy made a buoy. She set it in the water. To her surprise the buoy flipped upside down. What could Dorothy do to make the buoy sit upright in the water?

4. John also made a buoy. He set it in the water. It sank. What could John do to make his buoy float?
Making a Floater Stable

Directions: Write the correct words in the spaces.

<table>
<thead>
<tr>
<th>upright</th>
<th>floating</th>
<th>sinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>sideways</td>
<td>low</td>
<td>water</td>
</tr>
</tbody>
</table>

1. The straw __________.

2. The straw is __________.

3. The straw is __________.

4. The straw is not in the __________.

5. The straw is __________.

6. The straw is __________ in the water.
Lesson Nine

Concept: The Effects of Changing Shape on Floatation: Foil

Resources/Materials: Worksheet #2B.9 (optional, student copies)  
sheets of foil (have extras on hand)  
tub of water

Introduction: Discuss that one way to make an object float is by adding something lightweight to it. Explain that today students will have the chance to find another way.

Procedure:

1. Have students carefully fold their sheets of foil several times. **Try not to get any wrinkles.** Press down so you get a nice tight bundle.

2. Place the folded foil in the water. What happens? (should sink) Discuss why.

3. **Carefully** unfold the foil and smooth it out.

4. Now try to shape it into a boat-shape.

5. See if it will now float in the water. (This may take a few tries for some. Foil tears easily.)

6. Once all students has a floatable boat, have students carefully poke a hole in the bottom of their foil boats. Then place the boat in the water. Observe. (Boat should gradually take on water. As it does, it will start to sink.)

7. Discuss that as long as water does not get into the inside of the boat, it will float. However, if water does get in, the inside of the boat becomes heavier. The mass of the boat becomes greater than the buoyant force of the water and the boat sinks.

8. On Worksheet #2B.9 OR in their notebooks, have students tell what they did and what they observed. They should draw pictures to go with each step.

Assignment:

Tell what was done and what was observed on Worksheet #2B.9 or in notebooks.
**Foil Boats**

**Directions:** For each step, tell what you observed. Draw a picture.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Observation</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I folded a piece of foil and put it in the water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I made the foil into the shape of a boat. I put it in the water.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I made a hole in the bottom on my foil boat. I put it in the water.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #2B.9
Lesson Ten

Concept: The Effects of Changing Shape on Floatation: Plasticine

Resources/Materials: Worksheets #2B.10a and #2B.10b (optional, student copies)
Plasticine (4 pieces for each student, each 4 or 5 cm in diameter)
tub of water

Introduction: Recall making a boat out of foil and making it float. Explain that today students will be making a boat with a different kind of material.

Procedure:

1. Have students place one of their pieces of Plasticine in the water. Observe. (sinks) Place wet pieces of Plasticine on some newspaper to dry.

2. Explain that students are to use the other three pieces of Plasticine to shape into boats.

3. They should shape one; then test it to see if it floats. Encourage them to make modifications to the Plasticine boats in order to get them to float.

4. They should try different shapes with the other two pieces, again modifying, if necessary.

5. On Worksheets #2B.10a and #2B.10b students should describe and draw their boats and tell how they behaved when placed in the water. If you like, have them do this in their notebooks instead.

NOTE: In this activity students have the opportunity to make several different boats. In addition to the wad of Plasticine, they will have to choose there of their boats to describe.

Assignment:

Make several different boats. Tell how well they floated on Worksheets #2B.10a and #2B.10b.
1. What happened when you placed a lump of Plasticine in the water? Draw a picture.

2. In the spaces below, draw three of the boats you made. Tell what happened when you placed each in the water.
3. Describe the boat that floated the best.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

4. What would happen if you poked a hole in the bottom of your boat? Explain why.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________
Lesson Eleven

Concept: Buoyancy and Boats, Part I Test

Resources/Materials: Buoyancy and Boats, Part I Test (student copies)

Introduction: Explain that the first part of the unit on Buoyancy and Boats is almost over. Now it is time for a test.

Procedure:

1. Distribute the tests.

2. If you have grade one students in the group, you will most likely have to go through the test, question by question with the class.
1. What will happen if each of the following is placed in a tub of water? Circle **float** or **sink**.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>sponge</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>b</td>
<td>bottle full of water</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>c</td>
<td>metal washer</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>d</td>
<td>cork</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>e</td>
<td>empty pop bottle with a cap on it</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>f</td>
<td>pencil</td>
<td>float</td>
<td>sink</td>
</tr>
<tr>
<td>g</td>
<td>lump of Plasticine</td>
<td>float</td>
<td>sink</td>
</tr>
</tbody>
</table>
2. Circle the best answer to each question.

| a | Ben laid a paper towel on the water. What will happen? | • The towel will float; then after a while it will sink.  
• The towel will sink right away. |
|---|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| b | Which will most likely float just below the surface of the water? | • a sponge  
• a soccer ball |
| c | Debbie would like to make a cork sink. What should she do? | • tape a piece of wood to the cork  
• tape a heavy metal bolt to the cork |
| d | Jolene wants to make metal nut float. What should she do? | • tie a large rock to the nut  
• tie a large cork to the nut |
| e | Jonathan taped an empty pop bottle with a cap on it to a small rock. What will happen? | • The rock will float.  
• The rock will sink. |
| f | Cindy wants to make a sheet of foil float. What is the best thing for her to do? | • shape the sheet of foil into a boat  
• fold the sheet several times and press down |
| g | Mrs. Hill made a boat out of a sheet of foil. She placed it on the water. After a while, the boat sank. What could be the reason? | • The foil had a hole in it.  
• The foil was too light. |
| h | Melissa made a boat out of a lump of Plasticine. She placed her boat in the water. It sank! What should Melissa do to make her boat float? | • make the walls of the boat thicker  
• make the walls of the boat thinner |
| i | Kevin asked his teacher how he could make a paper clip float. She gave him a piece of string and a balloon. What should Kevin do with the string and balloon? | • tie the balloon to the paper clip without blowing up the balloon  
• blow up the balloon and then tie it to the paper clip |
| j | Lydia wants to make a straw float. What should she do? | • put a piece of Plasticine on both ends before putting it on the water  
• put a piece of Plasticine on both end after putting it on the water |
| k | Matilda would like to make a straw float upright in the water. What should she do? | • put a large piece of Plasticine on one end of the straw and a small piece on the other end  
• put same sized pieces of Plasticine on the end of the straw |
| l | Simon made a straw float upright in water. He wants to make it float lower in the water. What should he do? | • make sure he puts more air into the straw.  
• put a little more water into the straw |
Lesson Twelve

Concept: Stability – Part I

Resources/Materials: Mini Textbook, pages 20 – 23
Worksheets #2B.12a and #2B.12b (older student)
Worksheets #2B.12c and #2B.12d (younger students)
glass cup
tape
empty plastic pop bottle with cap
strip of wood, a ruler, or washers
tub of water

Introduction: Place the cup right side up in the water. (It should float.) Then place the cup upside side in the water. (It will most likely fill with water and then sink.) Explain that it is important for a watercraft to remain right side up; otherwise it will sink. To do this, we want to make sure that it is stable; that is, make sure it won’t easily tip over.
Explain that there are several things boat designers do to try to make boats and other watercraft stable.

Procedure:


2. Place the empty pop bottle (cap on) in the water. Show students how easily the pop bottle can be make to roll in the water.

3. Then tape the strip of wood (or ruler or a few washers in a row) down the length of one side of the pop bottle.

4. Place it in the water so that the wood strip is on top. Note that the bottle will roll over so that the wood strip is on the bottom.

5. Place the bottle in the water so that the wood strip is on the bottom. Try to roll the bottle. (It should roll back so that the wood strip is on the bottom.)

6. Explain that a watercraft will usually right itself if the heaviest part is on the bottom. Conclude that watercraft that are heaviest on the bottom are the most stable.

7. Distribute Worksheets #2B.12a and #2B.12b (older students) or Worksheets #2B.12c and #2B.12d (younger students). Go over the directions, if necessary. Note: For Worksheet #2B.12b, question 3: Adding a ball of Plasticine to the bottom will help weight the bottom and keep it stable.

Assignment:

Do Worksheets #2B.12a and #2B.12b (older students)
or Worksheets #2B.12c and #2B.12d (younger students).
Science Grade Two Topic B: Buoyancy and Boats, Part II
Worksheets

Making Watercraft Stable – Part I

1. Explain what it means for a watercraft to be stable.


2. For each of the following tell what will happen. Draw a picture.

You place an empty pop bottle in a tub of water. You try to roll the bottle.

You tape a ruler down one side of an empty pop bottle. You place it in a tub of water so that the ruler is on top.

You tape a ruler down one side of an empty pop bottle. You place it in a tub of water so that the ruler is on the bottom. You try to roll the pop bottle.
1. Write the names of the objects below the pictures. Choose from words in the box.

bottle  water  tub  ruler

2. Label the picture.
3. Jennifer wanted to make a sailboat. She cut out a sail. Then she poked one end of a long toothpick into the sail. The other end she poked into a cork.

When Jennifer set her sailboat into the water, it tipped over. What could Jennifer do to make her sailboat stable? Draw a picture to show what you mean.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4. What did you learn about how to make a watercraft stable?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
3. Circle the pictures of the watercraft that will be stable. Colour the pictures if you have time.
Lesson Thirteen

Concept: Stability – Part II

Resources/Materials: Mini Textbook, pages 24 – 26
Worksheet #2B.13a (older student)
Worksheet #2B.13b (younger students)
small empty plastic pop bottles with caps
tape
tub of water
Miscellaneous items that can be used to connect two pop bottles, such as
Popsicle sticks, bamboo skewers, short rulers, cardboard, etc.

Introduction: Recall that it is important for watercraft to be stable. When watercraft are stable they will not tip easily and if they do tip, they will right themselves.
Recall also that one way to help make a boat stable is by ensuring that the bottom parts are heavier than the top.
Explain that today students will find out about another way to make a watercraft more stable.

Procedure:


2. Explain that the wider a boat is, the more stable it will be. The narrower a boat, the less stable it will be. (Explain also that most watercraft are long and narrow because a narrower boat will glide through the water more easily.)

3. First, place an empty pop bottle (with cap on) in the water. Note how easily it will roll.

4. Explain that you would like students to make a watercraft that is made up of two empty pop bottles. They are to use the bottles and other materials you have to make a watercraft that is more stable than a single bottle.

5. With students establish a question that will guide the activity, such as Will a wide boat be more stable than a narrow boat? Write the question on the board.

6. Tell students that they must first come up with a plan; then they may start construction. If the situation allows, require that students explain the plan to you before starting to build their boat. This emphasizes the importance of the planning stage. In addition, you can make suggestions to students if you detect weaknesses in their plan.

7. Have students construct their watercraft and then test it.

8. Distribute Worksheet #2B.13a (older students) or Worksheet #2B.13b (younger students). Go over the directions. Older students may need to help younger students.

Assignments:

Do Worksheet #2B.13a (older students) or Worksheet #2B.13b (younger students).
Making Watercraft Stable – Part II

Directions: Answer the questions to show what you did and what you found out.

1. What did you want to find out?

__________________________________________________________________________
__________________________________________________________________________

2. Describe how you made your watercraft. Draw a picture of it.

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

3. What did you learn about how to make a watercraft stable?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Making Watercraft Stable – Part II

1. What did you want to find out?

2. Draw a picture of your watercraft.

3. Write a sentence about your watercraft.

4. Which is more stable, a narrow boat or a wide boat?
Lesson Fourteen

Concept: Carrying a Load - Part I

Resources/Materials: Mini Textbook, pages 27 and 28
Worksheet #2B.14a (student copies)
Worksheet #2B.14b (older students)
Worksheet #2B.14c (younger students)
miscellaneous materials, such as
foil
Plasticine
Styrofoam meat trays
stir sticks
tape (various kinds)
index cards
4 stones (each 2 – 3 cm in diameter) to be used as the load
tub of water
Popsicle sticks
cotton balls
cork (stopper type and sheets)
different kinds of paper (scraps are fine)
string
plastic grocery bags

Introduction: Explain that you have a challenge for students. They must design and construct a watercraft that will hold a load.

Procedure:


2. If necessary, explain that a watercraft’s load is what is must carry.

3. The watercraft must be able to hold the load without tipping over and without the load getting wet. The watercraft must not sink while holding the load.

4. Hold up the four stones. Explain that the watercraft students build must hold all four stones.

5. Show the materials students have to work with. **Emphasize the importance of planning before beginning. Also emphasize the importance of not wasting.**

6. If a student’s original design did not work well, encourage him/her to try to figure out why and try to improve it.

7. Students are to describe and illustrate their designs on Worksheet #2B.14a. They are to tell how well their design worked.

8. Discuss the importance of using floaters, keeping water out, even weight distribution, balancing the load, etc.

9. Distribute Worksheet #2B.14b (older students) or Worksheet #2B.14c (younger students). Go over the directions.

Assignment:
Do either Worksheet #2B.14b (older) or #2B.14c (younger).
Carrying a Load

Challenge: Design and build a watercraft that can carry a load.

