Physical Science
Worksheet

GRADE LEVEL: Third

Topic: Motion of Objects

Grade Level Standard: 3-3 Compare the common forces and the motion of objects.

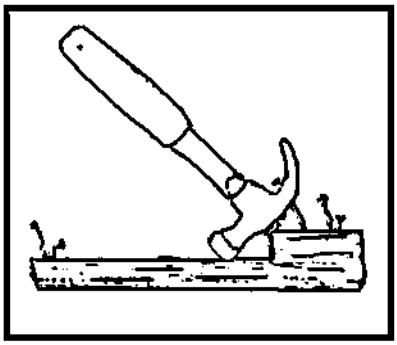
Grade Level Benchmark: 4. Identify and use simple machines and describe how they change effort. (IV.3.E.4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do simple machines change the effort needed to work?***	
1. "Using Simple Machines" ★ 2. "Using Levers" ★ 3. "Pulleys in Action" ★ 4. "The Inclined Plane" ★ 5. "The Wedge" ★ 6. "The Screw" ★ 7. "Using Legos® to Build a Pulley, Lever, and Wheel and Axle" ★ ★ Activity is attached	Pushes and Pulls MacMillian/McGraw Hill
Process Skills: Communicating, Observing, Predicting, Developing models, Controlling variables	

New Vocabulary: inclined plane, levers, pulleys, wedges, wheel and axle, force distance

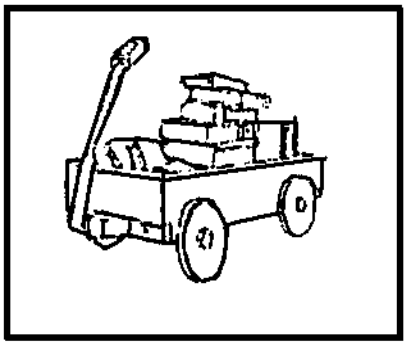
USING SIMPLE MACHINES

We use simple machines every day. They make our work faster and easier. In order for simple machines to be useful, we need to know how they can help us. The six simple machines are listed and described below.



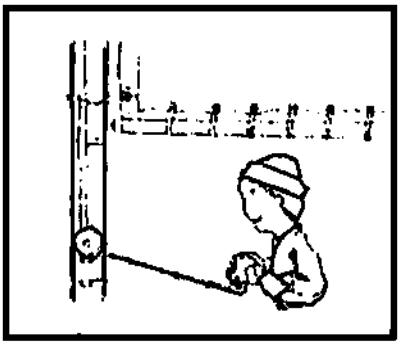
Lever:

Helps us move things with less force.



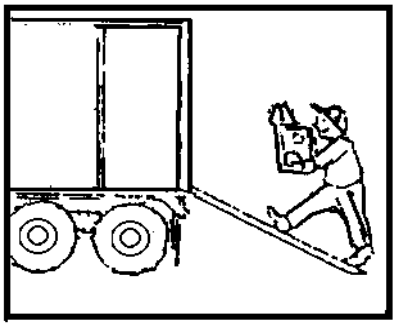
Wheel and Axle:

Used to move things from one place to another.



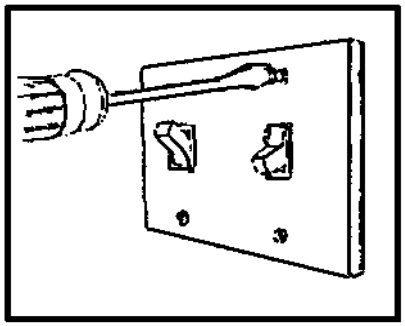
Pulley:

Use to lift loads more easily.



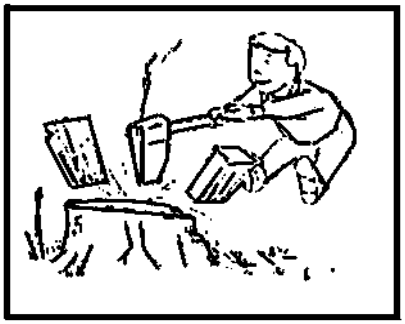
Inclined Plane:

Used to move things from a lower place to a higher place (or from a higher place to lower place).



Screw:

Hold things together.



Wedge:

Helps us cut or split things.

Anticipation/Reaction Guide: Simple Machines

Read the following statements. Mark if you agree or disagree using an X.

1. **Inclined planes** can be used to get hay from the ground to the hay loft.

   _____ agree _____ disagree

2. A **gear** is a type of lever.

   _____ agree _____ disagree

3. **Simple machines** make work harder.

   _____ agree _____ disagree

4. A **wedge** props a door open.

   _____ agree _____ disagree

5. A **pulley** moves a flag up a pole.

   _____ agree _____ disagree

6. A **screw** is used to hold things together.

   _____ agree _____ disagree

7. A rock can be moved using a **lever**.

   _____ agree _____ disagree

8. An **axle** is a simple machine

   _____ agree _____ disagree

USING LEVERS

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C1 : *Generate reasonable questions* about *the world, based on observation.*
C3: Manipulate simple mechanical devices and *explain how they work.*
R4: Describe how technology is used in everyday life.
PMO3: Use simple machines to make work easier.

KEY QUESTION

How are levers used to make work easier?

TEACHER BACKGROUND

A lever is a bar, resting on a turning point, called a fulcrum. Applying force at one end of the lever produces movement at the other end. If the placement of the fulcrum is changed, the amount of work is changed. The lever is the least complicated of all simple machines.

OBJECTIVE

To use common examples of levers to do work.

SCIENCE PROCESS SKILLS

observing, communicating, comparing, recognizing relationships, experimenting

KEY TERMS

lever

MATERIALS

- reading worksheet, The Lever
- worksheet, Anticipation/Reaction Guide: Levers
- book, *Simple Machines*
- bottle opener
- hammers (2)
- scrap wood (2 x 4 pieces)
- roofing nails (1 1/4")
- screwdriver
- safety goggles

<u>Teacher Provided</u>

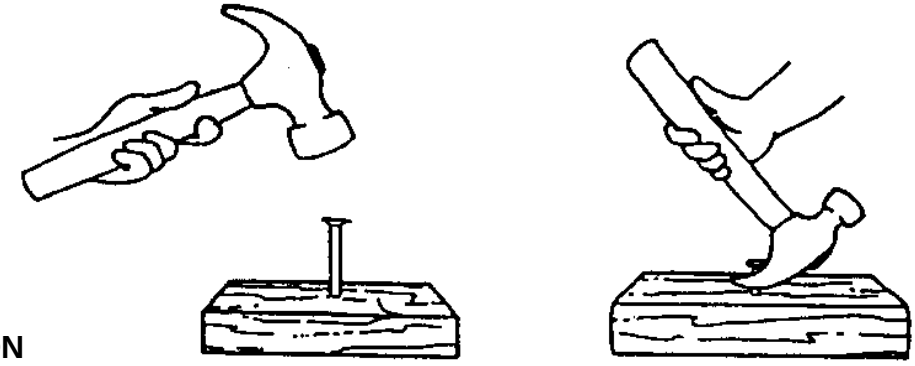
- cocoa container (with lid)
- metal spoon (teaspoon)

TIME

10-15 minutes; center time will vary

PROCEDURE

1. Ask: What is a lever? Discuss their ideas. Explain that a lever is a simple machine used to move things easier.
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Levers. Have students share their ideas.
3. Read the background information about levers. Begin marking a list of common levers found at school and home (teeter-totter, hammer, bottle opener, crowbar, nutcracker). Add pictures of levers to the class bulletin board/collage.
4. Ask: What levers have you used at home or school? Have you ever pulled a nail out of wood with a hammer? Have you ever put a nail into wood with a hammer? Explain that whenever we use a hammer, we are using a lever .
5. Show the students the can of cocoa. Ask: How can we remove the lid easily? Use the spoon or screwdriver to pry the lid off the container. Explain that the spoon/screwdriver is a lever. Ask: How could you remove the lid easily if you did not have a lever? Have a student try to remove the lid without using a lever.
6. Next, show the students a bottle opener. Ask: What is this lever used for? (opening bottles or cans) Discuss how we would open a can of Hi-C (or other juice can) without a bottle opener.
7. Explain that the students will have an opportunity to use a lever (a hammer) to do work. Set up a work station with hammers, nails, scrap wood and safety goggles. Review safety rules for using these tools. Students must where the safety goggles at all times when using the tools Make sure that they do not hammer the nails all the way into the wood I they are able to use the claw to take them back out.



DISCUSSION

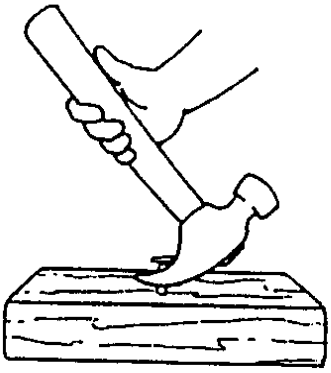
1. How do levers make it easier to do work?
2. What types of jobs can levers be used for?

EXTENSION

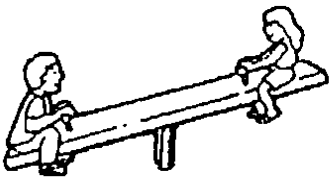
- Have the students share examples of levers with their family. Have them ask adults what levers they use at home or work. Students should share the types of levers they learned about with the class.
- Read and discuss levers in the book, *Simple Machines*.

