The *Program of Studies* requires that students participate in many hands-on activities. In this regard, teachers will have to collect many miscellaneous items. Almost all are found around home, at school, and the local dollar store. Please refer to the “About this Unit” section of each unit for more detailed information.

There are some materials that are must-haves for some of the units:

**Rocks and Minerals**
- Commercially prepared rocks and minerals collection (available at Science education supply outlets)
- Soil samples [clay soil, sandy soil, silty soil (good garden soil should do)] - be on the lookout for it in your travels
- Eyedroppers – just buy the least expensive ones you can find (available at Science education supply outlets)

**Building with a Variety of Materials/Testing Materials and Designs**
- Cardboard – cut apart large corrugated cardboard boxes
- Plasticine – try to get waterproof Plasticine. Some of the brands available at local retail outlets are not waterproof. The Plasticine brand and the Ocaldo brand seem to be the best.
- Popsicle sticks – you need a lot. They are fairly inexpensive and are usually sold in boxes of a thousand. Craft stores sell them, but they charge a lot. You are better off ordering them through a Science education outlet or some other education supply company.

**Hearing and Sound**
- Tuning forks – these are not essential, but are nice to have (The lesson plans are written so that you do not need to have tuning forks.)

**Animal Life Cycles**
- One of the requirements of the unit is that your class observes (and raises) an animal, so that students can observe it as it goes through the stages of development. You would have to bring the animal into class at the very beginning of the unit; otherwise, you may not have enough time to see any noticeable changes. In Lesson Two of the unit, there are guidelines about raising tadpoles and mealworms (darkling beetles).
Science Grade Three

Topics A, B, C
### SKILLS

<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><em>Students will:</em></td>
<td><em>Students will:</em></td>
</tr>
<tr>
<td>3-1 Investigate the nature of things, demonstrating purposeful action that leads to observations and inferences.</td>
<td>3-3 Investigate a practical problem, and develop a possible solution.</td>
</tr>
<tr>
<td>3-2 Identify patterns and order in objects and events studies; and, with guidance, record observations, using pictures, words and charts; and make predictions and generalizations, based on observations.</td>
<td><strong>Note:</strong> The problems will involve building a rigid or semi-rigid structure, using available materials.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specific Learner Expectations</th>
<th>Specific Learner Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Students will:</em></td>
<td><em>Students will:</em></td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td><strong>Focus</strong></td>
</tr>
<tr>
<td>• ask questions that lead to exploration and investigation</td>
<td>• identify the purpose of the object to be constructed: What is to be developed? What is it for?</td>
</tr>
<tr>
<td>• identify one or more possible answers to questions by stating predictions or hypotheses</td>
<td><strong>Explore and Investigate</strong></td>
</tr>
<tr>
<td><strong>Explore and Investigate</strong></td>
<td><strong>Explore and Investigate</strong></td>
</tr>
<tr>
<td>• identify, with guidance, procedures to be followed in finding answers to given questions</td>
<td>• attempt a variety of strategies to complete tasks</td>
</tr>
<tr>
<td>• carry out procedures developed by themselves or identified by others</td>
<td>• identify steps followed in completing the task and explain the purpose of each step</td>
</tr>
<tr>
<td>• identify materials and how they are used</td>
<td>• identify materials and how they are used</td>
</tr>
<tr>
<td>• work independently or with others to carry out the identified procedures</td>
<td>• engage in all parts of the task and support the efforts of others</td>
</tr>
<tr>
<td>• identify, with guidance, sources of information and ideas and, with guidance, access information and ideas from these sources. Sources may include library, classroom, community and <strong>computer-based resources</strong></td>
<td>• identify, with guidance, sources of information and ideas and, with guidance, access information and ideas from those sources. Sources may include library, classroom, community, and <strong>computer-based resources</strong>.</td>
</tr>
</tbody>
</table>

*Continued*
### Reflect and Interpret
- record observations and measurements, using captioned pictures and charts, with guidance in the construction of charts. *Computer resources may be used for record keeping and for display and interpretation of data*
- state an inference, based on observations
- identify applications of what was learned
- identify new questions that arise from the investigation.

### Reflect and Interpret
- communicate results of construction activities using written and oral language and pictures
- evaluate the product and identify possible improvements
- identify new applications for the design or method of construction.

## ATTITUDES

### General Learner Expectations

*Students will:*

3-4 **Demonstrate positive attitudes for the study of science and for the application of science in responsible ways.**

### Specific Learner Outcomes

*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 and willingness to consider new ideas
- perseverance in the search for understandings and for solutions to problems
- a willingness to base their conclusions and actions on the evidence of their own experiences
- a willingness to work with others in shared activities and in sharing of experiences
- appreciation of the benefits gained from shared effort and cooperation
- a sense of responsibility for personal and group actions
- a respect for living things and environments, and commitment for their care.
UNDERSTANDINGS

Topic A: Rocks and Minerals

Overview

Students learn about materials found on Earth’s surface – rocks, minerals and soil. By closely examining sample rocks, students discover similarities and differences and explore these, using simple tests and tools. Students learn that each kind of rock has a set of characteristics and that these characteristics can be used in classifying and identifying rocks. In studies of soil, students discover that the component materials include rock fragments and remains of living things, and that different soils have different compositions. Students learn that the characteristics of rock and soil are important to their use within the community.

General Learner Expectations

Students will:

3-5 Demonstrate knowledge of materials that comprise Earth’s crust, and demonstrate skill in classifying these materials.

Specific Learner Expectations

Students will:

1. Compare samples of various kinds of rock, and identify similarities and differences.
2. Given a description of the properties of a particular rock or mineral, identify a sample rock or mineral that matches those properties. Properties that students should be able to describe and interpret include:
   • colour
   • lustre or “shininess”; e.g., shiny, dull, glassy, metallic, earthy
   • texture; e.g., rough, smooth, uneven
   • hardness, based on scratch tests with available materials
   • presence of carbonates. Note that the presence of carbonates can be tested with vinegar or another mild acid
   • crystal shape for minerals, or overall pattern of rocks
3. Describe and classify a group of rocks and minerals, based upon the above properties.
4. Recognize that rocks are composed of a variety of materials, and given a course-grained rock and magnifier, describe some of the component materials.
5. Recognize and describe the various components within a sample of soil; e.g., clay, sand, pebbles, decaying plants; and describe differences between two different soil samples.
6. Describe ways in which rocks break down to become soil and demonstrate one or more of these ways; e.g., by shaking a group of small soft rocks in a jar of water; by striking rocks together.
   Note: Safety goggles should be used.
7. Describe some common uses of rocks and minerals; and identify examples of those uses within the school, home or local community.
Science Grade Three  
Outcomes

**Topic B: Building with a Variety of Materials**

**Overview**

Students use a variety of tools and simple techniques to build things for specific purposes. Their tasks may require that a bridge be built between two desks, a model lookout tower be constructed, or a water container be made, all from available materials. Through these projects, students learn the value of safety and good workmanship and that different materials and designs can be used to obtain the same result. They learn that working together on a common task is easier when ideas and materials are shared.

**General Learner Expectations**

*Students will:*

3-6 Use, safely, a variety of tools, techniques and materials in construction activities.

3-7 Construct structures, using a variety of materials and designs, and compare the effectiveness of the various materials and designs for their intended purposes.

**Specific Learner Expectations**

*Students will:*

1. Using a variety of materials and techniques, design, construct and test structures that are intended to
   - support objects
   - span gaps
   - serve as containers
   - serve as models of particular living things, objects or buildings
2. Select appropriate materials for use in construction tasks, and explain the choice of materials. Students should demonstrate familiarity with a variety of materials, such as papers, woods, plastics, clay and metals.
3. Select tools that are suitable to particular tasks and materials, and use them safely and effectively.
4. Understand and use a variety of methods to join or fasten materials.
5. Identify the intended purposes and use of structures to be built, and explain how knowing the intended purpose and use helps guide decisions regarding materials and design.
6. Understand that simple designs are often as effective as more complex ones, as well as being easier and cheaper to build, and illustrate this understanding with a practical example.
7. Recognize the importance of good workmanship, and demonstrate growth toward good workmanship.
8. Maintain and store materials and tools safely and properly.
9. Apply skills of listening, speaking and cooperative decision making in working with other students on a construction project.
Topic C: Testing Materials and Designs

Overview

Students study the materials and designs used in construction tasks. They compare paper, clay, cardboard, Styrofoam or other available materials to see which are the strongest – which ones resist bending, crushing, tearing – and which are most easily shaped and joined. They test different shapes and thicknesses to find out how much material is needed. Throughout the topic, students learn that many things are considered when materials and designs are selected and that different tasks may require different materials and designs.

General Learner Expectations

Students will:

3-8 Evaluate the suitability of different materials and designs for their use in a building task.

Specific Learner Expectations

Students will:

1. Recognize that functional structures must be sufficiently strong and stable and that unstable or weak structures are often unsafe to use.
2. Compare and evaluate the strength and stability of different modes or objects constructed.
3. Describe the distinctive properties of some common solids, such as wood, paper or plastic, that make them suitable for use as building materials.
4. Apply procedures to test the strength of construction materials, in particular, different stocks of papers, plastics or wood.
5. Apply procedures to test different designs.
6. Apply procedures to test the strength of different methods of joining.
7. Identify and apply methods for making a structure stronger and more stable; e.g. by adding or joining parts to form triangles.
Topic D: Hearing and Sound

Overview

Students explore the nature of sound, its sources, its qualities and what it is. They learn that sound is vibration and that changes in vibration can affect the loudness, pitch and quality of sound. They learn about sound travel by studying what things carry sound, what things make it louder or softer, and what happens to sound when it reaches their ears. The sensitivity of human ears and those of other animals is examined, as students learn about the safe used of this valuable sense.

General Learner Expectations

Students will:

3-9 Describe the nature of sound, and demonstrate methods for producing and controlling sound.

Specific Learner Expectations

Students will:

1. Identify examples of vibration.
2. Recognize that sound is the result of vibration; and demonstrate that the larger the vibration, the louder the sound.
3. Recognize that there are ways of measuring loudness of sounds and that loud sounds pose a danger to the ear.
4. Recognize that pitch is the result of differences in the rate of vibration, and predict how a change in the rate of vibration will affect a sound.
5. Demonstrate a variety of ways of producing sounds; e.g., by striking an empty glass, by blowing air into a bottle, by constructing and using a device that involves vibrating strings.
6. Use sound-producing devices that the student has constructed to demonstrate methods for controlling the loudness, pitch and quality of sound produced.
7. Identify examples that show that sound can travel through a variety of materials, including solids, liquids and air, and that sound travels in all directions.
8. Describe how the human ear senses vibrations.
9. Compare the range of hearing in humans to that in other animals; e.g., dogs and bats.
10. Recognize that certain sounds have characteristics that cause them to be interpreted as pleasant or unpleasant, and identify these characteristics.
11. Describe changes in hearing that result from continued exposure to loud noise and from the natural process of aging.
13. Explain the role that sound plays in communication.
Topic E: Animal Life Cycles

Overview

Students learn about the growth and development of animals and discover that different animals have different life cycles. By observing the life cycle of one small animal from its earliest stage to adulthood, students acquire a reference point for the study of other animals and come to appreciate the beauty and fragility of life. Students learn that the egg larva, pupa and adult stages that are characteristic of many insects represents a different life story than that of the egg, young, adult life cycle that is common to most vertebrate animals. In studying these animals, students learn about the changes in needs of the young as they grow and develop and about the changing relationship between these animals and their environment.

General Learner Expectations

Students will:

3-9 Describe the appearances and life cycles of some common animals, and identify their adaptations to different environments.
3-10 Identify requirements for animal care.

Specific Learner Expectations

Students will:

1. Classify a variety of animals, based on observable characteristics; e.g., limbs, teeth, body covering, overall shape, backbone.
2. Observe and describe the growth and development of at least one living animal, as the animal develops from early to more advanced stages. The animal(s) should be from one or more of the following groups: mammals, birds, fish, reptiles, amphibians, insects. Suggested examples include: gerbils, guppies, mealworms, tadpoles, worms, butterflies/moths. Additional examples from other animal groups might also be included: brine shrimp, isopods, spiders.
3. Predict the next stages in the growth and development of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians, insects; and identify similarities and differences in their developmental sequences.
4. Identify the food needs of at least one animal from each of the following groups: mammals, birds, fish, reptiles, amphibians, insects, and describe changes in how each animal obtains food through different stages of its life.
5. Demonstrate awareness that parental care is characteristics of some animal and not of others, and identify examples of different forms of parental care.
6. Demonstrate awareness that animals require different habitats in order to meet their basic needs of food, water, shelter and space.
7. Recognize adaptations of a young animal to its environment, and identify changes in its relationship to its environment as it goes through life; e.g., tadpoles are adapted for life in an aquatic environment; adult frogs show adaptations to both terrestrial and aquatic environments.
8. Identify examples of environmental conditions that may threaten animal survival.
9. Recognize that habitat preservation can help maintain animal populations, and identify ways that student actions can assist habitat preservation.
10. Demonstrate knowledge of the needs of animals studied, and demonstrate skills for their care.
Topic A

Rocks and Minerals
About the Lessons

*Rocks and minerals* is a great unit for grade three students. It is structured to include plenty of hands-on activities. This means that having the proper materials and equipment will help make the unit more successful. Most can be found at school, at home, or at local dollar stores. But some must be purchased from science education supply companies.

Encourage students to look for, and bring to school, any rocks they might find unusual and particularly attractive. Even some of the rocks minerals found in gravelled areas of the community are quite attractive.

Must have materials and equipment include:
- A commercially prepared rocks and minerals collection.
- Eyedroppers
- Soil samples (clay, sandy, silty – like good garden soil)
- Sieves
- Magnifying glasses

Mini Textbook

A mini textbook is included for those teachers who prefer to have students read about the concepts in addition to learning about them with hands-on activities. The lessons are not dependent on the students having the mini textbook, however.

Multi-Grading

For instructional groups that are comprised of more than one grade, two sets of independent activities have been provided for many lessons, one being less challenging than the other. For these lessons teachers may choose to have all students do the same independent activities or to have some students do one set while some students do the other set.

Integrating Language Arts Instruction

At times suggested lesson plan presentation incorporates review and reinforcement of language arts skills. Science class is a great opportunity for teachers to enhance students’ oral and written English language development.
Science Grade Three
Topic A: Rocks and Minerals

Contents

Part I: The Properties of Rocks and Minerals

Lesson One      Introduction                        5
Lesson Two      Comparing Rocks and Minerals        6
Lesson Three    Types of Rocks: Sorting by Size     7
Lesson Four     Types of Rocks: Sorting by How They Were Formed 8
Lesson Five     What Are Properties?               9
Lesson Six      Properties: Colour                 11
Lesson Seven    Properties: Lustre                 12
Lesson Eight    Properties: Texture               13
Lesson Nine     Properties: Hardness                14
Lesson Ten      Properties: Presence of Carbonates 15
Lesson Eleven   Properties: Crystal Shape or Rock Pattern 16
Lesson Twelve   Properties of Rocks and Minerals: Making Inferences 17
Lesson Thirteen Classifying Rocks and Minerals According to Properties 18
Lesson Fourteen Rocks and Minerals, Part I Test      19
Part II: Rocks and Minerals Are Part of Soil

Lesson Fifteen  
Soil: Introduction  

Lesson Sixteen  
The Components of Soil  

Lesson Seventeen  
Types of Soil  

Lesson Eighteen  
How Rocks Break Down: Wind and Water  

Lesson Nineteen  
How Rocks Break Down: Other Ways  

Lesson Twenty  
Erosion  

Lesson Twenty-one  
Common Uses of Rocks and Minerals  

Lesson Twenty-two  
How Rocks and Minerals Are Used in the School, at Home, and in the Community  

Lesson Twenty-three  
Rocks and Minerals, Part II Test  


Lesson One

Concept: Introduction

Resources/Materials: Mini Textbook, pages 4 and 5  
Worksheet #3A.1a (older students)  
Worksheet #3A.1b (younger students)  
table salt  
Various objects made from rocks and/or minerals, such as  
ring with a gemstone  
pencil (lead)  
aluminum pot  
handful of gravel

Introduction: Display the object you have brought. Challenge students to tell you how they are alike. (Write down their ideas on the board, if you like) Explain that all the objects are either made from a rock or a mineral, and that this is the topic of this unit of study.

Procedure:

1. Explain that it took millions of years for rocks and minerals to form, so you can tell that it happens so slowly that you don’t really notice change from day to day. Explain also that rocks and minerals are being formed right now.

2. If you like, have students turn to Mini Textbook, page 4. Guide the reading of pages 4 and 5.

3. If you choose not to use the Mini Textbook, explain that rocks are not exactly the same as minerals. Rocks are made of minerals. Minerals are pure substances, like salt. (Show the salt.) A pure substance is a substance made up of only one thing. (If you have a ring with a gemstone, explain that the (diamond) is a mineral. It is made up of only of a mineral called diamond.)

4. On the other hand, a rock is made up of two or more minerals that have been combined by heat and pressure.

5. Distribute the pieces of gravel. Explain that most gravel is made up of rock. Minerals usually form crystals, like the salt. (It is not necessary to go into too much detail about the difference between rocks and minerals at this point.)

6. Distribute Worksheet #3A.1a (older students). Go over the directions.

7. Distribute Worksheet #3A.1b (younger students) along with a rock sample. Go over the directions. Younger students may need some guidance.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 4 and 5.
2. Do Worksheet #2A.1a (older students) OR Worksheet #3B.1b (younger students).
Directions: In the first box, tell what you already know about rocks and minerals. In the second box, tell what you would like to know about rocks and minerals.

What I already know:
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________

What I would like to know:
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
________________________________________
Rocks and Minerals

**Directions:** Draw a picture of your rock. Then fill in the spaces to tell what colours are in your rock. Colour your picture.

It is ________________.

It is ________________.

It is ________________.

**Colours:** white  yellow  black  red  green  orange  grey  brown  blue  purple

Worksheet #3A.1b
Lesson Two

Concept: Comparing Rocks and Minerals

Resources/Materials: Mini Textbook, pages 6 – 9
* Worksheets #3A.2a (teacher copy, cut into strips and folded)
  Worksheets #3A.2b and #3A.2c (older students)
  Worksheets #3A.2d and #3A.2e (younger students)
  two or three different colours of Plasticine (primary colours are best)

*Alternately, copy each sentence onto a large strip of paper.

Introduction: With students review the difference between rocks and minerals (Minerals are composed of only one substance, while rocks are composed of two or more minerals.). Explain that the first part of this unit examines the properties of rocks and of minerals. Properties are the things that tell what a substance is like. They help us know how a substance is different from other substances. Explain that today’s lesson looks at how rocks and minerals are the same and how they are different.

Procedure:

1. As a demonstration or as a student activity, take different colours of Plasticine (a 2 cm or 3 cm ball of each). Explain that the different Plasticines represent different minerals. Push them together into one big ball, so that the different colours are clearly visible. Explain that in some rocks you can clearly see the minerals that make it up. Now start to knead the ball with your fingers so that the Plasticine takes on a more marbled look. Explain that in some rocks the minerals are blended together even more. Finally, knead the Plasticine ball so that the original colours are no longer visible. (If you used primary colours, it will mostly like be a shade of brown.) Explain that in some rocks the minerals are blended together so well that you can’t really tell what minerals the rock is made of.


3. Put the folded strips from Worksheet #3A.2a into a container. Explain that some of the strips tell how rocks and minerals are alike; others tell how they are different.

4. One at a time draw out a strip and read it. Have students tell you if the sentence tells how rocks and minerals are alike or if it tells how they are different. After each sentence, expand on the information in the sentence, if you think it is necessary. *If you copied the sentences onto large strips of paper, write the headings “Alike” and “Different” on the board. Tape each strip under the correct heading after the group has discussed it. When all sentences have been taped, have the class read the sentences.

5. Distribute Worksheets #3A.2b and #3A.2c (older students) OR Worksheets #3A.2d and #3A.2e (younger students). Go over the directions.

Assignments:
1. OPTIONAL. Read Mini Textbook, pages 6 – 9.
2. Do Worksheets #3A.2b and #3A.2c (older students) OR Worksheet #3A.2d and #3A.2e(younger students).
**Comparing Rocks and Minerals**

**Teacher Directions:** Cut up the sentences, fold the strips, and place them in a container.

- Rocks and minerals are part of the earth.
- Rocks and minerals are found in all parts of the earth.
- Rocks and minerals take millions of years to form.
- Rocks and minerals can be different sizes.
- Rocks and minerals are solids.
- Minerals are made of only one substance, but rocks are made up of more than one substance.
- Most minerals are made of crystals, but most rocks are not made of crystals.
- Most minerals are very pretty, but rocks are usually not that pretty.
- Most minerals have a particular kind of shape, but rocks usually do not have a definite kind of shape.
- Most minerals are the same colour throughout, but most rocks are not the same colour throughout.
### Comparing Rocks and Minerals

**Directions:** Cut apart the sentences. Paste them under the correct heading.

<table>
<thead>
<tr>
<th>Rocks and minerals are solids.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most minerals are the same colour throughout, but most rocks are not.</td>
</tr>
<tr>
<td>Most minerals are pretty, but most rocks are not as pretty.</td>
</tr>
<tr>
<td>Rocks and minerals are found all over the earth.</td>
</tr>
<tr>
<td>Minerals are made of only one substance, but rocks are made of more than one substance.</td>
</tr>
<tr>
<td>Rocks and minerals are part of the earth.</td>
</tr>
<tr>
<td>Rocks and minerals take millions of years to form.</td>
</tr>
<tr>
<td>Rocks and minerals can be different sizes.</td>
</tr>
<tr>
<td>Minerals usually have a particular shape, but rocks do not.</td>
</tr>
<tr>
<td>Most minerals are made up of crystals, but rocks are not usually made up of crystals.</td>
</tr>
</tbody>
</table>
Directions: Cut apart the pictures. Paste them in the correct boxes.
### Rocks

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

### Minerals

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

Worksheet #3A.2c
Lesson Three

Concept: Types of Rocks: Sorting by Size

Resources/Materials: Mini Textbook, pages 10 and 11
Worksheet #3A.3a (teacher copy, cut up) OR printed on word cards
Worksheets #3A.3b and #3A.3b (older students)
Worksheet #3A.3d (younger students)
Various sizes of rock (whatever you can gather – big as you can handle down to smaller sizes like baseball-sized, large gravel, small gravel, sand, and stone dust (from a whetstone or even pencil lead dust)

Introduction: Review that minerals and rocks are similar in some ways and different in others. Explain that the next few lessons will be about rocks. Recall that rocks can be of various sizes. People use the word “rock” to stand for anything that is made up of minerals. Scientists have different names for rocks, depending on their sizes.

Procedure:

1. One at a time, and in this order, introduce the various terms that describe rock sizes. (You may want to use Mini Textbook, pages 10 and 11 to help you explain.) Hold up the word card or the cut up words from Worksheet #3A.3a. **mountain, boulder, rock, stone, pebble, sand, grain, dust, speck**

   Hold up the appropriate rock samples to illustrate, for example how big a pebble is.

2. If you like, have students turn to Mini Textbook, page 10. Guide the reading of pages 10 and 11.

3. Display the words on a table or on the ledge of the white/chalkboard (if you made word cards) in order from largest to smallest. Have the class read the words two or three times.

4. In random order, describe one of the rock sizes. Have students tell you which words matches your description.

5. Distribute Worksheets #3A.3b and #3A.3c to older students and Worksheet #3A.3d to younger students. Go over the directions. **Leave the words you displayed in #3 above, in order, so students can refer to them, if necessary.**

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 10 and 11.
2. Older Students. Do Worksheets #3A.3b and #3A.3c.
3. Younger Students. Do Worksheet #3A.3d.
Sorting Rocks by Size

mountain
boulder
rock
stone
pebble
sand
grain
dust
speck
Sorting Rocks By Size

Directions: Match the sizes of rocks with their descriptions.

a. mountain  _____ really fine powder

b. boulder   _____ can hold it in two hands

c. rock      _____ smallest

d. stone     _____ large; can get arms around it

e. pebble    _____ largest

f. sand      _____ like a crystal of sugar or smaller

g. grain     _____ taller than a person

h. dust      _____ can hold it with two fingers

i. speck     _____ tiny pieces of rock you might find on a beach
**Directions:** At the bottoms of the boxes, write the names of the rock sizes. Then draw and colour pictures to illustrate the rock sizes.
**Sorting Rocks by Size**

**Directions:** Draw and colour a picture to go with each rock size.

<table>
<thead>
<tr>
<th>mountain</th>
<th>boulder</th>
<th>rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>stone</td>
<td>pebble</td>
<td>sand</td>
</tr>
<tr>
<td>grain</td>
<td>dust</td>
<td>speck</td>
</tr>
</tbody>
</table>
Lesson Four

Concept: Types of Rocks: Sorting By How They Were Formed

Resources/Materials: Mini Textbook, pages 12 – 15
Worksheets #3A.4a, #3A.4b, and #3A.4c (optional, transparencies or enlarged copies)
Worksheets #3A.4d and #3A.4e (older students)
Worksheets #3A.4f and #3A.4g (younger students)
OPTIONAL: several colours of Plasticine, flattened into sheets about 1 cm thick
OPTIONAL: large clear container (like a jar or straight-sided bowl) and several
different colours of granules and powders (e.g. white flour, whole wheat
flour, oatmeal, brown sugar, bread crumbs)

Introduction: Review that rocks can be put into categories according to their sizes. Explain that another
way to sort rocks is by how they were formed.

Procedure:

1. Explain that it takes many years – often millions – for rocks to form. Rocks are forming right
now, but it can happen so slowly that you would never see it happening.

   Next guide the reading of Mini Textbook, pages 12 – 15 or do steps #2 - #4 below.

2. Explain that rocks form in three ways. The first type of rock is called sedimentary. (Write on
board.) Layers of soil pile on top of each other. The weight of the top layers presses the soil
together so hard that it actually becomes rock.

   Illustrate the layers by putting layers of the different granules and powders into the jar or bowl.
   Be sure to level each layer off before adding the next layer. (Show Worksheet #3A.4a.)

3. Explain that deep inside the earth it is hot – so hot that the material inside is like a very stiff liquid.
   Usually the earth’s surface keeps that hot liquid inside, but sometimes a crack in the earth surface
   opens up and some of the liquids spews out into the air. When this hot liquid cools, it becomes a
   solid and that solid is igneous rock. (Show Worksheet #3A.4b.) (Igneous means “fire”.)

4. Finally, explain that sometimes sedimentary or igneous rock gets pressed down and heated until it
   changes. Illustrate this by piling layers of Plasticine one on top of the other. Then press down on
   it until the layers flatten more and deform a little. Explain that the layers were represented the
   layers in sedimentary rock. When the layers are pressed together, they get thinner and wavy. The
   same can happen with igneous rock – it changes with pressing together. This rock is called
   metamorphic. (Metamorphic means “changed”.) (Show Worksheet #3A.4c.)

5. Distribute Worksheets #3A.4d and #3A.4e (older) OR Worksheets #3A.4f and #3A.4g (younger).
   Go over the directions.

Assignments:
1. OPTIONAL. Read Mini Textbook, pages 12 – 15.
2. Do Worksheets #3A.4d and #3A.4e (older) OR. Worksheets #3A.4f and #3A.4g (younger).
For thousands, even millions of years, little pieces of our earth have been eroded – broken down and worn away by wind and weather. These little bits of our earth are washed downstream where they settle to the bottoms of the rivers, lakes, and oceans. Layer after layer of eroded earth is deposited on top of each. These layers are pressed down more and more through time, until the bottom layers slowly turn into rock.
Igneous rocks are called fire rocks and are formed either underground or above ground. Underground, they are formed when the melted rock, called magma, deep within the earth becomes trapped in small pockets. As these pockets of magma cool slowly underground, the magma becomes igneous rocks.

Igneous rocks are also formed when volcanoes erupt, causing the magma to rise above the earth’s surface. When magma appears above the earth, it is called lava. Igneous rocks are formed as the lava cools above ground.
Metamorphic rocks are rocks that have “morphed” into another kind of rock. These rocks were once igneous or sedimentary rocks. How do sedimentary and igneous rocks change? The rocks are under tonnes and tonnes of pressure, which fosters heat build up, and this causes them to change. If you examine metamorphic rock samples closely, you will discover how flattened some of the grains in the rock are.
How Rocks Are Formed

1. What are the three types of rocks?
   a. ________________________________
   b. ________________________________
   c. ________________________________

2. Fill in the spaces with words from the boxes.

Sedimentary Rocks

<table>
<thead>
<tr>
<th>gritty</th>
<th>lakes</th>
<th>layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>softer</td>
<td>weight</td>
<td>years</td>
</tr>
</tbody>
</table>

a. Sedimentary rocks are formed in ________________________.

b. It takes many thousands or millions of __________ for these layers to form.

c. These layers most often form at the bottom of ________________ and oceans.

d. The ________________ of the top layers makes the bottom layers turn to rock.

e. Most sedimentary rocks are ________________ than other types of rock.

f. Most sedimentary rocks feel ________________.
Igneous Rocks

<table>
<thead>
<tr>
<th>after</th>
<th>erupt</th>
<th>igneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>glasslike</td>
<td>rises</td>
<td>volcanoes</td>
</tr>
</tbody>
</table>

a. Igneous rocks are formed from ________________.
b. Liquid rock from deep within the earth ________________ up.
c. Some of the liquid rock and gases ________________ onto the earth’s surface.
d. Some of the liquid rock cools ________________ it reaches the earth’s surface.
e. When liquid rock cools, it forms ________________ rock.
f. Some igneous rock is shiny and ________________.