Materials Used: ____________________________

________________________________________

________________________________________

My Watercraft:

How My Watercraft Worked:

________________________________________

________________________________________

________________________________________
Designing Watercraft to Carry Loads

Directions: Some grade two students built some watercraft that were supposed to carry a load of four stones. The watercraft either sank or turned over, dumping the stones. Tell what each could do to make his or her watercraft better.
Carrying a Load

Directions: Colour each watercraft. Draw in its load of stones.

1. The boat is red. It has five stones.

2. The boat is blue. It has two stones.

3. The boat is yellow. It has four stones.

4. The boat is green. It has three stones.

5. The boat is orange. It has ten stones.
Lesson Fifteen

Concept: Carrying a Load – Part II

Materials/Resources: Mini Textbook, pages 29 - 31
Worksheets #2B.15a and #2B.15b (student copies)
pennies (lots) Scotch tape
glue tub of water
Miscellaneous materials, such as
cardboard glue gun
Manila tag foil
Plasticine plastic wrap
Wax crayons waxed paper

Introduction: Discuss that a large passenger van is more useful sometimes because it can carry more people than a small car. The same is true for boats and ships. Sometimes we need to make changes to a watercraft so that it can carry a bigger load. Have students try to come up with ways to increase the amount of load a boat can carry (make it bigger, use lighter weight materials, change the shape.)

Procedure:


2. Distribute Worksheet #2B.15a. Help students to make the pattern into a boat. (It is really just a box without a top.) Besides gluing down the flaps, have students use Scotch tape to seal the joints.

3. **Caution students not to waste time as the paper, glue, and tape are not waterproof.** Have students add pennies to the boat, one at a time until it sinks. Write the number down in the correct spot on Worksheet #2B.15b.

4. Then using the materials you have on hand, challenge students to make a boat that will carry a larger load. Explain that they must first come up with a plan and write it down on Worksheet #2B.15b.

5. Students should then construct their watercraft and try to see how many pennies it can carry.

6. **Note:** Be sure to emphasize that what we think will work, does not always work in the end. This is just part of being a scientist. If necessary, have students alter their designs until they are successful.

7. Have students tell about their modified boats and then tell how well they worked on the bottom of Worksheet #2B.15b.

Assignment:

Make a new boat. Write down your design and tell how well it worked on Worksheet #2B.15b.
Directions:

- Cut on the solid lines.
- Fold on the dotted lines.
Carrying More Load

1. How many pennies did your first boat carry? ______________

2. Describe the boat you plan to build. Draw a picture of it.

3. How many pennies did your new boat carry? ______________

4. Was your new boat able to carry a bigger load? __________
   Explain why.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
Lesson Sixteen (Optional)

Concept: Keeping Cargo Ships Stable

Resources/Materials: Mini Textbook, page 32
               Worksheet #2B.16a (teacher copy)
               Worksheet #2B.16b (student copies)
               1 L Milk cartons (one side cut off) or small foil loaf pans
               Manila tag or Bristol board
               tape                       tub of water
               several marbles

Introduction: Explain that cargo ships are designed to go across the ocean. When there is a storm in the ocean, waves can become violent and the ship gets tossed about. (Show students a copy of the picture, or a transparency, on Worksheet #2B.16a.) Explain that when a ship moves so much and so suddenly, the ships load can shift so that all the load is on one side. Discuss why this is dangerous.

Procedure:


2. Take one of the milk cartons or foil pans. Put a handful of marbles into the milk carton. Distribute them evenly. The tilt the milk carton suddenly to on side, so that all the marbles roll quickly to one side. If the milk carton does not roll over and upset, explain that in some circumstances it easily could.

3. Explain that on cargo ships, the storage area is not one large space, but several small ones.

4. Give students the mild cartons. Tell them to use the Bristol board or Manila tag to divide the cartons into several small “rooms”. They should tape the dividers into place.

5. Once this is done, tell students to put a couple of marbles into each of the sections; then place their boats in the tub of water and tilt it suddenly. They should explain what they did and observed on Worksheet #2B.16b.

Assignment:

1. Divide a milk carton or foil pan into rooms using Bristol board or Manila tag.
2. Do Worksheet #2B.16b.
Cargo Ships

1. What happened when the undivided cargo ship was tilted suddenly?

2. Draw a diagram of your divided cargo ship.

3. Tell what happened when you tilted your divided cargo ship suddenly.

4. Which is more stable, a divided or an undivided cargo ship. Tell why.
Lesson Seventeen (done over two or three days)

Concept: Evaluating Watercraft

Students will be making two boats, evaluating each.

Resources/Materials: Mini Textbook, pages 33 – 42
Worksheet #2B.17a (2 or 3 copies per student)
Worksheet #2B.17b (student copies)
Worksheet #2B.17c (copies on Manila tag)
lots of pennies bond paper
Bristol Board Manila tag
foil tapes (various kinds)
glue gun (low temp.) Plasticine
Styrofoam meat trays other materials
tub of water

Introduction: Ask the students what they think makes a good watercraft. Write their answers on the board or on a chart. Explain that today and for the next day or so, students will be building watercraft and then evaluating them. If necessary, tell them that evaluating means to test them out to see how well they work.

Procedure:


Day 1

2. Explain that today students will be making a paper boat. They will then evaluate it.

3. Distribute Worksheet #2B.17a. Go over the sheet with them.

4. Distribute Worksheet #2B.17b along with a sheet of bond paper. Have students make the boat as per the directions on Worksheet #2B.17b. Tell them their boat must be able to carry a load of ten pennies. Older students will have to help younger students with the directions.

5. Once students have constructed their boats, have them test them by floating them in the water and then adding the load of ten pennies. Then have students complete Worksheet #2B.17a/

Day 2 and/or Day 3

6. Give students a copy of Worksheet #2B.17c. Explain that they are to use this as a pattern. They may use any materials they want to make their boats. If you like, on Day 3 have students make a similar boat out of another material and then test it.

7. Like yesterday, they must test it out and then complete Worksheet #2B.17a.

Assignments:
Make boats (Worksheets #2B.17b and #2B.17c), test them and complete Worksheet #2B.17a.
1. For each sentence write **yes** or **no**.

<table>
<thead>
<tr>
<th>Statement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>My boat can float on its own.</td>
<td></td>
</tr>
<tr>
<td>My boat can carry its load without sinking.</td>
<td></td>
</tr>
<tr>
<td>My boat is stable in the water.</td>
<td></td>
</tr>
<tr>
<td>My boat is made from waterproof material.</td>
<td></td>
</tr>
<tr>
<td>The joints of my boat are waterproof.</td>
<td></td>
</tr>
<tr>
<td>My boat will not break easily.</td>
<td></td>
</tr>
</tbody>
</table>

2. Tell what you used to make the boat. Draw a picture.
**Paper Boat**

1. Fold 8" x 11" sheet of paper in half along its length.

2. Open and flatten the paper. Mark off a 3 cm strip on both sides of the crease.

3. Flip the sheet over and fold along each dotted line. When done, the sheet folds will produce a "W" shape.

4. Fold the two halves together with the center indented.

5. Fold each end over 2/3 of the way down from top to bottom and tape the flap in place.

6. Open the boat up and flatten out the bottom.

- From Edmonton Public Schools
Lesson Eighteen

Concept: Matching the Watercraft to the Use

Resources/Materials: Mini Textbook, pages 43 – 45
Worksheets #2B.18a, #2B.18b, and #2B.18c (student copies)

Introduction: Review with students that watercraft come in all shapes and sizes. This is because each is designed to do different things. Explain that in today’s lesson students will think about some of the different kinds of watercraft and how they are used.

Procedure:

1. Have students turn to textbook, page 43. Guide the reading of pages 43 – 45. **This lesson relies on students reading these pages.**

2. Explain that the watercraft shown on the Mini Textbook pages are just of few of the many types of watercraft.

3. Ask students a few riddles. Have them guess what kind of watercraft the riddle asks about. For example:
   - I am small.
   - You might see me in swimming pool.
   - A child might lie on me. (air mattress)

4. Distribute Worksheets #2B.18a, #2B.18b, and #2B.18c. Go over the directions. Have older students help younger students.

Assignment:

Do Worksheet #2B.18a, #2B.18b, and #2B.18c.
Matching Watercraft to Their Uses

1. Match the watercraft to their uses. Draw lines.

I make a path through the ice so that ships that get stuck in the ice can go free.

fishing boat

You try to stand on me. I use ocean waves to move.

aircraft carrier

I take people out to catch fish. You can store fish in me.

ice breaker

I am used to move people and cars across the water.

ferry

Small airplanes can land on me.

surfboard
2. Circle the watercraft that would be best.

   a. I need to carry a big load across the ocean. I have to be wide and very stable.

      motorboat             cargo ship             boogie board

   b. I need to be able to race through the water. I have to be narrow and propelled only by oars.

      canoe                 rowboat               scull

   c. I am used for fun. I have a motor and I can roar across the water.

      sailboat              riverboat             Ski-doo

   d. I am a fighting ship. I have to be big and heavy.

      frigate               trireme               scull

   e. You will usually find me on a lake. You use oars to make me go. I am pointed at one end and square at the other.

      canoe                 rowboat               speedboat

   f. I am made of Styrofoam. I am used for fun. I am small.

      sailboat              cruise ship            boogie board
3. Explain how each of these watercraft is used.

a. canoe

b. oil tanker

c. riverboat

d. air mattress

e. cruise ship

f. sailboat

g. raft
Lesson Nineteen

Concept: Using Wind to Propel Watercraft

Resources/Materials: Mini Textbook, pages 46–47
Worksheet #2B.19a (student copies)
Worksheet #2B.19b (2 copies per student)
Styrofoam meat trays
small bamboo skewers
paper (scrap is alright)
Plasticine Scotch tape
*tub of water fan or hair dryer (optional)

* Testing out the watercraft made in Lessons 19 and 20 are really best done in a bathtub. Try to arrange to go to one of the student’s or the German teacher’s home to do this.

Introduction: Explain that surfboards and boogie boards rely on the ocean waves to propel them through the water. (Write “propel” on the board.) Ask students about other ways that watercraft are propelled through the water. Write them on the board. Explain that the next two lessons have to do with making watercraft that are propelled through water.

Procedure:


2. Explain that today students will be constructing a watercraft that uses a sail to propel it through the water.

3. Distribute Worksheet #2B.19a. Go over the directions.

4. Give each student a meat tray. Explain that students are to use the meat tray to cut out hulls of two different shapes. Encourage them to make hulls that will enable their watercraft to glide through water easiest. Warn students that they do not want to make the hulls too big.

5. Then give each student a couple of skewers and some scrap paper. Explain that students are to use the paper and skewers to make a sail and a mast for each of their meat tray hulls. If skewers are long, cut them in half with side cutters.

6. Test out the sailboats. You can use a fan or hair dryer to make wind. Warn students ahead of time of the dangers of operating an electrical appliance near water. Only the teacher should operate the fan or hair dryer.

7. Distribute two copies of Worksheet #2B.19b. Have students complete them.

Assignments:

1. Make two wind-powered watercraft.
2. Do Worksheet #2B.19b for each watercraft.
Making a Wind-Powered Watercraft

Materials: meat tray, bamboo skewers, paper, tape, Plasticine

Procedure:

1. With your scissors cut out two different-shaped hulls from the meat tray. Here are some shapes you can try.

2. For each hull cut out a sail. Here are some shapes you can try.

3. Tape the sail to a bamboo skewer.

4. Poke one end of the bamboo skewer into the hull. Put Plasticine around it so that it will not wobble.

5. Try out your sailboat. Look to see how well it moves through the water.
Wind-Powered Watercraft

1. Tell how you made your wind-powered watercraft.

2. Draw a picture of your watercraft.

3. How well did it work? Be sure to tell what worked well and also what did not work well.
Lesson Twenty

Concept: Balloon-Powered Watercraft.

Resources/Materials: Mini Textbook, pages 48 and 49
Worksheet #2B.20a and #2B.20b (student copies)
1 L milk carton (cut in half lengthwise)
plastic straw (large diameter, is possible)
tape single hole punch
* tub of water (bath tub full of water is MUCH better)

Introduction: Recall from the last lesson that besides paddles and oars, wind can be used to power watercraft. Explain that motors are also used to power boats and ships. The motors actually produce a stream of air, which pushes against a set of blades called a propeller. The propeller turns. When it turns, it pushes the boat through the water.

Procedure:


2. Remind students that a stream of air created by the motor on a watercraft turns a propeller.

3. Explain that today students will construct a boat that is powered by a stream of air. This boat will not need a propeller. The stream of air will come from the air escaping from an inflated balloon.

4. Distribute Worksheet #2B.20a. Go over the directions with the students. Since these directions are quite complex, it would be better if you could go through the boat-building process step-by-step with the students.