THE LEVER

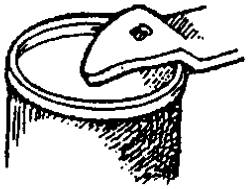
A **simple machine** called a **lever** helps make it easier to lift heavy objects. You use it every day. Some examples of levers are: teeter-totters, bottle openers, hammers, your arm, and nut crackers.



hammer

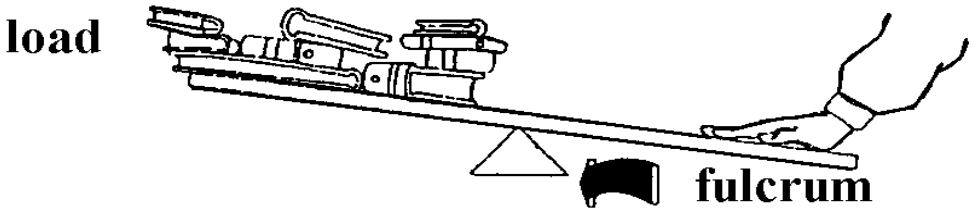


teeter-totter



bottle opener

The point where a lever is help up is called the **fulcrum**. For a lever to work, it must move back and forth on the fulcrum.



You can lift heavy objects easier by moving the fulcrum closer to the load. The load is the object or objects you want to lift. If you want to use the least amount of energy, move the fulcrum closer to the load. The longer the lever the easier it is to lift a heavier load.

Anticipation/Reaction Guide: Lever

Read the following statements. Mark if you agree or disagree using an X.

1. A bottle opener is an example of a lever.

_____	_____
agree	disagree

2. A hammer is an example of a lever.

_____	_____
agree	disagree

3. A lever is used to hold things together.

_____	_____
agree	disagree

4. A lever needs a fulcrum to do work.

_____	_____
agree	disagree

PULLEYS IN ACTION

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C *1:* *Generate reasonable questions* about *the world, based on observation.*
C3: *Manipulate simple mechanical devices* and *explain how they work.*
R4: *Describe how technology is used in everyday life.*
PMO3: *Use simple machines to make work easier.*

KEY QUESTION

How do pulleys make work easier?

TEACHER BACKGROUND

A pulley is a wheel which is a grooved edge. A rope is fitted in the grove and is used to lift heavy objects. When the rope is pulled downward, the pulley turns and lifts the object. A pulley makes the amount of force (effort) needed to do work feel easier because the direction of the effort is changed. Pulleys are used to raise flags to the top of flag poles, move elevators up and down and move clothes along a clothesline.

OBJECTIVE

To build a pulley that can be used to lift an object off of the floor.

SCIENCE PROCESS SKILLS

observing, communicating, experimenting, making models

MATERIALS

- reading worksheet, The Pulley
- worksheet, Anticipation/Reaction Guide: Pulleys
- pulley
- yarn
- wooden spools
- straws
- book, *Simple Machines*

<u>Teacher Provided</u>

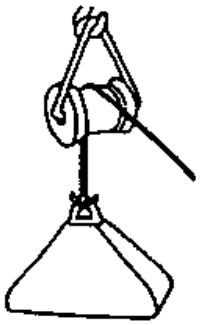
- miscellaneous classroom objects

TIME

15-20 minute introduction; time to build pulleys will vary

PROCEDURE

1. Ask: What is a pulley? Discuss their ideas. Explain that a pulley is a simple machine used to move heavy objects from a low place to a high place or a high place to a low place.
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Pulley. Have students share their ideas.
3. Read the background information about pulleys. Begin making a list of common pulleys found at school and home. Add pictures or pulleys to the class bulletin board/collage.
4. Ask: What pulleys have you used at home or school?
5. Show the students the pulley. Find a place in the room to hook the pulley to. Thread the groove with a long piece of yarn. Find a small object to lift off the ground using the pulley. Have the students take turns lifting objects with the pulley. If possible, take a trip to the flagpole. Ask the students to look for the pulley at the top of the pole. Move the flag up and down using the pulley.
6. Next, explain that the students will be working in teams to construct a working pulley using straws, yarn, wooden spools and other classroom supplies.
7. Divide the students into 8-10 teams. Encourage the teams to discuss possible ways to make a pulley using the supplies provided. Give them their supplies and let them investigate ways to make a pulley.
8. After the pulleys are constructed, the groups should try to lift small objects with it. They should make changes to their pulley based on how well it works. Let them reconstruct pulleys that do not work well.



DISCUSSION

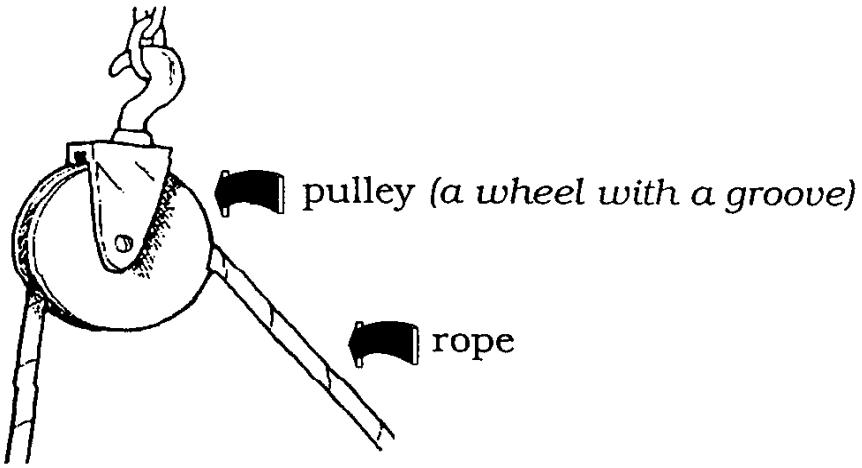
1. How do pulleys make it easier to do work?
2. What types of jobs can pulleys be used for?

EXTENSION

Read and discuss pulleys in the book, *Simple Machines.*

THE PULLEY

A pulley is a special kind of wheel. A rope fits into the groove of the wheel. As the rope is pulled, the wheel turns.



Pulleys are used in many ways. There is a pulley at the top of flag poles. Can you find the pulley at the top of the flagpole? There is a pulley at the top of a sailboat mast to raise and lower the sails. Construction workers use pulleys to lift steel beams. Pulleys are used to lift a load up, down, or sideways. Where have you seen a pulley lift something off the ground?

Anticipation/Reaction Guide: Pulley

Read the following statements. Mark if you agree or disagree using an X.

1. A pulley is a wheel with a groove.

   _____ agree _____ disagree

2. A pulley is a simple machine.

   _____ agree _____ disagree

3. A pulley can be used without a rope.

   _____ agree _____ disagree

4. A pulley can be used to raise a flag on the top of a pole.

   _____ agree _____ disagree

INCLINES MAKE WORK EASIER!

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1: *Generate reasonable questions* about *the world, based on observation.*
C2: *Develop solutions to unfamiliar problems through reasoning, observation and/* or *experimentation.*
C3: *Manipulate simple mechanical devices and explain how they work.*
PMO1: *Describe or compare* the *motions of common objects in terms of speed and direction.*
PMO2: *Describe how forces speed up, slow down, stop, or change the direction of a moving object.*
PMO3: *Use simple machines to make work easier.*

KEY QUESTION

How do inclined planes make our work easier?

TEACHER BACKGROUND

Inclined planes are used by people to make lifting or moving an object easier. An inclined plane is any sloping surface. It is one of the most important machines used in industry. Inclined planes are used to get objects from one place to another. If you push objects up an incline, you must move them a longer distance than if you tried to lift them straight up. However, less effort is needed when using an inclined plane. The same amount of work is completed, but the work is easier. Common examples are: staircases, hills, wheel chair ramps, slanted roads, spiral roads up mountains and hills and slides on the playground.

OBJECTIVE

To observe how using an inclined plane makes it easier to move objects from one place to another.

SCIENCE PROCESS SKILLS

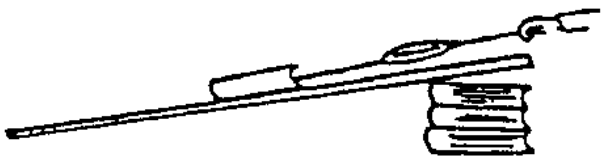
observing, experimenting, communicating, comparing, measuring, drawing conclusions

KEY TERMS

force, work, inclined plane

MATERIALS

- string or yarn
- spring scales
- inclined planes
- blocks of wood with screw eye
- book, *Simple Machines*
- reading worksheet, The Inclined Plane
- activity worksheet, Anticipation/Reaction Guide: Inclined Plane



TIME

20-25 minutes

PROCEDURE

1. Ask: What are inclined planes used for? (to move objects) Where have you seen inclined planes?
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Inclined Planes. Have students share their ideas.
3. Read the background information about inclined planes. Begin making a list of common inclined planes found at school and home (hill, slide, stairs, wheelchair ramp). Add pictures of inclined planes to the class bulletin board/collage.
4. Ask: What inclined planes have you used at home or school?
5. Have the students predict: Does it take more force to lift an object or move it up an incline? Discuss their predictions.
6. Show the students the spring scale. Explain that they will use the scale to measure the amount of force needed to lift a piece of wood.
7. Divide the class into groups of 3-4 students. Give each group a spring scale. Have them look at it. There are two sets of numbers. Explain that they will be using the numbers labeled N .
8. Give each group a block of wood and piece of string about 30 cm. (12 in.) in length. Have the groups tie the string through the screw eye. Next, the students should tie the other end of the string around the end (hook) of the spring scale. Each student in the group should take turns lifting the block off the floor by pulling upwards (vertically). Groups should observe and record the number from each trial.
9. Pass out the inclined planes. Have the groups place 5 textbooks under one end. They should put the wood at the bottom of the incline and slowly pull it up. Each group member should take turns pulling the block up the incline. Groups should observe and record the number from each trial.
10. Students should notice that the amount of force needed to lift the book straight up is more than if it is pulled up an incline.

DISCUSSION

1. What does this investigation show about the usefulness of using an inclined plane to do work?
2. What could we put under the wood to make it even easier to move it up the incline? (wheels, a smooth material like waxed paper, etc.)