Metamorphic Rocks

<table>
<thead>
<tr>
<th>below</th>
<th>heat</th>
<th>igneous</th>
<th>sedimentary</th>
</tr>
</thead>
</table>

a. Metamorphic rocks are formed ________________ the surface of the earth.
b. They were once ________________ or ________________ rocks.
c. When these rocks were put under a great deal of ________________ and pressure, they changed.
### Numbers and Colours of Rocks

**Directions:** Draw and colour each.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>one blue rock</td>
<td>two black rocks</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>three red rocks</td>
<td>four green rocks</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>five purple rocks</td>
<td>six white rocks</td>
</tr>
</tbody>
</table>
1 = one  
2 = two  
3 = three  
4 = four  
5 = five  
6 = six  
7 = seven  
8 = eight  
9 = nine  
10 = ten

seven yellow rocks

eight brown rocks

nine orange rocks

ten brown rocks

two yellow and green rocks

four black and brown rocks

Worksheet #3A.4g
Lesson Five

Concept: What Are Properties?

Resources/Materials: Mini Textbook, page 16
Worksheet #3A.5 (student copies)
eraser (new, white, with sleeve removed)
for each student – some food item that is in one piece, but has several obvious components, such as a piece of granola bar or an raisin oatmeal cookie (It’s a good idea to have two per student – one for handling and one, later, for eating.)
paper towels

Introduction: Briefly review the three types of rocks (sedimentary, igneous, metamorphic). Then explain that in today’s lesson, students will learn about how to describe something – but with a particular purpose in mind. Students will learn to describe something in such a way that the description tells what it is like so that a person could also tell how it is different from other things.

Procedure:

1. Show the eraser. Ask students to describe it. Write responses on the board. Elicit ideas such as:
   - White in colour
   - Shaped like a box
   - Can be bent slightly
   - Rubs away pencil marks
   - Corners become rounded with rubbing
   - Smell like rubber

2. Explain that the list on the board tells about the properties of the eraser.

3. If you like, have students turn to Mini Textbook, page16.

4. Explain that it is now the students’ turn to describe the properties of an object. Give each student a paper towel and the cookie, granola bar, or whatever you managed to bring.

5. Distribute Worksheet #3A.5. Go over the directions. Warn students that like rocks, the cookie has several components. Telling about the components is part of listing the properties. Have older students help younger students.

6. If possible, go over students’ responses, as a class.

7. Finish the class by having students discard their handled food and giving them one to eat.

Assignments:

1. OPTIONAL. Read Mini Textbook, page 16.
2. Do Worksheet #3A.5.
Directions: Tell about the properties of the object your teacher gives you.

Name of Object: __________________________

Properties:
1. __________________________
2. __________________________
3. __________________________
4. __________________________
5. __________________________
6. __________________________
7. __________________________
8. __________________________
ADVANCE PREPARATION: LESSONS SIX TO TWELVE

1. From your rocks and minerals collection, select five or six rocks and five or six minerals. If they do not already have numbers or letters on them, assign a number to each. Separate the rocks from the minerals. You may want to put each in a separate container with the number/letter written on the container. BE SURE TO USE THESE EXACT SAME ROCKS AND MINERALS FOR LESSONS SIX THROUGH ELEVEN.

2. Try to choose rock and mineral samples such that they include a range of colours, textures, hardness, lustre, and crystal shape or rock pattern.

3. Your rocks and minerals collection will most likely have some way to identify each of the rocks/minerals by name. If not, then on a separate sheet of paper, write the numbers/letters and the names of the rocks/minerals. This will act as a quick reference guide for you. DO NOT LET STUDENTS SEE THIS PAPER.

4. Make a copies of Worksheets #3A.6a and #3A.6b on transparencies or on large wall charts. You will need to fill parts of these charts at the end of each class so that you have a cumulative record of the students’ observations for Lesson Thirteen.
Lesson Six

Concept: Properties: Colour

Resources/Materials: Mini Textbook, pages 17 and 18 (top half)
Worksheets #3A.6a and #3A.6n (transparencies or reproduced on a large wall charts)
Worksheet #3A.6c (student copies)
Collection of preselected rocks and minerals

Introduction: Review the term properties. Explain that information on the properties of various rocks and minerals can help us identify and unknown rock or mineral.

Explain that for the next several classes, we will be examining some rocks and minerals and writing down their properties.

Procedure:

1. Explain that today, students will be looking at six (or five) minerals and six (or five) rocks. You will not be telling them the names of the rocks and minerals. Each has a number (or a letter).

2. Explain that the first property the class will be looking at is colour. Explain that minerals are almost always one colour, while rocks may be more than one colour.

3. OPTIONAL. Have students turn to Mini Textbook, page 17. Guide the reading of all of page 17 and the top part of page 18.

4. Distribute Worksheet #3A.6c. Have students write the numbers and/or letters you have assigned to the minerals/rocks in the left hand column of each chart.

5. If you have a small group, have the group look at the samples, one at a time; then write the colours in the appropriate boxes on the chart on Worksheet #3A.6c.

If you have a large group, divide the group into pairs (pair a younger with an older student); then rotate the samples.

Encourage them to use words like dark or light in addition to the colour.

6. If possible, once all students have had the chance to view all the samples, have them help you fill in Worksheets #3A.6a and #3A.6b.

Assignments:

1. OPTIONAL. Read Mini Textbook, page 17 and 18 (top).
2. Do Worksheet #3A.6c.
<table>
<thead>
<tr>
<th>Sample #</th>
<th>Property</th>
<th>Colour</th>
<th>Lustre</th>
<th>Texture</th>
<th>Hardness</th>
<th>Carbonate?</th>
<th>Crystal Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Science Grade Three Topic A: Rocks and Minerals, Part I*
<table>
<thead>
<tr>
<th>Property</th>
<th>Sample #</th>
<th>Sample #</th>
<th>Sample #</th>
<th>Sample #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lustre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonate?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pattern</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Colour**

**Directions:** Look closely at each sample. Then tell what colour or colours each is.

<table>
<thead>
<tr>
<th>MINERALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROCKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

black
white
red
blue
yellow
orange
green
orange
purple
grey
pink
brown

Worksheet #3A.6c
Lesson Seven

Concept: Properties: Lustre

Resources/Materials: Mini Textbook, pages 18 and 19
        Worksheets #3A.6a and #3A.6b (transparencies or large wall charts)
        Worksheet #3A.7 (student copies)
        something metallic, like foil
        something dull, like dull rock
        something waxy, like orange
        something pearly

Introduction: Review that colour is one of the properties that can be used to describe rocks and minerals. Explain that today, we will look at another property – lustre. Write lustre on the board. Explain that lustre refers to shininess.

Procedure:

1. Explain that there are several words to describe lustre. Write these words on the board. Use the items you brought in to help you explain what they mean.

   dull  waxy  oily  pearly  silky  glassy  metallic

2. If you like, have students turn to Mini Textbook, page 18 and guide the reading of pages 18 and 19.

3. Follow similar procedure as you did for the last class. Distribute Worksheet #3A.7. Have the students fill in the numbers or letters. Then record their observations.

4. Similar to the last class, fill the transparency or chart of Worksheets #3A.6a and #3A.6b.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 18 and 19.
2. Do Worksheet #3A.7.
**Lustre**

**Directions:** Look closely at each sample. Then tell what lustre each has.

### MINERALS

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Lustre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- dull
- waxy
- oily
- pearly
- silky
- glassy
- metallic

### ROCKS

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Lustre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Eight

Concept: Properties: Texture

Resources/Materials: Mini Textbook, page 20
Worksheets #3A.6a and #3A.6b (transparencies or large wall charts)
Worksheet #3A.8 (student copies)
samples of different materials of varying texture
If you have any rock samples that show coarse-grains, medium-grains, and
fine-grains that would be great

Introduction: Explain that today’s lesson is about texture. Basically, texture refers to how a rock or
mineral feels.

Procedure:

1. Write these words on the board. Explain each, using any samples you brought in.
   rough smooth uneven sharp bumpy jagged

2. Warn students that they shouldn’t be fooled by rocks and minerals that have been specially cut or
   smoothed out. Most can be made to have a smooth finish. We are more interested in what they
   are like as they occur in nature.

3. Distribute Worksheet #3A.8. After students have filled in the numbers or letters, allow them to
   examine the samples and fill in the chart.

4. Fill in the transparencies or wall charts.

Assignments:

1. OPTIONAL. Read Mini Textbook, page 20.
2. Do Worksheet #3A.8.
Directions: Look closely at each sample. Then tell what texture each is.

<table>
<thead>
<tr>
<th>MINERALS</th>
<th>Minerals and Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
<td>Texture</td>
</tr>
<tr>
<td></td>
<td>rough</td>
</tr>
<tr>
<td></td>
<td>smooth</td>
</tr>
<tr>
<td></td>
<td>uneven</td>
</tr>
<tr>
<td></td>
<td>bumpy</td>
</tr>
<tr>
<td></td>
<td>jagged</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROCKS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
<td>Texture</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Nine

Concept: Properties: Hardness

Resources/Materials: Mini Textbook, pages 21 and 22
Worksheets #3A.6a (transparency or wall chart)
Worksheet #3A.9 (student copies)
*For each group: copper penny
   nail
   emery file

*Strongly consider doing this lesson as a demonstration instead of a hands-on activity.

Introduction: Review the properties students have learned about so far. (colour, lustre, texture) Explain that the next property applies only to minerals. It is hardness.

Procedure:

1. Explain that we describe a mineral’s hardness by describing it as extremely hard, very hard, semi-hard, soft, or very soft.

2. We determine hardness by using **scratch tests**. We know that some things are harder than others. For example an iron is harder than a fingernail. An iron nail can scratch harder things than a fingernail.


4. Distribute Worksheet #3A.9. Explain how the Mohs Scale works. Using your fingernail, the penny, nail, glass, steel file, and the corundum, perform the scratch tests on each of the minerals.

5. Complete the Hardness section of Worksheet #3a.6a.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 21 and 22.
2. Do Worksheet #3A.9.
Directions: Perform scratch tests on each of the minerals. Then tell if your mineral is extremely hard, very hard, semi-hard, soft, or very soft.

<table>
<thead>
<tr>
<th>Hardness</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>extremely hard</td>
<td>• can be scratched by corundum&lt;br&gt;• can’t be scratched by an emery file, nail, penny, or fingernail</td>
</tr>
<tr>
<td>very hard</td>
<td>• can be scratched by an emery file&lt;br&gt;• can’t be scratched by a fingernail, penny, or nail</td>
</tr>
<tr>
<td>semi-hard</td>
<td>• can be scratched by a nail&lt;br&gt;• can’t be scratched by a fingernail or penny</td>
</tr>
<tr>
<td>soft</td>
<td>• can be scratched by a penny&lt;br&gt;• can’t be scratched by a fingernail</td>
</tr>
<tr>
<td>very soft</td>
<td>• can be scratched by a fingernail</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Fingernail</th>
<th>Penny</th>
<th>Nail</th>
<th>Emery File</th>
<th>Corundum</th>
<th>How hard is this mineral?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>can be scratched by a fingernail</td>
<td>can be scratched by a penny, but not a fingernail</td>
<td>Can be scratched by a nail, but not a penny or fingernail</td>
<td>can be scratched by an emery file, but not a nail, penny, or fingernail</td>
<td>can be scratched by corundum, but not an emery file, nail, penny, or fingernail</td>
<td></td>
</tr>
</tbody>
</table>
Lesson Ten

Concept: Properties: Presence of Carbonates

Resources/Materials: Mini Textbook, page 23
Worksheets #3A.6a (transparency OR wall chart)
Worksheets #3A.10 (student copies)
small dishes of good quality vinegar eydopppers
small clear plastic cups damp cloths
piece of chalk paper towels

*If you plan to have students do this as a hands-on activity, give students practice using the eyedroppers. Have them try to suck up water and then dispense it one drop at a time.

Introduction: Explain that the next property is quite unusual. We will test to see if a particular mineral or rock has something called a carbonate in it. Explain that chalk has a carbonate in it called calcium carbonate.
Place about 50 mL of vinegar into a clear plastic cup. Add the piece of chalk. It should fizz a little.
Note: Depending on the strength of the vinegar, students may have difficulty seeing the fizz—it may be more like a few bubbles.

Conclude that the “vinegar test” indicates whether or not a carbonate is present in the rock or mineral. (If there is a carbonate, there will be fizzing.) Explain that we cannot necessarily see that there is a carbonate, but that the fizzing leads us to believe there is a carbonate. This is called making an INERENCE.

Procedure:

1. OPTIONAL. Have students turn to Mini Textbook, page 23 and guide the reading of the Presence of Carbonates section.

2. Distribute Worksheet #3A.10. Go over the directions. Write the rock and mineral sample numbers or letters in the appropriate boxes.

3. Then distribute the dishes of vinegar, eyedroppers, and paper towels.

4. Have students take a rock/mineral sample, place it on the towel, and then place three drops of vinegar on it. Observe.

5. Record answers on the worksheet.

6. Be sure to rinse off the rock and mineral samples when the activity is completed.

7. Complete the appropriate sections on the transparencies or wall charts of Worksheets #3A.6a and #3A.6b.

Assignments:
1. Read Mini Textbook, pages 23.
2. Do Worksheet #3A.10.
**Presence of Carbonates**

**Directions**: Place three drops of vinegar on each rock and mineral sample. Did it fizz? Write **yes** or **no**.

<table>
<thead>
<tr>
<th>MINERALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
<td>Did it fizz?</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROCKS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample #</td>
<td>Did it fizz?</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Eleven

Concept: Properties: Crystal Shape or Rock Pattern

Resources/Materials: Mini Textbook, pages 23 – 26
Worksheets #3A.6a and #3A.6b (transparencies or wall charts)
Worksheet #3A.11 (student copies)
salt magnifying glasses
black construction paper
sample of a speckled rock (preferably not polished or cut)

Introduction: Explain that there are many other properties that scientists look for in rocks and minerals, but we will look at just one more. The final property is to look at the shape of mineral crystals and the patterns found in rocks.

Procedure:

1. Sprinkle a few grains of salt on a sheet of black construction paper. Then have students look at the salt through a magnifying glass. They will notice that the salt crystals are really cube-shaped.


3. Explain that most minerals form crystals. Write these terms on the board and explain them. Drawing pictures will help.
   Block-shaped Curved Edges Thin Squares Round and Pointed Rectangular and Pointed

4. Next show students the speckled rock sample. Explain that some rocks are made of several different minerals with different colours. They have a speckled appearance. Note that in nature these rocks are usually quite rough. If the speckles are large, we say the rock is coarse-grained. If the speckles are really small, we say the rock is fine-grained. And if the speckles are medium-sized, we say the speckles are medium-grained.

Write these terms on the board and explain their meanings. Again, drawing pictures will help.
Layers Conglomerates Wavy Layers
Speckled: Coarse-Grained, Medium-Grained, Fine-Grained

5. Explain that some crystal and rocks are hard to describe. For grades one, two, and three, it is alright to draw a picture of what you see, if you can’t describe it in words.

6. Distribute Worksheet #3A.11 and the magnifying glasses. Go over the directions.

7. Complete the appropriate sections on the transparencies or wall charts of Worksheets #3A.6a and #3A.6b.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 23 – 26
2. Do Worksheet #3A.11.
Crystal Shape of Minerals and Rock Pattern

**Directions:** Describe the crystal shapes of the minerals and the patterns of the rocks.

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CRYSTAL SHAPES OF MINERALS**
- block-shaped
- curved edges
- thin squares
- round and pointed
- long, square, and pointed
- other (Draw a picture.)

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ROCK PATTERNS**
- layered
- conglomerate
- wavy layers
- coarse-grained
- medium-grained
- fine-grained
- no pattern
ADVANCE PREPARATION: Select two mineral and two rock samples from those students have already examined for their properties. Write the names of these mineral and rock samples in appropriate boxes on Worksheet #3A.12. Also, fill in the boxes for hardness and carbonates.

Lesson Twelve

Concept: Properties of Rocks and Minerals: Making Inferences

Resources/Materials: The Completed Transparencies or Wall Charts of Worksheets #3A.6a and #3A.6b
Worksheets #3A.12a and #3A.12b (student copies)
2 mineral samples (from the 5 or 6 students have tested)
2 rock samples (from the 5 or 6 students have tested)
magnifying glasses

Introduction: Explain that the completed charts (on transparencies or on wall) tell about many of the properties of some rocks and minerals. If someone gave us a sample of a mineral or rock, we could figure out which one it is by looking at the properties.

Explain that by determining the properties of an unknown mineral or rock, we can make an inference as to which mineral or rock it actually is by looking at the chart.
Clarify that observations are those things you can actually see (or touch, smell, etc.). Inferences are those things we can conclude from the observations.

Procedure:

1. Distribute Worksheet #3A.12a.

2. Display the two mineral and two rock samples. Explain that students are to examine each of the samples for:
colour     texture     lustre     crystal shape or rock pattern
Explain that they will not have to test for hardness or the presence of carbonates.

3. Have students examine the samples, filling in the charts as they proceed.

4. Then have them use the completed charts of Worksheets #3A.6a and #3A.6b to determine which sample from those charts matches those on Worksheet #3A.12a. Write the appropriate numbers in the spaces at the bottom of the charts.

5. Distribute Worksheet #3A.12b. On the transparencies or wall charts, write the actual names of the minerals and rocks. Then have students use the information to complete the worksheet.

Note: These activities may seem rather simple, but it may prove challenging for some students as they have to refer back and forth from the transparencies/wall charts to their own sheets to find a match. The activity is also intended to introduce the idea of inference to students.

Assignment:

1. Do Worksheet #3A.12a.
2. Do Worksheet #3A.12b.
**Making Inferences**

**Directions:** Examine each of the rock and mineral samples. Write their properties in the chart. Then figure out the matching sample numbers.

<table>
<thead>
<tr>
<th>MINERALS</th>
<th>ROCKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property</strong></td>
<td><strong>Property</strong></td>
</tr>
<tr>
<td>Sample Name:</td>
<td>Sample Name:</td>
</tr>
<tr>
<td>Colour</td>
<td>Colour</td>
</tr>
<tr>
<td>Lustre</td>
<td>Lustre</td>
</tr>
<tr>
<td>Texture</td>
<td>Texture</td>
</tr>
<tr>
<td>Hardness</td>
<td>Carbonate?</td>
</tr>
<tr>
<td>Carbonate?</td>
<td>Pattern</td>
</tr>
<tr>
<td>Crystal Shape</td>
<td>Sample #</td>
</tr>
<tr>
<td></td>
<td>Sample #</td>
</tr>
</tbody>
</table>

Worksheet #3A.12a
The Mystery Rocks and Minerals

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Name of the Mineral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Name of the Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Thirteen

**Concept:** Classifying Rocks and Minerals According to Properties

**Resources/Materials:** Worksheet #3A.13 (one or more copies per student)  
- rock and mineral samples  
- chart showing the names of the rocks and minerals – the one that came with the rocks and minerals collection (student copies)

**Introduction:** Briefly review the different properties we use to describe rocks and minerals. Explain that these properties can help us put rocks and minerals into categories. For example: We could put them into groups by colour. Another way would be to separate those that contain carbonates from those that do not.

**Procedure:**

1. Explain that today students will be given some rock and mineral samples. Each student (or group) must decide how they will put them into groups.

2. If you think it is necessary, take a few samples, decide on how you will group them, and then go ahead and physically put them into groups. Then show students how to determine the rock and mineral names by looking at the chart.

3. Distribute Worksheet #3A.13. The charts are set up so that students can separate their samples into three groups; however, explain that if they want to only separate them into two groups, they should leave one chart blank. Older students should write the names of the rocks and minerals on the board. If you like, have younger students draw and colour the sample instead of writing the names. This will take longer, however, so they may not be able to complete as many sortings as their older peers.

   **Note:** There is only room on the worksheet to do two different classifications. If you want your students to do more, give them another copy of the worksheet.

**Assignment:**

Do Worksheet #3A.13.
**Classifying Rocks and Minerals**

**Directions:** Sort your rock and mineral samples into two or three groups. Then give each group a heading. Write the names of the rocks and minerals you put in each group.

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

Worksheet #3A.13
Lesson Fourteen

Concept: Rocks and Minerals, Part I Test

Resources/Materials: Rocks and Minerals, Part I Test (student copies)

Introduction: Explain that the first part of Rocks and Minerals is now at an end and it is time for a test.

Procedure:

1. Since the first part of Rocks and Minerals is quite lengthy, you may want to review quickly the content covered.
   - Comparing rocks and minerals
   - Sorting rocks by size
   - Sorting rocks by how they were formed
   - Properties of minerals and rocks: colour, lustre, hardness, texture, presence of carbonates, crystal shape or rock pattern

2. Distribute the tests. Some of your students may not be able to read the test questions independently. If this is the case, you will have to go through the test question by question.
Rocks and Minerals, Part I
Test

1. Write S or D in the boxes.

S = How rocks and minerals are the same.
D = How rocks and minerals are different.

Rocks and minerals are found in all parts of the world.

Most minerals are made of crystals, but most rocks are not made entirely of crystals.

Minerals are the same colour throughout, but most rocks are not.

Rocks and minerals can be of many different sizes.

Rocks and minerals are part of the earth.

Minerals are made of only one substance, but rocks are made of more than one substance.
2. In each group, circle the rock that is the biggest.

- mountain
- pebble
- speck

- stone
- rock
- boulder

- dust
- rock
- grain

3. Match the type of rock with its description. Write the letters in the boxes.

a. sedimentary

☐ Sedimentary and igneous rocks are changed with heat and pressure.

b. igneous

☐ Liquid rocks cools.

c. metamorphic

☐ Layers of sand, shells, pebbles, and other materials are pressed down so much that they turn to rock.
4. Circle the name of the property that each group of words describes.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>red</td>
<td>texture</td>
</tr>
<tr>
<td></td>
<td>yellow</td>
<td>lustre</td>
</tr>
<tr>
<td></td>
<td>black and white</td>
<td>colour</td>
</tr>
<tr>
<td>b</td>
<td>dull</td>
<td>texture</td>
</tr>
<tr>
<td></td>
<td>pearly</td>
<td>lustre</td>
</tr>
<tr>
<td></td>
<td>metallic</td>
<td>colour</td>
</tr>
<tr>
<td>c</td>
<td>jagged</td>
<td>texture</td>
</tr>
<tr>
<td></td>
<td>smooth</td>
<td>lustre</td>
</tr>
<tr>
<td></td>
<td>uneven</td>
<td>colour</td>
</tr>
<tr>
<td>d</td>
<td>fine-grained</td>
<td>crystal shape</td>
</tr>
<tr>
<td></td>
<td>medium-grained</td>
<td>rock pattern</td>
</tr>
<tr>
<td></td>
<td>coarse-grained</td>
<td>presence of carbonate</td>
</tr>
<tr>
<td></td>
<td><strong>e</strong></td>
<td><strong>f</strong></td>
</tr>
<tr>
<td>---</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>Fingernail will scratch it.</td>
<td>blocks</td>
</tr>
<tr>
<td></td>
<td>Steel file will not scratch it.</td>
<td>rectangular and pointed</td>
</tr>
<tr>
<td></td>
<td>Penny will not scratch it, but an iron nail will.</td>
<td>thin squares</td>
</tr>
<tr>
<td></td>
<td><strong>texture</strong></td>
<td><strong>crystal shape</strong></td>
</tr>
<tr>
<td></td>
<td><strong>lustre</strong></td>
<td><strong>rock pattern</strong></td>
</tr>
<tr>
<td></td>
<td><strong>hardness</strong></td>
<td><strong>presence of carbonate</strong></td>
</tr>
</tbody>
</table>
5. Use the chart to determine the minerals with the properties shown. Circle the name of the correct mineral.

<table>
<thead>
<tr>
<th>Property</th>
<th>Quartz</th>
<th>Calcite</th>
<th>Mica</th>
</tr>
</thead>
<tbody>
<tr>
<td>colour</td>
<td>clear, white, or pink</td>
<td>clear</td>
<td>clear, brown, or black</td>
</tr>
<tr>
<td>lustre</td>
<td>glassy</td>
<td>glassy</td>
<td>glassy to pearly</td>
</tr>
<tr>
<td>hardness</td>
<td>very hard</td>
<td>soft</td>
<td>very soft</td>
</tr>
<tr>
<td>Vinegar Test</td>
<td>does not fizz</td>
<td>fizzes a lot</td>
<td>does not fizz</td>
</tr>
</tbody>
</table>

- a. brown
  - very soft: calcite
  - pearly: mica

- b. clear
  - fizzes: calcite
  - glassy: mica
6. Use the chart to determine the rocks with the properties shown. Circle the name of the correct rock.

<table>
<thead>
<tr>
<th>Property</th>
<th>Marble</th>
<th>Granite</th>
<th>Shale</th>
</tr>
</thead>
<tbody>
<tr>
<td>colour</td>
<td>usually white, but multi-coloured</td>
<td>multi-coloured</td>
<td>White, red, green, grey, brown, black</td>
</tr>
<tr>
<td>lustre</td>
<td>dull</td>
<td>somewhat shiny</td>
<td>dull</td>
</tr>
<tr>
<td>hardness</td>
<td>hard</td>
<td>very hard</td>
<td>very soft</td>
</tr>
<tr>
<td>Vinegar Test</td>
<td>fizzes</td>
<td>does not fizz</td>
<td>does not fizz</td>
</tr>
</tbody>
</table>

a) white          marble
     hard           granite
     fizzes         shale

b) speckled        marble
     a little shiny granite
     very hard      shale
Lesson Fifteen

Concept: Soil: Introduction

Resources/Materials: Mini Textbook, pages 27 and 28
Worksheet #3A.15 (student copies)
11” X 17” paper (optional)
little bit of dirt small plant (a weed will do)
leaf table scrap (like a little piece of meat)

Introduction: Hold up the items. (Alternately, write the words dirt, dead plants, dead animals, leaves, worms, pebbles, sticks, and bugs on word cards or on the board.) Ask students what they think these things all have in common. Entertain their guesses. Then tell them they are all parts of soil. Explain that the next section of the unit has to do with soil.

Procedure:

1. Clarify that not all soil is the same. Some has next to no rotting plants, while other soil has lots, for example.

2. Ask students for their ideas on the following questions. At this point, accept all contributions. Do not add to or correct any information.
   - Why is soil important?
   - How is soil formed?
   - How does soil change?

3. Explain that this part of the unit on Rocks and Minerals studies the answers to these and other questions.


5. Distribute Worksheet #3A.15. Go over the directions. This may be too difficult for younger students to do. You may want them to do the picture described in #6 below instead.

6. Younger Students. OPTIONAL FOR OLDER STUDENTS. Have students draw and colour a picture showing how soil is important. They should write a caption for their picture.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 28 and 29.
2. Do Worksheet #3A.15 (older students).
3. Make a picture about how soil is important. Include a caption. (younger students)
What I Know About Soil

Directions: Tell what you know about soil by answering the questions.

Why is soil important?

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Where does soil come from?

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

What is the connection between rocks and minerals and soil?

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Lesson Sixteen

Concept: The Components of Soil

Resources/Materials: Mini Textbook, pages 29 – 31
Worksheet #3A.16 (student copies)
fresh garden soil (try to ensure it has lots of “stuff” in it, like dead and decaying
plants, leaves, a few earthworms, rotting sticks, some little bugs, etc.)
newspapers magnifying glasses
sieves

Introduction: Write the words dirt and soil on the board. Read the words and then ask students to tell
what the two words mean. (Dirt refers to the tiny specks of ground up rock. Soil is dirt plus all the other
things like organic matter, stones, etc.) Explain that today’s lesson is all about examining the components of soil. The components are the things
that make up soil.

Procedure:

1. If you like, have students turn to Mini Textbook, page 29. Then guide the reading of pages 29 – 31. Note: You can also do this reading after the students examine an actual soil sample.

2. Give each student or group a newspaper and a generous sample of soil. Have them carefully and
thoroughly examine the soil, looking for its components.

   NOTE: Magnifying glasses can really help spot tiny things in the soil. If you have sieves,
   they are useful in helping to separate dirt from the other soil components.

3. Distribute Worksheet #3A.16. Go over the directions. Older students can make notes about what
they found. Younger students can draw pictures of what they saw. You may need to get
students started. For example:

   Dirt
   • brown
   • moist
   • crumbly

4. Explain that different soils have different amounts of each of the components, and that some soil
samples will have none of some of the components. Dirt is the only component that all soils
must have.

Assignments:

2. Do Worksheet #3A.16.
The Components of Soil

Directions: Tell about what you saw in your soil sample.

- Dirt
- Sand, Pebbles, Stones
- Dead and Rotting Plant Matter
- Dead and Rotting Animal Matter
- Living Things
- Other Things

My Soil Sample
Lesson Seventeen

Concept: Types of Soil

Resources/Materials: Mini Textbook, pages 32 – 35
- Worksheets #3A.17a and #3A.17b (older students)
- Worksheet #3A.17c (younger students)
- sandy soil
clay soil
- silty soil (good garden soil)
- newspapers
- pitcher of water
- magnifying glasses
- sieves

Introduction: Review the various components of soil. Review also different soils have different amounts of each of the components. Explain that we can put soils into groups in many different ways. One of the ways that people often group them is by the size of the dirt particles.

Procedure:

1. Ask students to think back about how rocks were sorted by their size. The four smallest sizes were sand, grain, dust, and speck.

2. Where soil is concerned, the size of the dirt particles is important. Generally, the larger the particles, the more space there is between the particles. The smaller the particles, the smaller the spaces between particles. (Illustrate this by drawing pictures on the board.)

3. The size of the particles in soil is particularly important to gardeners and farmers. It has to do with the fact that if the dirt particles are too large, the soil cannot hold water very well. It drains right through and the plants don’t have a chance to soak it up.

    On the other hand, if the dirt particles are too small, there is very little space between the dirt particles. Water cannot drain through very well. The plant roots sit in water and the plant can actually drown.

4. Present and name each of the soil samples. Tell students they will have a chance to examine them. Explain that most soils have a mixture of different-sized particles. Sandy soil has mostly larger dirt particles. Clay soil has mostly speck and dust-sized particles. Silty soil has mostly grain and dust-sized particles.


6. Distribute Worksheets #3a.17a and #3A.17b (older students) OR Worksheet #3A.17c (younger students) and discuss how students are to complete the sheets.