5. Once the boats are built, test them out.

6. Distribute Worksheet #2B.20b. Go over the directions.

Assignments:

1. Build a balloon-powered boat and test it out.
2. Do Worksheet #2B.20b.
Science Grade Two Topic B: Buoyancy and Boats, Part II
Worksheets

**Balloon-Powered Watercraft**

**Materials:**
- balloon
- 1 L milk carton, cut in half lengthwise
- tape
- half a straw
- single hole punch

**Procedure:**

1. Use the hole punch to make a hole in the centre of the back end of the milk carton half.

2. Stretch the balloon and blow it up slightly. Let out the air.

3. Put one end of the straw into the neck of the balloon so that the straw sticks out 2 or 3 cm. Then tape the neck of the balloon tightly to the straw. Test it out to see if any air leaks out when you try to blow up the balloon through the straw.

4. Poke the straw through the hole in the milk carton half. Tape the neck of the balloon to the bottom of the milk carton.

5. Blow up the balloon through the straw. Hold the end of the straw so the air cannot leak out.

6. Place your boat in the water. Let the straw go. Your boat should propel through the water.
Balloon-Powered Watercraft

1. List the steps you used to make your balloon-powered watercraft.

   
   
   
   
   
   
   
   

2. Tell what worked well with your boat.

   
   
   
   
   

3. Tell what did not work well with your boat.

   
   
   
   
   
   
   
   

Worksheet #2B.20b
Lesson Twenty-one

Concept: Buoyancy and Boats, Part II Test

Resources/Materials: Buoyancy and Boats, Part II Test (student copies)

Introduction: Explain that the second half of the “Buoyancy and Boats” unit is almost complete. It is time for a test.

Procedure:

1. Distribute the tests. Have students put their names at the top of the first page.

2. If you have younger students in your group, you will probably have to go through the test with the students, question by question.
Buoyancy and Boats, Part II
Test

1. Decide which will be the most stable when put in water. Circle it.

   a.

   b.

   c.
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a</strong></td>
<td>A wide boat will be more stable than a narrow boat.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>b</strong></td>
<td>A tall boat will be more stable than short boat.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>c</strong></td>
<td>A symmetrical boat will be more stable than one that is not symmetrical.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>d</strong></td>
<td>Rob wants to put a heavy load onto his boat. If he puts it as high up as he can, the boat will be the most stable.</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>e</strong></td>
<td>Betsy wants to load several heavy boxes onto her boat. To make the boat most stable, should she spread the boxes evenly around the boat deck?</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>f</strong></td>
<td>Jordan needs to load a big heavy box onto his boat. Should he lay it on one side of the boat?</td>
<td>Yes</td>
</tr>
</tbody>
</table>
3. For each question, circle the better answer.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Mary made a little boat from foil. It can hold 10 pennies. Now she wants to make a boat that holds 20 pennies. What should she do?</td>
</tr>
<tr>
<td></td>
<td>• Make a boat the same size as the foil boat, but make it out of paper.</td>
</tr>
<tr>
<td></td>
<td>• Make a boat another boat out of foil, but make it bigger.</td>
</tr>
<tr>
<td>b</td>
<td>Timothy made a boat out of Plasticine. It could hold 10 pennies. Now he wants to make another boat of the same size that can hold more than 10 pennies. What should he do?</td>
</tr>
<tr>
<td></td>
<td>• Make the boat out of Styrofoam.</td>
</tr>
<tr>
<td></td>
<td>• Make the boat out of Plasticine, but make the walls and bottom thicker.</td>
</tr>
<tr>
<td>c</td>
<td>Ruth made a paper boat that was long and narrow. It could only hold 5 pennies before it tipped over. She wants to make another paper boat that will hold more than 5 pennies. What should she do?</td>
</tr>
<tr>
<td></td>
<td>• Make the boat wider and shorter.</td>
</tr>
<tr>
<td></td>
<td>• Make the boat narrower and longer.</td>
</tr>
<tr>
<td>d</td>
<td>Johnny made a foil boat. It kept leaking where he had made the folds. What should Johnny do so that his boat will not leak?</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>• Put white glue in the folds.</td>
</tr>
<tr>
<td></td>
<td>• Use a glue gun to seal the folds.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>e</th>
<th>Susie made a boat out of paper. She set it in the water. Soon it began to sink. What could Susie do the next time so her boat would not sink so quickly?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Coat the paper with wax before making the boat.</td>
</tr>
<tr>
<td></td>
<td>• Use a glue stick to put the boat together.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>f</th>
<th>Mr. Simcoe has a wooden rowboat. One day he noticed that the wood was starting to rot. What should Mr. Simcoe do so that his boat will not rot?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Always leave the boat in the water.</td>
</tr>
<tr>
<td></td>
<td>• Paint the boat with paint that is waterproof.</td>
</tr>
</tbody>
</table>
Jerry's teacher explained that steel is very heavy. Jerry wondered why boats made of steel do not sink. What would Jerry's teacher most likely say?

- The hulls of all steel boats are filled with Styrofoam.
- The shell of a steel boat is thin and the inside is filled with air.

4. Look at the pictures of the watercraft. Circle those that are made to do work.
5. Tell how each of the watercraft is propelled. Choose words from the box.

<table>
<thead>
<tr>
<th>oar</th>
<th>paddle</th>
<th>wind</th>
<th>propeller</th>
</tr>
</thead>
</table>

a. ________________

b. ________________

c. ________________

d. ________________

e. ________________
Topic B

Buoyancy and Boats

Mini Textbook
# Buoyancy and Boats

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Buoyancy and Boats

Introduction

Long before people used cars, trains, and airplanes, they got from place to place on boats.

The Hutterites first came to North America from Europe on ship called the Hammonia.

Back then, everyone thought it was huge.

The Hammonia is small compared to the largest ships that sail the oceans today.

The Hutterites first came to North America on a ship called the Hammonia.
Watercraft

A *watercraft* is anything that takes people from place to place on water.

A watercraft must be *buoyant*. This means that it must float.

There are many different kinds of watercraft. Some are small and some are very large. Some are used for fun and some are used to do work.

Here are some different kinds of watercraft.

- **boogie board**
- **surfboard**
- **outrigger canoe**
- **row boat**
Constructing Watercraft

Introduction

To do its job, a watercraft must float.

If you put an object into water, the water pushes up on the object. This upward force is called the **buoyant force**. The more space an object takes up, the greater is the buoyant force that pushes up on it.

For objects that float, the buoyant force is greater than the weight of the object.

For objects that sink, the weight of the object is greater than the buoyant force.
Floaters and Sinkers

Some materials float.
Some materials sink.

Remember that in order for an object to float, the buoyant force of the water must be greater than the weight of the object.

Floaters

Objects that float are called floaters.

Materials that float have many air pockets in them.
These air pockets can be big or they may be so small that you cannot see them.

The air pockets help the object to take up more space without making it much heavier.
When the object takes up more space, the buoyant force pushing up on it is greater.

This swimmer can float because his lungs and other body parts are filled with air.
Here are some objects that float. They have air pockets.

- cork
- ping pong ball
- wood
- Styrofoam
- empty pop bottle with cap
- ice
Not all floaters are alike.

Some floaters sit mostly above water. Some floaters sit mostly below water.

Some objects will float at first. Then they will sink. This is because water starts to fill in the air holes. This makes the objects heavier.

A sponge and a paper towel will float at first. After a while they will sink.

Some objects keep on floating. They never sink.
Sinkers

Sinkers are objects that do not float. They sink when placed in water.

When an object sinks, the weight of the object is greater than the buoyant force pushing up on it.

Some sinkers have air pockets, but they do not make the objects light enough to float.

Here are some objects that sink.

- penny
- washer
- rock
- nail
Making Floaters Sink

Sometimes a watercraft sinks. This happens because it takes on too much weight for the amount of space it takes up. Then the buoyant force of the water is not as great as the weight of the watercraft.

A floating object can be made to sink in many different ways.

Following are some of them.

1. The part that is filled with air is replaced by something very heavy.

The bottle floats when it is empty and the cap is on.

If you fill the bottle with water, the bottle will sink.
2. Something very heavy is put into the watercraft.

The row boat floats because the inside is taken up by air.

When you put a big load in the row boat, the row boat is too heavy and it sinks.

3. The air is taken out of the floater.

The soccer ball will float. It is filled with air.

The air has been taken out of the soccer ball. It now takes up less space. It sinks.
Making Sinkers Float

We can make a sinker into a floater. We can do this by making it take up more space without adding too much more weight. If the object is bigger without getting too much heavier, the buoyant force of the water will be greater than the weight of the object. Then the object will float.

We can make sinkers into floaters in many different ways.

Following are some of them.

1. Take out the heavy things and put air in their place.

The bottle sinks when it is filled with rocks.

The bottle floats when we take out the rocks and put air into it.
2. Change the shape of the object.

A piece of foil that is folded up will sink.

The foil will float if you unfold it and make it into the shape of a boat.

3. Attach a large floater to the sinker.

By itself a nail is a sinker.

If you tape a big cork to the nail, it will float.
Adjusting Height in the Water

You can make an object that floats high in the water float lower in the water. You can do this by adding more weight without making the object take up more space.

Here is an example:

When the pop bottle is empty, it floats high in the water.

If you put a few rocks in the pop bottle, it floats lower in the water.

If you put even more rocks in the pop bottle, it floats even lower in the water.
Adjusting Position in the Water

The heaviest part of a watercraft is always at the bottom. If the top part of a watercraft gets too heavy, the watercraft will tip sideways.

If rocks are placed at the bottom of the bottle, it will float upright.

If the rocks are placed in the side of the bottle, it will float on its side.

If the rocks are placed in the top part of the bottle, it will float upside down.
Part II: Controlling Floatation

Introduction

Making Watercraft Stable

Carrying a Load

Evaluating Watercraft:
  Waterproof Materials
  Waterproof Joints
  Stiffness
  Buoyancy of Materials

Matching the Watercraft to the Use

Propelling Watercraft:
  Wind
  Balloons
Changing Shape Affects Floatation

The shape of an object affects how well it will float. If an object is heavy and has no air in it, it most likely will sink. If you shape the object so that it takes up more space but is not much heavier, it might float.

A lump of Plasticine will not float.

You can shape the Plasticine into a tub. If the sides and bottom of the tub are too thick, it will most likely sink.

If you shape the Plasticine into a tub with very thin sides and a thin bottom, it will most likely float.

In the end, the tub must take up enough space so that the buoyant force of the water is greater than the weight of the Plasticine.
Part II

Controlling Floatation

Introduction

You learned that some materials like cork, wood, and Styrofoam float because they are many tiny air pockets in them. A boogie board is an example of watercraft is made of a material that floats. It is made mostly of Styrofoam.

You learned that some objects like a ping pong ball, a soccer ball, and an empty pop bottle float because they have one large air pocket. Some surfboards are made so that they have one or two large air pockets. These surfboards are hollow inside.
You also learned that you can shape some materials like Plasticine and foil so that air takes up most of the inside space. Boats are made this way.

Watercraft are made to do different kinds of things.

Some are designed to carry small loads and others are designed to carry big heavy loads.

Some are designed to go fast and others are designed to travel slowly.

Some watercraft are designed to travel on ponds and small lakes.
Other watercraft are designed to travel on oceans with big high waves.

The next section of Buoyancy and Boats is about how watercraft can be made to fit different kinds of uses.
Making Watercraft Stable

Boats and other watercraft have to be constructed so that they are **stable**. When a watercraft is stable, it will not tip over easily.

For hundreds of years people have been travelling on the oceans. The waves were high and ships often overturned. People knew that it was important for their watercraft to be stable.

Today’s ships are made so that they will not tip as easily as those made long ago. Still ocean travel can be dangerous during a storm.
How to Make a Watercraft Stable

There are many things that watercraft makers do to make the watercraft stable. Here are some of them.

1. **Make sure the bottom parts of the watercraft are heavier than the top parts.**

   If the top parts of the watercraft are too heavy, it will roll over easily.

The bottom part of a ship is called the **hull**. Attached to the hull is a very heavy board that goes from the front to the back of the hull. This board is called the **keel**. The keel helps to keep the ship stable.
2. **Wider watercraft are more stable than narrow watercraft.**

Narrow boats can go through water much more easily than wide ones. But narrow boats tip more easily than wide ones.

Kayaks are used by people who live in the North. It takes a lot of skill to paddle them because they are narrow and tip easily.

This is an outrigger canoe. It is designed to make the canoe wider. This makes it more stable.

A catamaran is a ship with two hulls. This makes it very stable in the water.
Canoes were used by Canada’s First Nations people to travel on lake and rivers. They were pointed to make them go through the waters easily. The people who paddled canoes needed to be skilled because they could tip easily.

This modern day cargo ship is very wide so that it will be more stable.

A rowboat is also wide. This makes it more stable.
3. Watercraft that are symmetrical from front to back are more stable.

When a watercraft is symmetrical, one side matches the other side. If you draw a line down the centre of a boat, you will see that the left side and the right side match each other.

This diagram of a boat shows that it is symmetrical.