JOURNAL ENTRY

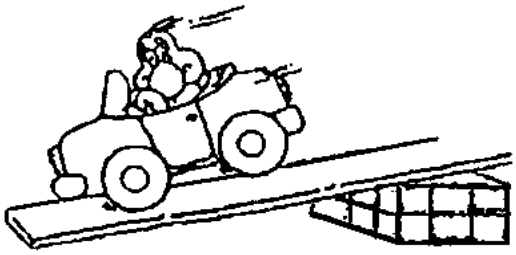
Have the students design a way to move a large rock from one place to another that would use the least amount of their energy. Have them explain how an inclined plane would be easier to use than carrying the rock in their arms.

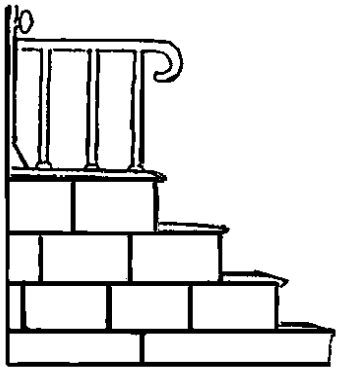
EXTENSION

Read and discuss inclined planes in the book, *Simple Machines.*

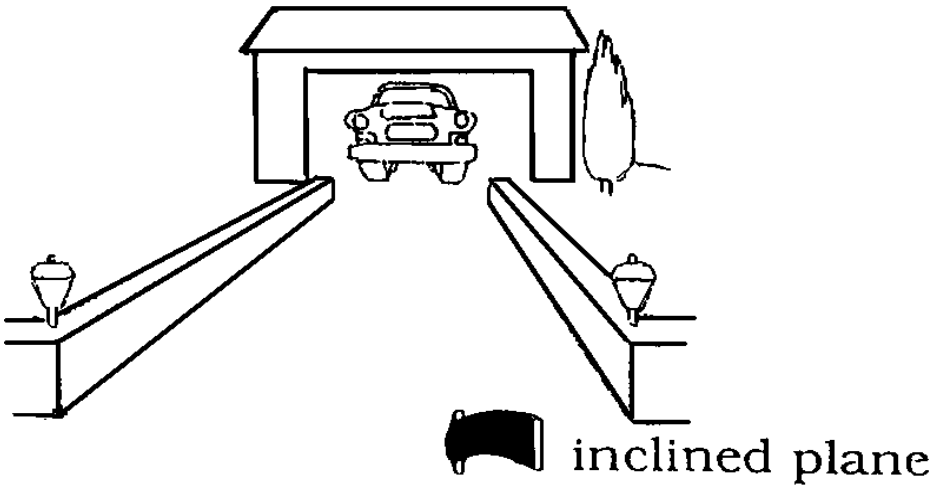
THE INCLINED PLANE

An **inclined plane** is a simple machine. Incline means slant. An inclined plane is a slanted surface that is used to move things from a low place to high place or from a high place to low place. Sometimes inclined planes are called ramps. The car in the picture is traveling down an inclined plane.





You use an inclined plane every day when you climb stairs, walk up ramps, slide down hills, or drive up a driveway. What are some inclined planes around your school? How do inclined planes help make your work easier?



Anticipation/Reaction Guide: Inclined Plane

Read the following statements. Mark if you agree or disagree using an X.

1. Inclined planes need a fulcrum.

   _____ agree _____ disagree

2. Inclined planes can be used to move heavy objects from a low place to a high place.

   _____ agree _____ disagree

3. An inclined plane is a simple machine.

   _____ agree _____ disagree

4. Stairs are an example of an inclined plane.

   _____ agree _____ disagree

5. A hill is an example of an inclined plane.

   _____ agree _____ disagree

PUSHING ASIDE!

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C1: *Generate reasonable questions* about *the world, based* on *observation.*
C3: Manipulative simple mechanical devices and *explain how they work.*
C4: Describe how technology is *used in everyday life.*
PMO3: Use simple machines to make work easier.

KEY QUESTION

How are wedges used to do work?

TEACHER BACKGROUND

A wedge is a small inclined plane that is used as a tool. Wedges are used to split or cut things apart. Nearly all cutting machines use the wedge: scissors, saws, and knives.

OBJECTIVE

To use wedges to cut or separate materials.

SCIENCE PROCESS SKILLS

observing, communicating, experimenting, making models

MATERIALS

- reading worksheet, The Wedge
- worksheet, Anticipation/Reaction Guide: Wedge
- activity worksheet, The Wedge
- activity worksheet, Can You Make a Wedge?
- wooden door wedges
- clay
- nails
- plastic knives
- push pin/thumb tack
- block of wood
- book, *Simple Machines*

<u>Teacher Provided</u>

- scissors
- pencil (sharpened)

TIME

15-20 minute introduction; center time will vary

PROCEDURE

1. Ask: What is a wedge? Discuss their ideas. Explain that a wedge is a simple machine used to cut or separate other materials.
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Wedge. Have students share their ideas.
3. Read the background information about wedges. Begin making a list of common wedges found at school and home. Add pictures of wedges to the class bulletin board/collage.
4. Ask: What wedges have you used at home or school (fork, knife, door stopper, nail, scissors, sewing needle, thumb tack)? Display common examples of wedges. Have the students look carefully at the objects. Ask: What part of these objects is a wedge? Explain that almost all cutting tools are wedges.
5. Explain that some wedges are used to life things. Give one student the wooden door wedge. Have them prop the door open with it. The wedge lifts the door slightly and exerts a strong force against it. Have another student try to close the door with the wedge in place. They should find it difficult to move the door with the wedge holding it open.
6. Set up a station with common wedges: door wedge, nails, and plastic knives. Also, put a slab of clay and square blocks of wood at the station. Students should first try to cut the clay using the square block of wood. Discuss how well it worked. Next, have them use the wedges to cut the clay. Ask: Did the wedge make it easier to cut the clay?

DISCUSSION

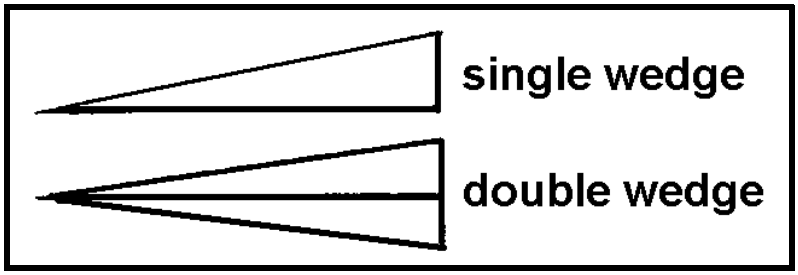
1. How do wedges make it easier to do work?
2. What types of jobs can wedges be used for?

EXTENSION

- Read and discuss wedges in the book, *Simple Machines.*
- Have the students make a paper wedge using the worksheet. Can you make a wedge?
- Have the students color the wedges on the worksheet, The Wedge.

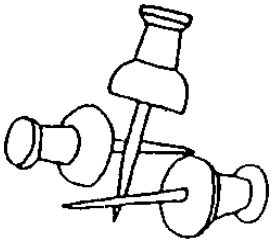
THE WEDGE

A wedge is a simple machine. There are two kinds of wedges. A single wedge is like an inclined plane. A double wedge is two inclined planes put together.

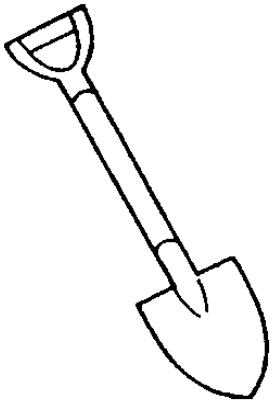


Wedges can be used to split things apart. They can cut things. The point of a nail is a wedge. A nail has a wedge point so it can go into wood more easily. The point of a screw is also a wedge. An ax blade is a wedge that splits wood apart. Other examples of wedges are: the end of a push pin, the point of a needle, the edge of a shovel and the sharp edge of a knife.

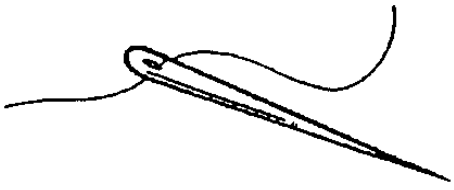
ax



push pins



shovel

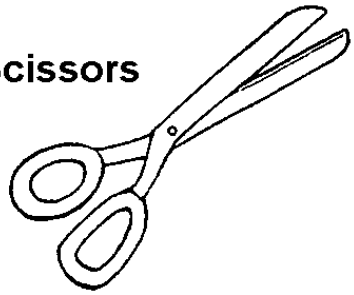


needle

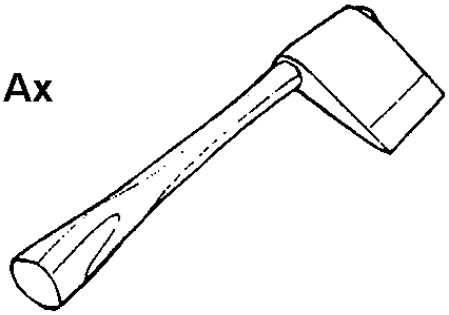
THE WEDGE

We make use of wedges in many different ways. For each object below, color the wedge.

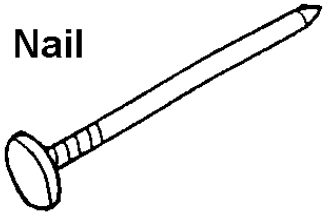
Scissors



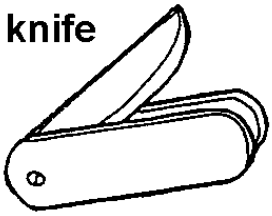
Ax



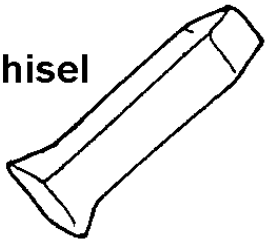
Nail



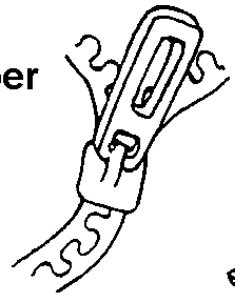
Pocket knife



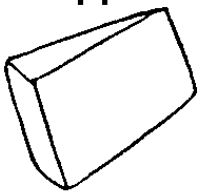
Chisel



Zipper



Door Stopper



Log Splitter

Anticipation/Reaction Guide: Wedge

Read the following statements. Mark if you agree or disagree using an X.