7. Distribute the soil samples, one at a time, along with newspapers. For each sample, have students complete the appropriate sections of Worksheet #3A.17a (older) OR Worksheet #3A.17c (younger). **Note: If a soil sample is too dry, add a bit of water and stir to distribute the water.**

Assignments:
1. OPTIONAL. Read Mini Textbook, pages 32 – 35.
2. Do Worksheets #3A.17a and #3A.17b (older) OR Worksheet #3A.17c (younger).
1. Examine each of the soil samples. Then complete the chart to show what you observed.

<table>
<thead>
<tr>
<th>Observations</th>
<th>Sandy Soil</th>
<th>Silty Soil</th>
<th>Clay Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Picture of the Soil Sample</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>How the Soil Feels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Colour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Components Found in the Sample</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Tell what kind of soil each sentence describes.

<table>
<thead>
<tr>
<th>sandy</th>
<th>silty</th>
<th>clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>It has very fine particles.</td>
<td>Water drains out of it very quickly.</td>
<td>It has mostly coarse particles.</td>
</tr>
<tr>
<td>It is best for growing most things.</td>
<td>It holds water very well.</td>
<td>It has medium-sized particles.</td>
</tr>
<tr>
<td>Water drains out of it extremely slowly.</td>
<td>The spaces between the particles are very small.</td>
<td>When it dries, it becomes very hard.</td>
</tr>
<tr>
<td>It is difficult to form it into a ball, even when it is wet.</td>
<td>You can form it into crumbly ball.</td>
<td>It is difficult to form it into a ball, even when it is wet.</td>
</tr>
<tr>
<td>You can form it into a ball that will stick together.</td>
<td>It dries out very quickly.</td>
<td>It holds water better than sandy soil, but not as well as clay soil.</td>
</tr>
<tr>
<td>It is most likely to have dead and rotting plants in it.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Science Grade Three Topic A: Rocks and Minerals, Part II
Worksheets

Types of Soil

1. Draw and colour each of the soil samples.

| Sandy Soil | Silty Soil | Clay Soil |

2. Write the words **sandy**, **silty**, and **clay** under the correct types of soil.
Lesson Eighteen

Concept: How Rocks Break Down: Wind and Water

Resources/Materials: Mini Textbook, pages 36 – 39
- Worksheets #3A.18a and #3A.18b (older students)
- Worksheets #3A.18c and #3A.18d (younger students)
- Jar (1 L or larger) softer rocks (limestone, shale, sandstone)
- Water sieve pail

Introduction: Review that dirt is really small particles of rock and mineral. At one time, the dirt particles were really much bigger rocks and minerals. Ask students how they think the big rocks and minerals actually became the small particles that make up dirt.

Procedure:

1. Remind students that sedimentary rocks started out as layers of dirt, pebbles, and stones. They turned to rock because of the weight of the layers on top of them.

2. Explain that rocks of all kinds, including sedimentary, igneous, and metamorphic, can become particles of dirt in several different ways. Regardless of the way, the process is very slow.

3. OPTIONAL. Have students turn to Mini Textbook, page 36 and guide the reading of pages 36 and 37.

4. Explain that when the wind blows, it blows against rocks. Little bits of rock break off. This is the beginning of the making of dirt. In the same way, when water runs over rock, it causes tiny little bits of the rock to wear away. When rocks wear away because of wind and water, it is called weathering because wind and water are both parts of weather.

5. Distribute Worksheet #3A.18a and #3A.18b (older) OR Worksheets #3A.18c and #3A.18d (younger). Show students a few soft rocks. As a class note what the rocks look like. Have students draw pictures of the rocks in the appropriate space on Worksheet #3A.18a or #3A.18c.

6. Put the soft rocks in the jar. Fill with water. Put the lid on securely. Ensure that the outside of the jar is dry. Shake the jar for a couple of minutes. You could even have students take turns shaking the jar (10 – 20 times each).

7. Use the sieve and pail to separate the rock pieces from the water.

8. With students observe the rocks now. How have things changed?

9. Have students complete the rest of the worksheet questions.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 36 and 37.
2. Do Worksheets #3A.18a and #3A.18b (older) OR Worksheets #3A.18c and #3A.18d(younger).
Weathering: Wind and Water

What We Wanted to Find Out: Can water break down rocks?

The Materials We Used:

What We Did:

What We Observed:

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
</table>

Can water break down rocks? ____________________________

Worksheet #3a.18a
Weathering: Wind and Water

1. What is weathering?

2. How does weathering help to make dirt?

3. Explain how wind shaped these rocks.

4. Explain how water shaped these rocks.
1. Draw a picture of the rocks **before**.

2. Draw a picture of the rocks **in the jar**.

3. Draw a picture of the rocks **after**.
4. Read these words. Then print them **three** times each.

wind _________________________________

water _______________________________

rock _________________________________

dirt _________________________________

weather ______________________________

5. Fill in the missing letters.

w ___ n d   w ___ t ___ r

r ___ c k   d ___ r t

w ___ ___ t h ___ r
Lesson Nineteen

Concept: How Rocks Break Down: Other Ways

Resources/Materials:  Mini Textbook, pages 38 and 39
Worksheet #3A.19a and #3A.19b (older students)
Worksheet #3A.19b (younger students)
vinegar uncooked egg jar with lid
AND/OR charcoal briquettes (broken in half or so with hammer) Ziploc freezer bag

Introduction: Review that rocks and minerals become dirt because they break down due to weathering. This process takes a long time. Review also that wind and water are two major ways that weathering occurs. Explain that there are other ways too.

Procedure:


2. If you did not have students read the Mini Textbook pages, briefly explain that rocks also break down when water freezes in cracks in the rocks. When water freezes, it expands. This causes the rocks to split.

Rocks also break down when they tumble against each other. First, any sharp corners break off; then the outside wears off. It is a bit like how sandpaper can wear away wood.

Another way that rocks break down is by something called chemical weathering. Substances in the air actually cause bits of rock to soften and break off. Near the ocean the air is full of salt. Salt causes many softer rocks to break down. In some areas, factory smoke combines with rain. When this happens an acid is formed which causes some rocks to break down. This rain is called acid rain.

3. Do Activity A and/or Activity B. Have students fill in the spaces on Worksheet #3A.19a and #3A.19b (older students) OR Worksheet #3A.19c (younger students)

   Activity A (tumbling)
   Put slightly broken charcoal briquette pieces into a freezer Ziploc bag. Have students take turns shaking the bag. They will notice that the rocks tumbling against each other causes pieces to break off.

   Activity B (chemicals)
   Tell students that an eggshell has a mineral called calcium in it. This the same mineral found in many rocks that contain carbonates. Vinegar has the same effect on an eggshell as acid rain. Place the egg in the jar and the cover it with vinegar. Secure the lid. Let the egg sit in the vinegar overnight. Remove the egg. Allow students to handle it carefully. They will notice that the eggshell is no longer hard, but soft. This is because the calcium has combined with the vinegar. In the same way, rocks that contain calcium are worn away.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 38 and 39.
2. Do Worksheet #3A.19a and #3A.19b (older) OR Worksheet #3A.19c (younger)
More About Weathering

What did you want to find out?

What materials did you use?

List the steps that tell what you did.

Draw what you observed.

Before

After
Tell what you observed.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

What did you learn?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
More About Weathering

Directions: Draw pictures. Tell about each picture.

Before

During

After

Worksheet #3A.19c
Lesson Twenty

Concept: Erosion

Resources/Materials: Mini Textbook, pages 40 – 43
Worksheet #3A.20a and #3A.20b (older students)
Worksheet #3A.20c (younger students)
soil   electric fan   newspapers
AND/OR soil   water   large cake pan or equivalent
pitcher of water

Introduction: Review that weathering was the breaking or wearing away of rock. Explain that some of the same things that weathered rocks also move the broken away bits to other places. When the pieces of rock are carried from one place to another, it is called erosion.

Procedure:

1. Have students speculate about which things that weathered rocks might also erode the broken off pieces. (Most likely wind and water)


3. Explain that wind and water are indeed the most common ways that dirt is eroded. Do Activity A and/or Activity B. Have students complete either Worksheets #3A.20a and #3A20b (older students) OR Worksheet #3A.20c (younger students). Note these worksheets are identical to the Lesson Nineteen worksheets. Only the title has been changed.

Activity A (wind)
Lay down several sheets of newspaper. Dump a pile of soil towards on end. Position an electric fan directly on the soil and turn it on low, then medium, then high. Notice that the top layers of soil move and some even become airborne. This is how wind causes erosion. Also the windborne dirt particles blast against rocks they hit and cause further weathering and erosion.

Activity B (water)
Lay down a small pile of dirt at one end of a baking pan. Tilt the pan slightly. Pour a slow steady stream of water aiming toward the top of the pan. Students will notice that the top layers of soil will start to move down the pile and toward the other end of the pan. This is how water erosion occurs. Rivers move dirt in the same way.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 40 – 43.
2. Do Worksheets #3A.20a and #3A.20b (older) OR Worksheet #3A.20c (younger).
Science Grade Three Topic A: Rocks and Minerals, Part II
Worksheets

Erosion

What did you want to find out?

What materials did you use?

List the steps that tell what you did.

Draw what you observed.

Worksheet #3A.20a
Tell what you observed.

What did you learn?
Erosion

Directions: Draw pictures. Tell about each picture.

Before

During

After
Lesson Twenty-one

Concept:  Common Uses of Rocks and Minerals

Resources/Materials:  Mini Textbook, pages 44 – 47
                      Worksheets #3A.21a and #3A.21b (student copies and transparency, if possible)
                      Worksheet #3A.21c (student copies)

Introduction:  Discuss that soil is important for all of us, especially if we have gardens or grow crops. Explain that creating dirt is not the only reason why rocks and minerals are important. People in the past used them in their daily lives and we still use them today.

Procedure:

1. Explain that there are many products that we use that are made from making changing to rocks and minerals. For example, the penny is made from a type of rock that contains copper. Steel is made from a rock that contains iron. The list goes on and on.

2. OPTIONAL. Have students turn to Mini Textbook, page 44. Guide the reading of pages 44 – 47.

3. Distribute copies of Worksheets #3A.21a and #3A.21b. Put up the transparency, if you can.

4. With the class go over the uses of rocks and minerals long ago and today.

5. Distribute Worksheet #3A.21c. Review how a Venn diagram compares and contrasts. If you have the time, complete the Venn diagram with students; otherwise do two or three points so they get the idea.

   Note:  At this level, it is not necessary to include all the information from the charts in the Venn Diagram. Four or five in each section of the Venn diagram should be plenty.

   Older students will have to help younger students.

Assignments:

   1. OPTIONAL. Read Mini Textbook, pages 44 – 47.
   2. Do Worksheet #3A.21c.
Common Uses of Rocks and Minerals

Long Ago

- Making hammers and axes
- Weapons for catching animals and protection against enemies
- Stone walls for making houses
- Making sparks to start fires
- Flat stones were used for making roads
- Making clocks
- Making steps
- Carving letters and pictures into flat stones (writing tablet)
- Making wheels to grind wheat and corn
- Making large buildings like the Egyptian pyramids
- Making clay pots
- Making stone walls
## Common Uses of Rocks and Minerals

**Today**

- Making hammers and axes which are made steel that is made from iron.
- Building foundations and wall are made of concrete, which contains sand, gravel, and cement (made from limestone).
- Concrete is used to build some highways.
- Concrete is used to make pavers for sidewalks and driveways.
- Stone is used to make steps.
- Making clay pots.
- Roof tiles are made of clay.
- Sidewalks are made of concrete.
- Pencil leads are made from a mineral called graphite.
- Drill bits are embedded with diamonds so they can cut harder stones and minerals.
- Chalk.
- Table salt.
- Aluminum pots and baking pans.
- Tools are made of iron and steel.
- Coins are made from minerals.
- Glass is made from a mineral called silica.
- Jewellery is made from mineral crystals and from metals.
- Wall boards are made from a mineral called gypsum.
Comparing Common Uses of Rocks and Minerals

Long Ago

Today
NOTE: This activity involves taking a tour around the school and community to look for uses of rocks and minerals. It is probably a good idea to get permission from the German teacher, in advance. Also it would be great if you could go into someone’s home as well.

Lesson Twenty-two

Concept: How Rocks and Minerals Are Used in the School, at Home, in the Community

Resources/Materials: Worksheet #3A.22 (student copies)  
                   clipboard, paper, pencil

Introduction: Discuss that rocks and minerals are commonly used today, just as they were long ago. Explain that today, we want to take a tour around the school, (a home), and the community to see if we can find uses of rocks and minerals.

Procedure:

1. If you can, try to tour the school, a home, and the community, looking for ways in which rocks and minerals are used at your colony. Take a clipboard and pencil to record what you saw.

   When you get back, use your notes as reference and write what you observed on chart paper. When this done, have the class read the lists several times.

2. If you are unable to take the walk, have students brainstorm for ideas as you write them in three categories on three separate charts. When your lists are complete, have the class read them together for practice.

3. Distribute Worksheet #3A.22. Students can refer to the charts, as needed to complete the worksheet.

Assignment:

Do Worksheet #3A.22.
How We Use Rocks and Minerals

At Home:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

At School:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

In the Community:

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Lesson Twenty-three

Concept: Rocks and Minerals, Part II Test

Resources/Materials: Rocks and Minerals, Part II Test (student copies)

Introduction: Explain that the unit on Rocks and Minerals is almost finished. It is time for a test.

Procedure:

1. If you like, briefly review the main concepts covered before administering the test.

   - The components of soil
   - Types of soil: clay, sandy, silty
   - How rocks break down: weathering
   - How rocks and minerals are moved: erosion
   - Common uses of rocks and minerals
   - Uses of rocks and minerals in our school, home, and community
Rocks and Minerals, Part II
Test

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

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Dirt, rotting plants, and earthworms are all components of soil.</td>
<td>yes</td>
</tr>
<tr>
<td>b</td>
<td>Dirt can have particles of different sizes.</td>
<td>yes</td>
</tr>
<tr>
<td>c</td>
<td>Dirt is made up of small particles of rock and minerals.</td>
<td>yes</td>
</tr>
<tr>
<td>d</td>
<td>The smaller the particles of dirt, the easier water drains out of it.</td>
<td>yes</td>
</tr>
<tr>
<td>e</td>
<td>Dead and decaying plants in the soil can make the soil richer for gardening and growing crops.</td>
<td>yes</td>
</tr>
<tr>
<td>f</td>
<td>Large stones in the soil make crops grow better.</td>
<td>yes</td>
</tr>
<tr>
<td>g</td>
<td>Earthworms in the soil make the soil richer.</td>
<td>yes</td>
</tr>
</tbody>
</table>
2. Circle the type of soil goes with the words and phrases.

| a | • larger size particles of dirt  
• does not hold water well  
• is difficult to form into a ball | clay soil  
sandy soil  
silty soil |
|---|---|---|

| b | • very small size particles of dirt  
• can be formed into a tight ball  
• holds water very well | clay soil  
sandy soil  
silty soil |
|---|---|---|

| c | • makes the best garden soil  
• holds water well  
• can be formed into a crumbly ball | clay soil  
sandy soil  
silty soil |
|---|---|---|

3. If you shake a jar full of softer jagged rocks, what will you most likely notice after a few minutes? (Circle the best answer.)

- The pieces of rock will join together.
- The edges of the rocks will become more jagged.
- The rocks will become smoother.
4. Match the types of weathering with their descriptions.

   a. wind  
       Water freezes in cracks in rocks.  
       When the frozen water expands.  
       It splits the rock apart.

   b. water  
       Rocks rub against each other as  
       they move. The jagged edges  
       of the rocks become smoother.

   c. ice  
       When wind blows against a rock,  
       tiny pieces of rock break off.

   d. tumbling  
       Substances in the air mix with  
       water. They form an acid which  
       breaks down rocks.

   e. chemicals  
       Moving water rubs against rocks.  
       This causes some tiny pieces of  
       rock to break off.
5. Put a check mark (✓) in front of all the sentences that are true about **erosion**.

   ____ Erosion has to do with moving tiny rock particles from one place to another.

   ____ Wind is one way that erosion happens.

   ____ Water is a way that erosion happens.

   ____ Erosion happens only in the winter.

   ____ Erosion helps dirt to form layers.

   ____ Fast-moving water can carry more rock particles than slow-moving water.

6. Tell about one way that rocks and minerals are used in your school.

   ____________________________________________________________

7. Tell about one way that rocks and minerals are used in your home.

   ____________________________________________________________

8. Tell about two ways that rocks and minerals are used in your community.

   ____________________________________________________________

   ____________________________________________________________
9. Look at the chart comparing how rocks and minerals were used long ago and how they are used today.

<table>
<thead>
<tr>
<th>Long Ago</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Roads were made with flat stones.</td>
<td>• Walls of buildings are made of concrete. Concrete is made of rocks and minerals.</td>
</tr>
<tr>
<td>• Walls of building were made of stone.</td>
<td>• Some roof tiles are made from concrete and others are made from clay.</td>
</tr>
<tr>
<td>• Large buildings were made of stone.</td>
<td>• Pencil leads are made from a mineral called graphite.</td>
</tr>
<tr>
<td>• Some clocks were made of rocks.</td>
<td>• Granite is a rock that is often used in kitchens and bathrooms.</td>
</tr>
</tbody>
</table>

a. What inference can you make from the information in the chart? (Circle the best answer.)

- Rocks and minerals were not important long ago.
- Rocks and minerals were important long ago and are still important today.
- We longer use rocks and minerals to make buildings.
Topic A

Rocks and Minerals

Mini Textbook
Rocks and Minerals

Contents

Introduction 4

Part I: The Properties of Rocks and Minerals

Introduction 6
Comparing Rocks and Minerals 7

Types of Rocks

Sorting Rocks by Size 10
Sorting Rocks by How They Were Formed 12

Properties 16

Colour 17
Lustre 18
Texture 20
Hardness 21
Presence of Carbonates 23

Crystal Shape for Minerals and Patterns of Rocks 23
Part II: Rocks and Minerals Are Part of Soil

Introduction 27

The Components of Soil 29

Type of Soil 32

Sandy Soil 33

Clay Soil 34

Silty Soil 35

How Rocks Break Down 36

Erosion 40

Wind 41

Water 42

Common Uses of Rocks and Minerals 44

In the Past 44

Today 46
Rocks and Minerals

Introduction

Rocks and minerals are all around us.

We see them everyday.
We use them everyday.

Some are so small, we cannot see them.
Others are bigger than a house.

This is a big rock found just outside the town of Okotoks, which is south of Calgary.
The rock is bigger than your school.

Rocks and minerals come in all different colours and shapes.

Some are very useful to people.
Others are not as useful to people.

The lead in your pencil is made from a mineral called graphite.
How are rocks and minerals different?

Scientists point out that rocks and minerals are not the same. They are, however, related.

A mineral is made entirely from the same substance. If you look at a piece of mineral carefully, you would see that it looks the same all the way through. The colour would be the same. The feel would be the same.

This is not a rock. It is a mineral called chalcocite. It is all one colour.

A rock is made up of pieces of minerals. Each rock is made from different amounts and types of minerals. Nature presses the minerals together and heats them until they become a rock. You can tell a rock is a rock because you can usually see different colours in it. We have names for minerals, but we do not have names for all rocks. That is because no two rocks are alike.

Rocks like this one have many colours. They are made up of two or more minerals.
Part I

The Properties of Rocks and Minerals

Introduction

In science, when we want to describe a rock or a mineral, we look at its properties.

Properties are the things that tell what a substance is like. A substance’s properties give you an idea of how that substance is different from other substances.

When it comes to rocks and minerals, we look at particular properties.

Before we look at the properties of rocks and minerals, let’s take a closer look at how rocks and minerals are alike and how that they are different.

Rocks and minerals are not exactly alike. We often find them in the same places, however.
Comparing Rocks and Minerals

It is not easy to tell the difference between rocks and minerals. There are so many kinds of them. It takes a scientist many years to know when something is a rock and when it is a mineral.

How Rocks and Minerals Are Alike

Rocks and minerals are alike in many ways.

- They are part of the earth.
- They are found in all parts of the earth, even at the bottoms of oceans.
- They take millions of years to form.
- They can be big or small.
- They are solids.

Under all this snow there are rocks and minerals.

The bottom of the ocean is covered with rocks and minerals.
How Rocks and Minerals Are Different

You learned before that minerals are only made of one type of substance. You also learned that rocks are made of two or more minerals.

You can most often see the different minerals that make up a rock. Each mineral has a different colour and shininess.

Can you see the different minerals that form this rock?

Sometimes it is very hard to see the different minerals that make up a rock. This is because the minerals are mixed together so much that they look all one colour.

This piece of obsidian looks all one colour. However, it is made of several minerals, like silicon, magnesium, and iron. They are all blended together.
Look at the chart below. It tells about some of the important ways that rocks and minerals are different.

<table>
<thead>
<tr>
<th>Minerals</th>
<th>Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made of only one substance</td>
<td>Made up of more than one mineral</td>
</tr>
<tr>
<td>Some are made up of crystals</td>
<td>Is not made up of a single crystal</td>
</tr>
<tr>
<td>Usually pretty</td>
<td>Not usually as pretty</td>
</tr>
<tr>
<td>Usually have a particular kind of shape</td>
<td>No definite shape</td>
</tr>
<tr>
<td>Colour is usually the same throughout</td>
<td>Colour is usually not the same throughout</td>
</tr>
</tbody>
</table>

**Garnet is a mineral that forms crystals. It is dark red.**
Types of Rocks

Rocks are not all the same. We can sort them into categories in different ways.

Sorting Rocks by Size

One way to sort rocks is by their size. We have names for the different sizes of rock.

**Mountain** – huge, giant hunk of rock that is tall and part of the earth

Mount Logan is Canada’s tallest mountain. It is found in the Yukon.

**Boulder** – large, taller than a person
Rock – large, but you can get your arms around it. It is usually jagged and has broken off of a bigger piece

River Rock – round rocks found along the edges and bottoms of fast-flowing rivers

Water makes river rocks smooth.

Stone – medium-sized. You could hold it in two hands

Pebble – small. You could hold it with two fingers

Sand – made up of tiny pieces of rock

Sand makes this beach a great place to have fun.

Grain – tiny, like one crystal of sugar or smaller

Dust – really fine powder

Speck – very small; like a speck of dirt
Not all rocks are formed in the same way. Scientists divide rocks into three groups. The rocks in each group were formed in the same way.

All the rocks in each group are similar in some ways, but in each group there are many different types of rocks.

1. Sedimentary Rocks

Sedimentary rocks are formed from layers of sand, shells, pebbles, and other materials. Over millions of years, more and more layers form. The weight of the top layers turns the bottom ones to rock.

Most of the earth's surface is covered with sedimentary rocks. If you cut a slice of the earth's surface away, you would most likely see sedimentary rocks. They look like ribbons of rock.

Most sedimentary rocks are softer than other types of rock. They break apart or crumble easily. They usually feel gritty.

Most sedimentary rocks formed at the bottom of a large body of water. They formed in layers.
The Hopewell Rocks in New Brunswick are sedimentary rocks that have been worn to their shape by the ocean water. They are made of a type of sedimentary rock called conglomerate.

This photo was taken at Writing-on-Stone Provincial Park near Milk River, Alberta. The strange rocks are called hoodoos. They are made of a sedimentary rock called sandstone. Wind and water have given them their odd shapes. Can you see the layers?
2. Igneous Rocks

Igneous rocks are formed from volcanoes. When a volcano erupts, liquid rock from inside the earth spits out onto the earth’s surface. This liquid rock is really hot. When the liquid rock cools, it forms igneous rocks.

We have igneous rocks thanks to volcanoes. When a volcano erupts, gases and liquid rocks spit out onto the earth’s surface.

There are many different types of igneous rock. Some are shiny and glasslike. Others have crystals in them.

Pumice is an igneous rock. It looks like a sponge, but it is very hard. It has tiny holes in it because gas bubbles were trapped in the rock while it was cooling.
3. Metamorphic Rock

Metamorphic rocks are formed under the surface of the earth.

Metamorphic rocks were once sedimentary or igneous rocks. When these rocks are put under a lot of pressure and heat, they change. The result is metamorphic rocks.

Slate is a metamorphic rock that is formed from a sedimentary rock called shale.

![shale](image1)  ![slate](image2)

Gneiss is a metamorphic rock formed from an igneous rock called granite.

![granite](image3)  ![gneiss](image4)
Properties

You learned earlier that rocks are made up of minerals. Minerals are made up of only one substance. For this reason, it is easier to tell about their properties.

Rocks are made up of different types of minerals.

Some rocks have names. For example, granite is the name for a whole family of igneous rocks, with different colours and patterns. What makes them a family is that all types of granite are made of the same three minerals.

Granite is the name for a family of rocks. They have many of the same properties.

What properties do scientists look at when describing rocks and minerals?

There are many different properties scientists look at when describing rocks and minerals.

The most common properties are listed on the new few pages.
1. Colour

Minerals will be the same colour throughout. Many times a particular mineral will always be the same colour. Other times, a particular mineral can be more than one colour.

Sulphur is a mineral that is always yellow.

The mineral corundum can be more than one colour. Blue corundum is called sapphire. Red corundum is called ruby.

Sapphire is blue. Ruby is red.

Rocks are usually more than one colour. But in some rocks the minerals are blended together so much that they are one colour.

Uluru is a giant rock found in Australia. It looks like it is all red. Really, it is made of sandstone. Sandstone is mainly made up of two minerals: quartz and feldspar.
Minerals and rocks can be all kinds of different colours from white to black, from red to blue, from green to orange, and everything in between.

Besides the usual colour names, we can describe a rock or mineral as being metallic, or non-metallic.

Other words to use are streaked, speckled, layers, dull, bright, light, and dark.

2. Lustre

Lustre tells what the surface of a rock or mineral looks like in the light. Here are some words used to describe a rock or mineral's lustre.

<table>
<thead>
<tr>
<th>Word</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dull</td>
<td>not shiny at all</td>
</tr>
<tr>
<td>waxy</td>
<td>looks like the surface of a candle</td>
</tr>
<tr>
<td>oily</td>
<td>looks greasy, like Vaseline</td>
</tr>
<tr>
<td>pearly</td>
<td>looks like a pearl</td>
</tr>
<tr>
<td>silky</td>
<td>has a shiny surface like a piece of silk or satin cloth</td>
</tr>
<tr>
<td>glassy</td>
<td>looks like glass</td>
</tr>
<tr>
<td>metallic</td>
<td>very shiny</td>
</tr>
</tbody>
</table>
Pumice is dull.

Opal is waxy.

Talc is pearly.

Quartz is glassy.

Gold is metallic.
3. Texture

Texture tells about how it feels when you touch it. You can usually tell what a rock or mineral’s texture is by looking at it.

However, the best thing to do is to pick up the rock or mineral and feel it with your fingers.

Some words to describe texture are:

- rough
- smooth
- uneven
- sharp
- bumpy
- jagged

This piece of conglomerate looks like many different-sized rocks. It has an uneven texture.

This emerald crystal is green in colour and smooth in texture.

This piece of marble is rough.
4. **Hardness**

Some rocks and minerals are harder than others. Some are so soft they fall apart easily. Some are so hard that it is next to impossible to cut them.

We test for hardness by figuring out how hard it is to scratch a rock or mineral. The hardest minerals are the hardest to scratch.

Talc is one of the softest minerals and is very easy to scratch. Diamond is the hardest mineral. Nothing can scratch it, except for another diamond.

![Talc](image1.png)  ![Diamond](image2.png)

Talc is the softest mineral. Diamond is the hardest.

**Describing Hardness**

We can use the following things to determine how soft or hard a rock or mineral is:

- fingernail
- copper penny
- iron nail
- piece of glass
- steel file
- piece of corundum
A fingernail can only scratch the softest rocks and minerals.
A copper penny can scratch things that are soft, but cannot scratch anything hard.
A piece of corundum can scratch just about anything. It cannot scratch diamond, though.

Scientists use numbers to tell how hard a rock or mineral is. Ten is the hardest. One is the softest.

<table>
<thead>
<tr>
<th>Number</th>
<th>What Can Scratch It</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>fingernail</td>
<td>Very soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Easily crumbles</td>
</tr>
<tr>
<td>2</td>
<td>fingernail</td>
<td>Soft</td>
</tr>
<tr>
<td>3</td>
<td>copper penny</td>
<td>Soft</td>
</tr>
<tr>
<td>4</td>
<td>iron nail</td>
<td>Semi-hard</td>
</tr>
<tr>
<td>5</td>
<td>iron nail</td>
<td>Hard</td>
</tr>
<tr>
<td>6</td>
<td>piece of glass</td>
<td>Hard</td>
</tr>
<tr>
<td>7</td>
<td>steel file</td>
<td>Very hard</td>
</tr>
<tr>
<td>8</td>
<td>steel file</td>
<td>Very hard</td>
</tr>
<tr>
<td>9</td>
<td>piece of corundum</td>
<td>Extremely hard</td>
</tr>
<tr>
<td>10</td>
<td>diamond</td>
<td>The hardest</td>
</tr>
</tbody>
</table>
5. Presence of Carbonates

Carbonates are substances found in many minerals.

We test to see if there is a carbonate in a rock or mineral by using acid. If we put a drop of acid on a rock or mineral and it starts to fizz, you can be sure there is a carbonate in it.

Vinegar is an acid. We can use vinegar to test to see if a rock or mineral has a carbonate.

6. Crystal Shape for Minerals and Patterns of Rocks

You learned before that most minerals form crystals. The crystals can be of different shapes.

Salt crystals are shaped like blocks.

An alum crystal is rounder in shape.
Calcium carbonate crystals look like thin squares.

These gypsum crystals were found in a cave in Mexico. They are over 10 m long and 1 m thick.

Quartz crystals are long and pointed.
Rocks can have many different patterns. The patterns found in rocks depend on the minerals that make them up and how they were formed.

Following are a few types of rock patterns:

Layers. Layered rocks are almost always sedimentary rocks.

This photo of layered rock was taken near Banff, Alberta.

Conglomerates. Conglomerates are also sedimentary rocks. They are made up of different-sized materials cemented together.

The Hopewell Rocks in New Brunswick are made of conglomerate rock. They look like piles of dirt with rocks in them. When you touch them, you find that they are rocks!