Look carefully at these watercraft. They are all symmetrical. This helps them to be stable in water.
Carrying a Load: Placement of the Load

A watercraft must be built to float itself. It must also be able to carry people and other things. The people and things that a watercraft carries are called its load.

A watercraft must be stable. This means that it will not tip easily. If a watercraft is not stable, it may tip over and sink.

Placing the load in the right spot can help to keep a watercraft stable.

Following are some ideas about where to place a load so that the watercraft will keep stable.

1. **Place the load in the bottom of the watercraft.**

   This will keep the bottom part of the watercraft the heaviest. If the watercraft is heaviest at the bottom, it will more likely stay upright.
2. Place the load in the middle of the watercraft.

Placing the load all on one side or the other will mean that one side of the watercraft is heavier than the other. This may cause it to tip over.

3. Spread the load out evenly.

Putting all of the load in one spot will make that part of the watercraft heaviest. This will make it unstable.
Changing a Watercraft So It Can Carry More

When a watercraft takes on too heavy a load, the weight of the watercraft and load can become greater than the buoyant force pushing up on the watercraft. The watercraft will sink.

What can be done so that a watercraft can carry a bigger load?

1. **Make the watercraft bigger.**

   Making the watercraft bigger means that more load can be put on the deck and in the hull.

   A small cruise ship might be 100 metres long, 15 metres wide, and 20 metre high. It can carry 300 people.

   A large cruise ship might be 360 metres long, 50 metres wide, and 70 metres high. It can carry 9000 people.
2. Use lighter weight materials to make the watercraft.

Using lighter weight materials to make the watercraft itself makes the total weight of the watercraft less. Using lighter weight materials does not change the amount of buoyant force. This means that a watercraft made of light materials can carry more load than a watercraft of the same size make of heavy materials.

A surfboard is made of a light weight material called Fibreglass. It can carry a larger person.

Some row boats are made of aluminum. Aluminum is light weight.
3. **Change the shape of the watercraft.**

A watercraft can be shaped so that it can carry a lot. Ships designed to carry big loads are usually wide. They also cannot go through the water quickly.

![Image of a scull](image1.jpg)

This type of boat is called a scull. It is long and narrow. It can only carry a light load, but it can travel quickly through the water.

![Image of a barge](image2.jpg)

A barge is designed to carry big loads. It is big and wide. A barge has no engine of its own. It must be pulled by a tugboat.
Keeping Cargo Ships Stable

Many of the things that are grown in Canada are shipped to other countries on cargo ships. Beef, pork, wheat, canola, and barley make their way from Canadian farms to places all over the world.

If the load on a cargo ship rolls to one side of the ship, the ship will not be stable. It may tip. A cargo ship is designed so that its load cannot do this. The load is put into the hull. The hull is divided into rooms. This way, even if the ocean waves are big, the loads will stay in their rooms.

Most cargo ships store their loads in the hull. The hull is the bottom part of the ship.

The hull of a cargo ship is divided up into several rooms.
Evaluating Watercraft

Introduction

Whenever we make something or buy something, we want to know how well it works. This is called **evaluating**.

When we make a watercraft, we want to know if it will do what we want it to and how well it will do it.

In order to evaluate a watercraft, we have to decide what it is that makes a watercraft good. There are many questions people ask themselves when they are evaluating a watercraft.

1. Is it stable?
2. Can it carry a load?
3. Are the materials waterproof?
4. Are the joints waterproof?
5. Will it break easily?
6. Are the materials buoyant?

You have already learned about why it is important for a watercraft to be stable. You have also learned about why being able to carry a load is important.
You will now learn about the other things.

A. Are the Materials Waterproof?

It is important that the materials used to make watercraft are waterproof. This means that the materials will not absorb water easily.

If a watercraft was not waterproof, it would absorb water. Water would fill all the air pockets. This will make the watercraft heavier. When this happens, the weight of the watercraft will be greater than the buoyant force pushing up on the watercraft. The watercraft will sink.

Some materials do not absorb water well, such as plastic, glass, and metal.

Many objects made from plastic, glass, and metal are waterproof.
There are other materials that are waterproof too. Some of them are

- rubber
- fibreglass
- wax

You can make some objects waterproof by coating them with waterproof materials.

Following are some examples:

- Wooden boats ships are coated with special paints so that the wood will not absorb water. This also helps to keep the wood from rotting.
• Metal boats and ships are also coated with special paints. This helps keep these watercraft from rusting. Rust can eat a hole through a boat or ship. Then it will take on water. It will no longer be waterproof.

A metal ship that is not painted often will get rusty. It can then start to take on water.

• Some watercraft such as surfboards and boats are coated with fibreglass. A clear plastic is then painted over the Fibreglass. When it dries, the plastic gets very hard.

This boat has a fibreglass and plastic coating to keep it waterproof.
Are all waterproof materials good for making watercraft?

The answer is “no”.

Some materials like wax are waterproof, but they are too soft. A watercraft made from wax would not last very long.

Some materials break too easily. Can you imagine a boat made just from glass?

Rubber is a waterproof material. It can tear easily so it would not be the right material for making a watercraft.
B. Are the joints waterproof?

A joint connects two different parts. Some watercraft have only one or two joints, but others may have thousands.

It is possible to build a simple boat just by folding a piece of paper. This kind of boat does not use any glue or tape, so the joints will not be waterproof.

This boat was made by folding a sheet of paper. Its joints are not waterproof.

Glues and tapes are often used to join parts of an object together. They are hardly ever used to join parts of a watercraft, however.
Most glues and tapes are not waterproof. They will let water seep into a watercraft. Then the watercraft will become so full of water that it will sink.

White carpenter’s glue, white school glue, glue stick glue, and tapes cannot be used to join parts of a watercraft. They are not waterproof.

Yellow carpenter’s glue and hot glue gun glue are waterproof.
Silicone, tree resin, and tar are waterproof. They can be used to fill the joints of watercraft.

Silicone comes in a tube.

You can often see resin on the trunks of spruce and pine trees.

Tar is black and gooey.
C. Will it break easily?

Watercraft are only useful if they do not break when they are used.

They must be made of materials that will not break easily. That is why they are hardly ever made from materials like glass, cardboard, or cloth.

Watercraft must be stiff. When they are stiff, they will not lose their shape.

Watercraft that travel on oceans must be stiffer than those that travel on small lakes.

Travelling on some rivers means a boat could break easily if it is not stiff enough.

Ocean waves can break a ship that is not made strong enough.
D. Is the watercraft made from buoyant materials?

Materials such as wood, Styrofoam, and cork are filled with many air pockets. These materials are buoyant.

Watercraft made from buoyant materials do not sink easily.

Some rafts are made from lumber or logs that are tied or nailed together.

Most large watercraft are made from steel. Steel is not a buoyant material, but it is strong. Steel can be shaped so that it forms a shell with the inside filled with air.

Ships are usually made of steel that has been shaped into a shell filled with air. The air is what helps the steel ship float.
Matching the Watercraft to the Use

Watercraft come in all sizes and shapes. This is because there are many different uses for watercraft. It is important that the size and shape of a watercraft is right for how it will be used.

Some watercraft are used for fun.

boogie board  surfboard  scull

air mattress  sea-doo  sailboat
Some watercraft are made to do work. The size and design of the ship depend on the type of work the ship will do.

A fishing boat has to have a place to keep the fish that are caught.

A passenger ship is like a big hotel. It must have lots of rooms for people to sleep. It must also have lots of place to eat and lots of places to have fun.

An oil tanker must have big tanks to hold the oil it is moving.
Riverboats carry passengers or cargo. They must be smaller than cruise ships.

A frigate is big and heavy. It is designed to do battle at sea.

An ice breaker breaks up ice that forms on rivers, lakes, and oceans.

An aircraft carrier has a big wide deck so that jets can land on it.
Propelling Watercraft

Watercraft can be **propelled** through the water. This means that they are pushed through the water.

This can happen in several different ways.

1. **Paddles or Oars**

   People have used paddles and oars to propel boats and ships through water for many years.

   **Paddles are used to propel canoes through water.**

   **Oars are used to propel rowboats through water.**

   Over two thousand years oars were used to propel big ships. It took hundreds of men to move these ships.
2. Using Wind

Many watercraft use sails to catch the wind. The force of the wind on the sails propels a ship or boat along.

A sailboard is used for fun.

Sailboats are small. They are used mainly on lakes.

Tall ships used many big sails to propel ships across the ocean.
3. Using Motors

Most boats and ships use motors. The motors turn propellers. When the propellers turn, the boat or ships are pushed through the water.

Propellers help to push a boat or ship through the water.

The larger the ship, the bigger the propellers must be. Some ships have more than one propeller.

A motorboat can go through the water quickly. It is used for fun.

A coast guard ship helps to keep Canada's shores safe. It has big motors so that it can travel quickly.
Cargo ships have large motors. They do not travel fast.

A tugboat is small, but its motor is large. It has to be able to pull a large barge full of cargo.

A speedboat is designed for racing. It has a big motor.
During magnetic resonance imaging (MRI), a narrow tube moves the patient through a tunnel-like structure. Inside the structure, radio waves pass through a magnetic field around the patient, creating a 3-D image of the internal structures.
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Magnets Have Different Strengths

Lesson Eleven
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The Strength of a Magnet Can Change

Lesson Thirteen
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Lesson Fourteen
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Lesson Fifteen
Device That Uses a Magnet: Fridge Magnets

Lesson Sixteen
Device That Uses a Magnet: Fishing Pond

Lesson Seventeen
Device That Uses a Magnet: Dumpster Diving

Lesson Eighteen
Device That Uses a Magnet: Driving Lessons

Lesson Nineteen
Device That Uses a Magnet: Rafting

Lesson Twenty
Magnetism, Part II Test

\[ \text{Diagram of magnetic interactions} \]
Lesson One

Concept: Introduction

Resources/Materials: Mini Textbook, pages 4 – 6
Worksheet #2C.1a (optional, student copies)
Worksheets #2C.1b and #2C.1c (optional, student copies)
variety of magnets and magnetic devices, such as fridge magnet,
magnetic letters, etc.

Introduction: Tell students that you are going to ask them a series of riddles. The first letter of each of the answers will spell the name of the subject of the next science unit. (Make up riddles to suit your particular class.) Write the initial letters on the board as the riddle answers are given.

Example: M
A
G
N
E
T
I am the opposite of your father. (mother)
It is what we breathe. (air)
I am the opposite of a boy. (girl)
I am a person who helps take care of you in a hospital. (nurse)
I am the largest animal that lives on land. I have a long nose. (elephant)
You find me outdoors. I have leaves. Some birds live in me. (tree)

Once the word “magnet” has been determined, ask students what they already know about magnets. Explain that today students will have the chance to work with some magnets.

Procedure:

1. Distribute the Mini Textbooks and allow them to flip through the pages for a moment or two. Then guide the reading of pages 4 – 6. (NOTE: The use of the Mini Textbook is optional throughout the unit.)

2. Show students the various types of magnets you have and name them. Write the names on the board.

3. Emphasize that magnets are not toys. They must be treated with care. (no banging, dropping, hitting, etc.) Allow students 10 or 15 minutes to explore how magnets work. Have them try “sticking” them to various objects in the room.

4. As a group, discuss observations students made about magnets. Write them on the board. As a class, read the observations two or three times.

5. Distribute Worksheet #2C.1a. Go over the directions.

6. OPTIONAL. Distribute Worksheets #2C.1b and #2C.1c. Go over the directions. These worksheets can be done as a group. As the class comes up with responses, write them on the board for students to copy into their notebooks. NOTE: Worksheet #2C.1c is about how to take care of magnets. If you are not using the Mini Textbook, go over the rules for taking care of magnets with the students before they do this worksheet.

Assignments:

1. Do Worksheet #2C.1a.
2. OPTIONAL. Do Worksheets #2C.1b and #2C.1c.
Directions: Draw pictures of four different types of magnets. Write the names of the magnets below the pictures.
What I Know About Magnets

Directions: Fill in the boxes to tell what you know about magnets.

Appearance (what they look like)

Things Magnets Stick To

Things Magnets Do Not Stick To

Worksheet #2C.1b
Directions: Think of four rules for taking care of magnets. Draw a picture for each rule. Write a sentence for each picture.
Lesson Two

Concept: What Are Magnets?

Resources/Materials: Mini Textbook, pages 7 and 8
various types of magnets
large nail
Worksheet #2C.1a (older students)
Worksheet #2C.1b (younger students)

Introduction: Review with students what they discovered about magnets in the last class. Then write on
the board: What is a magnet? Have students try to answer the question. On the board write words and
phrases that paraphrase their responses.

Procedure:

1. Explain that some magnets are made of a substance found in nature called magnetite. Magnetite
is sometimes called lodestone. Today most magnets are made by people. They are called ceramic
magnets. Still others are made by running electricity around a piece of iron. Some magnets are
made by stroking objects made of iron with an actual magnet. After a while, they lose their
magnetism, so they are called temporary magnets. Conclude that magnets are made in
different ways, but what they have in common is that they have the ability to pull certain
kinds of objects toward them.