1. A wedge is an example of a simple machine.

_____ agree _____ disagree

2. An example of a wedge is a knife.

_____ agree _____ disagree

3. An example of a wedge is a light bulb.

_____ agree _____ disagree

4. A wedge can be used to move objects from a high place to a low place.

_____ agree _____ disagree

ROUND AND ROUND

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1: *Generate reasonable questions* about *the world, based* on *observation.*
C3: *Manipulate simple mechanical devices* and *explain how they work.*
R4: *Describe how technology is used in everyday life.*
PMO3: *Use simple machines* to *make work easier.*

KEY QUESTION

How are screws used to make work easier?

TEACHER BACKGROUND

A screw is a simple machine used to hold materials together. Some screws are used to open and close objects, such as vices. A screw can also be used to drill holes. A screw in the form of a propeller moves boats and airplanes.

OBJECTIVE

To use screws to hold objects together.

SCIENCE PROCESS SKILLS

observing, communicating, experimenting

MATERIALS

- reading worksheet, The Screw
- worksheet, Anticipation/Reaction Guide: Screw
- book, *Simple Machines*
- screwdrivers
- screws
- scrap wood
- safety goggles

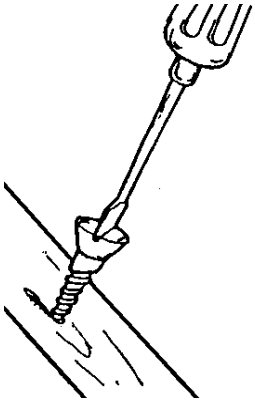
TIME

10-15 minutes; center time will vary

PROCEDURE

1. Ask: What is a screw? Discuss their ideas. Explain that a screw is a simple machine used to hold things together, move objects or drill holes.
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Screws. Have students share their ideas.
3. Read the background information about screws. Begin making a list of screws found at school and home. Add pictures of screws to the class bulletin board / collage.

4. Ask: What screws have you seen at home or school? Have you ever used a screwdriver to put screws into wood? Why might you use screws instead of nails?
5. Explain that the students will have an opportunity to use a screw and screwdriver to do work. Set up a work station with screwdrivers, screws, scrap wood, and safety goggles. Review safety rules for using these tools. Students must wear the safety goggles at all times when using the tools. Make sure that they do not put the screws all the way into the wood so they are able to take them back out.



DISCUSSION

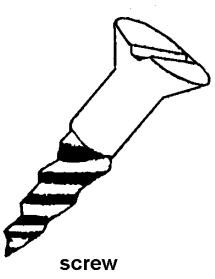
1. How do screws make it easier to do work?
2. What types of jobs can screws be used for?

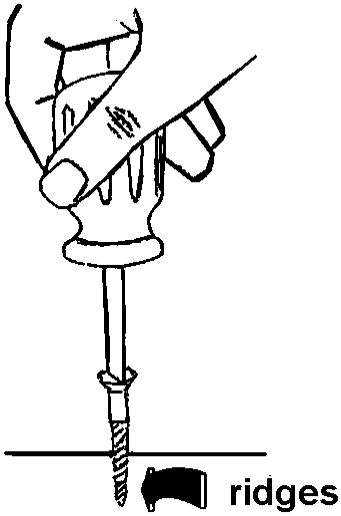
EXTENSION

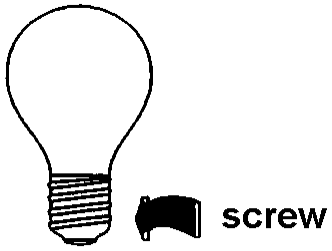
- Have the students use screwdrivers to take apart old appliances (toasters, telephones, clocks, etc.) Have them look for other simple machines inside the appliances. Discuss how the six simple machines are used by people every day.
- Read and discuss screws in the book, *Simple Machines.*

THE SCREW

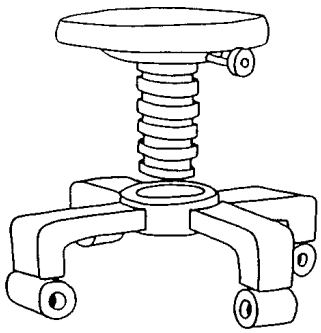
A **screw** is a simple machine. Some kinds of screws hold things together. Where have you seen screws holding things together? Screws are not smooth like nails. They have little ridges when screws are put into wood, the ridges keep it from being pulled out easily. Screws hold better than nails. Some examples of screws are: tops on bottles and jars, and the end of a light bulb.





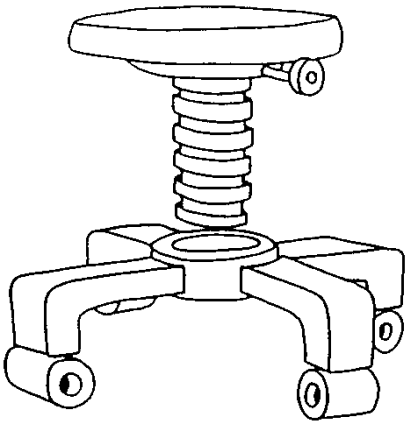


Some kinds of screws are used for lifting. Some chairs have big screws for making the seats go up and down. Can you find the screw that makes this chair move up and down?



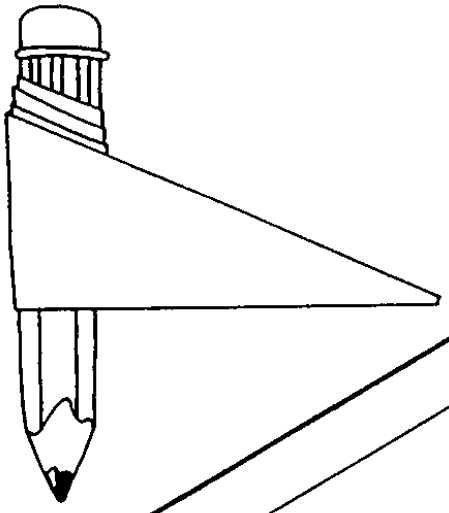
HOW IS A SCREW USEFUL?

A screw is a simple machine. Some kinds of screws hold things together. Screws are not smooth like nails. They have little ridges. When they are put in wood, the ridges make tiny grooves so that they cannot be pulled out easily. Screws hold better than nails.



Some kinds of screws are used or lifting. Some chairs have big screws for making the seats go up and down. A screw is a kind of inclined plane.

Color the inclined plane line on the triangle below. Cut out the triangle. Wrap it around a pencil starting with the straight edge. Be sure the colored edge is on the outside. Hold your finger on the colored edge and turn the pencil. What happens?



Anticipation/Reaction Guide: Screw

Read the following statements. Mark if you agree or disagree using an X.

1. The end of a light bulb is an example of a screw.

_____ agree _____ disagree

2. A screw is used to hold things together.

_____ agree _____ disagree

3. A screw has a smooth surface.

_____ agree _____ disagree

4. A driveway is an example of a screw.

_____ agree _____ disagree

USING LEGOS ® TO BUILD A PULLEY, LEVER, AND WHEEL AND AXLE

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1 : *Generate reasonable questions about the world, based on observation.*
C2: *Develop solutions to unfamiliar problems through reasoning, observation and/or experimentation.*
C3: *Manipulate simple mechanical devices and explain how they work.*
C6: *Construct a chart and graphs and prepare summaries of observations.*
Rl: *Develop an awareness for the need for evidence in making decisions scientifically.*
PMO 1: *Describe or compare motions of objects in terms of speed and direction.*
PMO2: *Describe how forces speed up, slow down, stop or change the direction of a moving object.*
PMO3: *Use simple machines to make work easier.*

KEY QUESTION

How do simple machines make work easier?

OBJECTIVE

To build simple machines using Lego® sets.

SCIENCE PROCESS SKILLS

communicating, making models

KEY TERMS

lever, pulley, wheel and axle

MATERIALS

- Lego Dacta® Pulley
- Lego Dacta® Gear
- Lego Dacta® Lever
- activity worksheet, Using Legos®

TIME

will vary; *need up to 5 days to rotate all students through the centers*

ADVANCE PREPARATION

Set up three stations with the Lego® sets. You have one of each set in your kit. You might consider borrowing sets from other teachers in your building. Make sure that the pieces do not mix together. Each kit has a limited number of pieces that are necessary to complete the machines. The pieces are small and can be lost easily. Make sure that students inventory the pieces before and after use. New pieces cannot be purchased to replace any that are missing.

PROCEDURE

1. Group the students into teams of 2 students. Allow one team of students to work on a set. Make sure that all teams have an opportunity to build all three types of simple machines.
2. Students should record what they learned on the activity worksheet, *Using Legos*®. Use the worksheet to assess understanding about how simple machines make work easier.

USING LEGOS®

What simple machines did you build from Legos®?

_____

_____

_____

Did you change or improve the simple machines you built? Explain what you did.

_____

_____

_____

Why are simple machines important to us?

_____

_____

_____

What are the six simple machines?

_____

_____

_____

Assessment
Grade 3

MOTION OF OBJECTS

Classroom Assessment Example SCI.IV.3.E.4

The teacher will present pictures of simple machines or objects that are used as simple machines.