In this close-up photo the Hopewell Rocks look like dirt. They are not.
Wavy Layers. Many wavy layered rocks are sedimentary. Some wavy layered rocks are metamorphic. Heat and pressure made the layers become wavy.

This wavy-layered rock is near Bathurst Inlet in Nunavut.

Speckled. Most speckled rocks are igneous. Speckled rocks have crystals in them.

Granite rocks have speckled patterns.

Carbonate. Carbonate rocks start out as sedimentary rocks. Some become metamorphic rocks. Many carbonate rocks contain the fossils of sea animals.

This photo was taken in Cape Breton Island in Nova Scotia. Can you see the fossils of sea animals in this carbonate rock?
Part II

Rocks and Minerals Are Part of Soil

Introduction

We all know that farmers need soil in order for their crops to grow.
We all know that gardeners need soil in order for their gardens to grow.

Soil is not just important when it comes to the things humans plant.
Soil is also important when it comes to plants put in our world by nature.

Only a little bit of the land on earth is actually used for people to grow things. Most of the land is home to plants put in place by nature.
Soil covers almost all the land in the world.

In some places there are thick layers of soil. In other places the layer of soil is so thin you can just barely see it.

In northwest Ontario, the soil is so thin in some places that only a few plants grown amongst the rocks.

It takes millions of years for nature to make a thick layer of soil. Soil is always changing. Some of it is actually turning to rock! Some rocks are becoming soil! All this happens so slowly that we don’t even notice it.

In this section of Rocks and Minerals you will find out more about what soil is, the different types of soil, how soil becomes rocks, and how rocks become soil. You will also learn about some of the ways that humans use rocks and minerals.
The Components of Soil

Components are the things that something is made of. The components of soil are those things that make up soil.

The components of soil are not always exactly the same. It all depends on where you get the soil.

Here are some of the components you might find if you look closely at a sample of soil.

1. Dirt

Most soil is mostly dirt. Dirt is really very tiny specks of rocks and minerals.

Dirt can be many different colours: light brown, dark brown, grey, red, and black. The colour of dirt depends a lot on the particular kinds of rock and mineral specks it is made of.

The dirt in Prince Edward Island is red. This is because there is a lot of iron in the rocks that make up the dirt.
2. Sand

Sand is really just a tiny piece of rock or mineral. Some soil has a lot of sand in it. Other soil has very little sand in it.

3. Stones

Just like dirt and sand, stones are pieces of rock. They are much larger than sand.

This machine picks up stones from a farmer’s field. Farmers like dirt, but they do not like stones.

4. Dead and Rotting Plants Matter

When plants die, they become part of the soil. They begin to rot and turn brown and black. Finally, they seem to disappear into the soil altogether. They don’t actually disappear, but they break down so much that they no longer look like plants. When plants break down, they make the soil richer.

After harvest these wheat plants will begin to rot and become part of the soil.
5. Dead and Rotting Animals Matter

Just like plants, dead and rotting animals also become part of the soil. And just like plants, when dead animals break down, they no longer look like animals. Dead and rotting animals make the soil richer.

When this beetle dies, it will become part of the soil.

6. Small Animals

Many small animals are also part of the soil. They help break down rotting plants and animals.

Small animals like earthworms make the soil richer and looser.

The boulder in this field is too big to move away. Under the grass, in the soil, there are most likely other boulders just like it or even bigger.
Types of Soil

There are many different types of soil. We can sort them into groups in different ways. One way to group soils is by the size of the dirt pieces. Remember that dirt is really just tiny pieces of rocks and minerals.

The three main types of soil we have in our province are sandy, silty, and clay.

Three Types of Soil

Left: Sandy  Middle: Silty  Right: Clay

These potatoes could not grow without soil.
1. **Sandy Soil**

The pieces of dirt in sandy soil are quite large. They are made up mostly of sand. In sandy soil, the spaces between the pieces of dirt are also quite large. This means that water easily drains through it. This then means that sandy soils can dry out easily.

Farmers who have sandy soil in their fields often add dead and rotting plant matter. This helps the soil to drain more slowly and keep it moist.

It is hard to form sandy soil into a ball with your hands, even when it is wet. You can easily pour sandy soil out of your hand. This is because the size of the dirt pieces is so large.

![A handful of sandy soil](image1)

![Young plants struggling to grow in sandy soil](image2)
2. Clay Soil

The dirt pieces in clay soil are very tiny. In fact, they are so tiny that there is next to no space between them. Water does not easily go through them. Clay soils do not drain well.

When plants are planted in clay soil, their roots can rot because they sit in water too long.

If you put some moist clay soil into your hand, you easily make it into a ball. The ball will hold its shape.

Clay is used to make pots like this one. The pots can hold water.

Clay soil is not very good for planting crops. The roots of plants have a hard time growing in the clay. Farmers try to make this type of soil better by adding manure and dead and decaying plant matter.

Clay soil clumps up when dried. It is hard to break up the clumps.

This field of clay soil formed big hard pieces when it dried up.
3. Silty Soil

The dirt pieces in silty soil are medium-sized. They are not as large as sand, but are larger than clay. In some ways silty soil is like sandy soil. In other ways it is like clay soil.

Silty soil is the best for growing crops and garden fruits and vegetables. This is because it is one of the richest soils.

It is made up of minerals like Quartz and also fine organic particles. Organic particles are tiny pieces of things that were once living.

Silty soil is gritty like sandy soil, but it holds moisture better. It drains better than clay soil.

You can form silty soil into a loose ball, that will fall apart easily.

Silty soils are usually dark brown or black. They are found in the top layer of soil.
How Rocks Break Down

You learned that dirt is the most important component of soil.
You also learned that dirt is really just little pieces of rock.

You may wonder how a mountain or boulder can become dirt.
It takes a long time – millions of years.
Big rocks like mountains and boulders become dirt through **weathering**. In weathering, things like rain, wind, ice, and salt break rocks down.

Let us take a look at some types of weathering.

1. Wind

   When wind blows against big rocks, some of the pieces of the rocks break off. Then wind carries away the little particles of rock.

   Wind has shaped this sandstone into **hoodoos**. This photo was taken near Drumheller, Alberta.
Wind has carved out this arch in the country of Jordan.

2. Water

When water flows, it is strong. It can wear away the hardest rocks. The water carries away the little pieces of rock.

Flowing water has worn away the rock until it has formed a canyon. A canyon has steep rocky sides.

These river rocks were once jagged and sharp. They have become smooth as water runs over them.
3. Ice

When water freezes to form ice, it gets bigger. The force of the freezing water is so strong that it can split a rock in two.

This rock has broken into several pieces because of ice. Wind and water will also cause it to break down even more.

4. Tumbling

Sharp rocks become smoother when they tumble against each other.

These rocks became very smooth when they rubbed against other rocks. They were inside a glacier, which is a great big mass of moving ice. As the glacier moved, the rocks rubbed against each other and the rock underneath. All the sharp corners wore away.
5. Chemicals

Some substances in the air can also break down rocks. These substances are called chemicals. Some of these chemicals are in the air naturally. Others come from factory smokestacks.

Salt in the air near the Pacific Ocean has caused this rock to break down. It has made holes in the rock.

This old building is made of rock. It is beginning to wear away because of chemicals in the air.

This statue is also wearing away. The left hand photo shows the statue only 50 years ago. The right hand picture shows the statue today. Chemicals have worn away much of the statue.
Erosion

Weathering is the breaking down of rocks by wind, water, ice, tumbling, or chemicals. Weathering is the first step in turning rocks into soil.

The next step is erosion. Erosion happens when pieces of rock are moved from one place to another.

Big masses of moving ice called glaciers moved these rocks from the mountains to the plains.

Erosion and weathering usually happen together. As wind is loosening pieces of a big rock, it is also blowing those pieces to another place. As water is wearing away rock, it is carrying those pieces downstream. Chemicals may wear away rock and wind or water might carry those particles away.
When erosion moves a great amount of dirt to one spot, a thin layer of dirt is formed. After more erosion, more layers of dirt are formed. Soon plants begin to grow. When they die, they become part of the soil.

The layers of soil in this picture, taken in the country of United Kingdom, are not very deep. It is deep enough for some grasses to grow.

There are many types of erosion, but there are two kinds are the most important in our area.

1. Wind

Even a slight breeze can cause small particles of dirt to move. If you stand in a bare field on a windy day you will see and feel particles of dirt moving. Remember, dirt is another name for small particles of rock and mineral.

This is not a photo of a cloud. It is dirt being moved by wind.
Wind has filled up this ditch with dirt.

2. Water

If you have ever looked into a stream or a river and it looks muddy, you are seeing water erosion in action. The river is muddy because it is carrying particles of dirt.

Fast-moving water can carry rock particles farther and faster than slow-moving water.

Water can carry small particles farther than it can large particles.

This photo shows some people rafting on the Fraser River in British Columbia. The water is moving very fast. This means that the river is weathering away the rocks very quickly. It also means that the river is carrying a lot of rock particles.
When a river slows down, much of the dirt it was carrying settles out. That is, it stops moving.

The slower the river becomes, the more particles will settle out.

This is another photo of The Fraser River. Here it is flowing much more slowly. Much of the dirt it was carrying has formed islands in the middle of the river. These islands are made of soil. The soil is rich.

Weathering and erosion are happening all the time. In this way, even the largest rocks become dirt, and part of the soil, at some time.

It is hard to believe, but this large rock will someday become part of the soil.
Common Uses of Rocks and Minerals

For thousands of years humans have used rocks and minerals in their everyday lives. People learned how to shape rocks and minerals to make them useful.

In the Past

People used rocks and minerals to make their life better. Some ways that people long ago used rocks and minerals are:

- used caves for homes
- made tools to get food and make things
- carved messages in flat stones
- made clocks
- used stones to grind corn and wheat
- made steps out of stone
- made roads
- made buildings
- made pyramids

Roads were made from flat stones. A type of clock called a sundial was made of stone.
First Nations made hammers and arrowheads out of rocks.

The Greeks built this building out of stone thousands of years ago. It is still standing today.

These pyramids are built out of huge blocks of stone. They are thousands of years old. Many people visit them today.

These pictures were carved into the sides of rocks by early First Nations. They are found at Writing-on-Stone provincial Park near Milk River, Alberta.
Today

We use rocks and minerals in our lives more than ever. If you look around your school, your home, and your community, you will see many places where rocks and minerals are used.

Following are just a few examples:

- pencil leads
- dishes
- chalk
- sidewalks
- foundations for buildings
- coins
- metal pipes
- machinery

This stove and table saw are made from minerals.

The salt we use at the kitchen table is a mineral.
Coins are made by making some changes to rocks and minerals.

Some roofs are made from tiles that are made from clay.

Driveway pavers are made from concrete. Concrete is a mixture of stones, sand, and limestone.

These girls are on steps made of concrete.

This pot is also made of clay.

The tiles on the floor and walls are made from stone.

This saw blade is made of steel. Diamonds in edges make it sharp.
Topic B

Building with a Variety of Materials
About the Lessons

*Building with a Variety of Materials* is divided into two sections. Part I centres on the factors that students should take into consideration when undertaking any construction project. Part II involves students building various structures. In contrast to Part I, Part II essentially involves a series of hands-on building projects.

Teachers do have the option of skipping Part I entirely and going directly to Part II. In this case, teachers must incorporate the concepts and skills covered in Part I in the Part II lessons.

In Part II, it is not necessary that students do all the activities. They should do at least one project from each of the categories, however (See page 13.).

Finally, consider doing Grade Three Topic C: *Testing Materials and Designs* before doing this unit.

Mini Textbook

Each student will need a copy of the Mini Textbook, especially while doing Part I. Many of the independent activities require that students draw upon Mini Textbook information.

Materials

As building structures is the major thrust of this unit, teachers will need to gather many different types of materials. Most can be found around the school and at home. The following should be considered as essential:

- corrugated cardboard (lots; large boxes cut up work well)
- small boxes
- Plasticine (try to get the waterproof type like Ocaldo; Play Doh will not work)
- Popsicle sticks
- masking tape
- straws
- string
Science Grade Three
Topic B: Building with a Variety of Materials:

Contents

Part I: Building Materials

Lesson One Introduction 5
Lesson Two Building Materials 6
Lesson Three Joiners and Fasteners 7
Lesson Four Tools 8
Lesson Five Using the Right Materials 9
Lesson Six Good and Bad Design 10
Lesson Seven Workmanship 11
Lesson Eight Building with a Variety of Materials, Part I Test 12
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Nine</td>
<td>Introduction to Construction</td>
<td>14</td>
</tr>
<tr>
<td>Lesson Ten</td>
<td>Constructing Structures That Support Others</td>
<td>15</td>
</tr>
<tr>
<td>Lesson Eleven</td>
<td>Containers</td>
<td>16</td>
</tr>
<tr>
<td>Lesson Twelve</td>
<td>Bridges: Introduction</td>
<td>17</td>
</tr>
<tr>
<td>Lesson Thirteen</td>
<td>Beam Bridges</td>
<td>18</td>
</tr>
<tr>
<td>Lesson Fourteen</td>
<td>Arch Bridges</td>
<td>19</td>
</tr>
<tr>
<td>Lesson Fifteen</td>
<td>Truss Bridges</td>
<td>20</td>
</tr>
<tr>
<td>Lesson Sixteen</td>
<td>Cantilever and Suspension Bridges</td>
<td>21</td>
</tr>
<tr>
<td>Lesson Seventeen</td>
<td>Structures That AreModels of Living Things</td>
<td>23</td>
</tr>
<tr>
<td>Lesson Eighteen</td>
<td>Models of Structures in the Community</td>
<td>24</td>
</tr>
<tr>
<td>Lesson Nineteen</td>
<td>Building with a Variety of Materials, Part II Test</td>
<td>25</td>
</tr>
</tbody>
</table>
Lesson One

Concept: Introduction

Resources/Materials: Mini Textbook, pages 4 – 6
Worksheet #3B.1a (older students)
Work sheets #3B.1b and #3B.1c (younger students)
Variety of materials: try to include Plasticine, various papers, wood,
foil, Styrofoam, cardboard, glue, stapler, tape, string, etc.

Introduction: Hold up the materials you brought to class, one at a time. If you have grade one students
in the group, be sure to name them as you hold them up. Challenge students to tell you how all these
items are alike (can be used to build things).

Explain that the next unit of study is about building things. Students will have the chance to try their hand
at building during the second half of the unit.

Procedure:

1. Explain that the first thing we will do is to look at some of the materials we use to build things.


3. On the board write the headings:
   Stiff
   Bendable

   If necessary, go over the meanings of these words.

4. Explain that you will say the name of a building material and the students should tell you if the
material is “stiff” or “bendable”. Some words to use: paper, wood, Styrofoam, foil, corrugated
cardboard, rubber, plastic. Write the words under the appropriate heading. If a word can go under
both, write it under both.

5. Explain to students that we can sort building materials in several different ways. Have them help
you decide on some of these ways:

   Hard to Cut/Easy to Cut
   Recyclable/Not Recyclable
   Made of Paper/Not Made of Paper
   Strong/Weak

6. Distribute Worksheet #3B.1a to older students. Explain that students are cut the words apart;
then divide them into two or three categories. They are to write headings at the top of separate
pages in their notebooks, and then paste the words under the correct headings.
Distribute Work sheets #3B.1b and #3B.1c to younger students. Name each item and have
students point to the picture and repeat the word. On the worksheet have students fill in the
missing letters and write the whole word.

Assignments:

1. OPTIONAL. Read Mini Textbook, pages 4 – 6
2. Do Worksheet #3B.1b (older) OR Work sheets #3B.1b and #3B.1c (younger).
**Classifying Words**

**Directions:** The words in the boxes are the names of different kinds of building materials. Cut them apart and sort them into two or three groups. Paste them in these groups in your notebook. Write the heading for each group.

<table>
<thead>
<tr>
<th>plywood</th>
<th>white glue</th>
<th>construction paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>masking tape</td>
<td>elastic band</td>
<td>Plasticine</td>
</tr>
<tr>
<td>corrugated cardboard</td>
<td>foil</td>
<td>Bristol board</td>
</tr>
<tr>
<td>paint</td>
<td>screws</td>
<td>nuts and bolts</td>
</tr>
<tr>
<td>plastic bottle</td>
<td>glass bottle</td>
<td>Styrofoam cup</td>
</tr>
<tr>
<td>white photocopy paper</td>
<td>metal rings</td>
<td>newspaper</td>
</tr>
<tr>
<td>staples</td>
<td>wooden ruler</td>
<td>cement</td>
</tr>
<tr>
<td>pebbles</td>
<td>Magic Mending tape</td>
<td>string</td>
</tr>
<tr>
<td>Manila tag</td>
<td>cloth</td>
<td>glue stick</td>
</tr>
</tbody>
</table>
**Different Kinds of Materials**

**Directions:** Fill in the missing letters. Then write each word two times.

<table>
<thead>
<tr>
<th></th>
<th>glue</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g l __</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>paper</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p __ p __ r</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>wood</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>w __ d</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Paint

Foil

Cardboard

b______rd

c____rd

f____l

p____nt
Lesson Two

Concept: Building Materials

Resources/Materials: Mini Textbook, pages 7 – 11
Worksheets #3B.2a, #3B.2b, and #3B.2c (student copies)

Introduction: Review that building materials refer to things that are used to build or construct something else. Review also that when it comes to building materials, there are all sorts of things to choose from.

Point to any object in the classroom. Discuss what building materials were used to make a student desk. Ask students why other materials were not used. (e.g., Why wasn’t paper used to make the desk? Why wasn’t gold used?) Repeat for two more objects.

Explain that today’s lesson is all about what materials are used to make certain structures.

Procedure:

1. Have students turn to Mini Textbook, page 7. Guide the reading of pages 7 – 11. If you have the time, as you are discussing each of the structures, ask what kinds of materials would not be used.

2. Distribute Worksheets #3B.2a, #3B.2b, and #3B.2c. Go over the directions. (Younger students can draw pictures instead of writing words. OR Have older students help younger students.)

Challenge students to fill in all the boxes. They can put more than one word in each box, if necessary.

Assignments:

1. Read Mini Textbook, pages 7 – 11.
2. Do Worksheets #3B.2a, #3B.2b and #3B.2c.
Choosing Materials

Directions: In the boxes tell what materials would be needed to make each thing.

Chair

Table
Lesson Three

Concept: Joiners and Fasteners

Resources/Materials: Mini Textbook, pages 12 – 15
- Worksheets #3B.3a and #3B.3b (older students)
- Worksheets #3B.3c and #3B.3d (younger students)
- various joiners: glue, tape
- various fasteners: paper clip, nail, screw

Introduction: Display the items you have brought into class. Challenge students to see if they can find what is common about them. (join materials together)

Separate out the tape and glue (and other joiners). Ask students if they know how they are different than the other items. (stick materials together more or less permanently) Explain that they are called joiners.

The others are fasteners. Fasteners are used to connect two or more materials. You have to screw, pound, or push the fastener to make it do its job. Fasteners can be taken out, whereas joiners cannot. (Example: a paper clip can be remove, whereas glue and tape cannot without damaging the materials.)

Procedure:


2. Distribute Worksheets #3B.3a and #3B.3b (older students) OR Worksheets #3B.3c and #3B.3d (younger students). Go over the directions.

Assignments:

2. Do Worksheets #3B.3a and #3B.3b (older) OR Worksheets #3B.3c and #3B.3d (younger).
Joiners and Fasteners

Directions: Use Mini Textbook, pages 12 – 15 to help you with the questions.

1. Read each situation. Then tell what joiner or fastener you would use.

   a. Jacob wants to make a booklet out of five sheets of paper.

   ___________________________

   b. Linda wants to be able to close up the front of her jacket quickly.

   ___________________________

   c. Bill wants to make a sidewalk. He needs something to hold the sand and gravel together.

   ___________________________

   d. Jill wants to attach a knob to a cupboard door. She may want to change the knob some time in the future.

   ___________________________

   e. The blacksmith is making a piece of machinery. He wants to join two pieces of steel.

   ___________________________
2. Name two joiners that are sticky.


3. Name two joiners that must dry before they join materials together.


4. Name four fasteners that you must pound or push.


5. Name two fasteners that you must turn.


6. Name two fasteners that you must sew on before they can be used.


7. Name a fastener that must be bent before it works.


8. Name type of joiner that comes in a bottle or a stick.


Joiners and Fasteners

Directions: Use Mini Textbook, pages 13 to help you with the questions.

1. Match the words in the box with the pictures.

<table>
<thead>
<tr>
<th>glue</th>
<th>tacks</th>
<th>Velcro</th>
</tr>
</thead>
<tbody>
<tr>
<td>bolts</td>
<td>staples</td>
<td>nails</td>
</tr>
</tbody>
</table>

Worksheet #3B.3c
2. Circle the words than name fasteners in each sentence.

This is a picture of paper clips.

This picture shows nuts, bolts, and washers.

When cement dries, it joins things together.

Buttons hold your clothes together.
Lesson Four

Concept: Tools

Resources/Materials: Mini Textbook, pages 16 – 20
Worksheets #3B.4a, #3B.4b, and #3B.4c (older students)
Worksheets #3B.4d and #3B.4e (younger students)
Various tools: scissors, stapler, tape dispenser, hole punch, hammer, paper cutter, X-acto knife, etc.

Introduction: Review that building structures involves choosing materials and deciding how best to join them together.

Display the tools you have brought into class. Challenge students to tell you what else is needed when building things. (tools)

Procedure:

1. Explain that good builders use the right tool for the right job. Some tools are meant for cutting and shaping; other tools for joining and fastening.


3. If you have the time, ask students some “tool” questions, such as:
   
   What tool is best for cutting paper? (scissors, paper cutter)
   What tool is best for cutting wood? (saw)
   What tool is best for joining two pieces of plastic? (glue gun)
   What tool could be used for joining two pieces of cloth? (sewing machine or needle)

4. Distribute Worksheets #3B.4a, #3B.4b, and #3B.4c (older students) OR Worksheets #3B.4d and #3B.4d (younger students). Go over the directions.

Assignments:

2. Do Worksheets #3B.4a, #3B.4b, and #3B.4c (older students) OR Worksheets #3B.4d and #3C.4c (younger students).
Choosing the Right Tools

Directions: Use Mini Textbook, pages 16 – 20 to help you with the questions.

1. The answer to each riddle is the name of a tool.
   a. I am sharp.
      I have one blade that is jagged.
      
      What am I? ________________________
   b. I am sharp.
      I have two blades.
      I am usually used to cut paper.
      
      What am I? ________________________
   c. I am made of metal.
      I am used to turn bolts.
      
      What am I? ________________________
   d. I am long and straight.
      I am used to measure distances.
      
      What am I? ________________________
   e. I am long, but get shorter as I am used.
      I am in every student's desk.
      
      What am I? ________________________
2. Tell what tool or tools you would use for each of the following:

a. You want to make a booklet out of four sheets of paper.

b. You want to make a round hole in a piece of wood.

c. You want to fasten one piece of wood to another.

d. You want to twist two pieces of wire together.

e. You need a sheet of construction paper that is 30 cm wide and 45 cm long.

f. You need to make a small round hole in a piece of Manila tag.

g. You want to sew a button onto a shirt.
3. Unscramble each set of words to make rules about taking care of tools.

a. Store correctly your tools.

b. Ilying Do leave tools not around.

c. permission Always get use to tools.

d. Keep organized your tools.

e. tools right in the way Use.

f. working Keep in good order your tools.
**Tools**

**Directions:** Write sentences starting with the words

- This is a ________________.
- OR These are ________________.

Then draw a picture to go with each sentence.

<table>
<thead>
<tr>
<th>Sentence</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Sentence</td>
<td>Picture</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Five

Concept: Using the Right Materials

Resources/Materials: Mini Textbook, pages 21 – 23
- Worksheet #3B.5a (older students)
- Worksheets #3b.5b and #3B.5c (younger students)
- Sheet of paper

Introduction: Write the word “purpose” on the board. Discuss what it means. Discuss a few examples of purposes of objects in the classroom.

Procedure:

1. Ask students to explain the connection between the purpose of an object and the materials used to make it.

2. Hold up the sheet of paper. Explain that paper can be used to make a container. Discuss the kinds of containers paper would be appropriate for making (envelopes, box to hold very lightweight things).

3. Discuss the types of containers where using paper would not be appropriate. (Heavier things, wet things)

4. Conclude that a good builder chooses the materials, joiners, and tools that suit the purpose of the structure.


6. Distribute Worksheet #3B.5a (older students) OR Worksheets #3B.5b and #3B.5c (younger students). Go over the directions.

Assignments:

2. Do Worksheet #3B.5a (older) OR Worksheets #3B.5b and #3B.5c (younger).
**Using the Right Materials**

**Directions:** For each structure, tell what materials you would use and why.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Purpose</th>
<th>Materials You Would Use and Why</th>
</tr>
</thead>
<tbody>
<tr>
<td>cup</td>
<td>drink cold liquids</td>
<td></td>
</tr>
<tr>
<td>cup</td>
<td>drink hot liquids</td>
<td></td>
</tr>
<tr>
<td>monkey bars</td>
<td>children to play on</td>
<td></td>
</tr>
<tr>
<td>box</td>
<td>hold carpenter tools</td>
<td></td>
</tr>
<tr>
<td>toy dog</td>
<td>a newborn baby to play with</td>
<td></td>
</tr>
<tr>
<td>card</td>
<td>Mother's Day</td>
<td></td>
</tr>
<tr>
<td>sign</td>
<td>for the entrance to the colony</td>
<td></td>
</tr>
</tbody>
</table>
Using the Right Materials

Directions: Underline the sentence that goes with the picture.

- The shirt is made of cloth.
- The shirt is made of glass.

- The window is made of glass.
- The window is made of paper.

- The card is made of steel.
- The card is made of paper.

- The bin is made of steel.
- The bin is made of paper.
The table is made of wood.
The table is made of glass.

The wagon is made of wood.
The wagon is made of cloth.

The pencil is made of cloth.
The pencil is made of wood.

The house is made of stone.
The house is made of glue.
Lesson Six

Concept: Good and Bad Design

Resources/Materials: Mini Textbook, pages 24 – 26
Worksheet #3B.6 (transparency or enlargement)
11” X 17” paper

Introduction: Show the students the transparency or enlargement of Worksheet #3B.6. Explain that someone made a mistake either when they were designing or building this house. Challenge students to find out what it is. (Balcony has no access.)

Explain that this is an example of bad design. Design tells about how materials are shaped and put together to make a structure.

Procedure:

1. Explain that bad design actual happens quite often.


3. Once the reading is finished, summarize:
   - Bad design can occur if looks is emphasized too much.
   - Bad design occurs when the object cannot do what is it supposed to do.
   - Complex design does not necessarily mean good design. Sometimes simple is better.

4. Give students each a large sheet of paper (11: X 17”). Have them fold the paper in half. On one side the students should illustrate bad design. On the other side the students should make a corresponding illustration that shows good design. Finally, have the students write a sentence about each.

Assignments:


2. Make illustrations of good and bad design. Write captions for each.
Good and Bad Design
Lesson Seven

Concept: Workmanship

Resources/Materials: Mini Textbook, pages 27 and 28
Worksheets #3B.7a and #3B.7b (older students)
Worksheets #3B.7c and #3C.7d (younger students)

Introduction: Write the word “lemon” on the board. Explain that sometimes we call a machine, like a car, a lemon. Discuss what kinds of machines might be called lemons.

If necessary, clarify that a lemon is a machine that does not work properly from the beginning and that efforts to make improve do not seem to help.

Explain that a “lemon” is usually the result of poor workmanship. That is, the person or people who built that particular machine, made a mistake of some kind.

Procedure:

1. Students might have experience with objects that reflected poor workmanship. If they do, allow them a few moments to relate them.


3. Conclude that good workmanship is important. It takes time, but is well worth the effort.

4. Distribute Worksheets #3B.7a and #3B.7b (older students) OR Worksheets #3B.7c and #3B.7d (younger students). Go over the directions, if necessary.

Assignments:

1. Read Mini Textbook, pages 27 and 28.
2. Do Worksheets #3B.7a and #3B.7b (older) or Worksheets #3B.7c and #3C.7b (younger).
Directions: Use Mini Textbook, pages 27 and 28 to help you with the questions.

1. What is workmanship?

2. What are four reasons that good workmanship is important?
   a. 
   b. 
   c. 
   d. 

3. What are six signs of poor workmanship?
   a. 
   b. 
   c. 
   d. 

4. In the spaces below illustrate good and poor workmanship.

| Good Workmanship | Poor Workmanship |
Directions: Carefully cut out the boxes. The put them together to make an important message.
Science Grade Three Topic B: Building with a Variety of Materials, Part I
Worksheets

Workmanship
Lesson Eight

Concept: Building with a Variety of Materials, Part I Test

Resources/Materials: Building with a Variety of Materials, Part I Test (student copies)

Introduction: Explain that the first part of the unit is now almost complete. It is time for a test.

Procedure:

1. Distribute the tests.

2. If necessary, go through the test with students, question by question.
**Building with a Variety of Materials, Part I**

**Test**

1. Circle the names of the **two** materials that would be **most** important in building each object.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td><strong>bicycle</strong></td>
<td>wood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>metal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rubber</td>
</tr>
<tr>
<td>b</td>
<td><strong>envelope</strong></td>
<td>paper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>glue</td>
</tr>
<tr>
<td></td>
<td></td>
<td>screws</td>
</tr>
<tr>
<td>c</td>
<td><strong>bench</strong></td>
<td>wood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>soil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nails</td>
</tr>
<tr>
<td>d</td>
<td><strong>student’s desk</strong></td>
<td>paper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>metal</td>
</tr>
</tbody>
</table>
2. Circle the word that tells which joiner or fastener would be the best to use join each set of materials.