3. On the board write the three terms: permanent magnet, temporary magnet, electromagnet. Go
over what each means.

4. Hold up the nail. Explain that the nail is made from a metal called iron. Explain that iron is often
combined with other things to make other metals, such as steel.

5. With one of the magnets, show how the magnet attracts the iron nail. If you have a steel cabinet in
the room or if the students’ desk legs or frame are made from steel, show how the magnet sticks to
it/them.

6. Distribute Worksheet #2C.2a (older students) or #2C.2b (younger students). Go over the
directions.

Assignment:

Do Worksheet #2C.2a (older) or #2C.2b (younger).
What Are Magnets

1. For each sentence write true or false.
   a. __________ A magnet sticks to all things.
   b. __________ Some magnets are found in nature.
   c. __________ Some magnets are made using electricity.
   d. __________ All magnets are shaped like a bar.
   e. __________ Some magnets are made by people.
   f. __________ Some magnets are made of lodestone.
   g. __________ Things made of iron will stick to a magnet.
   h. __________ Some magnets are temporary.

2. The following words all have to do with magnets. The vowels have been taken out. Fill in the vowels to make the words.

   m__g n__t
   __r__n
   __ l__c t r__m__g n__t
   b__r
   b__t t__n

   l__o d__s t__n__
   p__r m__n__n t
   t__m p__r__r__
   h__r s__s h__

   b l__ c k
### Magnet Words

**Directions:** Look at the pictures. Fill in the missing letter or letters for each word.

<table>
<thead>
<tr>
<th>magnet</th>
<th>bar magnet</th>
<th>pick up</th>
</tr>
</thead>
<tbody>
<tr>
<td>horseshoe magnet</td>
<td>iron</td>
<td>nail</td>
</tr>
<tr>
<td>U-magnet</td>
<td>stick</td>
<td>pull</td>
</tr>
</tbody>
</table>

- **ail**
- **magnet**
- **pull**

- **aragnez**
- **irn**
- **U-magnet**

- **hiseoe**
- **magnet**
- **pick**

- **pick up**
Lesson Three

Concept: Where Magnets Are Found

Resources/Materials: Mini Textbook, pages 9 – 12
- devices using magnets
- Worksheets #2C.3a and #2C.3b (teacher copy)
- Worksheets #2C.3c and #2C.3d (teacher copy, cut up; fold the pieces)
- Worksheet #2C.3e (optional, student copies)

Introduction: Review that magnets attract certain types of objects. For the most part these objects contain steel. Explain that there are other materials that are attracted to magnets besides steel, but those made of iron are the most common. Explain that today’s lesson is about the things we use in everyday life that use magnets.

Procedure:

1. Ask students if they can think of anything that uses a magnet. (Write their responses on the board.)


3. On the board or on sheets of chart paper, write these headings:

<table>
<thead>
<tr>
<th>At School</th>
<th>At Home</th>
<th>On the Colony</th>
<th>Other</th>
</tr>
</thead>
</table>

4. Place the cut-up and folded pieces of Worksheets #2C.3c and #2C.3d in a container. Explain that on the pieces of paper are words and phrases that name objects that use magnets. Have students take turns drawing a paper. Have the class try to explain how the device uses a magnet. Clarify, add to, or correct information as appropriate. (Use the information on Worksheets #2C.2a and #2C3b.) Then have students tell you where you would most likely find the object. Write it under the correct heading.

5. In their notebooks or on Worksheet #2C.3e, have students write the names of devices/objects using magnets under the correct headings. If you like, adjust the number of devices for each heading, depending on the grades of particular students.

Assignment:

Do Worksheet #2C.3e or do the exercise in notebooks.
Uses of Magnets

1. **Paper Clip Holder.** The top is magnetic. This keeps the paper clips in one spot, preventing them from spilling out onto the counter or table.

2. **Magnetic Letters.** They are typically plastic with a small magnet attached to the back. They are used on a white board to help younger students with reading/spelling.

3. **Compass.** The compass needle is actually a small bar magnet. One end of the compass needle points to the magnetic north.

4. **Telephone.** The ringer uses an electromagnet. A telephone’s ring is actually a series of short rings, as opposed to one continuous ring. The short rings are a result of the electromagnet turning off and on.

5. **Cabinet Doors.** Some cabinet doors, especially in furniture, stay closed using magnets. Touch-latch doors also use magnets.

6. **Refrigerator Doors.** These stay closed using a magnetic strip that runs around the door opening.

7. **Fridge Magnets.** Fridge magnets are used to hold up art work, notes, and pictures to a refrigerator door.

8. **Oil Pan Drain Plug.** Oil pan drain plugs typically are screwed on. But they can come loose due to the motor vehicle’s movements. They are magnetic to hold them in place.

9. **Screwdriver Head.** Some screwdrivers have heads made of magnets. A person can stick the head of the screw onto the screwdriver head. This way the screw will not drop while the person is trying to get the screw started.

10. **Knife and Tool Organizers.** These are typically magnet bars that are screwed to the wall. Then tools or knives can be placed on the bar. This keeps the tools/knives visible.

11. **Office Supplies Organizer.** A magnetic steel plate is screwed to the wall. Supplies are put into tiny metal containers. These containers usually have see-through lids. The containers are stored on magnetic steel plate.

12. **Electric Can Opener.** These are usually designed so that once the lid has been cut from the can, it sticks to a magnet, preventing it from falling back into the can.

13. **Clothes Dryer.** The drum turns because of the action of an electromagnet in the motor that turns the drum.

14. **Electric Drill.** The drill turns because of the action of an electromagnet in the motor.
Uses of Magnets (continued)

15. **Electricity Generators.** They use an electromagnet.

16. **Grain Cleaners.** When grains are cleaned, metals from the machinery can drop into the grain. Magnets are run through the loads of grains. The magnets attract any bits of metal.

17. **Microwave Oven.** During a heating cycle, the power switches on and off. This along with the turntable turning are the result of a magnet.

18. **Vending Machines.** Magnets are used to separate coins from slugs (made from aluminum or wood) that are put into the machine.

19. **Scrap Metal Sorters.** Electromagnets are used to separate metal from non-metal materials.

20. **Computers.** Computers use magnets to form images on the monitor. They also use magnets to store, organize, send, and receive information.

21. **Gift Cards.** Gift cards, along with credit, debit, and loyalty program cards have a magnetic strip on the back. This strip stores information, such as the dollar amount, person’s name, address, and so on.

22. **High Speed Trains.** One of the reasons that these trains can travel so quickly is that magnetism actually makes the train cars float above the tracks.

23. **MRI.** Magnetic Resonance Image. This machine uses magnets to take a picture of the inside of a person’s body.

24. **Computer Disk.** Information is stored and taken from computer disks using a magnet.
Uses of Magnets – Page 1

1. paper clip holder
2. magnetic letters
3. compass
4. telephone
5. cabinet doors
6. refrigerator doors
7. fridge magnets
8. oil pan drain plug
9. screwdriver head
10. knife and tool organizer
11. office supplies organizer
12. electric can opener
<table>
<thead>
<tr>
<th></th>
<th>Uses of Magnets – Page 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>clothes dryer</td>
</tr>
<tr>
<td>14.</td>
<td>electric drill</td>
</tr>
<tr>
<td>15.</td>
<td>electric generator</td>
</tr>
<tr>
<td>16.</td>
<td>grain cleaner</td>
</tr>
<tr>
<td>17.</td>
<td>microwave oven</td>
</tr>
<tr>
<td>18.</td>
<td>vending machine</td>
</tr>
<tr>
<td>19.</td>
<td>scrap metal sorters</td>
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<tr>
<td>20.</td>
<td>computers</td>
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<tr>
<td>21.</td>
<td>gift cards</td>
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<td>22.</td>
<td>high speed train</td>
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<tr>
<td>23.</td>
<td>MRI</td>
</tr>
<tr>
<td>24.</td>
<td>computer disk</td>
</tr>
</tbody>
</table>
Uses of Magnets

Directions: Think about where magnets are used. Write the uses in the correct boxes.

At School

At Home

Around the Colony

Other Places
Lesson Four

Concept: Purposes of Magnets

Resources/Materials: Mini Textbook, page 9 – 12
Worksheet #2C.3c and #2C.3b (student copies)
Worksheet #2C.4 (student copies)

Introduction: Briefly review the many devices that use magnets. Review that in the last class, students organized these devices according to where these devices were found. Explain that in today’s class students will organize the devices in a different way.

Procedure:

1. Distribute copies of Worksheets #2C.3c and #2C.3d. Have students look over the names of the devices. (Students can also add other devices that use magnets.)

2. Then discuss with students, how magnets are used. (The idea is to get the students to come up with categories according to the functions of magnets.) The categories you and the class decide upon are entirely up to you. Some examples might be:

   Alternative 1: To Run Motors; To Sort Things; To Lift Small Objects
   Alternative 2: To Make Things Move; To Attract Things; To Store Information
   Alternative 3: Used with Electricity; Used without Electricity

3. If you like, have students cut the boxes on Worksheets #2C.3c and #2C.3d apart. Then sort them into piles.

4. Distribute Worksheet #2C.4. Have students write the names of the headings at the top of each box; then list the names of the devices. (Note: If you have more than three categories, have students write the other category(s) on the back of the page. If you have two categories, they should leave one of the boxes blank.)

Assignment:

Do Worksheet #2C.4.
**Purposes of Magnets**

**Directions:** At the top of the boxes write headings that tell how magnets are used. Then list devices that use magnets in each way.

<p>| | | |</p>
<table>
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</tbody>
</table>
Lesson Five

NOTE: You must fill in the names of the objects you will have your students test on Worksheet #2C.5 before photocopying it for students. ALTERNATELY. You can write the list of objects the students will be testing on the board. Students can copy them in the correct places on the worksheet.

If you have a larger number of students, make a set of objects to be tested for each student (or pair) and put the sets into Ziploc bags. This helps keep things organized for students and you.

Concept: Magnets Attract Only Some Materials: Predicting

Resources/Materials: Mini Textbook, pages 13 - 16
*Worksheet #2C.5 (student copies; see note above)
magnet
various magnetic and non-magnetic objects (See ideas in box below.)

old key, bread tag, pencil, string, paper clip, staple, pin, plastic ruler, pipe cleaner, Styrofoam packing chip, eraser, penny, screw, nut, bolt, cloth, paper, nail, crayon, chalk, foil, penny, nickel, brass fastener, dime, thumb tack, cork, Popsicle stick

Introduction: Review that magnets are used in many different settings and that magnets can be used to perform many different types of functions. Explain that all of the devices they have learned about work because of the fact that some materials are attracted by magnets and others are not. (Imagine what it would be like if everything was magnetic!)

Procedure:

1. Hold up the magnet. Have students tell you which items in the classroom will be attracted to the magnet. (Test to see if their predictions are true.) Do the same for things that will not be attracted to a magnet.

2. Discuss how students know if something will be attracted to a magnet or not.

3. If you like, have students turn to Mini Textbook, pages 13 – 16 and guide the reading. (Alternately, you can wait until the next class before you do this.) Note: There is little nickel in the nickel coin. The metal nickel is magnetic, but ordinary magnets will not pick up the nickel coin.

4. Distribute Worksheet #2C.5. Explain that today students will predict if an object is magnetic. The next science class they will test to see if their predictions are correct.

5. Distribute a set of materials to be tested. Have students write their predictions on Worksheet #2C.5.

Assignment:
Predict whether an object is magnetic or not on Worksheet #2C.5.
**Magnetic or Not?**

**Directions:** For each object predict if a magnet will attract it. Then test each object.

<table>
<thead>
<tr>
<th>Object</th>
<th>Prediction</th>
<th>Magnetic?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Will a magnet attract it? (yes or no)</td>
<td>Did a magnet attract it? (yes or no)</td>
</tr>
</tbody>
</table>

Worksheet #2C.5
Lesson Six

Concept: Magnets Attract Only Some Materials: Testing

Resources/Materials: Mini Textbook, pages 13 – 16
Worksheet #2C.5 (students have this)
various magnetic and non-magnetic objects (from last class)
magnets

Introduction: Recall with students that during the last class they predicted whether objects were magnetic or not. Explain that today, they will be testing those objects out.

Procedure:

1. If you are using the Mini Textbook and did not read pages 13 – 16 during the last class, you may want to do the reading.

2. Discuss with students that most objects that are magnetic have iron in them. Some objects might be pure iron, but most are probably just have iron in them. For example, most staples are made from steel, which is made from iron.

3. Have students take out Worksheet #2C.5. Then give each student or pair the set of materials to be tested and a magnet.

4. If you have the time, make up some notes about magnetism with students. Students can copy them into their notebooks. This can also be done on a different day. Ideas for notes might be:
   - Types of magnets
   - Uses of magnets
   - Magnetic objects

Assignment:

Test various objects for magnetism. Record answers on Worksheet #2C.5.
Lesson Seven

Concept: Creating a Pictograph

Resources/Materials: Worksheet #2C.7a (student copies + transparency or copied onto chart or board)
15 objects – mixture of magnetic and non-magnetic, divided into three equal sets of 5 objects (magnetic and non-magnetic in each set).