For example:

Inclined plane: slide, wheelchair ramp
Screw: pencil sharpener, twist-on cap
Lever: baseball bat, broom
Wedge: knife, scissors
Wheel and axel: door knob, AV cart, or computer cart
Pulley: flagpoles, blinds

Each student will prepare and complete a chart that includes the following information:

Identification of the type of simple machine
Explanation of the purpose of the simple machine
Description of how the simple machine makes work easier

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.3.E.4

Criteria	Apprentice	Basic	Meets	Exceeds
Identification of simple machines	Identifies one to three machines.	Identifies four to five machines.	Identifies six simple machines.	Identifies six simple machines.
Accuracy of information	Information is inaccurate with many incorrect ideas.	Information is accurate with some incorrect ideas.	Information is accurate with few incorrect ideas.	Information is accurate with no incorrect ideas.

Physical Science
Worksheet

GRADE LEVEL: Third

Topic: Motion of Objects

Grade Level Standard: 3-3 Compare the common forces and the motion of objects.

Grade Level Benchmark: 5. Manipulate simple mechanical devices and explain how their parts work together. (IV.3.E.5)

Learning Activity(s)/Facts/Information	**Resources**
Central Question ***How do we manipulate simple machines and make their parts work together?*** 1. "Mix It Up" ★ 2. "Road Races" ★ ★ Activity is attached	
Process Skills: Communicating, Observing, Predicting, Developing models, Controlling variables	

New Vocabulary: gears, screws

MIX IT UP!

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1 : *Generate reasonable questions about the world, based on observation.*
C3: *Manipulate simple mechanical devices* and *explain how they work.*
R4: *Describe how technology is used in everyday life.*
PMO3: *Use simple machines to make work easier.*

KEY QUESTION

How does the wheel and axle make our work easier?

BACKGROUND INFORMATION

A wheel and axle is a machine that makes it possible to roll a load instead of dragging it from one place to another. Machines with a wheel and axle are: roller skates/blades, automobiles, tractors, bicycles, wagons, toys, and clocks.

Gears are wheels with edges like teeth. An egg beater is an example of a simple machine that uses gears. When the handle (axle) is turned, the gears work together to move the beaters. When the big gear turns, it moves the little gears at an accelerated rate.

OBJECTIVE

To use a wheel and axle (and gears) to make work easier.

SCIENCE PROCESSES

observing, communicating, recognizing relationships, experimenting

KEY TERMS

wheel and axle, gear

MATERIALS

- egg beater
- plastic spoon
- bowls, small plastic
- Hot Wheels vehicles
- worksheet, Anticipation/Reaction Guide: Wheel and Axle
- reading worksheet, The Wheel and Axle
- dish soap
- book, *Simple Machines*

<u>Teacher Provided</u>

- electric mixer

TIME

20-30 minutes; center time will vary

PROCEDURE

1. Ask: What is a wheel and axle? Discuss their ideas. Explain that a wheel and axle is a simple machine used to move objects from one place to another.
2. As a class, in small groups or individually, complete the worksheet, Anticipation/Reaction Guide: Wheel and Axle. Have the students share their ideas with the class.
3. Read and discuss the background information on the worksheet, The Wheel and Axle. Begin making a list of common wheels and axles found at home or school. Add pictures of wheels and axles to the class bulletin board/collage.
4. Next, pass around the Hot Wheels vehicles. Ask: How many wheels and axles can you find. Have the students discuss how well the vehicles would move without the wheels and axles.
5. Ask: What is a gear? Discuss how a gear is a wheel with teeth.
6. Show the students the hand mixer. Point out the gears.
7. Ask the students to predict: What is more work-Using a spoon, egg beater or electric mixer to make bubbles? Record their predictions on the board.
8. To test their predictions, fill 3 bowls with water. Put 5 drops of dish soap into each bowl. For 1 minute, have one student beat a bowl of water with a spoon, another student beat a bowl with the egg beater and you beat the last bowl with the electric mixer. After the minute is up, compare the bowls. Which had the most suds? Compare the results with the prediction chart.

DISCUSSION

1. Where have you seen examples of wheels and axles?
2. How does the wheel and axle help do work?
3. What would our life be like without the wheel and axle?
4. What is a gear? How do gears help us do work?
5. What is more work-using a spoon, egg beater or electric mixer?

EXTENSION

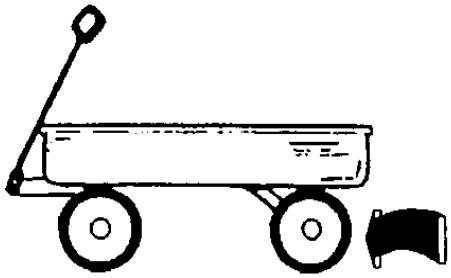
Read about the wheel and axle in the book, *Simple Machines.*

THE WHEEL AND AXLE

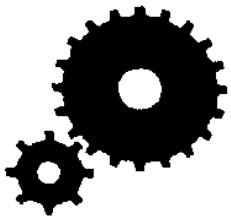
A **wheel and axle** is a simple machine made of a rod attached to the center of a wheel. A wheel and axle helps us do work without having to increase our effort.

Sometimes a wheel turns an axle. This is how a doorknob works. The knob is the wheel and it turns a long rod (axle) that opens the latch.

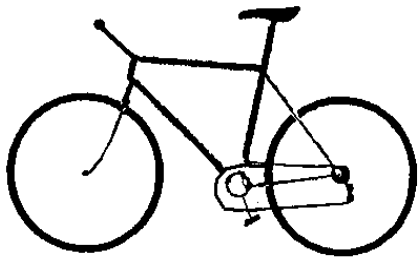
Sometimes an axle turns a wheel. This is what happens when we pedal a tricycle. The pedals are part of the axle and they turn the front wheel.


wheel and axle

gears



Some wheels have jagged edges. These wheels are called **gears**. Gears are special wheels with pointed edges like teeth. These pointed edges help the wheels turn each other. There are two gears on a bicycle. The large pedal gear is connected with the smaller back gear by a chain. You can find gears in watches, ice cream makers, egg beaters, and cars.



Anticipation/Reaction Guide: Wheel and Axle

Read the following statements. Mark if you agree or disagree using an X.

1. A wheel and axle can be used to lift objects off the ground.

_____ agree _____ disagree

2. A wheel and axle make it easier to move heavy objects.

_____ agree _____ disagree

3. Cars have wheels and axles.

_____ agree _____ disagree

4. A wheel is a simple machine.

_____ agree _____ disagree

ROAD RACES

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

CI: *Generate reasonable questions* about *the world based on observation.*
C2: *Develop solutions to problems through reasoning, observation and/or experiment.*
C6: *Construct charts* and *graphs* and *prepare summaries of observations.*
PMO1: *Describe or compare motions of common objects in terms of speed* and *direction.*
PMO2: *Describe how forces speed up, slow down, stop, or change the direction of* a *moving object.*
PMO3: *Use simple machines to make work easier.*

KEY QUESTION

How can simple machines make work easier?

OBJECTIVE

To investigate the effect of varying heights of inclined planes on distances traveled.

SCIENCE PROCESS SKILLS

experimenting, predicting, measuring, observing, communicating, comparing, collecting and recording data, interpreting data, drawing conclusions

KEY TERMS

measurement, tape measure, inclined plane, distance, wheel and axle, graph

MATERIALS

- rulers
- toy vehicles (variety)
- inclined planes (wooden)
- worksheets, Road Races
- measuring tapes

Teacher Provided

- textbooks

TIME

45-60 minutes each day (2 -4 class periods)

PROCEDURE

1. Ask: What is an inclined plane? (any slanted surface) Where have you seen inclines around school? (wheel chair ramps, slides, stairs, hills) How could inclined planes help make it easier for people in wheel chairs? in cars? on bikes? (the slant makes it easier and faster to get from a high point to a low point or a low point to a high point)

2. Ask: If you placed a wagon at the top of a steep hill and let go, what would happen? (it would move) Why would the wagon travel to the bottom of the hill? (gravity) What force would eventually stop *the* wagon from moving? (friction between the wheels and the ground)
3. Explain that the students will be conducting investigations with inclined planes and toy cars. Pass out the activity worksheet, Road Races. Review the directions and rules with the students.
4. Divide the class into teams of 4 students. Show the students the different materials that they will be working with: text books, metric rulers, metric measuring tapes, toy vehicles and inclined planes.
5. On the investigation form, the students should write the question to be investigated: **Does the height of an inclined plane affect the distance a wheeled object travels?** Have them record the question and their predictions on the worksheet.
6. Each team will conduct four investigations. In the first trial, teams will use 5 textbooks to raise the end of their incline. For the second trial, each team will remove 3 books. The third and fourth trial mimic the first two, except they are done on a different surface. Each group should test their incline 5 times, always placing the vehicle at the very top--with the back wheels at the top edge of the incline. They will record the distance traveled from the *end of the incline to the back wheels of the vehicle.*
7. As a team, the students construct bar graphs of the four trials. They should compare their results and answer the questions on their report.
8. As a class, discuss the results from the investigations. Discuss discrepancies in results. Ask: What differences could change results?

DISCUSSION

1. How did the different surfaces affect the distance your vehicle traveled?
2. How does the incline help make the car move easier? (easier to move from a high place to low place)
3. What force pulls the vehicles down the incline? (gravity)
4. What force causes the vehicles to slow down, turn or stop? (friction)
5. Did all the vehicles travel in a straight line?
6. How do the wheels on the car help make it move easier?
7. How well would the car travel down the incline if it did not have wheels?
8. How do all objects start moving? (a force—push or pull—is placed on them)

EXTENSIONS

- Compare the vehicle mass with distances traveled.
- Calculate average distances for each of the four trials and compare the averages with other groups.