<table>
<thead>
<tr>
<th></th>
<th>join one piece of paper to another</th>
<th>screw</th>
<th>nail</th>
<th>glue</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>join two pieces of wood</td>
<td>screw</td>
<td>paper clip</td>
<td>cement</td>
</tr>
<tr>
<td>b</td>
<td>join two pieces of metal</td>
<td>glue stick</td>
<td>welding</td>
<td>tack</td>
</tr>
<tr>
<td>c</td>
<td>join a piece of wood to a piece of metal</td>
<td>button</td>
<td>nail</td>
<td>nut and bolt</td>
</tr>
</tbody>
</table>
3. Answer **yes** or **no** about these sentences about tools.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>a</strong></td>
<td>It is important to choose the right tools for the job.</td>
<td>yes</td>
</tr>
<tr>
<td><strong>b</strong></td>
<td>One tool can be used to do different things.</td>
<td>yes</td>
</tr>
<tr>
<td><strong>c</strong></td>
<td>It is best to leave your tools out when you are not around.</td>
<td>yes</td>
</tr>
<tr>
<td><strong>d</strong></td>
<td>Tools will last longer if you store them properly.</td>
<td>yes</td>
</tr>
<tr>
<td><strong>e</strong></td>
<td>Instead of keeping your tools in good working order, it is better to buy new ones each time.</td>
<td>yes</td>
</tr>
</tbody>
</table>
4. Think about each situation. Then circle the object that is **most likely** being built.

<table>
<thead>
<tr>
<th></th>
<th>The builder is buying lumber, nails, and shingles.</th>
<th>bicycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td>grain bin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>house</td>
</tr>
<tr>
<td>b</td>
<td>The builder is cutting some paper and getting a stapler ready to use.</td>
<td>bench</td>
</tr>
<tr>
<td></td>
<td></td>
<td>booklet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pencil box</td>
</tr>
<tr>
<td>c</td>
<td>The builder has some cloth, scissors, and thread.</td>
<td>grain bin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>box</td>
</tr>
<tr>
<td></td>
<td></td>
<td>apron</td>
</tr>
<tr>
<td>d</td>
<td>The builder has some metal and a welder.</td>
<td>bedside table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dresser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>piece of machinery</td>
</tr>
<tr>
<td>e</td>
<td>The builder has some clay.</td>
<td>table</td>
</tr>
<tr>
<td></td>
<td></td>
<td>flower pot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>chair</td>
</tr>
</tbody>
</table>
5. Use the information in the table to answer the questions.

**Materials Grade Three Students Used**

<table>
<thead>
<tr>
<th>Material</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>paper</td>
<td>5</td>
</tr>
<tr>
<td>wood</td>
<td>19</td>
</tr>
<tr>
<td>Styrofoam</td>
<td>0</td>
</tr>
<tr>
<td>metal</td>
<td>4</td>
</tr>
<tr>
<td>glass</td>
<td>10</td>
</tr>
</tbody>
</table>

a. How many students used metal? ___________________________

b. What material was used by the greatest number of students?

__________________________

c. Which material was not used by any grade three students?

__________________________

d. How many students used either metal or wood?

__________________________
Using Part II

Part II of *Building with a Variety of Materials* is comprised of hands-on activities, with the exception of Lesson Nine, which sets up this section.

Teachers can choose to make this section of the unit as extensive as the interest of the children and time constraints allow. While it is not necessary to do all of the activities, it is strongly suggested that teachers give students the opportunity to construct at least one structure in each of the following categories:

- Structures That Support Objects
- Containers
- Bridges
- Models of Living Things
- Models of Structures in the Community

Depending on your particular students, you may choose to have students work individually or in small groups. Some combination of both is most likely the best.

If you chose to skip Part I and go directly to Part II, it is important that you incorporate the following concepts into your lessons:

- The materials you choose should be appropriate for the function of the structure.
- The joiners and fasteners you choose should be appropriate for the structure.
- The tools you use should be appropriate for the materials. In addition, good maintenance and storage of tools are important.
- The success of a construction project is based on good design.
- Workmanship is important to the quality of the construction.
Lesson Nine

Concept: Introduction to Construction

Resources/Materials: Mini Textbook, pages 29 – 31
   Worksheets #3B.9a and #3B.9b (older students)
   Worksheets #3B.9c and #3B.9d (younger students)

Introduction: Review that the first part of the unit dealt with the types of materials used to build structures and the importance of using the right materials for the job and the importance to good design and workmanship.

Explain that the second part of this unit deals with actually building structures.

Procedure:

1. Explain that the word construction is a synonym for building. When you construct something, you build it.

2. Construction involves a process; that is, there are steps that must be followed. These steps must be followed in a particular order.

3. Today’s lesson involves looking at this process.


5. Then explain that students will be able to try their hands at several different kinds of projects. Guide the reading of Mini Textbook, page 31.

6. Distribute Worksheet #3B.9a and #3B.9b (older students) OR Worksheets #3B.9c and #3B.9d (younger students). Go over the directions.

Assignments:

2. Do Worksheets #3B.9a and #3B.9b (older) OR Worksheets #3B.9c and #3B.9d (younger).
Introducing to Construction

Directions: Use Mini Textbook, pages 29 and 30 to help you with the questions.

1. Number these steps in the construction process in the order they would happen.
   
   _____ Try the structure out to see how well it works. Make any changes, if necessary.
   
   _____ Make a plan that includes the structure’s design, the materials to be used, and how the materials will be put together.
   
   _____ Decide on the purpose of the structure.
   
   _____ Construct the structure.
   
   _____ Get all the materials together.

2. Think about the steps in the construction process.
   
   a. Which step do you think will take the most thinking?

   ______________________________________

   b. Which step do you think will take the most time?

   ______________________________________

   c. Which step do you think will be the most fun for you?

   ______________________________________
3. Match the steps in the construction process with their descriptions.

<table>
<thead>
<tr>
<th>purpose</th>
<th>plan</th>
<th>gather materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>construction</td>
<td>testing</td>
<td></td>
</tr>
</tbody>
</table>

a. In this step, you decide how you will go about constructing the structure. This involves making a design, deciding which materials to use, and how they should be put together.

b. In this step, you want to see how well your structure actually works. You want to know if it does what you want it to do, if it is easy to use, and if it holds up after a few uses. This is the time to make any necessary changes.

c. In this step, you think about how the structure will be used.

d. In this step, the builder tries to get the materials he or she will be using. If a particular thing is not available, the builder must try to get something that will work just as well.

e. In this step, the builder actually constructs the structure. This is where good workmanship comes into play. A good builder will spot places where the plan will not work and make changes.
Steps in Construction

Directions: Cut out the words. Then paste them in the correct order.

Gather materials
Purpose
Testing
Plan
Construction
Science Grade Three Topic B: Building with a Variety of Materials, Part II
Worksheets

Steps in Construction
Lesson Ten

Concept: Constructing Structures That Support Objects

Resources/Materials: Mini Textbook, pages 32 – 35
Worksheet #3B.10a (student copy for each activity done)
Worksheet #3B.10b, #3B.10c, or #3B.10d (student copies)

Introduction: Briefly review the steps in the construction process. Explain that the first project students will do is make a structure that can support an object. This means that it can hold the object up without collapsing or falling over.

Procedure:

1. Discuss that tables, chairs, and towers are examples of structures that support objects. They have to be strong and stable. **Stable means it will not tip over easily.**

2. Before making a plan, we must first find out how to make a structure strong and stable.


4. Following the reading, with students, summarize some of the things to keep in mind when trying to build in strength and stability. Write them on the board.
   - A tube shaped is stronger than a flat sheet.
   - More legs make something stronger and more stable.
   - Crossbars and trusses make a structure stronger.
   - Thicker legs make a structure stronger.
   - A structure is more stable if it is wider at the bottom.

5. If you like, demonstrate that a structure is more stable if it is wider at the bottom by having a student stand with his/her feet right together. Show students how easy it is to push the student off balance. Then have the same student plant his/her feet well apart; then try to push the student off balance.

6. Introduce one or more of the construction activities from Worksheets #3B.10b, #3B.10c, and #3B.10d. Then assist them as they go through the construction process.

7. Prior to their beginning the activity, distribute Worksheet #3B.10a, which has them document the construction process steps as they go through them. It is probably a good idea to have students show you their plan for approval before proceeding with gathering materials and construction.

Note: The main activity on each worksheet is quite simple, so that even very young students can succeed. There is an “additional challenge”, which is more difficult for older students to try.

Assignments:

1. Read Mini Textbook, pages 32 – 35.
2. Do one or more of the construction activities and complete Worksheet #3B.10a for each activity.
Science Grade Three Topic B: Building with a Variety of Materials, Part II
Worksheets

Structures That Support

Challenge: __________________________________________________________

Materials I will use: ________________________________________________

What my structure will look like:

How well the structure worked: _______________________________________

Changes I made: ___________________________________________________
Science Grade Three Topic B: Building with a Variety of Materials, Part II
Worksheets

Structures That Support Objects: Newspaper Tower

Challenge: Make a 30 cm tall tower out of newspapers. The tower must stand on its own.

Materials: newspapers masking tape

Hints:

- Tubes are stronger than sheets.
- The wider the base, the more stable the structure

Additional Challenge: Make a 30 cm tall tower out of newspaper that can support a mass of 1 kilogram. (a larger encyclopedia has a mass of about 1 kg)
Challenge: Construct a table with no legs that is at least 10 cm tall and can support a mass of 2 kilograms.

Materials: Choose from:
cardboard       Popsicle sticks       foil
paper           boxes (smaller)      tubes
masking tape    straws               glue
other items

Hints:

• Wider tables are more stable.
• Braces and trusses make structures stronger.
• If using white glue, let the table dry overnight.

Additional Challenge: Construct a table that has four legs and can support a mass of 2 kilograms.
**Structures That Support: Stool**

**Challenge:** Make a stool out of newspapers that can support your weight.

**Materials:** newspapers  
masking tape  
cardboard (approximately 30 cm X 30 cm)  
4 cardboard tubes

**Hints:**

- A tube shape is stronger than a flat sheet.
- A wider stool is more stable than a narrow stool.
- Cardboard is strong enough to make a good seat.

**Additional Challenge:** Construct a stool that has four legs that can support your weight.
Lesson Eleven

Concept: Containers

Resources/Materials: Mini Textbook, pages 36 – 38
Worksheet #3B.11a (student copy for each activity done)
Worksheet #3B.11b, #3B.11c, or #3B.11d (student copies)

Introduction: Briefly review what students learned about constructing structures that support. Explain that the next activity has to do with structures that are designed to hold other objects.

Procedure:

1. Have students suggest the names of items that are used to hold objects (box, cup, bathtub, etc.)

2. Discuss what student think might be some things to keep in mind when constructing a container. (how heavy the substance that will go in the container is, if it needs to be water proof, does it need to have a cover or lid, etc.)


4. As a group, decide what was learned about constructing containers. Write the ideas on the board.
   - Some containers need to be stronger than others.
   - The shape of the container must match what it has to hold.
   - Some containers must be waterproof.
   - Some containers must have lids.

5. Tell student they will now have a chance to make a container.


7. Distribute either Worksheet #3B.11b, #3B.11c, or #3B.11d. Go over the challenge. Have students fill in the first sections of Worksheet #3B.11a.

8. Help students, as needed, as they complete the challenge. Then have them complete the rest of Worksheet #3B.11a.

Assignments:

2. Do one or more of the construction activities and complete Worksheet #3B.11a for each.
Science Grade Three Topic B: Building with a Variety of Materials, Part II
Worksheets

Containers

Challenge: ____________________________________________________________

Materials I will use: ________________________________________________

My Plan: (Tell what you plan to do or draw a picture.)

How my container turned out: _________________________________________

How I improved by container: _________________________________________

Worksheet #3B.11a
**Containers**

**Challenge:** Construct an envelope that can hold a greeting card that is 10 cm wide and 15 cm long.

**Materials:**
- large white paper (approximately 28 cm X 43 cm)
- glue or tape
- ready-made envelope
- other materials, as needed

**Hints:**

- Carefully take apart a ready-made envelope to see how it is shaped and how it is folded.

**Additional Challenge:** Design an envelope that can be used more than once.
Containers

Challenge: Construct a pot out of Plasticine that can hold 125 mL of water.

Materials: Plasticine (must be waterproof)
measuring cup water

Hints:

- Measure 125 mL of water into the measuring cup so you can see how big your pot needs to be. Then make your pot a little bit bigger.
- Knead the Plasticine for a few minutes to make it softer.
- Pat the Plasticine out into a flat circle first. Then pull up the edges to make sides. Use your fingers to smooth out the sides.

Additional Challenge: Construct a waterproof Plasticine pot made from long ropes of Plasticine. The ropes should be about 1 cm in diameter.
Containers

Directions: Make a box that can hold 10 paper clips, 3 erasers, and four unsharpened pencils. The box does not need to have a lid. Decorate your box.

Materials: Manila tag tape
            glue gift box
            crayons

Hints:

- Use the paper clips, erasers, and pencils to help you figure out how wide, long, and high the box needs to be. Don’t forget to make it just a little bit wider, longer, and higher, just to be safe.
- Take a careful look at the gift box to see how it is made. If you can, unfold the side of the gift box to see the shape.
- Measure, cut, and fold very carefully.

Additional Challenges:

1. Make a lid for your box. The lid should fit snugly, so that it does not come off too easily.

2. Make a box that has a flap for a lid.
Note: Bridge construction is relatively complex. It is recommended that all students do Lesson Twelve and Thirteen. Teachers can then choose if they want to do any of Lessons Fourteen, Fifteen, or Sixteen they wish to do with their students.

Lesson Twelve

Concept: Bridges: Introduction

Resources/Materials: Mini Textbook, pages 39 – 44
Worksheets #3B.12a and #3B.12b (older students)
Worksheets #3B.12c (younger students)

Introduction: Explain that one of the biggest challenges human have to overcome is how to get across rivers and canyons. The answer is by building bridges.

Procedure:

1. Have students describe some of the bridges in the local area. Discuss what might make them strong enough to hold up cars, trucks (and trains). (supports every so often, strong materials, good design)

2. Explain that there are several different types of bridges. They are put into groups according to how they are constructed. Some bridges are more suited to some situations than they are to others. Some bridges are a combination of two or more bridge types.

3. Have students turn to Mini Textbook, page 39. Guide the reading of pages 39 – 44. This may take some time, as there may be many words that are unfamiliar to the students. Some words to review:

   bridge deck supports (also called piers)
   span – the length of the bridge

4. Distribute Worksheets #3B.12a and #3B.12b (older students) OR Worksheet #3B.12c (younger students). Go over the directions.

Assignments:

1. Read Mini Textbook, pages 39 – 44.
2. Do Worksheets #3B.12a and #3B.12b (older) OR Worksheet #3B.12c (younger).
1. Match the pictures of the bridges with their names.

   a.   _____ suspension

   b.   _____ cantilever

   c.   _____ beam

   d.   _____ truss

   e.   _____ arch

Worksheet #3B 12a
2. Match the names of the bridges with their descriptions.

<table>
<thead>
<tr>
<th>beam</th>
<th>arch</th>
<th>truss</th>
<th>cantilever</th>
<th>suspension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These bridges hang from giant cables that curve over towers at either end.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These bridges are made of a one long strong piece that rests on either side of a river.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These bridges use structures made up of many triangles.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These bridges are supported by arches.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>These bridges are made up of two beams. Each beam rests on one of the shores. The two beams meet in the middle.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Label the diagram of the bridge.

supports  rail  bridge deck

Worksheet #3B.12b
Directions: Draw each type of bridge.

beam bridge

arch bridge

truss bridge

cantilever bridge

suspension bridge
Lesson Thirteen

**Concept:** Beam Bridges

**Resources/Materials:**
- Mini Textbook, page 40
- Worksheet #3B.13 (student copies)
- several thick textbooks (or encyclopedia volumes)
- strip of corrugated cardboard (approx. 10 cm X 50 cm)
- 500 g (approx.) object (gravel in a small plastic sour cream container will do)

For students:
- corrugated cardboard
- Popsicle sticks
- string
- other materials

For the teacher:
- glue (glue gun, if possible used only by teacher)
- tongue depressors
- cardboard tubes
- **paper cutter (to be operated by teacher only)**

**Introduction:** Briefly review the characteristics of a beam bridge. (If necessary, have students refer back to Mini Textbook, pages 40).
Explain that students will later construct their own beam bridges.

**Procedure:**

1. Stand two textbooks on end as far apart as possible, so that they will still support the cardboard strip. Explain that the cardboard is like the bridge deck and the books are like the shores of a river. Show students that the strip can span the distance between the books without bending. Then put a little downward pressure on the cardboard with your hand. Note that the cardboard bends. Explain that when people and vehicles go over the bridge, they put pressure on the bridge deck.

2. Stand a third textbook up in the middle of the cardboard. Explain that this is like a support. Add more textbooks. Note that the more supports in place, the less the bridge deck bends.

3. Next discuss how the direction the ribs in the cardboard affects how bendable it is.

4. Explain that the challenge for students is to build a beam bridge that can go over a span of 30 cm and support a mass of 500 g, with no supports.

5. Point out the items the students have to work with.

6. Distribute Worksheet #3B.13. Have them make their plan on the worksheet, show you, and with your approval, proceed with construction.
**NOTE:** Using a glue gun and a paper cutter will greatly help the students. However, most primary grade students should not operate these on their own.

7. When the construction is complete, have them test out their beam bridge. They should make revisions, if necessary.

**Assignments:**

Make beam bridge and complete Worksheet #3B.13.
Science Grade Three Topic B: Building with a Variety of Materials, Part II
Worksheets

Beam Bridge

Challenge: Construct a beam bridge that spans a gap of 30 cm and can support a mass of 500 g.

Materials I will use: ____________________________________________

______________________________________________________________

______________________________________________________________

What my bridge will look like (draw picture and label the picture):

How my bridge turned out: ______________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

Changes I made: ______________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________
Lesson Fourteen (Optional)

Concept: Arch Bridges

Resources/Materials: Mini Textbook, page 41
Worksheets #3B.14a and #3B.14b (student copies)
sheet of Manila tag or light Bristol board
1 kg mass
For students: corrugated cardboard
sheets of Manila tag or light Bristol board
Popsicle sticks (or tongue depressors)
Plasticine
**glue gun and paper cutter (operated by teacher only)**
other materials

Introduction: Briefly review what students learned about the construction of a beam bridge. Then go over the characteristics of a beam bridge. (If necessary, refer students to Mini Textbook, page 41) Explain that today students will have a chance to construct an arch bridge.

Procedure:

1. If necessary, review that with arch bridges, arch or arches can support the bridge deck from below or from above.

2. Take a sheet of Manila tag or Bristol board. Show students how to bend it into an arch shape. Put a little pressure on top to show how the arch shape itself helps withstand the pressure. Then show students how the ends of the arch want to move outward when pressure is place on the top of the arch. Explain that arch bridge builders attach the ends of the arch to **abutments**. Abutments are blocks that will hold the ends in place.

3. **Be sure to emphasize that the arch shape is strong because the mass is distributed evenly. No one point on the arch supports greater amount of mass than another point.**

4. Display the materials you have brought to class for students to use. Explain that their challenge is to build an arch bridge that will span a gap of 30 cm and carry a load of 1 kg. Warn students that this is a tricky type of bridge to build and not get discouraged if things don’t go as planned the first time.

5. Distribute Worksheets #3B.14a and #3B.14b. They should make a plan, show it to you for approval, and then begin construction.

6. Finally, students should complete Worksheets #3B.14a and #3B.14b.

Assignment:

Construct an arch bridge and complete Worksheets #3B.14a and #3B.14b.
Arch Bridge

Challenge: Construct an arch bridge that spans a gap of 30 cm and can hold a 1 kilogram mass.

Materials I will use: ___________________________________________

________________________________________

________________________________________

What is your plan for each of the following?

What the arches will be made of: _________________________________

What the bridge deck will be made of: ___________________________

What you will use for abutments: ________________________________

How you will attach the bridge deck to the arches:

________________________________________

________________________________________

________________________________________

How you will attach the ends of the arches to the abutments:

________________________________________

________________________________________

________________________________________
Draw a picture of your arch bridge. Label the arches, bridge deck, and abutments.

How well did your arch bridge work?

What changes did you make?

Where is the strongest part of an arch?
Lesson Fifteen (Optional)

Concept: Truss Bridges

Resources/Materials: Mini Textbook, page 42
Worksheet #3B.15a (enlargement or transparency)
Worksheets #3B.15b and #3B.15c (student copies)
4 strips of Manila tag (approx. 2 cm X 10 cm)
single hole punch 4 brass fasteners
glue gun and paper cutter (operated by teacher only)
1 kg mass
For students: corrugated cardboard masking tape
Popsicle sticks cardboard tubes
Styrofoam meat trays straws
masking tape paint sticks (ask for them at hardware store)
other materials pipe cleaners

Introduction: Review that it was the strength of the beam itself and of the supports that made a beam bridge strong. Explain that the strength of a truss bridge comes from trusses. A truss is a structure that is made of triangles.

Explain that today students will make a truss bridge. If necessary, refer students to the information about truss bridges on Mini Textbook, page 42.

Procedure:

1. Punch holes at both ends of each of the four Manila tag strips. Form the four strips into a square and fasten them together using the brass fasteners. Show the students how the square shape can change to a more diamond shape. Then remove one of the strips so that you have a triangle. Show students how the triangle is rigid.

2. Explain that trusses are rigid because they are formed entirely of triangles. Show the various truss patterns shown on Worksheet #3B.15a (transparency or enlargement). Point out that the top and bottom pieces are one continuous piece.

3. Explain that a truss bridge is a little like a beam bridge. The trusses are added to the sides of the bridge deck to give it more strength. Longer truss bridges have supports, just like beam bridges.

4. Explain that the challenge for today is to construct a truss bridge that can span a 30 cm gap and support a mass of 1 kg.

5. Show students the materials they have to choose from. Distribute Worksheets #3B.15b and #3B.15c.

6. Once students have submitted their plans for your approval, they can begin construction. Once construction is complete, they should test out their bridge, and make any revisions necessary.

Assignment:

Construct a truss bridge. Complete Worksheets #3B.15b and #3B.15c.
Challenge: Construct a truss bridge that spans a gap of 30 cm and can support a mass of 1 kg.

Materials I will use: _____________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Materials I will use to make the trusses: _________________________________________
____________________________________________________________________________
____________________________________________________________________________

How I will join the pieces used to make the trusses: ______________________________
____________________________________________________________________________
____________________________________________________________________________

Material I will use to make the bridge deck: ___________________________________
____________________________________________________________________________
____________________________________________________________________________

How I will attach the trusses to the bridge deck: _________________________________
____________________________________________________________________________
____________________________________________________________________________

Picture of the trusses:

Worksheet #3B.15b
Picture of my truss bridge:

How well my truss bridge worked:

Changes I made:

What makes a truss bridge strong?
Lesson Sixteen (Optional, Demonstration Lesson)

Concept: Cantilever and Suspension Bridges

Resources/Materials: Mini Textbook, pages 43 and 44
                  Worksheet #3B.16 (transparency or enlargement)
                  2 wooden rulers (30 cm) or paint sticks
                  2 Popsicle sticks          masking tape
                  2 textbooks or encyclopedias
                  string                    piece of corrugated cardboard (30 cm X 50 cm)
                  2 push pins

Introduction: Explain that cantilever and suspension bridges are quite common. It is often difficult to understand how they work, however.

Procedure:

1. Review cantilever bridges by having students turn to Mini Textbook, pages 43. Note that cantilever bridges almost always use trusses (structure composed of triangles) to give the bridge deck strength.

2. Place one of the rulers or paint sticks on the edge of table or deck so that two-thirds of the length of the ruler is sticking out over the edge. Hold the part of the ruler on the table firmly. Tell the student that a beam that sticks out from the edge is cantilevered.

3. Press down on the protruding end. Note how the end bends. Explain that cantilevered bridges use two beams that are cantilevered from either side of a river and then joined. (Cantilever another rule from another table and position the two rulers so that they meet. Use Popsicle sticks as "splints" and secure with tape. Show students how the Popsicle sticks make the place where the two rulers meet more rigid. Cantilever bridges use trusses and supports to make the bridge deck more rigid.

4. Now turn the students’ attention to suspension bridges. Have them turn to Mini Textbook, page 44 to refresh their memories. Remind students that with a suspension bridge, the bridge deck is actually hanging from two cables. The cable go over two towers and then are firmly anchored to either side of a river bank.

5. To show students how this works, do the following demonstration: Tie a long string around the tops of two books. Press down on the middle of the string. The pressure on the string makes the books topple over.

Continued…
Lesson Sixteen (continued)

6. Next take a piece of corrugated cardboard. Anchor one end of the string to the cardboard by tying it to a push pin. Then drape the string over two textbooks placed about 30 cm apart. Secure the other end of the string to a push pin on the other side of one of the textbooks. (See the diagram below.)

Push down on the string. Notice that the books stay upright.

7. Explain the books are like the towers of a suspension bridge. The push pins are like the anchors.

8. Explain that the bridge deck is hung from the suspension cables by using other cables. These cable go up and down connecting the suspension cable to the bridge deck. Show them the transparency or enlargement of Worksheet #3B.16 (also reproduced below).

9. If you have the time, you might have students try constructing a cantilever or a suspension bridge.

Assignment:

There is no specific assignment for this lesson. If you like, have students make pictures of one or both types of bridges.
Suspension Bridge

- Suspension cable
- Tower
- Suspenders
- Deck
- Stiffening girder
- Anchorage block
- Abutment
- Tower foundation
Lesson Seventeen

Concept: Structures That Are Models of Living Things

Resources/Materials: Mini Textbook, pages 45 and 46
Worksheet #3B.17a and #3B.17b (optional, student copies)
Worksheet #3B.17c (student copies)
doll or stuffed animal, if possible
pictures of various animals/birds/reptiles/amphibians
Plasticine toothpicks straws

Introduction: If you brought in a doll or stuffed animal, show it to students. Tell a little bit about how you came to get it, if you like. Explain that any doll or stuffed animal is really a model based on a real living thing.
Explain that today, students will have the chance to use Plasticine to make a model of a living thing.

Procedure:

1. Explain that the first step in making a model of a living thing is to examine closely what the living thing looks like.

2. If you brought in pictures, show the pictures to the students, pointing out various features of each of the animals, birds, etc. (If you did not bring in pictures, use the animals and birds on Worksheet #3B.17a and #3B.17b.) For example:
   - Elephants have big heavy bodies. They have large heads and their legs are big around.
   - Horses have long legs. They narrow at the bottom and wide at the top.
   - A Canada goose is quite fat. Its legs are short, but very skinny.

3. Then have one of the students go to the front of the room. Describe that person’s body. Discuss the proportions and shape.

4. Discuss that most animals have bones. You cannot see the bones, but they are there. The bones help to support the muscles. This way the animal can stand and move around without collapsing.


6. Tell students they are going to use Plasticine to construct a model of some kind of living thing. Explain that using toothpicks and pieces of straw will do the same thing as bones in real living things. Note: You can leave the assignment wide open or you can restrict it. For example, “You must choose an animal or bird that lives on the colony.”

7. Once the models are made, have students complete Worksheet #3B.17c.

8. OPTIONAL. Try making models using other materials: boxes, paper, wire, etc.

Assignments:

1. Read Mini Textbook, pages 45 and 46.
2. Make model of a living thing and complete Worksheet #3B.17c.
3. OPTIONAL. Try making models using non-Plasticine materials.
Making Models of Living Things – Page 2
Challenge: Construct a model of a living thing that can stand on its own.

My living this is a ________________________________.

Materials I used: ________________________________

Picture: 

What was the easiest thing about making the model?

____________________________________________________________________________________

What were the two most difficult things about making the model?

____________________________________________________________________________________

____________________________________________________________________________________
NOTE: If possible, take the students out for a short walk around the community. It may be a good idea to let the German teacher know ahead of time.

**Lesson Eighteen**

**Concept:** Models of Structures in the Community

**Resources/Materials:** Mini Textbook, pages 47 and 48
Worksheet #3B.18 (student copies)
geometric solids (cube, rectangular prism, triangular prism, cone, pyramid, cylinder)
small boxes
cardboard tubes
straws
Plasticine
clear acetate
Other materials
glue gun, X-acto knife, and paper cutter (operated by teacher)
corrugated cardboard
foil
Popsicle sticks
construction paper

**Introduction:** Explain that our final construction project for the unit involves making models of structures in the community.

**Procedure:**

1. Explain that most structures are based on some basic shapes. Hold up each of the geometric solids and name them.


3. If you can, take the students out for a walk around the community. Take the geometric solids with you. Use the geometric solids to show how the various buildings and other structures usually resemble these solids; e.g., the school is a triangular prism on top of a rectangular prism; the Quonset is half a cylinder; a grain bin is a cone on top of a cylinder.

4. Have individuals or groups select a structure in the community; then make a model of that structure. Show students the materials you have. Explain that you might not have everything they need, but they can bring it from home, with parental permission, or you will try to secure it for them.
Give tips as needed. For example: foil wrapped around a paper tube piece can be the bottom part of a grain bin.

5. Once the structures have been completed, distribute Worksheets #3B.18a and #3B.18b. Go over the directions.

6. OPTIONAL. Make other structures, such as playground structures, wagons, etc.

**Assignment:**

1. Make a model of a structure in the community; then complete Worksheets #3B.18a and #3B.18b.
2. Make other non-building structures.
**Challenge:** Construct a model of one of the structures in your community.

**Structure I constructed:**

**Materials I used:**

---

**Geometric solids that make up my structure:**

- cube
- rectangular prism
- triangular prism
- pyramid
- cylinder
- sphere
- cone
Picture of my structure:

How the structure turned out:  

Changes I made:  

What I learned:  

Lesson Nineteen

Concept: Building with a Variety of Materials, Part II Test

Resources/Materials: Building with a Variety of Materials, Part II Test (student copies)

Introduction: Explain that the unit on Building with a Variety of Materials is not at an end. It is time for a test.