Introduction: Review that some objects are magnetic, while others are not. Review also that we can test to see if an object is magnetic by seeing if it is attracted by a magnet.

Explain that today we are going to test some objects to see if a magnet attracts them. Then we are going to graph the results.

Procedure:

1. Explain that we are going to use a pictograph to show the number of magnetic objects there are in a whole set of objects. A pictograph uses little pictures. One picture represents one object.

2. Distribute copies of Worksheet #2C.7a and put up the transparency or chart.

3. Go over the parts of a pictograph.

   - Title (what the graph is trying to show)
   - Headings (what each row of pictures represents)
   - Pictures (drawings)
   - Legend (tells what one picture represents)

4. Tell students that you have three sets of objects. In each set some of the objects are magnetic and some are not. Tell students that we want to show the number of magnetic objects there are in each set. Then as a group decide on:
   - Title (example: Number of Magnetic Objects)
   - Headings (example: Set A, Set B, Set C)
   - Pictures (It is best to have students draw pictures of the type of magnet you are using to determine whether an object is magnetic or not; that is, bar, horseshoe, etc.)
   - Legend (example: 1 (picture of magnet) represents one magnetic object)

5. With students complete the pictograph on Worksheet #2C.7a.

6. Distribute Worksheet #2C.7b. With students, go over the information at the top of the page. Then tell them to make a pictograph to represent the information and answer the questions.

Assignment:

Do Worksheet #2C.7b.
Creating a Pictograph

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each represents 1 magnetic object.
**Pictograph**

**Directions:** Read the following information. Then make a pictograph showing the information.

Mrs. Hill gave the students 3 boxes of objects and a **bar magnet**. She told the students to use the magnet to figure out how many objects in each box were magnetic. The students tested the objects in the three boxes. They made a table to show what they found.

<table>
<thead>
<tr>
<th>Box</th>
<th>Symbols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box 1</td>
<td>++++ 1</td>
</tr>
<tr>
<td>Box 2</td>
<td>1</td>
</tr>
<tr>
<td>Box 3</td>
<td>+++- 111</td>
</tr>
</tbody>
</table>

Each symbol represents 1 magnetic object.
Lesson Eight (Optional)

Concept: Testing for Magnetism

Resources/Materials: Worksheet #2C.8a (2 or 3 copies per student on Manila tag)
Worksheet #2C.8b (student copies)
multiples of various tiny objects (some magnetic; others nonmagnetic)
magnets (be sure they are not too weak)

Introduction: Review that some objects are magnetic and others are not, and that information can be represented using a pictograph.

Explain that today students will be making little cubes and hiding objects in them. The class will test to decide if the objects inside are magnetic or not.

Procedure:

1. Give each student 2 or 3 copies of Worksheet #2C.8a. (If you have only a few students (less than 5), you should probably give each student 3 copies. If you have 5 more, give each student 2 copies each.

2. Show students how to make the net into a cube. Emphasize good cutting, sharp folding, and good pasting.

3. Have students make their cubes, leaving one side open. Make the little objects available. Direct students to secretly hide inside each cube, one of the small objects before pasting or taping it shut.

4. Have students make sure they put their names on each cube.

5. As a class or individually, place a magnet near or on the cube.

6. Discuss that if the object inside is magnetic, the cube will stick to the magnet.

7. On Worksheet #2C.8b have students write the names of the students in the class on the tally chart. They should then make a tally, keeping track of the number of magnetic object found. Note: If you have more than seven students in your group, you will have to modify worksheet #2C.8b to accommodate the correct number of students.

8. Finally, have students use the information from the tally chart into a pictograph.

Assignment:

On Worksheet #2C.8b make a tally chart showing the number of magnetic objects in the cubes. Then make a pictograph.
**Mystery Cubes**

**Directions:** Write the names of the people in your class in the tally chart. Test the cubes for magnetic objects. Make a tally. Use the information from the tally chart to make a pictograph.

<table>
<thead>
<tr>
<th>Students</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Each represents 1 magnetic object.
Patterns for Making Cubes
**Lesson Nine**

**Concept:** Magnetism, Part I Test

**Resources/Materials:** Magnetism, Part I Test (student copies)

**Introduction:** Explain that the unit on Magnetism is now almost half finished. It is time for a test.

**Procedure:**

1. If you like, briefly review the concepts covered so far.

2. Distribute the tests. Have students write their names at the top.

3. If you have younger students in the group, you most likely will have to go through the test with students, question by question.
1. Match the words with the pictures. Draw lines.

- block magnet
- bar magnet
- U-magnet
- horseshoe magnet
- ring magnet
2. Circle **yes** or **no** for each sentence.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>A magnet will get weaker if you drop it.</td>
<td>yes</td>
</tr>
<tr>
<td>b</td>
<td>A magnet will get stronger if you heat it.</td>
<td>yes</td>
</tr>
<tr>
<td>c</td>
<td>It is good for a magnet if you put it in water.</td>
<td>yes</td>
</tr>
<tr>
<td>d</td>
<td>Storing a magnet with a keeper will help it to stay strong.</td>
<td>yes</td>
</tr>
<tr>
<td>e</td>
<td>It does not hurt to store different kinds of magnets together.</td>
<td>yes</td>
</tr>
</tbody>
</table>
3. Write the letters of the words beside their descriptions.

   a. This is the most common type of magnet. Many of these magnets are made from magnetite or lodestone.

   b. This type of magnet can be made by stroking a magnetic object like a nail with a magnet.

   c. This type of magnet needs electricity for it to be magnetic. It is used in motors.

4. For each object write yes if it is magnetic. Write no if it is not magnetic.

   ___ paper clip
   ___ pencil
   ___ scissors
   ___ chalk
   ___ screw
   ___ tin can
   ___ key
   ___ eraser
   ___ pin
   ___ plastic bottle
   ___ staple
   ___ thumb tack
   ___ paper
   ___ penny
5. In each box circle the names of the objects that use magnets.

### At a School
- telephone
- paper clip holder
- paper cutter
- electric fan
- ruler
- pencil

### At Home
- knife
- doorknob
- refrigerator
- microwave oven
- pot
- shirt

### Other Places
- MRI
- computer disk
- gift card
- snow
- garden hoe
- television
6. Look at the pictograph below. Then answer the questions.

<table>
<thead>
<tr>
<th>Magnetic Objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag 1</td>
</tr>
<tr>
<td>Bag 2</td>
</tr>
<tr>
<td>Bag 3</td>
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<tr>
<td>Bag 4</td>
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</tbody>
</table>

1 🌐 represents 1 magnetic object.

a. How many magnetic objects were there in Bag 2?

_________________

b. Which bag had the most magnetic objects? ___________

c. How many more magnetic objects were there in Bag 3 than in Bag 4?

_________________
Lesson Ten

Concept: Magnets Have Different Strengths

Resources/Materials:  Mini Textbook, pages 17 and 18
        Worksheets #2C.10a and #2C.10b (student copies)
        4 different magnets (if possible, different shapes)
        paper clips or straight pins  Ziploc bag, iron filings, bar magnet (optional)

Introduction: Show students one of the magnets and lay it on a desk or table. Place a paper clip about a metre away from the magnet. (Most likely, it is too far for the magnet to attract it.) Move it closer and closer until the magnet pulls it in. Explain that a magnet creates a magnetic field. When a magnetic object comes within this magnetic field, it can then attract it. Explain that a magnetic field is invisible, so a person cannot see it. We know it is there, however by how magnetic things behave when they enter a magnet’s magnetic field. If you like demonstrate the presence of a magnetic field by placing bar magnet inside a large Ziploc bag; then sprinkling iron filing on the bag.

Procedure:

1. Explain that being able to create a magnetic field is a property of magnets; that is, it is one thing that tells what magnets are like.

2. Explain that the larger the magnetic field a magnet creates, the more powerful a magnet is.


4. Explain that today we want to find out if all magnets have the same strength. Guide the students into formulating a question to guide their inquiry. (Examples: Are all magnets equally strong? Are some magnets stronger than others? Do magnets have different strengths? and so on.)

5. If you like, have students come up with a way that they could decide if all magnets are equally strong. Alternately, tell them that they (or you) are going to see how many paper clips (or pins) each of the magnets you have can pick up. The more paper clips a particular magnet can pick up, the stronger it is.

6. Distribute Worksheets #2C.10a and #2C.10b. Explain that students will record their observations on the table at the top; then make a bar graph showing the results. [Note: You will have to help the students fill in one of the headings on the table (Paper Clips or Pins, as appropriate) as well as the names of the types of magnets you are using (Horseshoe, Bar, Block, Ring, etc.) If you decide to use four magnets of the same shape, you can call them Bar Magnet 1, Bar Magnet 2, Bar Magnet 3, and Bar Magnet 4, for example]

7. One at a time, see how many paper clips (or pins) each magnet can pick up. Record the answers in the table. Then as a class (or independently, if appropriate) make a bar graph showing the results. (Note: To make the bar graph students will have to write a title for the graph, and label the horizontal and vertical axes.)

Assignment:
Do Worksheets #2C.10a and #2C.10b.
The Strength of Magnets – Page 1

Question: 

------------------------

Materials: 

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<th>Type of Magnet</th>
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Worksheet #2C.10a
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(Title)
Lesson Eleven

Concept: Magnetic Forces Can Go Through Some Materials

Resources/Materials: Mini Textbook, pages 19 and 20
Worksheet #2C.11 (student copies)
sheets of acetate sheet of paper
Other: student workbook foil pie pan margarine tub lid
paper clips magnets

Introduction: Review that magnets attract some items, but do not attract others. Review also that magnets create a magnetic field. Magnetic objects must be within this magnetic field before the magnet will attract them.

Explain that today we will examine whether or not magnet force can pass through objects.

Procedure:

1. Hold up one of the magnets (preferably one of the strongest you have). Add a paper clip to one of the poles. Keep adding paper clips, one at a time, in a chain-like fashion; that is, one paper clip dangles from the one before it. Conclude that magnetic force can pass through magnetic objects.

2. If you are using the Mini Textbook, have students turn to page 19. Guide the reading of pages 19 and 20.

3. Hold up the acetate and paper. Explain that magnets do not attract either. Prove this by holding the magnet to the acetate and the paper.

4. Ask “Do you think that a magnet’s force can pass through these materials?”

5. With the acetate, place a paper clip on the top. Then hold a magnet to the bottom directly under where the paper clip has been placed. Move the magnet along the acetate. The paper clip should move as well. Have students tell you what happened.

6. Repeat with the paper.

7. If you like, allow students to try the activity on their own. In addition, encourage them to try it with other non-magnetic materials (e.g. margarine tub lid, aluminum pie pan) and other thicknesses; for example, through one of their workbooks.

8. Conclude that a magnetic force can pass through non-magnetic materials. Conclude also that the magnetic force gets weaker with the thickness of material.

9. Distribute Worksheet #2C.11. Go over the directions. (Have students tell about one of the materials they tested.)

Assignment:
Do Worksheet #2C.11.
A Magnetic Force Can Pass Through Non-Magnetic Materials

1. Explain what you were trying to find out.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

2. List the steps that tell what you did.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. What did you observe?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4. What can you conclude?

________________________________________________________________________
Lesson Twelve

Concept: The Strength of a Magnet Can Change

Resources/Materials: *Mini Textbook, pages 21 and 22
Worksheets #2C.12a, #2C.12b, #2C.12c, and #2C.12d (copied back-to-back folded and stapled on the fold to make booklets – student copies)
*If you are not routinely using the Mini Textbook, make copies of pages 21 and 22 for your students.

Introduction: Review that magnets have different strengths. Discuss that some magnets are stronger than other when all are brand new. However, with age and use, magnets do start to lose their strength. Explain that today’s lesson is about how magnets lose their strength.

Procedure:

1. Have students turn to Mini Textbook, page 21 (or distribute Mini Textbook, pages 21 and 22). Guide the reading of pages 21 and 22. Note that point 4 on page 22 is not really a factor in loss of strength, but more of a factor in initial strength.

2. Explain that students are going to make a booklet about why magnets lose their strength.

3. Write the title “Why Magnets Lose Their Strength” on the board. Then as a class, transform each of the headings on Mini Textbook, pages 21 and 22 to statements. Write these on the board. For example:
   - They get old.
   - They are not stored properly.
   - They have not been cared for properly.
   - They are small.
   - It is very hot.
   - There is too much moisture.
   - Some materials lose magnetism faster than others. (See below.)

4. Distribute booklets made from Worksheets #2C.12a to #2C.12d. At the bottom of each page have students write a reason why magnets lose strength. Then illustrate.

Assignment:

Complete a booklet about magnets losing strength (Worksheets #2C.12a to #2C.12d).