Investigation Report: Road Races

Date: _____ Scientist: _____

The **question** to be investigated:

_____

_____

What I **predict**:

_____

_____

Reason for my prediction:

_____

_____

_____

Type of wheeled vehicle your group used: _____

Surface type of the floor: (circle one) wood tile carpet

Materials Used: _____

Investigation # 1

Place 5 textbooks under one end of the board. Put your vehicle on the inclined plane so the back wheels are at the top edge. Let go of the vehicle. Measure the distance it traveled from the *bottom of the incline to the back wheels of the vehicle*. Record the results below.

Trial 1 _____cm Trial 2 _____cm Trial 3 _____cm

Trial 4 _____cm Trial 5 _____cm

What was the longest distance traveled? _____cm

What was the shortest distance traveled? _____cm

Investigation # 2

Remove 3 books from under your incline. Repeat the same investigation. Place your vehicle at the top of the inclined plane. Let go. Measure the distance it traveled. Measure from the *bottom of the incline the back wheels of the vehicle*. Record your results below.

Trial 1 _____cm Trial 2 _____cm Trial 3 _____cm

Trial 4 _____cm Trial 5 _____cm

What was the longest distance traveled? _____cm

What was the shortest distance traveled? _____cm

This is what happened when we did the two investigations:

_____

_____

_____

_____

_____

What I learned from these investigations:

_____

_____

_____

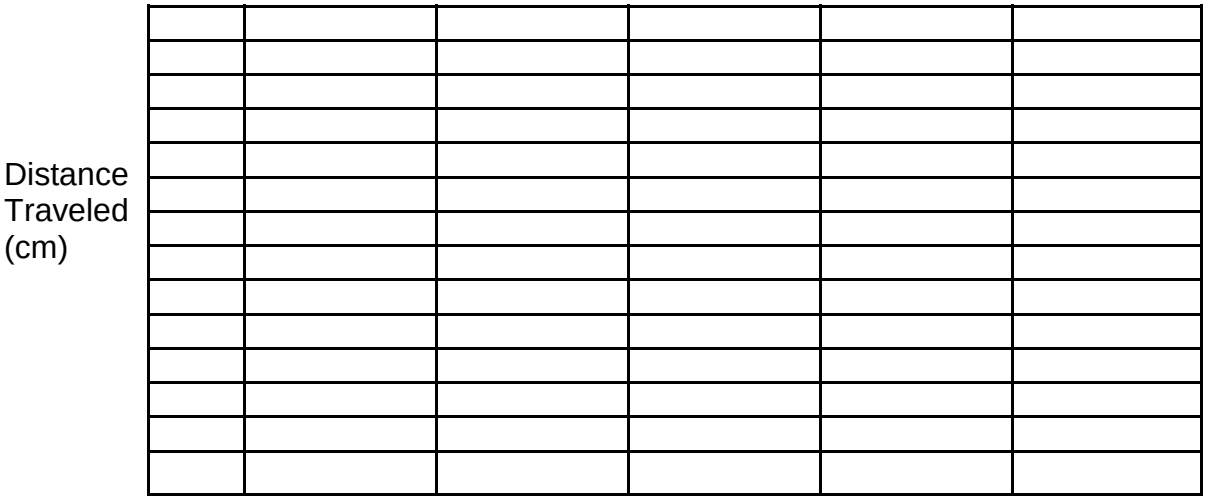
_____

_____

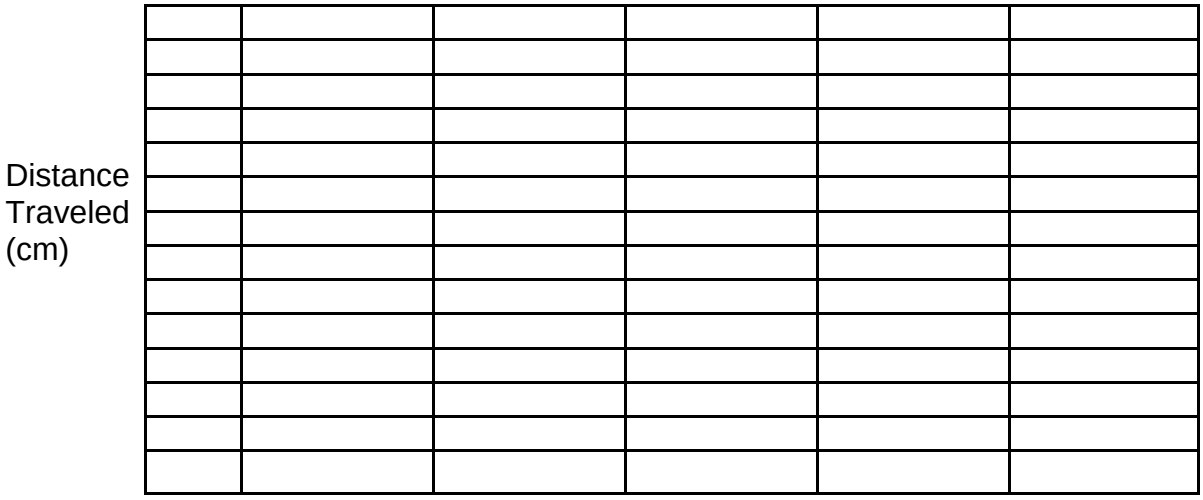
Graph Your Results

Use the data from investigation # 1 and # 2 to complete the bar graphs below.

Investigation # 1



Investigation # 2



Investigation # 3

Find a new surface. **Surface type:** _____

Put the same 5 textbooks you used in investigation # 1 under the board. Place your vehicle at the top of the inclined plane. Let go. Measure the distance it traveled. Measure from the *bottom of the incline to the back wheels of the vehicle*. Record your results below.

Trial 1 _____cm Trial 2 _____cm Trial 3 _____cm

Trial 4 _____cm Trial 5 _____cm

Investigation # 4

Remove the same two textbooks as you did in investigation # 2. Repeat the same experiment. Place your vehicle at the top of the inclined plane. Let go. Measure the distance it traveled. Measure from the *bottom of the incline to the back wheels of the vehicle.* Record your results below.

Trial 1 _____cm Trial 2 _____cm Trial 3 _____cm

Trial 4 _____cm Trial 5 _____cm

How did the second surface type change the distances your vehicle traveled?

_____

_____

_____

_____

_____

_____

Graph Your Results

Use the data from investigation # 3 and # 4 to make the bar graph below.

Investigation # 3

Distance Traveled (cm)

Trial Number

Investigation # 4

Distance Traveled (cm)

Trial Number

Assessment
Grade 3

MOTION OF OBJECTS

Classroom Assessment Example SCI.IV.3.E.5

The class will read or listen to Shel Silverstein's "Homework Machine." Each student will design a simple mechanical device for doing homework that uses at least three different simple machines. Each student will draw and label a diagram of his or her own homework machine. Each student will describe how the machine works in a paragraph, poem, or song.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.3.E.5

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of design	Designs homework machine with one simple machine.	Designs homework machine with two different simple machines.	Designs homework machine with three different simple machines.	Designs homework machine with more than three different simple machines.
Accuracy of explanation	Identifies simple machines incorrectly and provides little or no explanation.	Identifies simple machines correctly, but may not be able to explain how they work together.	Identifies simple machines correctly and explains how some of them work together.	Identifies simple machines correctly and explains how all of them work together.

E**arth/Space Science**
Worksheet

GRADE LEVEL: Third

Topic: Geosphere

Grade Level Standard: 3-4 Compare and contrast the features, materials, history, and the changes of the Earth's surface.

Grade Level Benchmark: 1. Describe major features of the Earth's surface. (V.1.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What is the Earth's surface like?*** 1. "Background Information: The Earth" ★ 2. "What Makes Up the Earth?" ★ 3. "Land Forms in the United States" ★ 4. "Grading Rubric - Land Research" ★ 5. "Composition of Earth" ★ 6. "Earth's Crust" ★ 7. "Earth's Composition and Crust" ★ ★ Activity is attached	
Process Skills: Observing, Classifying, Communicating, Developing Models and Theories	

New Vocabulary: Types of landforms: mountains, plains, valleys; Bodies of water: oceans; waterfalls, Great Lakes

BACKGROUND INFORMATION: THE EARTH

The Layers of the Earth

Everything that is known about the inside of the earth is based on indirect evidence. Much that is known about the core and mantle comes from studies of volcanic activity earthquakes and the earth's magnetism.

The Core

Scientists believe that the inner core is a mixture or iron, nickel, and cobalt. The inner core is surrounded by an outer core, mostly made up or iron. Evidence shows that the inner core is solid and the outer is liquid.

The Mantle

The middle layer, the mantle, is made up of rock. Although temperatures in the mantle are hot enough to melt rock, most of the rock remains solid because of the large amount of pressure deep inside the earth. Some of the rock, however, is liquid. Evidence of this is seen when melted rock, called magma, pours forth from volcanoes. When magma reaches the earth's surface, it is called lava.

The Crust

The crust is made up of many kind of solid rock. The earth's surface is constantly changing. Inside the crust, there are forces that raise and build up the earth's surface. Scientists believe that the crust is not one solid layer of rock. It is made of several large blocks called plates. These plates are moving very slowly. Many of the actions that change the earth's surface occur at plate boundaries. You cannot see the plates moving, but you can see the results of the movement. Mountains, volcanoes and earthquakes are formed by the movement of the plates. All these forces work together to build up the earth's surface and bring buried rocks to the surface.

Rocks and Minerals

The earth's surface is constantly changing; new rocks are added, while old rocks are worn away. In nature, rocks are continually broken down into smaller and smaller pieces. These changes balance each other so the amount of rock on the surface or the earth remains the same.

Minerals

A mineral is a naturally occurring, nonliving (inorganic) solid that has a definite chemical composition and a crystal structure. There are about 2,500 different kinds of minerals. Some are common and easy to find. Others are rare and quite valuable.

Many minerals come from magma, the molten rock beneath the earth's surface. When magma cools, mineral crystals are formed. How the magma cools and where it cools will determine the size or the mineral crystals.