Procedure:

1. Distribute the tests.

2. If there are students who cannot read the test independently, then consider going through the test, question by question, with the students.
Building with a Variety of Materials, Part II

Test

1. Below are the steps in the construction process. Number them in the correct order.

   ____ Gather the materials you will need.

   ____ Make a plan.

   ____ Build the object.

   ____ Test to see if the object can do what it is supposed to do.

   ____ Decide on the purpose of the object.

2. Circle the best answer to each question.

   a) Judy wants to make a stool. She wants to make sure it is stable. What should Judy’s stool look like?
      - tall and narrow
      - short and wide
      - short and narrow

   ![Stool Image]
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b</strong></td>
<td>John built a tower. It kept on falling over. What should he do so it will not fall over?</td>
</tr>
<tr>
<td></td>
<td>• Add more weight to the top.</td>
</tr>
<tr>
<td></td>
<td>• Make it wider in the middle.</td>
</tr>
<tr>
<td></td>
<td>• Make it wider at the bottom.</td>
</tr>
<tr>
<td><strong>c</strong></td>
<td>Susie has to make a container that will hold milk. What kind of material should Susie use?</td>
</tr>
<tr>
<td></td>
<td>• something that is waterproof</td>
</tr>
<tr>
<td></td>
<td>• cardboard</td>
</tr>
<tr>
<td></td>
<td>• something heavy</td>
</tr>
<tr>
<td><strong>d</strong></td>
<td>Joe built a bridge. When he went to test it, he found it was not strong enough in the middle. What should Joe do?</td>
</tr>
<tr>
<td></td>
<td>• Put a support in the middle of the bridge deck.</td>
</tr>
<tr>
<td></td>
<td>• Use a narrower bridge deck.</td>
</tr>
<tr>
<td></td>
<td>• Use a wider bridge deck.</td>
</tr>
</tbody>
</table>
3. Match the bridges with their names. Write the letters beside the pictures.

| a. beam     | b. arch     | c. truss    |
| d. cantilever | e. suspension |          |

---

[Bridge Diagrams]

---
4. Circle the best answer to each question.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Matthew made a model of an elephant out of Plasticine. He found that the elephant’s leg could not hold the weight of the elephant’s body. What could he do?</td>
</tr>
<tr>
<td></td>
<td>• Put straws or toothpicks inside the legs to make them stronger.</td>
</tr>
<tr>
<td></td>
<td>• Make the legs a skinnier.</td>
</tr>
<tr>
<td></td>
<td>• Make the elephant’s ears bigger.</td>
</tr>
<tr>
<td>b</td>
<td>Rebecca wanted to make a straw look like it was made of metal. What could she do?</td>
</tr>
<tr>
<td></td>
<td>• Paint the straw with green paint.</td>
</tr>
<tr>
<td></td>
<td>• Make sure the straw was not too long.</td>
</tr>
<tr>
<td></td>
<td>• Cover the straw with foil.</td>
</tr>
<tr>
<td>c</td>
<td>Shelley wanted to make a model of her school. Her teacher told her she could choose a box to start her model. What shape of box should Shelley choose?</td>
</tr>
<tr>
<td></td>
<td>• round</td>
</tr>
<tr>
<td></td>
<td>• rectangular</td>
</tr>
<tr>
<td></td>
<td>• heart-shaped</td>
</tr>
<tr>
<td>d</td>
<td>Jacob made a model of hog barn. He used blue construction paper to make the roof. The roof kept on caving in. What could Jacob use to make his roof instead of blue construction paper, do it won’t cave in?</td>
</tr>
<tr>
<td></td>
<td>• foil</td>
</tr>
<tr>
<td></td>
<td>• red construction paper</td>
</tr>
<tr>
<td></td>
<td>• cardboard</td>
</tr>
</tbody>
</table>
5. Write the letter of **one** geometric solid that goes with each building.

- a. cube
- b. rectangular prism
- c. triangular prism
- d. pyramid
- e. cylinder
- f. sphere
- g. cone
Topic B

Building with a Variety of Materials

Milltown Colony, 1890. Over a hundred years ago many colony building were made of stone.
Science Grade Three Topic B: Building with a Variety of Materials
Mini Textbook

Building with a Variety of Materials

Contents

Introduction 4

Part I: Building Materials

Building Materials 7
Joiners and Fasteners 12
Tools 16
Using the Right Materials 21
Good and Bad Design 24
Workmanship 27
Part II: Construction

Introduction 29

Types of Construction Projects 31

Structures That Support Objects 32

Containers 36

Bridges 39

Structures That Are Models of Living Things 45

Models of Structures in the Community 47
Building with a Variety of Materials

Introduction

Look at all the things there are around you.

If you are in school, you most likely see desks, chairs, and tables. You might also see shelves for books, a pencil sharpener, pencil cases, and many other things.

Most things in a school have been built.

If you step outside, you will see all the buildings in your community: houses, the kitchen, barns, shops, and grain bins.

You might also see cars, trucks, vans, tractors, farm machinery, clotheslines, and wagons.

Who do you think built what this young man is sitting on?
Inside your home, there are tables and chairs, beds, dressers, and lamps.

What has been built in this photo?

What do all of these things have in common? They are all things that have been built.

Some things are simple to build. Some things are hard to build. They take more time.

Before a person builds something, he or she has to make a plan. In order to make a good plan, the person must ask several questions:

- What will it be used for?
- Who will be using it?
- What materials will I need?
- What should I use to join the parts together?
- How much of each material will I need?
- How much will it cost?
- What tools will I need?
Only when a plan has been made, can the actual building begin.

Good builders are always careful to do the best job they can.
To do this, they must always be thinking about what they are doing.

Building things is fun.
Being able to build something that can do what it is supposed to do feels good!

A carpenter’s job is to build houses and furniture. But a carpenter is not the only person that builds things.
Building Materials

Building materials are the things that are used to make something. Building materials must be changed in some way and then put together to make the object. This might mean cutting, bending, and melting. It could also mean punching a hole, twisting, and rolling.

The materials that a builder chooses to make an object depend mainly on
- what the object will be used for,
- who will use the object,
- and how much the materials cost.

Let’s take a look at some objects and the materials needed to build them. Not all of the materials needed are shown. Try to figure out what has been left out.

![Pop-Up Card](image)

![Paper](image)

?
Science Grade Three Topic B: Building with a Variety of Materials
Mini Textbook

- steel
- rubber

Truck

- glass
- nuts and bolts

?
Joiners and Fasteners

Some of the materials used when building things are joiners and fasteners.

Experts use the words joiners and fasteners to mean two different things.

**Joiners** are materials that hold other materials together more or less forever. Glues, pastes, welds, tapes, and cements are example of joiners.

**Fasteners**, on the other hand, join two or more objects together, but they are designed so that they can be put in and also taken out. Screws, nuts and bolts, nails, and tacks are examples of fasteners.
Grade three students can use the words *joiners* and *fasteners* as if they mean the exact same thing.

Let's take a look at some joiners and fasteners.
In this batching plant, cement is used to join gravel and sand to make concrete.

The blacksmith welds two pieces of metal together. He is joining them.

Two different fasteners are used in this photo. The girl's shirt closes with snaps. The boy's shirt closes with buttons.
Choosing Joiners and Fasteners

Builders decide which joiners and fasteners to use by thinking of several different things:

- How will the object be used?
- How strong does it need to be?
- Does it need to be waterproof?
- What materials it is going to join?
- How big should the joiner or fastener need to be?
- Do I want the materials to hold together forever or do I want to be able to separate them?

Buttons are useful for fastening clothing, but not for holding a car together.

Different kinds of nails are used for different purposes.
Tools

An important part of building is using tools.

Good builders try to use the right tools and use them in the right ways. This helps them to make what they are building better.

Some tools are small and easy to use. Other tools are large and harder to use.

Some tools can be used by young children. Other tools should only be used by adults.

Let's take a look at some tools.

At School

scissors

ruler

hole punch

stapler
At Home

- sewing machine
- knife

In the Shops

- wrench
- pliers
- screwdriver
- saw
- hammer
- drill
Taking Care of Tools

Tools will last longer and be able to do their jobs better if you take care of them.

Here are some things to keep in mind:

1. **Use tools in the right way.**

   You can wreck a tool if you use it the wrong way. Then the tool will not be as useful when you go to use it again.

2. **Do not leave tools lying around.**

   Once you are finished using a tool, put it away. A young child could come along and hurt him or herself. Someone could come along and step on the tool and get hurt.

3. **Store your tools correctly.**

   Store your tools in a way that they will not get damaged. For example, if you put your tools near a place where they could get wet, they may get rusty. Then they will not work as well.
4. Keep your tools organized.

It is easy just to throw your tools into any drawer or box. This is not the best way. Store them in such a way that you will be able to find any particular tool the next time you want to use it.

5. Keep your tools in good working order.

This means that if a tool needs to be fixed, fix it as soon as you can. Tools that do not work correctly cannot do a good job.

6. Always get permission to use tools.

There are some tools that you know how to use correctly, like a ruler. Your teacher or your parents do not need to teach you how to use it.

There are other tools that should be used only by adults who know how to use them correctly. Ask an adult if you can use these tools. If he or she says you cannot, it is because you are either too young or because you have not learned how to use it.

Grade three students are too young to use a tool like this circular saw.
A pencil box will help keep school tools organized and in one place.

Having a place for each of the shop tools will make it easy to find the tools you need. It will also help keep the tools in good shape.
Using the Right Materials

A good builder matches the materials he or she uses to how the object will be used.

Some materials are strong. It takes special tools to cut strong materials. These materials are used to make objects that cannot break easily.

Wood and steel are strong materials. They are used to make buildings and cars.

Some materials can be molded to make different shapes.

Clay can be molded into shapes. When it is baked, it becomes very hard. This pot is made from clay.
Some materials are soft. They are used to build things that people or animals wear.

Shoes and clothing are made from softer materials.

Some materials are lightweight and can be cut and folded easily.

This greeting card is made from paper. It is perfect for the job because you can cut it with scissors and fold it easily.

This sheet metal worker uses a special machine to bend large thin sheets of metal to make heating ducts.
Some materials are waterproof. They are used to make things designed to hold liquids.

Plastic is often used to make dishes because it can hold liquids.

Some materials are used because you can see through them.

Glass is used to make windows because you can see through it.

Some materials are quite strong and light weight. They are used to hold things that are light and medium weight.

Cardboard is used to make boxes. It is light weight, but still quite strong.
Good and Bad Design

The design of an object tells about how the materials are shaped and put together to make the object.

A good design can make an object work well. A bad design can lead to all kinds of problems.

Here are some things to think about when it comes to design.

1. Some people think that because something looks good, it has good design. This is not true.
   You could have a chair that is nice to look at, but if it is not comfortable to sit on, it does not have good design.

   This chair is covered with sharp spines. It might look nice, but no one would want to sit in it.

These shoes are designed to look nice. How comfortable do you think they are?
2. The design of an object must fit the purpose.

If an object has good design, it will be easy to use and it will do its job.

If an object has bad design, it will be difficult to use. It might not last long either.

This photo shows the city of Kobe in a country called Japan. In 1995 an earthquake damaged the city. The buildings with good design stayed standing. Those with poor design fell apart.

This coffee pot has a very poor design. Can you see why?
3. Simple designs are often as good or better than complex designs.

Simple designs just try to get the job done. They do not try to be fancy.

The opposite of simple is complex. Complex designs are often more difficult to think up and always more difficult to build.

There is less chance of things going wrong with a simple design. On the other hand, there is a greater chance of things going wrong with a complex design.

This bicycle has a simple design. If it is used properly, it will last for years.

This bicycle has a complex design. It has many parts. It is not comfortable. It is difficult to pedal and it is difficult to steer. There is more of a chance of things going wrong with a design like this.
Workmanship

Workmanship refers to how well the materials are measured cut, shaped, and put together to make an object.

Good Workmanship

Something that has been built with good workmanship is more likely to be able to do its job. It will be easier to use. It will also most likely last longer. Things built with good workmanship are nicer to look at.

Good workmanship on a desk means it will be comfortable and strong enough to hold a student.

A van made with good workmanship will take you from place to place easily and safely.
Poor Workmanship

Poor workmanship happens when the builder tries to cut corners and go too fast.

Signs of poor workmanship include:

- careless measuring, which results in using the wrong sizes of pieces
- sloppy cuts
- using the wrong materials
- using the wrong kinds of joiners and fasteners
- poor joining and fastening
- the object not being stable (tips over easily)

This chair leans because of poor workmanship.

Poor workmanship on this house means that it would not be a comfortable or safe place to live.
Part II: Construction

Introduction

You have learned about building materials and how important it is to match the building materials with how an object will be used.

You also learned about why good workmanship is important.

Now it is time to look at some of the different kinds of things that can be built.

As a grade three student, you will be able to construct or build many different objects.

This pumpkin is made out of construction paper.

The snowhouse is made of marshmallows and cardboard.
Steps in Construction

There are several steps to keep in mind when constructing an object.

1. **Purpose.** Decide what your object has to be able to do. Does it have to hold something? If it does, what does it have to hold and how much? Does a person have to be able to sit in it? If so, how big a person?

2. **Plan.** The next thing to do is to make a plan. Part of the plan includes designing the object. What will it look like? How big will it be? What materials will I use? How will I join or fasten the materials together?

3. **Gather Materials.** Get the materials you will need. Make sure they are the right ones for the job. Decide how much of each material you will need. A good builder never wastes. He or she only uses what is needed.

4. **Construction.** This is where good workmanship comes in. In this step, you measure, cut and put your materials together. Working carefully is important. As you build, you may decide that some of the design has to be changed. This happens in construction all the time.

5. **Testing.** In this step, you try out your object to see if it can do what it is supposed to do. If it cannot, you must think of how you could change things so that it can.
Types of Construction Projects

There are many different types of structures you could build. Structures are objects that are built and can hold their own shape. Most structures can stand on their own.

There are several different kinds of structures that grade three students can make.

1. **Structures That Support Objects.** These structures must be able to hold themselves up, without tipping over or squashing.

2. **Structures That Contain Objects.** These structures must be able to hold other things.

3. **Bridges.** Bridges connect two objects that are quite far apart.

4. **Structures That are Models of Living Things, Objects, or Buildings.** Models are meant to look like other things, but they do not have to work like them. For example, you could make a model of your school. It would look like your school from the outside, but would not have a furnace or desks inside.

Now let us take a closer look at some of the types of things you could construct.
Structures That Support Objects

Structures that support objects must hold things up.

These structures must be strong enough to hold any objects placed on them. These structures must also be stable. This means that they will not tip over easily.

The materials used to make these kinds of structures must be strong themselves. They must also use joiners and fasteners that will not come loose easily.

Sometimes materials that are not very strong can be changed to make them stronger. Here is an example:

A newspaper is not strong. If you roll a whole newspaper into a tube, it becomes much stronger.

- From Edmonton Public Schools
Here are some structures that support.

1. Chair. There are many different kinds of chairs. Some have one large leg, like some stools. Other chairs have three or four legs.

   The important thing about a chair is that it must not wiggle back and forth when you sit on it. It must support the person who sits on it.

Which chair do you think is the strongest and most stable?

Goldilocks looked for just the right chair.
2. **Table.** We use tables everyday. The shape and size of a table depend on how we use it.

A table with its legs far apart will be more stable than a table with its legs close together.

The table’s top must be flat. If it is not, objects sitting on it will fall over. The table’s top must also be strong.

![Image of a small table]

*This table is small, but it is strong and stable.*

![Image of a tall table]

*This table is tall and not very wide. It might not be very stable.*

![Images of various tables]

*Which table do you think is the strongest and most stable?*
3. **Towers.** There are many different types of towers. Some towers are very high. They are so high that when you are at the top, you can see a long ways off.

Some towers support giant wires. Electricity runs through the wires.

Some towers support large restaurants. The restaurants are at the very top. People eating can see the whole city or countryside.

You will find the Calgary Tower in the middle of the city. There is a big restaurant at the top. You can see the whole city and even the Rocky Mountains.

Utility towers must be strong enough to hold up heavy electrical wires. They must be able to stay up, even when it is windy and snowy.
Containers

A container is an object that is designed to hold other objects inside of itself.

Containers come in all sizes and shapes.

Some are small and only hold one tiny thing. Others are very large and can hold many tonnes.

Some containers must be able to hold liquids, while other containers do not need to be waterproof.

Some containers have lids, while others are open.

This napkin holder is designed to hold paper napkins. It is open on almost all sides.

This container is very large. It can hold a car. It can be placed on trucks, trains, and ships. It is waterproof so that rain and big ocean waves will not make what is inside wet.
Following are a few types of containers.

1. **Dry Containers.** These containers are mainly used to hold things that are not liquids or that are not moist. They can be made of many different materials like paper, plastic, wood, cardboard, and metal.

   Pencil boxes, cardboard boxes, and shopping bags are examples of dry containers.

   ![Milk crate]

   **This milk crate is a container.** It is made of plastic. It does not need to be waterproof, but it must be strong.

   ![Shopping bag]

   **This shopping bag is made of paper.** The handles make it easy to carry.

   ![Pencil holder]

   **A pencil holder is another dry container.** If it is too big around the pencils will all fall over.
2. **Wet Containers.** These containers must be able to hold liquids without letting the liquid leak out.

Wet containers are usually built out of strong materials because liquids are heavy.

Most wet containers are made from glass, metal, or plastic. Wet containers can also be made from materials that are not waterproof. To do this, a person must coat the material with something to make it waterproof.

Most wet containers are made from plastic, glass, or metal.

Wax is put on cardboard to make it waterproof. A special paint called a glaze makes a clay pot waterproof.
Bridges are designed to go from one piece of land to another.

They usually go over a river or part of an ocean.

Sometimes bridges go over steep canyons.

Bridges are of all different sizes. Some bridges only go over a little ditch and are a metre or so long.

Other bridges are several kilometres long.

A log over a ditch or a stream is a simple type of bridge.

The longest bridge in Canada is the Confederation Bridge. It is 13 kilometres long. It joins Prince Edward Island with New Brunswick.
Kinds of Bridges

There are several different kinds of bridges. They are put into groups according to how they are built.

1. Beam Bridge. This is the simplest type of bridge. It is made of a beam that rests on either side of a river or canyon. Beam bridges are usually short, but can be long. Longer beam bridges have supports in the middle to hold the deck up.

Like other types of bridges, most beam bridges have a rail or a wall on either side of the bridge deck, so people and cars will not fall off the bridge.
2. **Arch Bridge.** Arch bridges are named after their shape. Bridge builders have found that an arch is very strong.

Arch bridges made long ago were made of stone. Today most arch bridges are made of steel.

The bridge deck can rest on top of the arches or it can be below the arches.
3. **Truss Bridge.** Trusses are structures that are made up lots of triangles. A truss bridge has trusses to help hold up the bridge deck.

A truss bridge is like a beam bridge, but the trusses make it a lot stronger. It can carry many cars. Railway bridges are often truss bridges. This is because trains are very heavy.

This railway bridge in Lethbridge is a special kind of truss bridge. The trusses form supports called *trestles*. This bridge is the highest railway bridge for its height in the world.
4. **Cantilever Bridge.** A cantilever bridge is made up of two beams. Each beam sticks out from each side of a body of water. The beams meet in the middle. There are supports that help to hold up the beams.

Many cantilever bridges also use trusses to help make them stronger.

Québec City in the Province of Québec is home to the largest cantilever bridge in the world.
5. **Suspension Bridge.** On a suspension bridge, the bridge deck actually hangs from giant cables. The big heavy cables are curve over towers at either end. At the ends of the bridge, the cables are held down to the ground.

The Lion’s Gate Bridge in Vancouver, British Columbia is one of Canada’s longest suspension bridges. It is so high that large ships can pass under it.
Structures That Are Models of Living Things

A model is a structure that looks like the real thing. It is usually smaller than the real thing, but it can be the same size or even larger.

If a model is designed and built well, anyone looking at it will know what it is.

Models should be able to stand on their own without falling or tipping over.

This model of a cowboy on his horse is found in Calgary. If you look carefully, the cowboy is following a calf. The model is made of metal.

This model was carved by an Inuit artist. It is made of stone.
This model of a fat little frog is made of Plasticine.

These little animals are made of different colours of Plasticine.

These dolls are models of people, complete with clothing.
Models of Structures in the Community

If you look around your community, you will see many different kinds of structures.

They have different shapes and sizes.

Some are very small, while others are really big.

Some are shaped like boxes, while other are shaped more like cylinders or cones.

This photo was taken at Riverview Colony in Saskatchewan. Look carefully. How many different shaped structures do you see?
This barn is wide and long, but it is not very high.

A quonset has a curved roof but flat ends.

Steel grain bins are cylinders with cones on top.
Topic C

Testing Materials and Designs
About the Lessons

These lessons focus on testing materials and designs in a formalized and scientific manner. This unit presents students with their first experience with a **fair test**. For many students this may prove to be a difficult concept to grasp.

Part I focuses on testing materials while Part I focuses on testing designs. It is recommended that all students do Lessons One through Four. Lessons Five through Seven provided for those teachers who want more practice with the idea of the fair test. You may decide to proceed straight to Lesson Eight, especially if you want students to do more hands-on activities.

While Lessons One through Seven are more theoretical in nature, Lessons Eight through Twenty are hands-on. They are designed to help students apply what they learned about the fair test in earlier lessons.

The first sections of Part I provides several alternate independent activities for younger students whose reading level is still in the very early stages of development. The latter sections of Part I and all of Part II do not include separate activities for younger students. It is recommended that either older students or the teacher give the additional support necessary.

Materials
The hands-on nature of this unit means that teachers will have to begin gathering materials. Most material is readily available at school or at home. Although readily available, teachers will need to collect a few larger cardboard boxes that can be cut apart with a utility knife.

Mini Textbook
Some lessons rely on the use of the Mini Textbook. It is recommended that teacher photocopy a Mini Textbook for each student.
Science Grade Three
Topic C: Testing Materials

Contents

Part I: Testing Materials

Lesson One          Introduction          5
Lesson Two          Properties of Materials – Part I  6
Lesson Three        Properties of Materials – Part II  7
Lesson Four          The Fair Test       8
Lesson Five          Parts of a Fair Test  9
Lesson Six           Fair Test: Formulating a Testable Question and a Hypothesis 10
Lesson Seven         Fair Test Review    11
Lesson Eight         Testing Paper Strength 12
Lesson Nine          Testing Corrugated Cardboard 13
Lesson Ten           Testing Plastic Bags  14
Lesson Eleven        Testing Glue and Tape  15
Lesson Twelve        Testing Materials and Designs, Part I 16
### Part II: Testing Designs

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thirteen</td>
<td>Stability</td>
<td>17</td>
</tr>
<tr>
<td>Fourteen</td>
<td>Triangles</td>
<td>18</td>
</tr>
<tr>
<td>Fifteen</td>
<td>Arches</td>
<td>19</td>
</tr>
<tr>
<td>Sixteen</td>
<td>Beams</td>
<td>20</td>
</tr>
<tr>
<td>Seventeen</td>
<td>Pillars</td>
<td>21</td>
</tr>
<tr>
<td>Eighteen</td>
<td>Brick Patterns</td>
<td>22</td>
</tr>
<tr>
<td>Nineteen</td>
<td>Methods of Joining</td>
<td>23</td>
</tr>
<tr>
<td>Twenty</td>
<td>Testing Materials and Designs, Part II Test</td>
<td>24</td>
</tr>
</tbody>
</table>
Lesson One

Concept: Introduction

Resources/Materials: Mini Textbook, pages 4 and 5
Worksheet #3C.1a (older students)
Workheets #3C.1b and #3C.1c (older students)

One item each made (all or mostly) of the following:
cloth wood paper plastic glass metal

Introduction: Write the word test on the board. Have students read it and then tell you what it means. (Most will refer to tests that teachers give them to see how much they know.) Explain that there is another meaning of the word “test”. Test can also mean to look at something very carefully to decide how good it is.

Explain that the next unit of study involves students doing some testing. They will be examining some materials and designs to decide how good they are.

Procedure:

1. Explain that in this unit, students will be testing materials in the same way that a scientist would. Scientists must be careful and follow some exact steps.

2. Explain that the first thing to do is know how to think about materials.

3. If you like, distribute the Mini Textbook. Allow students to flip through the pages for a moment or two. Then guide the reading of pages 4 and 5.

4. One at a time, hold up the articles you brought to class. As each is identified, write the name of the material from which it is principally made on the board. If you need to, have students read the words as you point to them, for practice.

5. Explain that today students will classify some objects according to the material with which they are made.

6. Distribute Worksheets #3C.1a (older students) OR Worksheets #3C.1b and #3C.1c (younger students). Go over the directions. Note: The answers to Worksheet #3C.1a can vary. Accept any reasonable answer.

Assignments:

1. Read Mini Textbook, pages 4 and 5.
2. Do Worksheet #3C.1a (older) OR Worksheets #3C.1b and #3C.1c (younger).
Classifying Materials

Directions: Write the names of the objects in the box under the correct headings, according to the material they are made of.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>frying pan</td>
<td>window pane</td>
<td>desk</td>
<td>pencil</td>
</tr>
<tr>
<td>notebook</td>
<td>student ruler</td>
<td>truck</td>
<td>pop can</td>
</tr>
<tr>
<td>canning jar</td>
<td>cardboard box</td>
<td>house</td>
<td>pop bottle</td>
</tr>
<tr>
<td>workbook</td>
<td>coffee cup</td>
<td>bench</td>
<td>fork</td>
</tr>
<tr>
<td>card</td>
<td>eye glasses</td>
<td>shirt</td>
<td>shawl</td>
</tr>
<tr>
<td>apron</td>
<td>jacket</td>
<td>telephone</td>
<td>bowl</td>
</tr>
</tbody>
</table>

Glass | Wood | Plastic

Metal | Paper | Cloth
Directions: Under each picture tell what kind of material the object is mostly made of.

- paper
- metal
- glass
- wood

Table

Cup

Pan

Card

Chair

Truck

Worksheet #3C.1b
Lesson Two

Concept: Properties of Materials - Part I

Resources/Materials: Mini Textbook, pages 6 – 8
Worksheet #3C.2a OR #3C.2b OR (student copies)
sheet of acetate (or clear plastic) sheet of photocopy paper
pitcher of water dishpan
Objects to test: waxed paper clear plastic wrap glass dish
metal pan foil Manila tag
tracing paper Kleenex metre stick
piece of cloth eraser plastic grocery bag

Introduction: Review that one way to classify or sort materials is by thinking about what they are made of. Explain that another way to think about materials is to look at their properties. (Write the word “properties” on the board.) Explain that when we look at the properties of a material, we think about what they are like. The properties of a material tell us how they are different from other materials.

Procedure:

1. Explain that today, we will be examining the properties of several different types of materials.

2. Write each of the following properties on the board as you explain what they mean.

   **waterproof**  **flexible**  **transparent**  **strong**

3. If you like, have students turn to Mini Textbook, page 6. Guide the reading of page 6 and 7 and the top part of page 8.

4. Conduct tests to see which of the properties that the sheet of acetate has. That is, pour water over the acetate to see if the water soaks into it, bend the acetate to see if it is flexible, etc. **Note: If you do not have any acetate or clear plastic, use any other material you think has most of the properties listed in #2 above.**
   Repeat for the sheet of photocopy paper.

5. Explain that students will now have a chance to test some materials to see which properties they have. Distribute Worksheet #3C.2a OR Worksheet #3C.2b OR Worksheet #3C.2c. Show students how the sheet works.

6. Have students test the materials you have brought to class or have them Do Worksheet #3C.2c.

Assignments:
1. Read Mini Textbook, pages 6 – 8.
2. Do Worksheet #3C.2a OR Worksheet #3C.2b OR Worksheet #3C.2c.
Testing Materials for Properties

Directions: Write **yes** if the material has the property. Write **no** if it does not.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>Waterproof</th>
<th>Flexible</th>
<th>Transparent</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>waxed paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic wrap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glass dish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>foil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manila tag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tracing paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kleenex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>metre stick</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>piece of cloth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eraser</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic grocery bag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #3C.2a
Testing Materials for Properties

**Directions:** Write **yes** if the material has the property. Write **no** if it does not.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>Waterproof</th>
<th>Flexible</th>
<th>Transparent</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #3C.2b
**Testing Materials for Properties**

**Directions:** Write **yes** if you think the material has the property. Write **no** if you think it does not.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>Waterproof</th>
<th>Flexible</th>
<th>Transparent</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>large piece of wood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your shirt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>top of your desk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic grocery bag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>spoon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>window pane</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>your bedroom door</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>workbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>shoe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic wrap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #3C.2c
Lesson Three

Concept: Properties of Materials - Part II

Resource/Materials: Mini Textbook, pages 8 and 9
Worksheet #3C.3a OR Worksheet #3C.3b OR Worksheet #3C.3c (student copies)
Plasticine
Objects to test: sponge Plasticine eraser
wooden ruler glass mug paper towel
piece of cloth toilet paper Styrofoam cup
elastic band clay or ceramic pot/vase textbook

Introduction: Review the meaning of the word “property”. Then review the four properties from last class. Explain that today we will explore some other properties.

Procedure:

1. Explain each of these properties, writing them on the board as you discuss them. Note that flexible and bendable have very similar meanings. Things that are flexible are bendable in several different directions. Things that are bendable need only be flexible in one direction.

2. If you like, have students turn to Mini Textbook, page 8. Guide the reading of pages 8 and 9.

3. Test some Plasticine for each of the properties.

4. If you choose to make this a hands-on activity, display and identify the things you have brought in.

5. Then distribute Worksheet #3C.3a OR Worksheet #3C.3b OR Worksheet #3C.3c. Go over the directions.

Assignments:

1. Read Mini Textbook, pages 8 and 9.
2. Do Worksheet #3C.3a OR Worksheet #3C.3b OR Worksheet #3C.3c.
### More Properties

**Directions:** Write **yes** if the material has the property. Write **no** if it does not.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>Squeezable</th>
<th>Stretchable</th>
<th>Slidable</th>
<th>Twistable</th>
<th>Bendable</th>
</tr>
</thead>
<tbody>
<tr>
<td>sponge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasticine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eraser</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wooden ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>glass mug</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>paper towel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>piece of cloth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>toilet paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Styrofoam cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>elastic band</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clay pot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>textbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**More Properties**

**Directions:** Write **yes** if the material has the property. Write **no** if it does not.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>Squeezable</th>
<th>Stretchable</th>
<th>Slidable</th>
<th>Twistable</th>
<th>Bendable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet #3C.3b
**More Properties**

**Directions:** Write **yes** if the material has the property. Write **no** if it does not.

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>Squeezable</th>
<th>Stretchable</th>
<th>Slidable</th>
<th>Twistable</th>
<th>Bendable</th>
</tr>
</thead>
<tbody>
<tr>
<td>sponge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plasticine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eraser</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pencil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dish towel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chair leg</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>table</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Styrofoam cup</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>elastic band</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plastic pop bottle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>textbook</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson Four

Concept: The Fair Test

Resources/Materials: Mini Textbook, pages 10 – 12
Worksheets #3C.4a and #3C.4b (student copies)
5 sheets photocopy paper sheet of Manila tag or Bristol board
pair of sharp adult scissors pair of blunt child scissors

Introduction: Review the concept of “properties” of materials. Tell students that today you want to test two types of paper for another property. You want to see which type of paper cuts most easily.
Take the stack of five sheets of photocopy paper. Try to cut the stack with child scissors. Note that it is impossible. Then use the sharp adult scissors to cut the Manila tag. With students discuss whether this was a good way to test to see which type of paper was easier to cut and why. (No)

Procedure:

1. Explain that in the paper cutting test, you didn’t know whether the Manila tag was easier to cut because of the scissors or because there was only one sheet of it.