Types of Permanent Magnets
Ceramic – (also known as Ferrite) are made of a composite of iron oxide and barium or strontium carbonate. They are a good balance of magnetic strength, resistance to demagnetizing, and economy. Most magnets are ceramic.
Alnico – made of a composite of aluminum, nickel, and cobalt. They have good temperature stability, but are easily demagnetized.
Samarium Cobalt – This is a rare earth magnet material. It is highly resistant to oxidation, can be used in high temperatures, but break easily.
Why Magnets Lose Their Strength

By: ____________________________
Lesson Thirteen

Concept: Magnets Have Poles

Resources/Materials: Mini Textbook, pages 23 – 25
Worksheet #2C.13a (student copies)
Worksheet #2C.13b (older students) or Worksheet #2C.13c (younger students)
2 bar magnets U- or horseshoe magnet
paper clips metre stick string (1 m)

Introduction: Ask “Do all parts of a magnet have equal strength?” To answer this question, try to dangle as many paper clips as possible at the north end of a bar magnet, the south end, and then in the middle. (The ends of the magnet should be able to hold the most paper clips.) Conclude that the ends of a magnet have the greatest strength and the middle has the least strength.

Procedure:

1. Explain that the places of greatest magnetic strength on a magnet are at the ends. The ends of a magnet are called its poles. One end is the north pole and the other the south pole.

2. One at a time hold up the other magnets. Point out the poles. (On many magnets, the poles are not labelled because it has no real bearing on their practical use.)


4. Tell students that you are going to show them some more interesting properties of magnets.

5. Tie one end of the string around the exact centre of a bar magnet, so that the magnet hangs parallel to the floor when suspended from the string. Tie the other end to the middle of a metre stick.

6. Place the metre stick across two tables or desks so that the magnet hangs freely.

7. As the you do the following, be sure to explain what you are doing to the students.
   • Take another magnet. Slowly approach the N pole of the hanging magnet with the S pole of the one in your hand. Observe. (The two magnets attract or pull toward each other.)
   • Slowly approach the S pole of the hanging magnet with the N pole of the one in your hand. Observe. (The two magnets attract.)
   • Slowly approach the N pole of the hanging magnet with the N pole of the one in your hand. Observe. (The two magnets repel or push away from each other.)
   • Repeat with the S pole of the hanging magnet and the S pole of the one in your hand.

8. Conclude that unlike poles attract one another; like poles repel away from each other.

9. If you have time, allow students to take two bar magnets, putting like and unlike poles together.

10. Distribute Worksheets #2C.13a and #2C.13b (older) or #2C.13c (younger). Go over the directions.

Assignment:
Do Worksheets #2C.13a and #2C.13b (older) or #2C.13c (younger).
Magnets Have Poles

1. Look at the bar magnet below. Put a check mark (√) on the two places where the magnet is strongest. Put an X where the magnet is weakest.

N


S

2. Look at the bar magnets below. Draw arrows to show if the poles will attract or repel each other.

N


S

N


S

N


S

S


N

S

S

N

S

S

N

Worksheet #2C.13a
3. Answer these questions in sentences.

a. Where are magnets the strongest?

b. Where are magnets the weakest?

c. What happens when you put two unlike poles of bar magnets together?

d. What happens when you put two like poles of bar magnets together?
3. Label **N** and **S** on the bar magnet.

4. Label **N** and **S** on the sets of magnets.

6. Below each set of magnets, write **attract** or **repel**.

   | N | S |
   --|--|--
   S | N |

   | N | S |
   --|--|--
   N | S |
Lesson Fourteen

Concept: Magnetizing Objects: Making a Temporary Magnet

Resources/Materials: Mini Textbook, pages 26 and 27
Worksheets #2C.14a and #2C.14b (student copies)
strong bar magnet  scissors
large nail  paper clips

Introduction: Recall that most nails are made of iron and thus, are attracted to magnets. Put a pile of paper clips on the table. Stick the end of the nail into the pile of paper clips. Notice that the paper clips do not stick to the nail.
Then hold the nail against one end of the magnet, so that it sticks out well past the magnet and is parallel to the magnet. Stick the end of the nail into the pile of paper clips. Notice that some paper clips now stick to the nail.
Take the nail away from the magnet; then stick the end into the paper clips. Notice that few, if any, paper clips now stick to the nail.

Procedure:

1. Explain that just by touching the magnet, the nail itself became a magnet, but when the nail from taken away from the magnet, it lost its magnetic qualities. The nail was a temporary magnet; that is, it had the qualities of a magnet for just a short while.

2. Explain that we can increase the time that an object has the qualities of a magnet by stroking it with a magnet.

3. If you are using the Mini Textbook, guide the reading of pages 26 and 27.

4. Take a pair of scissors. Stroke the scissors 10 times in one direction with a strong magnet. See how many paper clips the scissors can pick up. Conclude that stroking the scissors with the magnet made the scissors into a temporary magnet.

5. Distribute Worksheet #2C.14. Record the number of paper clips the scissors could pick up after the 10 strokes, in the appropriate space.

6. Have students predict how many paper clips the scissors could pick up if they are stroked an additional 5 times. (15 strokes in all). Then give the scissors the 5 more strokes and see how many paper clips they can pick up.

7. Repeat this process until the table on Worksheet #2C.14a is completed.

8. Conclude that an object containing iron can become a temporary magnet. Also the more times it is stroked with a magnet, the stronger its magnetic force.


Assignment:
Do Worksheet #2C.14b.
**Making Temporary Magnet**

**Directions**: Predict how many paper clips the scissors will pick up. Then tell how many paper clips it actually picked up.

<table>
<thead>
<tr>
<th>Number of strokes with the magnet</th>
<th>Prediction (number of paper clips they will pick up)</th>
<th>Actual (number of paper clips they picked up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
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<td>20</td>
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<td>25</td>
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<td>45</td>
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<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Which of the following could you make into a temporary magnet? Circle them.

<table>
<thead>
<tr>
<th>nail</th>
<th>scissors</th>
<th>pencil</th>
<th>eraser</th>
</tr>
</thead>
<tbody>
<tr>
<td>chalk</td>
<td>brass fastener</td>
<td>staple</td>
<td>knife</td>
</tr>
<tr>
<td>screw</td>
<td>plastic pail</td>
<td>bolt</td>
<td>book</td>
</tr>
</tbody>
</table>

2. Sarah’s class has been studying about magnets. The class keeps all the materials in a big box. When Sarah looked in the box, she noticed that some pins were sticking to a large nail. She knew that a nail was not a magnet. Can you tell her what might have happened?

3. Kenny told Sarah that the nail was only a temporary magnet. What does Kenny mean by that?
Making Devices That Use Magnets

Lessons Fifteen to Nineteen describe various devices that you might want to have your students make. Teachers can pick and choose the ones that suit their particular students. It is not necessary to do all of them. In addition, teachers and students are encouraged to think of their own “magnet” devices.
Lesson Fifteen

Concept: Device That Uses a Magnet: Fridge Magnets

Teacher Directions:

- Most fridge magnets are simply some kind of lightweight decoration with a small magnet attached to the back.
- Magnetic tape is good for use in making fridge magnets because you can cut it to the size you need. It is available at craft stores.
- Fridge magnets can be complex or simple.
- Patterns always make crafts, such as fridge magnets more polished, but sometimes it is nice to let each student create his/her own items.

A Few Ideas

1. **Bumblebee, Butterfly, or Tractor**
   - Photocopy bumblebee, butterfly, or tractor (pattern on Worksheet #2C.15).
   - Have students colour it in nice bright colours.
   - Cut out roughly and paste onto stiffer paper, such as cardstock, Manila tag, or Bristol board.
   - Then cut out more exactly.
   - Attach a piece of magnetic tape to the back.
   - You’re finished.

2. **Ladybug** (pattern on Worksheet #2C.15).
   - Trace pattern A on black craft foam.
   - Trace pattern B on red craft foam. Cut in half.
   - Use a single hole punch to punch out several dots from black craft foam.
   - Assemble to make the ladybug shown. (Use white glue.)
   - Let dry 30 minutes or so.
   - Attach a piece of magnetic tape to the back.

3. **Snowman**
   - Trace the pattern onto white Bristol board or craft foam.
   - Cut out a hat and nose from scrap construction paper or craft foam.
   - Use a single-hole punch to make eyes, mouth pieces, and buttons (from black construction paper or black craft foam).
   - Assemble and glue using white glue.
   - Attach a piece of magnetic tape to the back.

4. **Valentine**
   - Photocopy pattern (Worksheet #2C.15) on cardstock or white Bristol board.
   - Colour, cut out, and attach a piece of magnetic tape to the back.
   - You can make it more complex by having students cut out a basic heart and then cutting out smaller hearts to decorate it.
Lesson Sixteen

Concept: Device That Uses a Magnet: Fishing Pond

Resources/Materials: Worksheet #2C.16 (several copies on cardstock, Bristol board, or Manila tag)
bar magnet        metre stick
paper clips        1.5 m string
large box or screen

Teacher Directions:

1. Have students cut out the fish.

2. Attach a paper clip to the mouth or back of each fish. (The paper clips will stay in place better if you punch a hole in each fish’s body; then thread the paper clip through the hole.)

3. Place the fish in the box or behind the screen. (That’s the pond.)

4. Make a fishing rod by tying one end of the string to the magnet and the other end to the metre stick.

5. Students take turns fishing by lowering the magnet behind the screen or into the box.

6. Make the fishing pond more interesting by doing any of the following or any other thing you can think of:

   • Write the name of a small prize on the each fish, such as a Smartie, a Cheerio, or something more elaborate. The student gets the prize written on the fish he/she fishes.
   • Write a number on each fish. The students take turns fishing for two fish each. They have to add (or subtract or multiply) the numbers on the fish.
   • Write a physical activity on each fish. (Jump up and down 10 times.) Students must read and do the activity they fish.
   • Write sight words on the fish. Divide into teams. If student can read the word he/she fishes, his/her team gets a point.
   • Make three sets of fish, each of different coloured paper. Put the fish into three different “ponds”. The first and third ponds should be for consonants only. The second should contain vowels only. Student fishes out one fish from each pond. Then he or she tries to make a word. Depending on your students, put consonant blends (br, st, cl, etc.), consonant digraphs (sh, ch, th, ck, etc.), and vowel combinations (oo, ea, ai, etc.) on the fish.
   • Make two sets of fish on two different colours. Students take turns fishing one fish from each of two different ponds. Each turn is limited to fishing one fish from each of the ponds. They keep on taking a turn until they can form a compound word with their two fish.
   • A variation of the above is to divide names of colonies into two. Have students suggest the names of the colonies. Write the first half of the name on one fish and the second half on another. (Ever-green; Percy Lake; En-chant)
Fish Patterns
Lesson Seventeen

Concept: Device That Uses a Magnet: Dumpster Diving

Resources/Materials: Matchbox cars (or equivalent – must be made of steel)  
medium-sized box or shoebox  
bar magnet  
Styrofoam packing chips  
blindfold (optional)

Teacher Directions:

1. Place the Styrofoam chips into the box.
2. Hide the cars in the chips.
3. Challenge is for students to use the magnet to find the cars, without allowing their hands to touch the Styrofoam.
4. To add an extra challenge, have students try to find the car while blindfolded.
Lesson Eighteen

Concept: Device That Uses Magnet: Driving Lessons

Resources/Materials: Worksheets #2C.18a, #2C.18b, and #2C.18c
Magnet magnetic tape
Large piece of corrugated cardboard (or lid from photocopy paper box)
Large sheet of construction paper or roll paper (not white)
cardstock, Bristol board, or Manila tag
low temperature glue gun

Teacher Directions:

1. Make a map of your colony. First, make sure that the magnet is strong enough to go through the corrugated cardboard.

2. Cover the cardboard with construction or roll paper.

3. Use the patterns on Worksheets #2C.18a, #2C.18b, and 2C.18c. Make as many copies of the various buildings, cut the buildings out, and paste them on the paper-covered cardboard so that you end up with a map of the colony. (The amount of detail you include is up to you.)

4. Be sure you leave enough space between the buildings so that a “car” can drive between them.

5. Have students choose a car or truck to colour from Worksheet #2C.18a. Have them colour their cars and cut them out roughly. Then have them paste their cars onto stiffer paper. Cut out the cars carefully. Glue gun two paper clips to the bottom of the cars.

6. OPTIONAL. With a felt marker draw in the roads within the colony.

7. Set the cardboard between two level tables or desks. Hold it in place with stacks of books.

8. Students “drive” around the colony by controlling their cars with a magnet placed under the cardboard map. You might want to tell students where to drive:
   - Go from the carpenter’s shop to the chicken barn.
   - Go from the school to the slaughter house, going past the hog barn.

VARIATIONS:
   - Instead of a map of the colony, make a map of the countryside.
   - Make a map of the school or the classroom. Instead of a car, use a person.
barn

dugout

slaughter house, quonset, etc.
Colony Buildings – Page 2

- houses
- school
- church/dining room/kitchen
Colony Buildings – Page 3

- shed/small shop
- granary
- kindergarten
- shops
Lesson Nineteen

Concept: Device That Uses a Magnet: Rafting

Resources/Materials: Styrofoam meat trays paper clips
glass cake pan (minimum 9” X 13’’) or rigid plastic pan
low temperature glue gun
magnet

Teacher Directions:

1. Make the raft by cutting out a 5 cm X 7 cm rectangle.

2. Attach a paper clip to the bottom of the raft using a glue gun. (If it is difficult to control the raft, try a stronger magnet or even a second paper clip.)