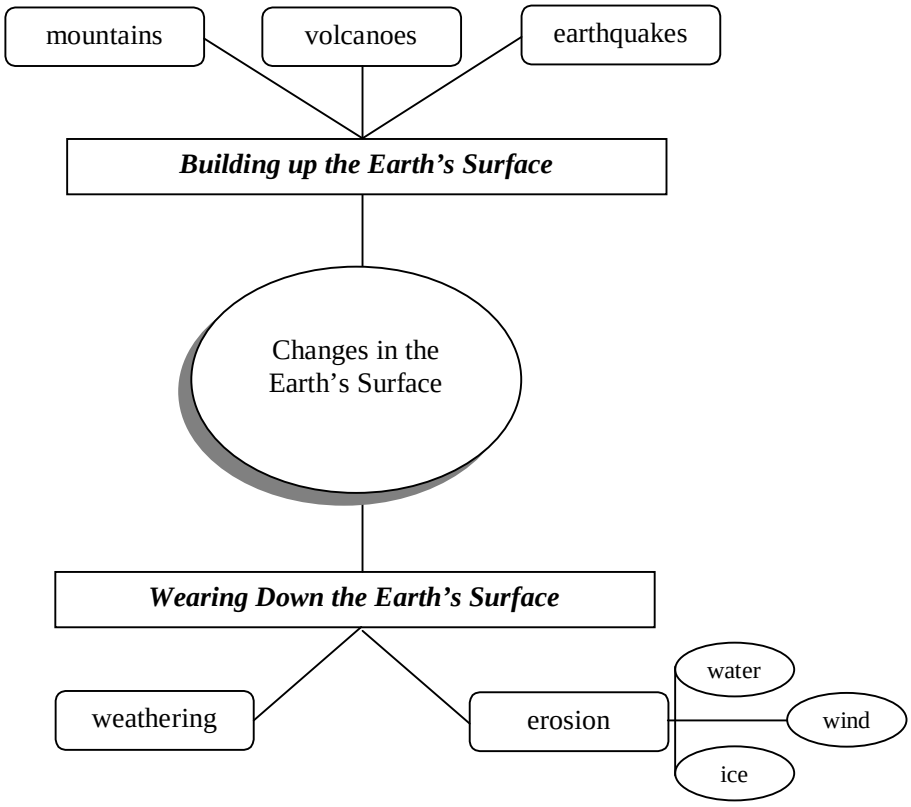
Rocks

Rocks are the building blocks or the earth. They form beaches, mountains, the ocean floor, and all other parts of the earth's crust. A rock is a hard substance made of one or more minerals. Usually, a rock is made of more than one kind of mineral. Rocks are grouped according to how they form: igneous, sedimentary, and metamorphic.

Igneous rocks are formed when molten (liquid) rock cools and hardens.
Sedimentary rocks are formed from particles, called sediments, that have been carried along and deposited by wind and water. These sediments include pieces of rock, sand, shells, bones, leaves, stems and other remains of once-living things. Over time, sediments are pressed together to form rocks.
Metamorphic rocks are formed when chemical reactions, heat and/or pressure changes existing rocks into new rocks. These new rocks (metamorphic) have physical and chemical properties that are usually very different from the original rocks.

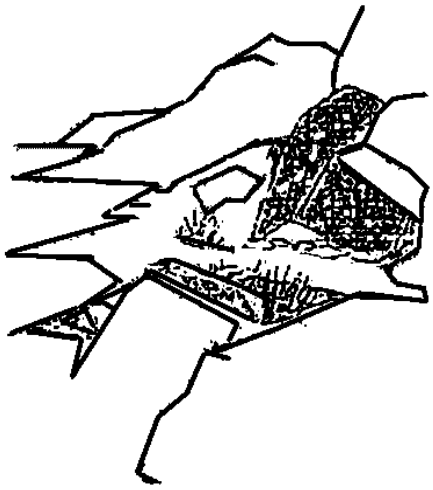
Forces that Change the Land

Water, wind, and ice are three factors that change the surface of the earth. All three natural elements carry away particles of rock, sand, and soil and deposit them elsewhere. These forces are involved in breaking down or wearing away at the crust. Other forces, including mountain building, volcanic activity and earthquakes can build up the surface. Below is a diagram of the processes involved in altering the surface of the earth.



MEAP STUDENT VOCABULARY TERMS

rivers
mountains
deserts
plains
valleys
oceans
volcanoes
earthquakes
erosion
cracks
fossils
extinct
rock layers
rigid
rough
smooth
size
flexibility
sand
clay
soil
molten rock
minerals
crystals
rocks



WHAT MAKES UP THE EARTH?

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES:

C 1: Generate reasonable questions about the world based on observation.
C6: Construct charts and graphs and prepare summaries of observations.
R3: Develop an awareness of and sensitivity to the natural world.
EG1: Recognize and describe features of the earth's surface.
EG4: Describe natural changes on the earth's surface.

THINK QUESTION

What does the earth look like?

BACKGROUND

The outer layer of the earth is called the **crust**. The crust is the part of the earth we live on. It is very thin relative to the size of the entire earth. From the tops of the mountains to the floor of the oceans, it is only 70 km. thick. The crust is made up of three layers: topsoil, subsoil and bedrock. No one has ever dug beneath the earth's crust. The deepest hole so far took 20 years to drill and only goes down 12 km.

The **mantle** is the next layer. Although scientists cannot see this layer, they do have some clues about it. Volcanic lava from the mantle is studied following an eruption. Also, because vibrations travel at different speeds through different types of rock, scientists have studied the vibrations caused by earthquakes for other clues.

Beneath the mantle is the **core**. The core has two parts: the inner core, which is a solid and the outer core, which is a liquid.

ACTIVITY

Developing a concept map about the earth and its natural changes.

NEW VOCABULARY

crust, landforms, surface features, changes

SCIENCE PROCESSES

communicating, mapping, recognizing relationships

OBJECTIVES

Students will 1) brainstorm what they know about the earth’s surface and 2) observe an example of the inside of the earth.

MATERIALS

- book, The Magic School Bus Inside the Earth
- worksheet, What Makes up the Earth?

Teacher Provided:

- **optional:** chart paper or poster board
- peach or nectarine
- knife
- social studies textbooks

TIME

15-30 minutes

PROCEDURE

Anticipatory Set:

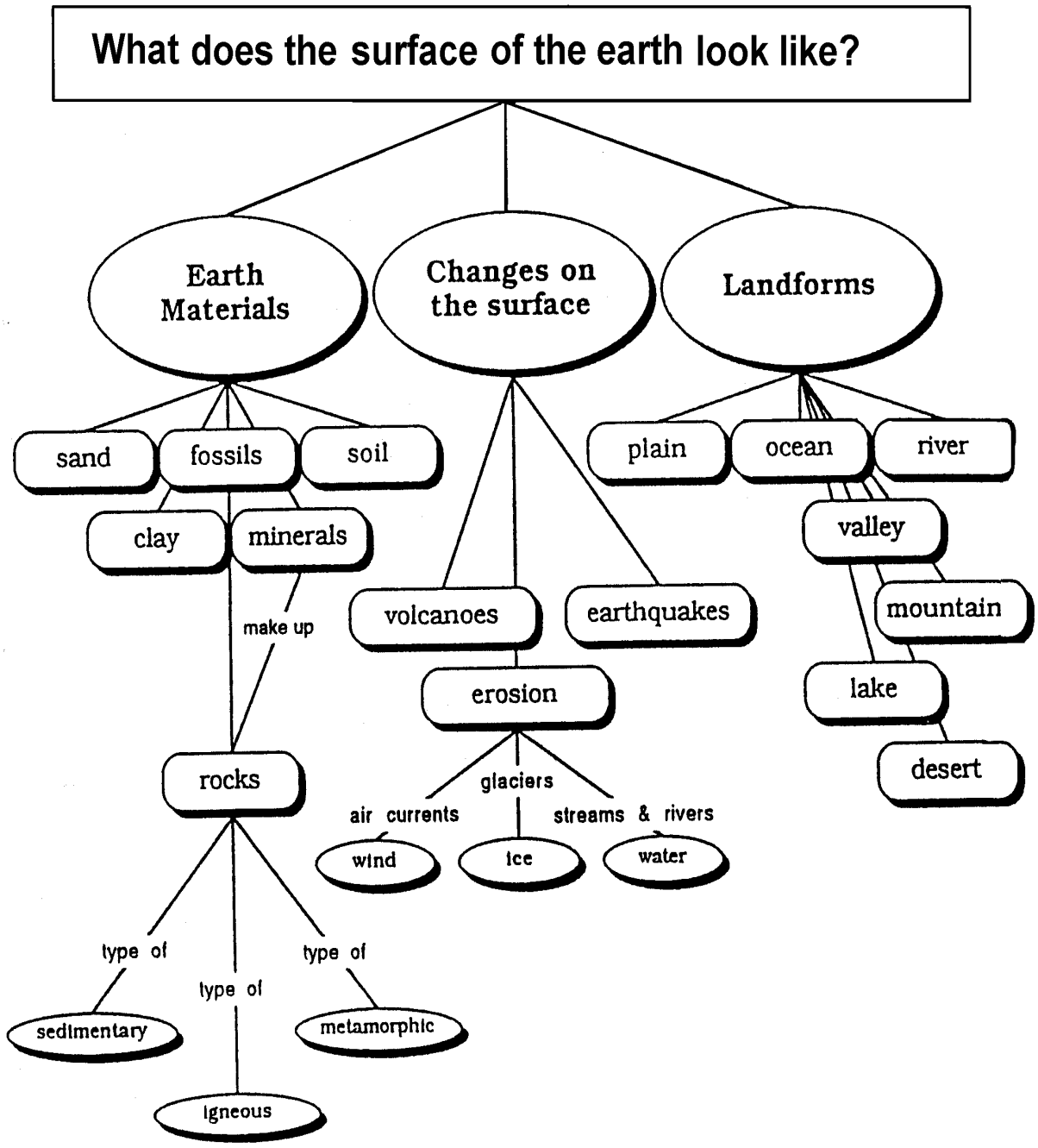
1. Ask the students to think about what they know about the earth and its surface.
2. On the board. draw the first parts of a concept map. See the outline of an example map that follows the lesson.
3. Divide the class into teams

Input:

1. Ask: What do you think is inside the earth? Is it solid or hollow?
2. Explain to the students that the earth is similar to the inside of a peach. Cut a peach in half (see the diagram).
3. Examine the inside of the peach. Point out the three parts: skin, seed and fruit. Discuss how these three parts are similar to the inside of the earth. The skin is the crust, the fruit is the mantle and the seed is the core.
4. Read and discuss the information about the Layers of the Earth on the first page of the worksheet. What Makes up the Earth.