2. Explain that scientists decided if they really want to know which material is better, they must make sure the test they use is fair. They call it a fair test. Scientists all over the world use fair tests.

3. If you like, use the explanation of a fair test by guiding the reading of Mini Textbook, pages 10 – 12. You might also choose to explain it yourself. The important thing to remember is that when you are testing to see which material is better, all other factors must be the same.

4. Distribute Worksheets #3C.4a and #3C.4b. Go over the directions. Note: This activity may be very challenging for younger students. You may want to pair up older and younger students.

Assignments:

1. Read Mini Textbook, pages 10 – 12.
2. Do Worksheets #3C.4a and #3C.4b.
Making Tests Fair

Directions: Read each scenario. Then tell how the students could make their tests fair.

1. Cindy and Blaine want to find out if glue from a glue stick sticks better than glue from a bottle.

They used the glue stick to stick two large pieces of note paper together. They used the glue from a bottle to stick two tiny pieces of waxed paper together. After a minute or so, they found that the pieces of waxed came apart easily. They decided that glue stick glue was better.

2. Liam and Evan wanted to know if a sponge ball bounced higher than a rubber ball. They had an old sponge ball and a new rubber ball. The rubber ball was about 30 cm wide and the sponge ball was about 10 cm wide. Liam bounced the rubber ball. It went up high. Evan bounced the sponge ball. It went up high too.
3. Jim and Dave wanted to know if the red tractor was stronger than the green tractor. They hitched the red tractor up to a big rock. The red tractor could pull it without a problem. They hitched the green tractor up to an even bigger rock. The green tractor could pull it without a problem.

4. Danny and Phil wanted to know which grew faster, beans or peas. They planted twenty bean seeds in the shade near the shed and fifty pea seeds in the sun near the pond. The pea seeds came up first.

5. Jane and Monica wanted to know which dish soap worked better, Dawn or Sunlight. Jane washed the three coffee cups in Dawn. They all came out clean. Monica washed sixty-two plates in Sunlight. Some of the plates she washed last did not get clean.
Lesson Five

Concept: Parts of a Fair Test

Resources/Materials: Mini Textbook, pages 13 – 15
Worksheets #3C.5a (teacher copy)
Worksheets #3C.5b and #3C.5c (student copies)

Introduction: Review that in a fair test only one thing can be different between the materials being tested.

Explain that today, students will learn more about the parts of a fair test.

Procedure:


2. After the reading, review each of the parts, referring to the names of the various parts as you do so.

3. Then present the following scenario on Worksheet #3C.5a. With students come up with a fair test.

4. Distribute Worksheets #3C.5b and #3C.5c. Go over the directions. Pair older and younger students.

Assignments:

2. Do Worksheets #3C.5b and #3C.5c.
**Teacher Directions:** Present the following scenario to students. Then as a class come up with a fair test.

*James and Tim want to know if the colour of construction paper makes a difference when it comes to how strong the construction paper is.*

Following is an example of a fair test for this scenario.

**Testable Question:** Will a sheet of black construction paper hold more weight than a sheet of yellow construction paper?

**Hypothesis:** I do not think black construction paper will hold more weight than yellow construction paper because colour has nothing to do with how strong something is.

**Materials:**
- 10 cm X 28 cm piece of black construction paper
- 10 cm X 28 cm piece of yellow construction paper
- Box of heavy metal nuts (all the same weight)
- Masking tape
- 2 Math textbooks

**What will be different:** colour of the construction paper (manipulated or independent variable)

**What will be the same:** size of construction paper (constants)

**What we will measure:** number of metal nuts the paper can hold before tearing (responding or dependent variable)

**Procedure:**
1. Place the two Math textbooks exactly 20 apart on a table.
2. Place the black strip of construction paper so that both ends sit on a Math textbook.
3. Tape the black construction paper to the Math textbook.
4. Hold the Math textbooks in place so they will not move.
5. Set the metal nuts on the centre of the black construction paper, one at a time until the paper tears.
6. Write down the number of metal nuts the black construction paper is able to hold before it tears.
7. Repeat for the yellow construction paper.

**Observations:** The black construction paper held 7 nuts.
The yellow construction paper held 7 nuts.

**What I Learned:** A sheet of black construction paper cannot hold more weight than a sheet of yellow construction paper. Colour has nothing to do with how strong construction paper is.

Worksheet #3C.5a
1. Match the parts of a fair test with their descriptions.

<table>
<thead>
<tr>
<th>testable question</th>
<th>hypothesis</th>
<th>materials</th>
<th>manipulated variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>constants</td>
<td>procedure</td>
<td>observations</td>
<td>responding variable</td>
</tr>
<tr>
<td>conclusion</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_________________________ the things you will use
_________________________ what you think will happen and why
_________________________ what you want to find out
_________________________ the things you will keep the same
_________________________ what you learned from doing the fair test
_________________________ the one thing you will change
_________________________ what you saw
_________________________ what you measured
_________________________ the steps you followed

2. Sylvia and Michelle wanted to know which would rot faster, an apple or an orange. They decided did a fair test to find out.

On the next page you will find the parts of their fair test. Tell what part of a fair test goes with each of the things they wrote.
Place the apple and the orange on a shelf. Do not touch either piece of fruit.
Check both pieces of fruit everyday to see if there is any mould.

We think mould will appear on an apple sooner because apples have thinner skins than orange.

A ripe apple  A ripe orange

Will mould appear sooner on an apple or on an orange?

The type of fruit

Ripeness of the fruit, where the fruit is placed, make sure both fruits have no bruises

We noticed mould starting to grow on the orange after six days.
We noticed mould starting to grow on the apple after eleven days.

How soon mould appears

We learned that mould appears sooner on an orange than on an apple.
Lesson Six (Optional)

Concept: Fair Test: Formulating a Testable Question and a Hypothesis

Resources/Materials: Mini Textbook, pages 16 – 19
Worksheet #3C.6 (student copies)

Introduction: Explain that the most important part of a fair test is the testable question. Explain that it is called a testable question because the question must be worded in such a way that you will be able to see and measure any difference between what you are testing. If you cannot see and measure something, it is not testable.

Procedure:


2. Present the following “bad questions” and with students comes up with “good testable questions”.

<table>
<thead>
<tr>
<th>Bad</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are pink erasers any good?</td>
<td>Will a pink eraser erase pencil marks with fewer strokes than a white eraser?</td>
</tr>
<tr>
<td>Does fertilizer really work?</td>
<td>Will a bean plant that has had fertilizer grow taller than a bean plant that has not had fertilizer?</td>
</tr>
</tbody>
</table>

3. Explain that a hypothesis tells what you think is the answer to the testable question. It also tells why.

4. Have students turn to Mini Textbook, page 18 and guide the reading.

5. As a class come up with hypotheses for the testable questions in #2 above. Emphasize that your hypothesis may not always be correct. Your fair test may prove your prediction was wrong.


Assignments:

1. Read Mini Textbook, pages 16 – 18
2. Do Worksheet #3C.6.
### Testable Questions and Hypotheses

**Directions:** For each **bad question**, write a **good testable question**. Then write a hypothesis.

<table>
<thead>
<tr>
<th>Bad Question</th>
<th>Good Testable Question</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Crayola pencil crayons break more than other kinds?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do Fords burn a lot of fuel?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does sitting up straight really make you do your work better?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is memorizing the addition tables a waste of time?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Worksheet #3C.6*
Lesson Seven (Optional)

Concept: Fair Test Review

Resources/Materials: Mini Textbook, pages 19 – 24
Worksheet #3C.7a (student copies)
Worksheets #3C.7b and #3C.7c (student copies)

Introduction: Review that a fair test is a way to find out if a particular material or design is suitable for what you want to build.

Explain that not all decisions can be made on the basis of a fair test.

Procedure:

1. Ask students “Are cookies with raisins better than cookies without?” Entertain the students’ responses, but in the end conclude that in this case it is a matter of opinion. Questions based on opinion cannot be answered using a fair test.

2. Emphasize that in order for you to use a fair test, you have to be able to actually observe and measure differences between two or more things.

3. Have students turn to Mini Textbook, page 19 and guide the reading of this page. Then guide the reading of pages 20 – 24, which give an example of a fair test.

4. Distribute Worksheet #3C.7a. Go over the directions. Have older students work with younger students.

5. If you would like students to have more practice with fair tests, distribute Worksheets #3C.7b and #3C.7c. Go over the directions.

Assignments:

2. Do Worksheet #3C.7a.
3. OPTIONAL. Do Worksheets #3C.7b and #3C.7c.
When to Use a Fair Test

Directions: Put a check mark in the box if a fair test can be used.

1. You want to know if plastic scratches more easily than glass.

2. You want to know if soccer is a better sport than baseball.

3. You want to know if people with blue eyes are nicer than people with brown eyes.

4. You want to know if cardboard is as strong as Bristol board.

5. You want to find out if vanilla ice cream is better than strawberry ice cream.

6. You want to find out if a clay pot holds water better than a plastic cup.

7. You want to know if wide elastic bands can be stretched more than narrow elastic bands.

8. You want to find out if coloured paper is stronger than white paper.

9. You want to know if houses with shingled roofs look nicer than houses with steel roofs.

10. You want to find out if Bob can learn his German school verses better if he is by himself or if he is with his brothers and sisters.
Directions: Read the scenario below. Then decide which of the choices better fits with each fair test part. Circle it.

Scenario: Gary and Sam want to build a bridge out of cardboard. They wanted to know if the length of the cardboard would make a difference in how strong the bridge would be.

1. Choose the better testable question.
   - Will a long piece of cardboard hold more weight than a short piece of cardboard?
   - Is a long piece of cardboard better?

2. Choose the better hypothesis.
   - I think a longer piece of cardboard will hold more weight.
   - I think a longer piece of cardboard will hold more weight because the weight can be put over a bigger area.

3. Choose the better list of materials.
   - 2 pieces of cardboard, some weights
   - 1 piece of cardboard – 4 cm wide and 10 cm long
     1 piece of cardboard – 4 cm wide and 20 cm long
     set of 100 g weights
     2 grade three math textbooks
     table
     masking tape

4. Which better tells what one thing Gary and Sam will keep the same?
   - length of the cardboard
   - number of weights used
5. Which of the following better lists the **things that will stay the same**?
   - width of the cardboard, textbooks used
   - size of the cardboard, textbooks used

6. Which of the following better tells what the boys should **observe and measure**?
   - how strong the cardboard is
   - how much weight each piece of cardboard can hold before its centre touches the table

7. Which of the following better lists the steps in the **procedure**?
   - Place the textbooks, side by side, on a table so that the ends of the shorter piece of cardboard rest on the textbooks by 1 cm. Tape the cardboard to the textbooks. Then place the 100 g weights on the middle of the cardboard. Keep doing this until the middle of the cardboard touches the table. Look to see how much weight was placed on the cardboard. Repeat the steps with the longer piece of cardboard.
   - Place the textbooks, side by side on a table. Then place the shorter piece of cardboard on the textbooks to make a bridge. Put weights on the bridge. Repeat with the shorter piece of cardboard.

8. Which of the following better tells about the **observation**?
   - The shorter piece held more weight than the longer piece.
   - The shorter piece held 500 g of weight.
     The longer piece held 400 g of weight.

9. Which of the following best tells **what was learned**?
   - The longer piece of cardboard is better to build a bridge.
   - A shorter piece of cardboard can hold more weight than a longer piece of cardboard.
Lesson Eight

Concept: Testing Paper Strength

Resources/Materials: Worksheets #3C.8a and #3C.8b (student copies, and transparency, if possible)
10 cm X 10 cm square of photocopy paper
10 cm X 10 cm square of construction paper
10 cm X 10 cm square of Manila tag
set of masses with hooks
single hole punch

Introduction: Discuss that one of the things we want to consider when choosing materials is how strong the material is – its strength. There are many different kinds of paper. Today’s activity involves conducting a fair test to see which of three different kinds of paper is the strongest.

Procedure:

1. Explain that in order to do a test that will tell us what we want to know we first have to come up with a question. It has to be a **testable question**. This means what we have to be able to answer it by being able to observe (see) something and measure the results.

2. In order for the test to be fair, we can only change one thing. In this case we are going to change the kind of paper. Everything else has to stay exactly the same.

3. Distribute Worksheets #3C.8a and #3C.8b. Go over the testable question.

4. Then discuss a possible hypothesis. Remind students that a hypothesis has to tell what students will think will happen and why. With students make up a hypothesis and write it on the board. Have students copy it onto Worksheet #3C.8a.

5. Go over the fair test to the end of the procedure.

6. With students, do the fair test.

7. Have students fill in the table in the observations; then write sentences to tell how much weight each of the types of paper could support.

8. Finally, help students write a conclusion that answers the testable question.

Assignments:

Do the fair test and complete Worksheets #3C.8a and #3C.8b.
Testable Question: Which type of paper will support the most weight, construction paper, photocopy paper, or Manila tag?

Hypothesis: ____________________________

Materials: 10 cm X 10 cm square of construction paper
            10 cm X 10 cm square of photocopy paper
            10 cm X 10 cm square of Manila tag
            set of weights with hooks
            single hole punch

The one thing that will change: type of paper

Things that will be the same: size of the paper
                              where the hole is
                              size of the hole
                              how the paper is held
                              type of weights

What will be observed and measured: amount of weight the paper will support before the weight tears through the hole

Procedure:

1. Punch a hole 2 cm from the bottom edge of each paper, at the halfway mark.

2. Hold each piece of paper up at the top corners, using your thumbs and pointing fingers.

3. Hook the weights through the hole. Start with 50 g and go up by 50 g each time, until the hook tears through the paper.
Observations:

<table>
<thead>
<tr>
<th>Type of Paper</th>
<th>construction paper</th>
<th>photocopy paper</th>
<th>Manila tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What I Learned (Conclusion):

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
Lesson Nine

Concept: Testing Corrugated Cardboard

Resources/Materials:  Worksheets #3C.9a and #3C.9b (student copies)
                       10 cm X 30 cm piece of corrugated cardboard, with ribs running the long way
                       10 cm X 30 cm piece of corrugated cardboard, with ribs running the short way
                       250 g weight
                       30 cm ruler
                       6 grade three math textbooks

Introduction: Review that a fair test is used to figure out if changing one thing can make a difference. Review also that a fair test always starts off with a testable question, where you can observe and measure the results of the test.

Procedure:

1. Explain that today’s fair test has to do with corrugated cardboard. (Show students a piece of cardboard and how it is constructed – a wavy sheet of stiff paper with flat sheets glued to either side.)

2. Show students that the “ribs” on corrugated cardboard all run one way and they are parallel to each other.

3. Explain that in today’s fair test, we want to find out if direction the ribs run will affect how strong the cardboard is. (Ask students what they think.)

4. Explain that we will find out. Show students the two pieces of cardboard. Explain that we will place the pieces of cardboard over two stacks of books, like a bridge. Then we will place the weight in the centre of the each cardboard bridge and see which one sags the most.

5. Distribute Worksheets #3C.9a and #3C.9b. With students come up with a testable question and a hypothesis. For example:
   
   Testable Question: Will corrugated cardboard with ribs running the short way sag more than corrugated cardboard with ribs running the long way?
   
   Hypothesis: I think the corrugated cardboard with the ribs running the short way will……… because………

6. Go over the fair test to the end of the procedure. Then as a class or in small groups, do the test.

7. Complete the observations and conclusion.

Assignment:

Conduct the fair test and complete Worksheets #3C.9a and #3c.9b.
Testable Question: 

Hypothesis: 

Materials: 10 cm X 30 cm piece of corrugated cardboard, ribs running the long way
10 cm X 30 cm piece of corrugated cardboard, ribs running the short way
250 cm weight
30 cm ruler
6 grade three math textbooks

The one thing that will change: direction the ribs run

Things that will stay the same: size of the corrugated cardboard
amount of weight placed on the cardboard
were the weight will be placed
height of the textbook stacks
distance between the textbook stacks

Procedure:

1. Make two textbook stacks with three textbooks in each stack. Place them exactly 26 cm apart on a table.

2. Lay one piece of cardboard on the textbook stacks so the cardboard forms a bridge. Make sure each end of the cardboard piece rests 2 cm on the textbook stacks.

3. Place the 250 g weight on the middle of the cardboard. Measure the distance between the table and the bottom of the cardboard.

4. Repeat the procedure for the other piece of cardboard.
Observations:

Draw pictures to show what you observed.

| ribs running the short way | ribs running the long way |

What I Learned (Conclusion):

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
Advance Preparation: Fill in the sections after Materials to the end of Procedure before you photocopy Worksheet #3C.10a for students.

Lesson Ten

Concept: Testing Plastic Bags

Resources/Materials: Worksheets #3C.10a and #3C.10b (student copies)
* 2 plastic bags of different weights, similar dimensions
** set of books (must be heavy, like encyclopedias)

* The bags must be in good shape and large enough to hold three or four encyclopedias. Most grocery store bags are big enough. Try going to two different retail outlets. They will either give them to you or charge you a very nominal amount. The important thing is that the weight of the bags is different.

** You can use anything heavy, but whatever choose, you want something with corners (like full milk cartons), as these seem to be what tears plastic bags. You also have to have four or five of them.

Introduction: Review the fair tests done so far. Ask students to think about instances where they have used a plastic bag that has torn. Tell students that today they will do a fair test on two different plastic bags to see which is stronger.

Procedure:

1. Explain that bags are meant to hold things. Hold up the plastic bags to be tested. You are going to see how much each bag can hold before it tears. Emphasize the bag does not need to rip open, spilling everything out. Something in the bag just needs to tear a hole in the bag or the handles need to rip.

2. Show students what you will use to put in the bags. (If you are using things of varying weights like some encyclopedia set volumes, then you have to decide on the order you will place the books into the bag. For example, if you are using the World Book Encyclopedias set, establish the order of the volumes you will put in, such as M, S, A, P, J-K, etc.)

3. Distribute Worksheets #3C.10a and #3C.10b. As a class decide on a testable question. Remind students how to write a hypothesis. Then have the students write their own hypotheses. Finally, have them fill in the materials section.

4. Do the fair test; then complete Worksheet #3C.10b.

Assignment:

Do the fair test and complete Worksheets #3C.10a and #3C.10b.
Testable Question: ________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Hypothesis: ______________________________________________________________________

____________________________________________________________________

____________________________________________________________________

Materials: ______________________________________________________________________

____________________________________________________________________

____________________________________________________________________

One thing that will change: ______________________________________________________________________

What will stay the same: ______________________________________________________________________

____________________________________________________________________

____________________________________________________________________

What will be measured: ______________________________________________________________________

Procedure: ______________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
Lesson Eleven (start on one day; finish the next)

Concept: Testing Glue and Tape

Resources/Materials: Worksheets #3C.11a and #3C.11b (student copies)
6 Popsicle sticks
white glue masking tape glue stick glue
items of equal mass (e.g., large metal nuts, 3 cm diameter balls of Plasticine)
ice cream pail (with handle)

Day One

Introduction: Tell students it is time for another fair test. Ask students which they think is stronger, white glue, masking tape, or glue stick glue. Explain that today and tomorrow, they will find out.

Procedure:

1. Explain that students are going to test the how well white glue, masking tape, and glue stick will hold two Popsicle sticks together.

2. Explain that they will stick two Popsicle sticks together by overlapping them by 2 cm. On one set they will put white glue between the sticks, on another, they will put glue stick glue, and on a third they will tape the sticks together where they overlap using masking tape. These will set overnight.

3. To test the tape and glue, students will place the Popsicle sticks between two tables that are about 10 cm apart. They will hang an ice cream pail so that the handle is directly on the overlapped part. Then they will add masses, one at a time, until the Popsicle sticks can no longer support the weight.

4. Have students make the sets of Popsicle sticks and set them aside.

5. Distribute Worksheets #3C.11a and #3C.11b. As a class, fill in the sections up to Procedure. Then have the students number the steps in the Procedure in the order they should be done.

Day Two

6. The next day, have students do the fair test; then complete the rest of Worksheet #3C.11b.

Assignments:

Do the fair test and complete Worksheets #3C.11a and #3C.11b.
Testable Question: _____________________________________________________________

Hypothesis: _______________________________________________________________

Materials: _________________________________________________________________

One thing that will change: ________________________________________________

Things that will be the same:

- size of the Popsicle sticks
- the number of Popsicle sticks
- distance of overlap
- where and how the pail is hung
- distance between the tables

What will be measured: ____________________________________________________
Procedure: (Number these sentences in the order you will do them.)

1. Glue or tape pairs of Popsicle sticks together, using the lines you drew to help you know where to overlap them.

2. Place weights, one at a time, in the pail until the Popsicle stick can no longer support any more weight.

3. Label the Popsicle sticks so you know what kind of glue or tape was used.

4. Let the Popsicle sticks dry.

5. Measure 2 cm from the end of each Popsicle stick and draw a line.

6. Hang an ice cream pail from the Popsicle sticks.

7. Place two tables so that they are exactly 10 cm apart.

Observations:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

What I learned:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Lesson Twelve

Concept: Testing Materials and Designs, Part I Test

Resources/Materials: Testing Materials and Designs, Part I Test (student copies)

Introduction: Explain that the first part of the unit is now almost complete. All that is left is to do a test.

Procedure:

1. Distribute the tests.

2. If you have students in the group who are not able to read the test independently, go through the test question by question.
Testing Materials and Designs, Part I

Test

1. Circle all the properties that go with each material.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>waterproof</th>
<th>flexible</th>
<th>transparent</th>
<th>strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>clear glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>plastic wrap</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>cloth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>Manila tag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Circle all the properties that go with each material.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>squeezable</th>
<th>stretchable</th>
<th>slidable</th>
<th>twistable</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Plasticine</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>sponge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>photocopy paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Tabitha and Melissa want to find out if plastic bags are stronger than paper bags. Circle the better answer to each question.

a) Which is the better good testable question?

- Are plastic bags as good as paper bags?
- Will a plastic bag support more weight than a paper bag?

b) Which is the better hypothesis?

- I think a plastic bag will support more weight than a paper bag because plastic is stretchable.
- I think a plastic bag will support more weight.
c. In this fair test, what will be the one thing the girls should change?

- type of bag
- the size of bag

d. In this fair test, what will the girls measure?

- the size of the bags
- the amount of weight each bag will support

e. This table shows what Tabitha and Melissa observed.

<table>
<thead>
<tr>
<th>Type of Bag</th>
<th>plastic</th>
<th>paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Supported</td>
<td>4 kg</td>
<td>3 kg</td>
</tr>
</tbody>
</table>

Which sentence tells what the girls learned from doing the fair test?

- Paper bags can support more weight than plastic bags.
- Plastic bags can support more weight than paper bags.
Lesson Thirteen

Concept: Stability

Resources/Materials: Mini Textbook, pages 25 – 27
Worksheets #3C.13a and #3C.13b (student copies)
3 empty plastic bottles of different shape (e.g., milk jug, pop bottle, lotion bottle)
large cardboard box (or larger piece of corrugated cardboard)
Plasticine textbooks of the same thickness

Introduction: Explain that in the first part of the unit, students tested materials for various qualities. Explain that the next part of the unit focuses on testing design.

Procedure:


2. Explain that the first fair test will involve testing some bottles to see which is the most stable.

3. Present the bottles you have brought and discuss their various shapes with the students. Then explain that you will create a 1 cm high Plasticine ridge in the middle of the cardboard box and stand each bottle behind it so it is just touching the Plasticine. The objective is to raise the back end of the box so that the bottle will tip over the ridge.

4. Next you will tilt the box carefully and place one textbook under the edge of the box. You will keeping stacking textbooks under the edge of the box until the bottle tips over. Keep track of the number of textbooks that can be stacked before the bottle tips over the Plasticine ridge.

5. Distribute Worksheets #3C.13a and #3C.13b. Go over the testable question. Then have students write their hypotheses.

6. With students complete the sections having to do
   - The one thing that will change: (shape of bottle)
   - What will be observed and measured: (height of the slant) – measured in textbooks

7. With students (or independently) complete the fair test. Then have students write their observations and conclusion (What I learned).

Assignment:

Do the fair test and complete Worksheets #3C.13a and #3C.13b.
Testable Question: Which shape of bottle will stay upright as the slant of the surface gets greater?

Hypothesis: ____________________________________________________________
________________________________________________________________________
________________________________________________________________________

Materials: large cardboard box Plasticine
3 empty plastic bottles of different shapes
  textbooks

The one thing that will change: _____________________________________________

Things that will stay the same:

  • cardboard box
  • height of the Plasticine ridge
  • place where the textbooks are stacked
  • where the bottles are placed inside the box

What will be observed and measured: _______________________________________
________________________________________________________________________

Procedure:

1. Make a 1 cm high by 10 cm long Plasticine ridge in the middle of the bottom of the cardboard box so that it divides the box in half the long way.

2. Place a bottle behind the Plasticine ridge so it just touches the Plasticine.

3. Raise the back end of the box carefully and just high enough that you can put a textbook under the edge of the box, creating a slant.

4. Keep raising the end of the box and adding to the stack of textbooks until the bottle tips over the Plasticine ridge. Repeat the steps for the other bottles.
Observations:

<table>
<thead>
<tr>
<th>Bottle</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Textbooks</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What I learned:

Which shape of object is the most stable?
Lesson Fourteen

Concept: Triangles

Resources/Materials: Mini Textbook, pages 28 and 29
  Worksheets #3C.14a and #3C.14b (older students)
  Worksheet #3C.14c (younger students)
  2 cm X 10 cm Manila tag strips (7 per student)
  single hole punch        brass fasteners (7 per student)

Introduction: Review that objects that are wider on the bottom are more stable. Then explain that today students will investigate another design feature that adds strength to structures.

Procedure:

1. Have students turn to Mini Textbook, pages 28 and guide the reading of pages 28 and 29.

2. Have students make the square and rectangles using the paper strips and brass fasteners, as shown on Mini Textbook, page 28.

3. Conclude that a triangle is rigid whereas a square is not.

4. Explain that builders often use this idea to make square objects more rigid by creating triangles. On the board draw a square. Then draw in braces at each corner. Point out that the braces create a triangular shape, making the square more rigid.

   ![Diagram](image)

5. Distribute Worksheets #3C.14a and #3C.14b (older) OR Worksheet #3C14c (younger). Go over the directions.

Assignments:

1. Read Mini Textbook, pages 28 and 29.
2. Do Worksheets #3C.14a and #3C.14b (older) OR Worksheet #3C.14c (younger).
Mark and Tom want to design a fair test to show that structures with triangles are stronger than those with squares or rectangles. Their teacher told them that a good way would be to take a small box and make triangular-shaped frames at either end. Then take another small box and make a square- or rectangular-shaped frame at each end.

Their teacher then said they could test to see which type of frame could support the most mass.

**Directions:** Design a fair test that will help Mark and Tom. Tom and Mark will not do the fair test, they will only design it.

**Testable Question:**  

**Hypothesis:**  

**Materials:**  

Worksheet #3C.14a
The one thing that will be different:

The things that will stay the same:

What will be measured:

Procedure:
Directions: Look carefully at each drawing. Then write **rigid** if it shows a structure that has a triangle in it. Trace each triangle.
Lesson Fifteen

Concept: Arches

Resources/Materials: Mini Textbook, page 30
Worksheet #3C.15a (on Manila tag, per student or group)
Worksheets #3C.15b and #3C.15c (student copies)
10 cm X 10 cm Manila tag square (per student or group)
blocks or other weights
textbooks

Introduction: Review how the triangle added to the rigidity of a structure and that rigidity affects strength. Explain that today students will examine another shape that adds to rigidity and strength. It is the arch.

Procedure:

1. Take a sheet of paper and bend it into an arch to demonstrate that an arch is continuous.

2. Have students turn to Mini Textbook, page 30 and guide the reading.

3. Explain that students are going to do a fair test that has been set up. They only have to record their observations and write a conclusion.

4. In preparation for the fair test, distribute Worksheet #3C.15a and have them cut out the rectangles. They should also fold one of the rectangles on its dotted lines to make a squared upside-down U.

5. Next distribute Worksheets #3C.15b and #3C.15c along with the Manila tag squares. Go over the fair test with the students.

Assignments:

2. Do the fair test and complete Worksheets #3C.15b and #3C.15c.
Directions: Cut each shape out carefully. Fold on the dotted lines.
Testable Question: Will a square shape support more weight than an arch shape?

Hypothesis: _________________________________________________________________

Materials: Manila tag arch shape  
10 cm X 10 cm piece of Manila tag  
2 textbooks  
Manila tag square shape  
blocks

What will be different: shape

What will stay the same:  
- size of the paper used to make the shape  
- material  
- width of the shape  
- weights used (for example, blocks)

Procedure:

1. Place the textbooks 10 cm apart. Set up the square shape between the textbooks.

2. Place the 10 cm X 10 cm square of Manila tag on top of the square shape.

3. One at a time, place the blocks on the square of Manila tag. Keep doing this until the square shape can no longer support the blocks.
Observations:

<table>
<thead>
<tr>
<th>Shape</th>
<th>square</th>
<th>arch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Blocks</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What I learned:

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________

____________________________________
This lesson has been adapted from an Edmonton Public Schools lesson plan.

Lesson Sixteen

Concept: Beams

Resources/Materials: Mini Textbook, pages 31 and 32
Worksheet #3C.16a (transparency or teacher copy)
Worksheets #3C.16b, #3C.16c, #3C.16d, #3C.16e, and #3C.16f (student copies)

Introduction: Briefly review the importance of the triangle and arch with regarding the strength of a structure. Explain that today we will be examining another part of a structure called a beam. A beam is a long piece of wood or steel that is used to support part of a building.