3. Put 1 or 2 cm of water in the bottom of the cake pan.

4. Place the raft on the water. Move the raft around using magnet held under the cake pan. Teacher holds the pan during this activity.
Lesson Twenty

Concept: Magnetism, Part II Test

Resources/Materials: Magnetism, Part II Test (student copies)

Introduction: Explain that the unit on Magnetism is now at the end. It is time for a test.

Procedure:

1. Distribute the tests. Have students put their names at the top.

2. If you have younger students in the group, go through the test question by question with the students.
Magnetism, Part II
Test

1. For each question circle the best answer.

a. Mr. Parker told his students they were going to do an activity to find out if all magnets were equally strong or not. He asked the students to come up with a question that told what they were to find out.

Which of the following is the better question?

- Are all magnets equally big?
- Are all magnets equally strong?

b. Pauline and Kevin put a plastic ruler and a bar magnet next to a pile of pins.

What would Pauline and Kevin most likely observe?

- The plastic ruler attracted the pins.
- The bar magnet attracted the pins.
2. Mr. Parker’s class wanted to know which of 4 bar magnets could pick up the greatest number of paper clips. They wrote what they found in the table below.

Make a bar graph to show this information.

<table>
<thead>
<tr>
<th>Magnet</th>
<th>Number of Paper Clips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnet A</td>
<td>10</td>
</tr>
<tr>
<td>Magnet B</td>
<td>9</td>
</tr>
<tr>
<td>Magnet C</td>
<td>4</td>
</tr>
<tr>
<td>Magnet D</td>
<td>8</td>
</tr>
</tbody>
</table>

Paper Clips Picked Up by Magnets

Number of Paper Clips

Magnet

Magnet A  Magnet B  Magnet C  Magnet D
3. Which of the following affects the strength of a magnet? Circle **yes** or **no**.

<p>| | | |</p>
<table>
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</thead>
<tbody>
<tr>
<td>a</td>
<td>age of the magnet</td>
<td>yes  no</td>
</tr>
<tr>
<td>b</td>
<td>how hot or cold it is</td>
<td>yes  no</td>
</tr>
<tr>
<td>c</td>
<td>if the magnet has been dropped or not</td>
<td>yes  no</td>
</tr>
<tr>
<td>d</td>
<td>the colour of paint on the magnet</td>
<td>yes  no</td>
</tr>
<tr>
<td>e</td>
<td>if the magnet has been stored properly</td>
<td>yes  no</td>
</tr>
<tr>
<td>f</td>
<td>what the magnet is made of</td>
<td>yes  no</td>
</tr>
<tr>
<td>g</td>
<td>the size of box the magnet comes in</td>
<td>yes  no</td>
</tr>
</tbody>
</table>
4. Look at the bar magnet below.

Put an X on the two places where it is the strongest. Put a Z on the place where it is the weakest.

N   S

5. Look at each pair of bar magnets. Decide if the magnets will attract or repel each other. Circle the correct word.

N   S   S   N
attract repel

N   S   N   S
attract repel

S   N   N   S
attract repel
6. Jonathan wants to use a bar magnet to make a pair of scissors into a temporary magnet.

Read each sentence. Then circle **yes** or **no**.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>To make the scissors into a magnet, Jonathan must stroke the scissors with a bar magnet.</td>
</tr>
<tr>
<td>b</td>
<td>Jonathan should stroke the scissors back and forth with the bar magnet.</td>
</tr>
<tr>
<td>c</td>
<td>The more strokes he makes with the bar magnet, the stronger of a magnet the scissors will become.</td>
</tr>
<tr>
<td>d</td>
<td>Once Jonathan makes the scissors into a magnet, the scissors will always be a magnet.</td>
</tr>
<tr>
<td>e</td>
<td>After Jonathan makes the scissors into a magnet, the scissors will attract an eraser.</td>
</tr>
</tbody>
</table>
7. Circle the names of the materials that a magnet's force can pass through.

<table>
<thead>
<tr>
<th>glass</th>
<th>paper</th>
<th>nail</th>
</tr>
</thead>
<tbody>
<tr>
<td>staple</td>
<td>paper clip</td>
<td>pin</td>
</tr>
<tr>
<td>scissors</td>
<td>aluminum foil</td>
<td>air</td>
</tr>
</tbody>
</table>
Topic C

Magnetism

Mini Textbook
Magnetism

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What Magnets Do

Introduction

Magnets are wonderful! Magnets help us to do many different kinds of things. Believe it or not, we use magnets everyday.

There are many different kinds of magnets. Magnets have different names. Most magnets are named after their shapes.
Taking Care of Magnets

It is important to take care of magnets. There are some rules to follow:

1. Do not drop a magnet.

   If you drop a magnet, it might not work.

2. Do not hit a magnet and do not hit an object with a magnet.

   This makes the magnet weaker.
3. Do not heat a magnet.

Keep magnets cool. This will help them to last longer.


Magnets will not work well if they get wet. Magnets are painted. This helps metal to stay dry.

5. Keep one type of magnet away from other types of magnets.

Mixing up different types of magnets makes them weaker.

6. Use a “keeper” to separate magnets.

The keeper helps magnets to stay strong. The keeper also helps to pull the magnets apart.
What Are Magnets?

A magnet is an object that can pull certain other objects towards it. These objects are most often made of a metal called iron.

Most nails are made of iron. If you put a magnet close to a nail, the nail will stick to it.

Types of Magnets

There are three main types of magnets.

1. Permanent Magnets

Permanent magnets are the most common type. Most are made of a material called magnetite. They are always magnetized. This means they pull objects made from metals, like iron, toward them.
2. Temporary Magnets

Temporary magnets are objects that are magnetized for a short period of time. After a while they lose their magnetism.

Temporary magnets get their magnetism by being rubbed by a permanent magnet. You can make a nail into a temporary magnet by rubbing a permanent magnet along its length.

A nail can be made into a temporary magnet.

3. Electromagnet

An electromagnet needs electricity in order for it to be magnetic. The electricity runs through wires. When the electricity is cut off, the electromagnet no longer works.

Scrap metal yards use electromagnets to move heavy loads of scrap metal.
Where Are Magnets Found?

Believe it or not, magnets are all around us. Magnets are part of many of the things we use in our lives.

Sometimes we can see a magnet at work.

Fridge magnets
Hold photos and Decorations to the front of a refrigerator.

This magnet helps to keep tools in place.

An electromagnet can be used to lift really heavy things.
A compass helps us in direction finding. It is made of a little bar magnet that always points toward the north.

This screwdriver has a magnet on its tip. How does this help?

A magnet makes sure that these paper clips stay in one place.

These little cans are used to hold little things. Magnets hold them to the wall.
Sometimes we cannot see a magnet because it is hidden inside a machine.

Magnets make sure that the doors on a refrigerator stay closed.

In Germany magnets help a train to "float" above the tracks.

The ringer on a telephone works with the help of a magnet.

Magnets are run through loads of wheat to make sure there are no metal scraps mixed in with the wheat.
A microwave oven uses magnets to heat food.

Credit cards have a magnetic strip on the back. The strip is used to store information.

This is a picture of the inside of someone's knee. It was taken using a machine that uses a magnet.

Television and computer screens use magnets.

Information is stored on computer disks using magnets.
What Is Attracted by a Magnet?

When a magnet attracts another object, it pulls the object toward it.

A magnet does not attract all objects. A magnet only attracts some objects.

Magnets attract many metals, but they do not attract all metals. Magnets most often attract things that have iron in them.

Objects That Magnets Attract

Here are some things that magnets attract:

- paper clips
- thumb tacks
- refrigerator door
- scissors
nails

staples

nut

pins

screw

steel shelf

key

loose leaf binder ring
Here are some things that magnets do not attract:

- plastic bag
- aluminum foil
- penny
- pencil
- paper
- Scotch tape
- book
- shirt
More About Magnets

Introduction

It would be hard for people to get along without magnets. We use them in so many ways.

Magnets have properties. Properties tell what something is like and what that thing can do.

One of the properties of a magnet is that it makes something called a magnetic field. A magnetic field is invisible, which means you cannot see it. If a magnetic object is in the magnetic field of a magnet, the magnet will attract it.

This picture shows the magnetic field of a bar magnet. You cannot see a magnetic field, but it is there. If a magnetic object is in the magnetic field, the magnet will pull on the object.
How Strong Are Magnets?

Just like magnets have different shapes, magnets also have different strengths. This means that some are stronger than others.

Some magnets like a giant electromagnet can lift tonnes of metal. Electromagnets are some of the strongest magnets.

Other magnets are very weak. They are just strong enough to hold a small piece of paper onto the door of a refrigerator.
Magnetic Forces Can Pass Through Other Materials

You learned before that magnets attract magnetic materials, such as paper clips and nails.

You also learned that magnets do not attract non-magnetic materials, such as paper, air, and glass.

This brings us to think about a property of magnets. **Magnetic forces can interact with magnetic materials by making them into temporary magnets.** This means that they will be magnets for a short time and not forever.

You can pick up a string of nails with a magnet. This is because the magnet makes the first nail into a magnet. The magnetic force of the nail will not be as strong as that of the magnet itself. The first nail will then make the second nail into a magnet, and so on.

![Magnetic Chain](image)

The magnetic forces of the bar magnet makes each of the nails into magnets too.
Magnetic forces can pass through non-magnetic materials.

Glass is a non-magnetic material.

If you put a sheet of glass between a screw and a magnet, the screw will pull up against the glass where you are holding the magnet.

If you move the magnet along the glass, the screw will move too.

Magnetic forces passes from the magnet, through the glass, and to the screw. This happens even though the glass is non-magnetic.
The Changing Strength of Magnets

A magnet’s strength does not stay the same. New magnets are quite strong, but all magnets become weaker depending on how old they are, how they have been treated, and how they have been stored.

How quickly a magnet becomes weaker depends on many things.

1. How old it is.

   As a magnet gets older, it gets weaker.

2. How it has been stored.

   Magnets keep their strength if magnets that are of the same time are kept together and away from magnets of a different type. Magnets stored with keepers will be stronger than those stored without keepers.

3. How it has been cared for.

   Magnets that have been dropped or hit will become weaker. Also magnets that have been used to hit other things will become weaker.
4. **How big the magnet is.**

   In most cases, the bigger the magnet, the stronger it is. There are some small magnets that are very strong and there are some large magnets that are quite weak, however.

5. **How hot or cold it is.**

   Usually the hotter it gets, the weaker a magnet is.

6. **How much moisture there is.**

   Moisture is water. If there is a lot of moisture in the air, a magnet will rust and become weaker. That is why most magnets are painted with special paint. The paint helps keep moisture away from the magnet.

7. **What the magnet is made from.**

   Magnets are not all made from the same material. Magnets made from some materials lose their strength more quickly than magnets made from other materials.
Magnets Have Poles

Magnets have two ends. These ends are called **poles**. One end is called the **north pole**. The other end is called the **south pole**.

In bar magnets, the poles are at either end of the bar.

In horseshoe and U magnets, the north pole is at one end and the south pole is at the other.

In button and ring magnets, the north pole is on one side of the magnet and the south pole is on the other side.
Where a Magnetic Field is Strongest

Magnetic fields are strongest at the poles.

If you try to pick up nails with a bar magnet, you will see that you can pick up more nails at the poles. You will not be able get as many nails to stick to the middle of a bar magnet.

How Magnets Act with Each Other

Another property of magnets is that they attract and repel each other.

Attract means to pull towards each other. Repel means to push away from one another.
Here is how magnets attract and repel each other.

1. The north pole of one magnet will attract the south pole of another magnet.

2. The south pole of one magnet will attract the north pole of another magnet.

3. The north pole of one magnet will repel the north pole of another magnet.

4. The south pole of one magnet will repel the south pole of another magnet.

The general rule is:

*Unlike poles attract and like poles repel.*
Magnetizing Objects

You can use a magnet to make a magnetic object into a temporary magnet.

Scientists say that a magnet is made up of many many tiny parts. These parts are so tiny that you cannot see them.

In a magnet, these tiny parts are lined up so that they are all facing the same way. Each tiny part also has two poles, a north pole and south pole. All the north poles face the same way and all the south poles face the same way.

\[\text{a non-magnetized steel bar}\]

\[\text{a magnet}\]
Magnetizing

To make any magnetic object into a magnet, you must stroke the object with a magnet. You must stroke several times and only in one direction.

This stroking makes the tiny invisible parts of the object line up. The object is then a magnet. It is only a magnet for a short time.

This girl has made a nail into a magnet by stroking the nail with the magnet. Now she can pick up some of the paper clips with the nail.