Explain that the first beams were tree trunks with the branches and bark removed. They were heavy and it took a lot of men to hoist them into position. Soon people found it better if they tried to square off the round tree trunks. This made it easier for them to nail other things onto it. Since then many changes have been made to beam to make them lighter and stronger.

Procedure:

1. Show students the transparency or copy of Worksheet #3C.16a. Point out the beam and, in particular, how it is irregular like a tree would be. Tell students there are probably several beams in this house. They would help hold up the roof.

2. Have students turn to Mini Textbook, page 31 and guide the reading of pages 31 and 32.

3. Explain that today students will be testing three beam shapes: one accordian, one rectangular, and a box girder attached to a flat piece.

4. Distribute Worksheets #3C.16b, #3C.16c, and #3C.16d. Have students make the beams, as shown below. Note: Warn students that over handling of the paper, makes the beams weaker. Also, good crisp folds will also make the beams stronger.

5. Distribute Worksheets #3C.16e and #3C.16f. With students go over the fair test so they know what to do. Have them write in a hypothesis.

6. Then have students carry out the fair test.

7. Once the fair test is completed, have them write up the rest of the fair test. Some students, particularly younger students, may need assistance with the bar graph.

Assignments:

Do the fair test and then complete Worksheets #3C.16e and #3C.16f.
Box Girder

cut along dotted line

Glue here.

fold along straight lines

Glue here.

fold along straight lines

Worksheet #3C.106
Accordion Beam

Cut along dotted line

Fold along straight lines

Fold along straight lines

Cut along dotted line
Testable Question: Which type of beam will support the most weight, an accordion beam, a box girder, or a rectangular beam?

Hypothesis: 

Materials: accordion beam box girder rectangular beam
4 textbooks blocks

Thing that will be different: type of beam

Things that will be the same:
- size of the paper used
- type of paper used
- the distance the beams will span (10 cm)
- where the blocks will be placed on the beams (centre)

Thing that will be measured: number of blocks the beams can support

Procedure:

1. Place two stacks of two textbooks each so they are 10 cm apart.

2. Place one of the paper beams on the stack of books so it makes a bridge. Make sure there is an equal amount resting on each stack.

3. Place the blocks on the beam, one at a time, and in the centre until the bridge collapses.

4. Repeat for the other two beams.
Observations:

<table>
<thead>
<tr>
<th>Number of Blocks</th>
<th>accordion</th>
<th>box girder</th>
<th>rectangular</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Type of Beam

Conclusion (What I learned):
Lesson Seventeen

Concept: Pillars

Resources/Materials: Mini Textbook, pages 33 and 34
Worksheet #3C.17a (transparency or teacher copy)
Worksheets #3C.17b, #3C.17c, #3C.17d, #3C.17e, and #3C.17f (student copies)
20 cm X 20 cm square of corrugated cardboard or very heavy Bristol board weights (like blocks)

Introduction: Briefly review stability, arches, beams, and triangles as they relate to building structures. Explain today students will learn about another part of some structures, particularly buildings.

Point out a table or desk leg. Discuss that its purpose (hold up the rest of the table or desk). Explain that a pillar is like a furniture leg, but it is much larger and is designed to hold up part of a building. Another name for a pillar is a column. Pillars come in all sizes and different shapes, but they all have the same purpose.

Procedure:

1. Show students the transparency or copy of Worksheet #3C.17a. Explain that this is a photo of the Legislature Building in Edmonton. This is where the laws for our province are made. Then point out the pillars holding up the front portico. These pillars are made of stone. They are solid (as opposed to hollow).

2. Explain that many years ago all pillars were solid and made of either stone or wood. Stone is stronger than wood. Discuss any other buildings with pillars students or you may have seen.

3. Have students turn to Mini Textbook, page 33 and guide the reading of pages 33 and 34.

4. Distribute Worksheets #3C.17b, #3C.17c, and #3C.17d. Using glue or tape, have students make the round, square, and triangular pillars. Emphasize accuracy in cutting and folding.

5. Explain that students will be conducting another fair test to see which of these pillar shapes can support the most weight.

6. Distribute Worksheets #3C.17e and #3C.17f. With students fill in the Testable Question and Hypothesis. (Which type of pillar can support the most weight, round, square, or triangular?)

7. Go over the other parts of the fair test. Have the students do the fair test and then complete the Observations and Conclusions sections.

Assignments:

1. Read Mini Textbook, pages 33 and 34.
2. Do the fair test and complete Worksheets #3C.17e and #3C.17f.
Science Grade Three Topic C: Testing Materials and Designs, Part II
Worksheets

The Alberta Legislature Building
Square Pillar

Glue here.
Testable Question: ____________________________________________

_________________________________________________________________

_________________________________________________________________

Hypothesis: _____________________________________________________

_________________________________________________________________

_________________________________________________________________

Materials: round pillar         square pillar         triangular pillar       
20 cm X 20 cm square of corrugated cardboard blocks

One thing that will be different: _______________________________________

Things that will not change:
- size of paper used to make each pillar
- height of the pillar
- type of paper used to make each pillar
- cardboard placed on each pillar

What will be measured: _____________________________________________

Procedure:

1. Centre the cardboard square on top of the round pillar.

2. Place the blocks, one at a time, on the cardboard square. Keep doing this until the pillar can no longer support the weight.

3. Repeat the procedure for the square and triangular pillars.
### Observations:

<table>
<thead>
<tr>
<th>Round Pillar</th>
<th>Square Pillar</th>
<th>Triangular Pillar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Blocks supported:
  - Round Pillar
  - Square Pillar
  - Triangular Pillar

---

**Conclusion (What I learned):**

---

---
Lesson Eighteen

Concept: Brick Patterns

Resources/Materials: Mini Textbook, pages 35 – 37
Worksheet #3C.18a (transparency or teacher copy)
Worksheets #3C.18b and #3C.18c (student copies)
blocks (Several sets of Dominoes are better yet.)
ruler

Introduction: Review that humans have used stones to build structures for thousands of years. Long ago they simply stacked stones they found.
Show students the photo of a stone fence on a transparency or copy of Worksheet #3C.18a. Explain that this photo was taken in a country called Ireland. This particular fence has been around for hundreds of years. There is no cement between rocks to hold the fence together. Long ago farmers used the stones they found in their fields to make these fences. They needed to be repaired every year. It was hard work. Today stones are not used as much. Instead people make bricks out of clay or sand and cement. Bricks are preferable to stones because they have flat sides and are easier to work with. Today’s bricks are held together with some kind of cement called mortar.

Procedure:
1. Bricks are actually quite strong. The places where one is joined to the next are the weakest part of a wall or fence. So, how the bricks are arranged has a lot to do with how strong a fence or wall is.


3. Explain that today students will have a chance to try building different types of brick fences. Instead of actual bricks, students will use blocks.

4. Have students choose any two patterns (from Mini Textbook, page 36) to test. Explain they are to see which particular pattern allows them to build the highest fence. They will not use any cement or glue.

5. Distribute Worksheets #3C.18b and #3C.18c. Help students to fill out the Testable Question (What arrangement of bricks can be stacked the highest?), Hypothesis, One thing that will be different (brick arrangement), and Thing that will be measured (height of the fence).

6. Have students complete the fair test and then finished Worksheet #3C.18c. Note: After each row of bricks is successfully completed, remind them to measure the height of the fence and write the height down.

NOTE: If you are short of bricks, you consider putting limits on the fences built; such as, the fence can be no more that four bricks wide OR build both fences until each fence has five rows. Then gently shake the table to see which fence toppled first.

Assignments:
2. Do the fair test and complete Worksheets #3C.18b and #3C.18c.
Testing Brick Arrangements

Testable Question: ________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Hypothesis: ________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Materials: blocks ruler

One thing that will be different: ________________________________________________

Things that will stay the same:
- size of the blocks
- table on which the fence will be built
- people building the fence
- direction the fence is facing

Procedure:

1. Choose one way to arrange blocks to make fence.

2. Build one row of the fence. Then use a ruler to measure the height of the row. Continue to build rows. After each row is completed, measure the height.

3. Keep putting up rows until the fence falls over.

4. Repeat this procedure with the other fence arrangement.
Observations:

<table>
<thead>
<tr>
<th>Brick Arrangement #1</th>
<th>Brick Arrangement #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of blocks:</td>
<td>Number of blocks:</td>
</tr>
</tbody>
</table>

What I learned: ______________________

__________________________________
__________________________________
__________________________________
__________________________________
__________________________________

Lesson Nineteen

Concept: Methods of Joining

Resources/Materials: Mini Textbook, pages 38 – 40
Worksheet #3C.19a (transparency or teacher copy)
Worksheets #3C.19b and 3C.19c (student copies)
toothpicks (round type) miniature marshmallows
Plasticine blocks
10 cm X 10 cm square of Manila tag

Introduction: Explain that today students will do their final fair test. Today’s lesson has to do with how the parts of structures are joined.

Procedure:

1. Have students turn to Mini Textbook, page 38 and guide the reading of pages 38 – 40.

2. Explain that in today’s fair test, students will not use any materials that are usually used to join parts of a structure. Instead they will be using Plasticine and marshmallows. The parts they will be joining are toothpicks. The structure they will be making is a cube.

3. Display the transparency or copy of the cube on Worksheet #3C.19a. Explain that this is a cube made of toothpicks and jellied candies. Discuss how the candies are used to join the toothpicks. Also discuss things like the number of toothpicks needed, the number of joiners needed, how to go about constructing the cube.

4. At this point, teachers must decide how much assistance they want to give students.

5. You might want to divide your class into smaller groups, depending on how many students you have.

6. Explain that the idea of the fair test is to construct two cubes, one where marshmallows are used to join the toothpicks and one where Plasticine is used to join them. Then students will place a Manila tag square on top of each cube and place blocks on the Manila tag to see how much weight the cubes can support.

7. Distribute Worksheets #3C.19b and #3C.19c. Have students complete the planning sections of the fair test on Worksheet #3C.19b. Then have them do the test and complete Worksheet #3C.19c.

Assignments:

2. Plan and do the fair test, completing Worksheets #3C.19b and #3C.19c.
Toothpick Cube
Science Grade Three Topic C: Testing Materials and Designs, Part II
Worksheets

Testing Toothpick Cubes

Testable Question: ____________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Hypothesis: ________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

The one thing that will be different: __________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Things that will stay the same:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

What will be measured? _____________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Procedure:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
Lesson Twenty

Concept: Testing Materials and Designs, Part II Test

Resources/Materials: Testing Materials and Designs, Part II Test (student copies)

Introduction: Explain that the unit on Testing Materials and Designs is now almost at an end. All that is left to do is a test.

Procedure:

1. Distribute the test.

2. If you have students in the group who cannot read the test independently, you will have to go through the test question by question.
1. Circle the picture that best answers each question.

a) Which table will be more stable?

b) Which frame will be able to support more weight?

c) Which frame will be able to support more weight?
d. Which beam will be able to support more weight?

e. Which pillar will be able to support more weight?

f. Which brick pattern will make a fence that is more stable?

g. Which toothpick cube will be able to support more weight?

marshmallows

Plasticine
2. Jennifer and Sharon want to know if a table supported by one large pillar is stronger than a table supported by four small pillars.

For each question circle the better answer.

<table>
<thead>
<tr>
<th>a</th>
<th><strong>Which is the better testable question?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Is a table supported by one pillar strong?</td>
</tr>
<tr>
<td></td>
<td>• Will a table held up by one large pillar support more weight than a table held up by four small pillars?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>b</th>
<th><strong>Which is the better hypothesis?</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A table held up by four small pillars will support more weight than one held up by one large pillar because the four small pillars will make a table more stable.</td>
</tr>
<tr>
<td></td>
<td>• A table held up by one large pillar will support more weight than a table held up by four small pillars.</td>
</tr>
</tbody>
</table>
c Which tells the one thing that will be different?

- number of pillars supporting the table
- height of the table

d Which of the following does not tell about something that will be kept the same?

- number of pillars
- what the pillars are made of

e What will be measured?

- height of the pillars
- weight each table can support

f The girls observed that the table with one pillar could support 8 blocks. The table with four pillars could support 11 blocks. Which tells what they can conclude?

- A table with one pillar can support more weight than one with four pillars.
- A table with four pillars can support more weight than one with one pillar.
Testing Materials and Designs

Contents

Introduction 4

Part I: Testing Materials

The Properties of Materials 6

Some Properties 7

More Properties 8

The Fair Test 10

Fair Test 12

Parts of a Fair Test 13

More About Fair Tests 16

Christina, Annie, and Adinna’s Fair Test 20
Part II: Testing Designs

Introduction 25

Looking at Good Design 26

Stability 26

Triangles 28

Arches 30

Beam Shapes 31

Pillar Shapes 33

Stone and Brick Walls 35

Joining Materials 37
Testing Materials and Designs

Introduction

The stores are filled with thousands and thousands of things to buy.

Sometimes you want to make something and you need to buy the right materials. Materials are the things you use to make other things. Different materials can do different types of things. You must try to choose the materials that are going to be right for the objects you want to make.
Once you have chosen the materials you want, you must think about how you are going to cut, shape, and put all the materials together. When you do this, you design the object you want to make.

Some designs are better than others. An object with a good design works much better than an object with a poor design. Objects with good designs are also safer to use.

As you get older and have more chances to use different kinds of materials, you will learn more about those different kinds of materials. In the same way, you will also know more about different designs.

This unit will help you to learn about many different types of materials and designs. You will learn how to test to see which ones are best for a certain use.
Part I

Testing Materials

Introduction

When testing materials, you want to know what they can and cannot do. When you know this, you can decide if the materials are the ones that are right for the object you want to make.

The Properties of Materials

The properties of a material tell what the material is like. It is the properties that help us understand how one material is alike and how it is different from other materials.
Some Properties

There are many different things we can look at when it comes to thinking about the properties of materials. Here are some of them:

1. Waterproof. Waterproof means that water does not soak into it.

   These boots are made from a material that is waterproof.

2. Flexible. Flexible means that you can bend the material. It also means that if you can bend the material, it will not break.

   A piece of cloth is flexible.

3. Transparent. Transparent means you can see through the material.

   This water glass is transparent.
4. **Strong.** If something is strong, you cannot break it easily.

   This piece of wood is strong.

**More Properties**

There are many other properties we can look at. Some of them are:

1. **Squeezable.** When a material is squeezable, you can push or squeeze in the sides.

   Sponge is squeezable.

2. **Stretchable.** Being stretchable is the opposite of being squeezable. If a material is stretchable, you can pull out on it.

   This elastic band is stretchable because it is made of rubber.
3. **Slidable.** If a material is slidable, you can pull one side of it in one direction and pull the other side in the opposite direction.

   Plasticine is slidable.

4. **Twistable.** A material that is twistable can be twisted. You can turn part of it a little without breaking it.

   Plasticine is twistable.

5. **Bendable.** A material is bendable if you can pull two of its sides down in the same direction.

   Paper is bendable.
The Fair Test

Introduction

When you play a game with your friends, you want everyone to play by the rules. This makes the game fair for everyone.

When you want to find out if one type of material is better than another, you can test both materials out. But just like the game, you want to do it in a fair way.

Let’s say your friend Benjamin wants to know if plastic cracks more easily than glass.

He decides to do a test.

He takes a small very thin round piece of glass and hits it really hard with a hammer. The glass cracks.

Then Benjamin takes a large thick square piece of plastic and taps it lightly with a piece of cloth. Nothing happens. The plastic does not crack.

Benjamin decides that plastic is stronger than glass.

Does this make sense to you?
Let's take a look at Benjamin's test.

This chart compares the glass with the plastic.

<table>
<thead>
<tr>
<th></th>
<th>Glass</th>
<th>Plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>size</td>
<td>small</td>
<td>large</td>
</tr>
<tr>
<td>thickness</td>
<td>very thin</td>
<td>thick</td>
</tr>
<tr>
<td>shape</td>
<td>round</td>
<td>square</td>
</tr>
<tr>
<td>What it was hit with</td>
<td>hammer</td>
<td>piece of cloth</td>
</tr>
<tr>
<td>How hard it was hit</td>
<td>really hard</td>
<td>light tap</td>
</tr>
<tr>
<td>What happened?</td>
<td>cracked</td>
<td>did not crack</td>
</tr>
</tbody>
</table>

You can see from the chart that everything about the glass was different from the plastic.

You don't know whether the glass cracked and the plastic did not because of their sizes, thicknesses, shapes, what they was hit with, or how hard they were hit.
Fair Test

Scientists decided that if you really want to know if one material is better than another, you have to do a **fair test**.

In a fair test, everything has to be the same except for one thing. And you have to be very careful when doing the test.

If Benjamin wants to know if plastic cracks more easily than glass, he would have to make sure that all of these things were the same:

- Size of the material
- Thickness of the material
- Shape of the material
- What it was hit with
- How hard it was hit

The only thing that could be the different would be the type of material – plastic or glass.

Now his test would be fair.
Parts of a Fair Test

Every fair test has the same parts. This goes for tests done by grade three students to scientists who have been doing tests for fifty or more years.

Let’s take a look at the parts to a fair test.

1. **Testable Question.** A testable question is asks what you want to find out.
   
   Will a piece of glass crack more easily than a piece of plastic if hit by a hammer?

2. **Hypothesis.** In the hypothesis you tell what you think will be the answer to the testable question and why.
   
   I think that a piece of glass will crack more easily than a piece of plastic because plastic is more flexible than glass.

3. **Materials.** This is a list of all the things you will use to do your fair test.

   1 cm thick square piece of glass (10 cm X 10 cm)
   1 cm thick square piece of plastic (10 cm X 10 cm)
   hammer
   gloves
   safety glasses
   table
4. **What Will Be Different.** Only one thing can be different. This is called the *manipulated* or *independent variable*.

*Type of material: glass or plastic*

5. **What Will Be the Same.** Everything else must be the same. These are called the *constants or constant variables*.

- Shape of the material
- Size of the material
- Thickness of the material
- What the materials are hit with
- How hard the materials are hit
- Person doing the hitting

6. **How I Will Know.** This tells how you how you will know; that is, what you will be watching for. This is called the *responding* or *dependent variable*.

- cracking or not cracking
7. **Procedure.** In the Procedure, you explain the steps you will use to do the fair test.

First, I will set the glass on a table. Second, I will hit the glass in the centre with a hammer. Third, I will set the plastic on the same table. Fourth, I will hit the plastic in the centre with a hammer. I will be careful to hit the plastic as hard as I hit the glass.

8. **Observations.** The observations tell what you saw. The observations should be written in sentences. As part of the observations you might also include drawings or graphs, if you think they will help others to understand what you observed.

The glass cracked when I hit it with the hammer. The plastic did not crack when I hit it with the hammer.

9. **Conclusion.** The conclusion tells what you learned. It answers the testable question.

I learned that glass cracks more easily than plastic when hit by a hammer.
More About Fair Tests

Testable Question

One of the most important parts of a fair test is the testable question. All the other parts of a fair test are done to answer the testable question, so it is important that you know how to think about and write one.

These questions are called testable questions because they tell exactly what you will be testing for and you will be able to observe the results.

Testable questions most often start with the words do, does, or will. A testable question tells what you want to compare and how you want to compare them.
Here are some examples of good and bad testable questions.

<table>
<thead>
<tr>
<th>Bad Questions</th>
<th>Good Testable Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are nails good for holding wood?</td>
<td>Will two boards held together with nails come apart more easily than two boards held together by screws?</td>
</tr>
<tr>
<td>Is paper strong?</td>
<td>Will plain photocopy paper support more mass than Bristol board?</td>
</tr>
<tr>
<td>Do plants need sunlight?</td>
<td>Which will grow taller, a plant that is in the sun or a plant that is in the dark?</td>
</tr>
<tr>
<td>How stretchy is rubber?</td>
<td>Will a thin sheet of rubber stretch out more than a thick sheet of rubber?</td>
</tr>
</tbody>
</table>
Hypothesis

The hypothesis has two parts.

The first part tells what you think is the answer to the testable question. The second part tells why you think the way you do.

The hypothesis usually looks like this:

*I think....... because.......*

Here are some examples of good and bad hypotheses.

<table>
<thead>
<tr>
<th>Bad Hypotheses</th>
<th>Good Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws are better.</td>
<td>Screws will hold two pieces of wood together better than nails because screws must be turned to put them in.</td>
</tr>
<tr>
<td>Bristol board is stronger than plain photocopy paper.</td>
<td>Bristol board will be stronger than plain photocopy paper because Bristol board is thicker than photocopy paper.</td>
</tr>
</tbody>
</table>
Can fair tests test anything?

Fair tests can test many things, but they cannot test everything.

Fair tests are best used when you can see the results and actually measure them in some way.

They are most often used when you want to know if one thing or variable changes another thing, and by how much.

When testing materials and designs, we are usually looking to find out things like if one type of material is stronger than another type, or if one material is more bendable than another.

Fair tests cannot be used when you want to know how someone feels about something. For example, you cannot do a fair test to see if strawberry ice cream is better than chocolate ice cream. This is because it all comes down to which flavour each person likes better. You cannot observe flavour. You also cannot measure it.
Christina, Annie, and Adinna’s Fair Test

Christina, Annie, and Adinna are students at Grossner Colony School.

Christina is in grade two. Annie is in grade one. Adinna is in grade three.

Christina, Annie, and Adinna

The Situation

The girls were working on an art project. For the art project they wanted to use a piece of material that was not very stretchy. The girls brought two pieces of material from home. One was made of cotton and the other from polyester. They wanted to know which material would be better to use.

Their teacher, Mrs. Kleinser, suggested they do a fair test to figure out the answer.
What the Girls Did

1. **Come up with a testable question.**

   The girls first had to come up with a testable question. Mrs. Kleinser told them the question had to be worded in such a way that they could observe and measure something in order to answer the question.

   Here is the question the girls came up with:

   **Which material will stretch more, polyester or cotton?**

2. **Decide on a hypothesis.**

   Mrs. Kleinser reminded the girls that the hypothesis had to tell which type of material they thought would be more stretchy and why.

   Here is the hypothesis the girls came up with:

   **Polyester will stretch more than cotton because when you wear clothes made out of polyester, they seem to feel looser than clothes made out of cotton.**
3. **List the materials they will use.**

   The girls’ teacher reminded them that they had to write down all the things they would use.

   Here is the girls’ list.

   - *piece of polyester material that is 20 cm long and 30 cm wide*
   - *piece of cotton material that is 20 cm long and 30 cm wide*
   - *metre stick*

4. **Tell what one thing will be different.**

   Mrs. Kleinser told the girls that they could only choose one thing that could be different about the two samples of fabric.

   Here is what the girls decided on.

   - *the type of material*

5. **Tell all things that will be the same.**

   The girls decided that the colours of the material samples would not make a difference, so they did not write that down. Here is what the girls wrote:

   - *size of the fabric*
   - *person doing the stretching*
6. Tell what you will observe and measure.

The girls decided they could tell just by looking. Mrs. Kleinser said they had to be more exact than that.

Here is what the girls decided on:

• length of the fabric after it was stretched

7. List the steps that you will follow.

The girls were used to doing this. Here is what they wrote.

• Place the cotton fabric on a table.
• Place one hand on either side of the long side of the cloth.
• Pull the cloth until it will not stretch anymore.
• Measure to see how long the cloth gets when it is stretched.
• Repeat the steps with the polyester cloth.

8. Write down what you observed.

To Mrs. Kleinser’s surprise, the girls had no trouble doing this. Here is what they wrote:

<table>
<thead>
<tr>
<th>Cotton</th>
<th>Polyester</th>
</tr>
</thead>
</table>

The cotton cloth stretched to a length of 31 cm.
The polyester cloth stretched to a length of 36 cm.

The girls’ teacher asked if the fair test helped them to decide which type of material stretched more. They all said that the fair test helped them decide.

Here is what they wrote.

*We learned that polyester cloth stretches more than cotton cloth.*

What Happened?

Christina, Annie, and Adinna decided that they should use cotton cloth for their art project. They chose the cotton cloth because it did not stretch as much as the polyester cloth did.

The girls did their fair test just like a scientist would do it! Good going, girls!
Part II

Testing Designs

Introduction

You have learned that when you are going to build something, you must choose the right materials.

You also learned that one way to decide if a certain material is the right one is to do a fair test.

The design of an object tells about how the materials are cut, shaped, and put together.

The design of an object is important. An object with good design will do what it is supposed to do and do it well. An object with poor design will not.

Objects with good design are also safe. They won’t tip over or fall apart. They will not cause you any harm.
Looking at Good Design

There are many things we can look at to decide if an object has good or poor design. We will look at a few of them.

Stability

Stability refers to how well an object will stand up on its own. An object that is stable will not tip over very easily.

Things that are tall and narrow are usually not very stable.

This book shelf will tip over easily.

Things that are short and wide are usually very stable.

This set of shelves is long and low. It will be very stable.
A table that is wide at the bottom is more stable than a table that is narrow at the bottom.

The table on the left is not as stable as the table on the right.

A tree looks like it is wide at the top and narrow at the bottom. Yet a tree is stable. You cannot tip it over easily.

This is because you cannot see all of the tree. A tree has lots of roots hidden below the ground. Its roots are very wide.

A tree is stable because its roots grow to be very wide.


**Triangles**

If you look at many objects, you will see one or more triangles. This is not to make it look nice.

Triangles are an important part of the design of an object, especially if you want it to be strong.

You can make a square out of paper strips, using brass fasteners to hold the strips together. You will see that the square can easily go out of shape.

![A paper strip square can easily go out of shape.](image)

You can make a triangle out of paper strips too. You will see that the triangle is **rigid**. This means it will not easily lose its shape.

![A paper strip triangle is rigid.](image)
Designers and builders use triangles in their designs. They do this to make sure the structures they build are strong and stable.

The triangles in these doors help to make the doors more stable.

These towers are strong and stable because of the triangles in the design.

These pyramids are thousands of years old. A pyramid has triangles for sides.

Do you see the triangle on upper part of the wall? It is in the shape of a triangle to make it stronger.
Arches

The arch is another shape that makes a structure stronger and more stable.

The arch has been used in building structures for more than a thousand years.

Arches are still used today.

This house has an arch-shaped roof.

This is a famous arch found in the city of Paris in France.

This bridge is strong and stable because it is in an arch shape.

Nature made this rock in the shape of an arch.
Beam Shapes

Beams are long pieces of wood or steel that are used to make buildings.

In the past most beams were made of wood. They had to be very big because they had to hold up the building.

Big wooden beams hold up the roof in this house.

Today big buildings use beams made of steel. Steel is used because it is strong. Steel can also be made into different shapes.

Solid steel beams are not used very often. This is because they are very heavy.
These steel beams are hollow. That makes them light and strong. They are in the shape of a rectangle. These beams are also called box girders.

One of the most common types of beam is the I-beam. It gets its name from its shape.

These drawings show other beam shapes.
Pillar Shapes

A pillar is a big post.

Most pillars are used to hold up roofs. Sometimes pillars are called **columns**.

Pillars have been used for thousands of years. Most pillars are in the shape of a cylinder.

The pillars or columns in this photo are over 2000 years old. They are made of solid stone. The building is found in a city called Athens in the country of Greece.

The columns in this photo are not round. They are square. This is a photo of a religious building in a country called Thailand.
Most pillars used today are not solid. They are hollow. Builders find that hollow pillars are light in weight, but still strong.

These pillars are found in many basements. They hold up the floor above.

You cannot see them, but your school and your house are built on special pillars called piles. Piles are made of concrete and are in the ground. The piles hold your house up.

Most piles are made by pouring concrete into holes dug into the ground. But these piles will be pounded into the ground.
Stone and Brick Walls

Long ago many houses were made of stone. It was a lot of work. The builder had to find lots of stones. Then he had to carry the heavy stones to where he was building his house. The builder also had to fit big and little stones together to make a wall. Stone houses were not always strong. They did not always last a long time.

Later, when people learned how to use cement to hold the stones together, stone houses lasted much longer. Still it was a lot of work.

This stone wall must have taken a lot of time to build. The stones are held together with cement.

This woman is standing in front of a house made of stones that are stacked on top of each other. The roof is not made of stone. It is made of branches.
Today stone is not used very much to build houses.

Bricks are used instead of stones. That is because bricks can be made so that their sides are flat. The bricks are held together with cement.

There are many different ways that bricks are stacked. Some are stronger than others.

These drawings show different ways to stack bricks.

These bricks are made to look as if they are stone.
Today this is the most popular way to stack bricks. That is because this pattern makes the strongest wall.
Joining Materials

An important part of design has to do with how the pieces of a structure are joined to one another.

The material you use to join the pieces depends on what the pieces are made of and how well they must hold together.

There are many different materials that can be used to join pieces of a structure together. Let’s take a look at a few of them.

1. **Tape.** There are all kinds of tape. Most tape is sticky only on one side. Some tapes hold better than others.

![Tape images]

2. **Glue.** Just like tape, there are all kinds of glue. Many are very strong, like carpenter’s glue. Others are useful only for holding paper together, like a glue stick.

![Glue images]
3. **Cement.** Cement is related to glue. Cement starts out as a powder. Then a liquid and other things are added to it. In concrete, gravel and sand is held together by a type of cement.

Cement starts out as a powder.

4. **String and Rope.** These are useful when you want to be able to take the pieces of an object apart.

5. **Nails.** Most times nails are used to hold pieces of wood together.
6. **Nuts, Bolts, and Screws.** These have lots of different uses. They can be used to hold woods and metals.

7. **Zippers, Velcro, and Buttons.** They are used mainly to hold pieces of cloth together.