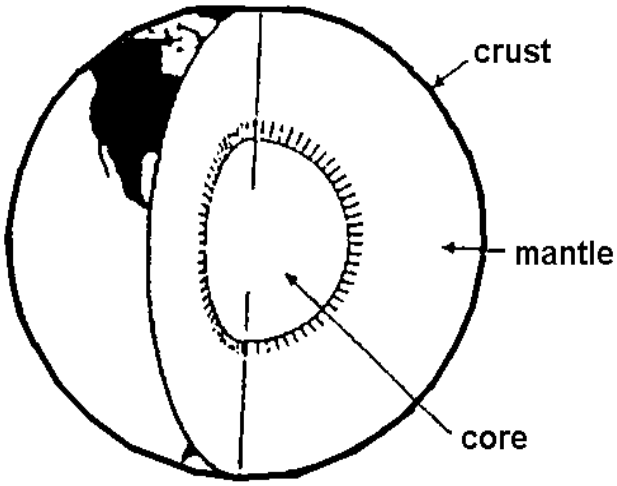
CLOSURE

- Read about the major landforms found on the earth, worksheet, What Makes up the Earth? Discuss which landforms can be found in Michigan. Use your social studies textbooks for more background reading and photographs.
- Read and discuss the story, *The Magic School Bus, Inside the Earth.* Explain that during this unit, students will learn about the different landforms, rocks, minerals and fossils and understand how the surface of the earth continually changes.


What does the surface of the earth look like?
Earth Materials
Changes on the surface
Landforms
sand
fossils
soil
clay
minerals
make up
rocks
type of
type of
type of
sedimentary
igneous
metamorphic
volcanoes
earthquakes
erosion
glaciers
air currents
streams & rivers
wind
ice
water
plain
ocean
river
valley
mountain
lake
desert

WHAT MAKES UP THE EARTH?

Layers of the Earth



Landforms are on the earth's surface. The picture shows what is inside the earth. Notice that the earth is made up of three different layers. The top layer is the **crust**. The crust is made up of rocks and soil. Landforms are part of the earth's crust. The crust is made of rocks and soil. Landforms are part of the earth's crust. The crust is made up of three major layers: **topsoils**, **subsoil**, and **bedrock**. No one has ever dug beneath the earth's crust.

They layer below the crust is called the **mantle**. The mantle is mostly solid rock. However, some of the rock is partly melted. Scientists can study the mantle when volcanoes erupt. Volcanic lava is from the mantle.

The layer below the mantle is called the **core**. The core has two parts. The outer part is made of melted rock. The inner part of the core is solid rock.

Landforms of the Earth

Imagine taking a trip across the United States. Your trip starts in Michigan and ends in California. You would notice that the shape of the land changes. Sometimes you would see mountains and other times sandy deserts. Different features of the land are called landforms. There are 7 major landforms: ***mountain, plains, valleys, rivers, oceans, lakes and deserts***.

Deserts

A desert is an area with very little rainfall and few plants. Some deserts have warm to hot weather all year long. Some deserts are sandy and bare. Other deserts can have temperatures as cold as -40°Celsius in the winter. There are also deserts that are very rocky.

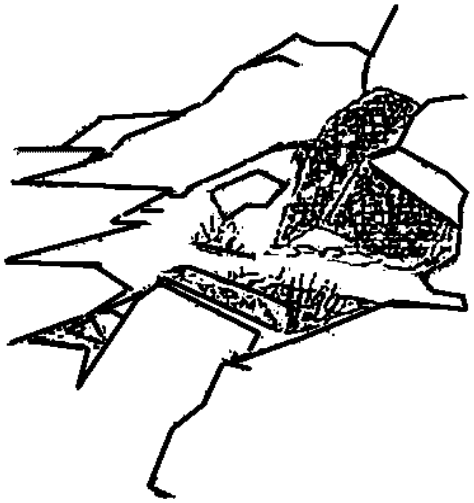
Mountains

A mountain is a part of the land that rises steeply from the land that is around it. The top of a mountain is usually peaked or round. Mountains are often found in groups called ranges. Mountains cover 1/5 of the earth's surface.

Plains
A plain is an almost level, often treeless piece of grassy land that stretches for many miles.

Valleys
A valley is a long, low place between hills or mountains. There is often a stream or river in a valley. Many cities and towns developed in valleys.

Rivers
A river is a long, narrow body of water that flows through the land. A river usually begins as a small stream. The world's largest rivers are the Amazon and the Nile. The two largest rivers in the United States are the Missouri River and the Mississippi River.



Oceans
An ocean is a large body of salt water. There are four oceans in the world: the Atlantic Ocean, the Pacific Ocean, the Indian Ocean, and the Arctic Ocean.

Lakes
A lake is a body of fresh water with land all around it. Lakes can be found in all parts of the world.

RESEARCH PROJECT:
LANDFORMS IN THE UNITED STATES

(1-2 days)

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1: Generate reasonable questions about the world, based on observation.
C5: Develop strategies and skills for information gathering and problem solving.
C6: Construct charts and graphs and prepare summaries of observations.
EG1: Describe the major features of the earth's surface.

THINK QUESTION

What are the major landforms in the United States?

BACKGROUND

The landforms that the students should know are: rivers, mountains, deserts, lakes, plains, valleys, and oceans. Students should understand that the landforms in their area are different from those found in other parts of the United States.

ACTIVITY

Researching and presenting information about the different landforms.

SCIENCE PROCESSES

recording data, communicating

NEW VOCABULARY

rivers, mountains, deserts, plains, valleys, oceans, landforms, characteristics

OBJECTIVES

Students will 1) discuss the different landforms, 2) research a landform, and 3) present their research to the class.

MATERIALS

- 3 x 5 index cards
- construction paper, white
- book, Michigan—An Illustrated History—

<u>Teacher Provided</u>:

- Reference information on landforms
- crayons
- old magazines
- scissors
- glue

TIME

30-45 minutes

PROCEDURE

Anticipatory Set:

1. Is all of Michigan's land like the Thumb?
2. Is all of the land around the U.S.A. the same? How is it different?

Input:

1. List of the major landforms on the board. Brainstorm the physical characteristics of each—what does it look like, what plants and animals live there, what part of the United States would you find it, etc.
2. Gather books, textbooks, magazines and reference books (dictionaries and encyclopedias) for the students to use as a resource.
3. Divide the class into 7 teams. Assign each team a different landform. They can use 3 x 5 index cards for note taking. **Optional:** You might have the students research to find out where these 7 landforms are found in (around) Michigan. For example, there are mountains in the Upper Peninsula and the Great Lakes are connected to the Atlantic Ocean via the St. Lawrence River.
4. Each group should draw a picture of their landform on white construction paper and write at least one paragraph explaining what it looks like, where it is found, etc. See the grading rubric for specific requirements for the project.

DISCUSSION

1. How are these landforms alike? different?
2. Which ones can be found in Michigan? Where would you find them?

CLOSURE

- Have each group get up in front of the class to present their information and poster. Display the posters and research in the classroom or make them into a class landform book.
- Begin reading the book. Michigan—An Illustrated History for Children. This book talks about landforms and how the land Michigan has changed over the years. This book should be read throughout the unit.
- **Optional:** Create a landform bulletin board or wall collage. Have students find pictures and words related to landforms. Put these pictures on the collage. Keep the collage going throughout the unit. You might make it into an Earth Mural. Students can show what they have learned about earth materials, landforms and surface changes through drawings, magazine pictures and vacation photos. You might take pictures of local landforms (rivers, lakes, plains) to add to the bulletin board.

Note to the Teacher: Research Project

The students will be conducting research on an assigned land feature. To make this process easier for the students, the fourth grade teachers in your building may wish to gather any background information that would help with their research. Also, ask the school librarian for any books or encyclopedias that would serve as reference materials. In order to share the research information, collaborate with the other teachers as to when they will be doing the research projects. Students will need information on the following land features: oceans, rivers, plains, deserts, mountains, lakes and valleys.

Throughout this unit, new vocabulary terms are listed according to the appropriate objectives. These terms are taken directly from Michigan's Essential Goals and Objectives for Science Education. An idea for learning the vocabulary is to make "bingo" cards with the vocabulary words written on them. The class writes definitions and can use the definitions during the first two games. Then, play the game without the study sheets. The teacher reads the definition, while the students cover the words.

GRADING RUBRIC: LAND RESEARCH

TASK

Research one of the 7 landforms.

REQUIREMENTS FOR THE TASK

1. List a minimum of three facts about your landform.
2. Make a drawing of your landform and its surrounding ecosystem. Include plants and animals found in, on or around your landform.
3. Tell at least 1 state in the United States your landform can be found. Tell if your landform can be found in Michigan. If so, where?
4. Definition of your landform in your own words.

AUTHOR

Your group as researchers.

PURPOSE

To learn more about the 7 landforms found on the earth.

FORM

A poster that includes the above information.

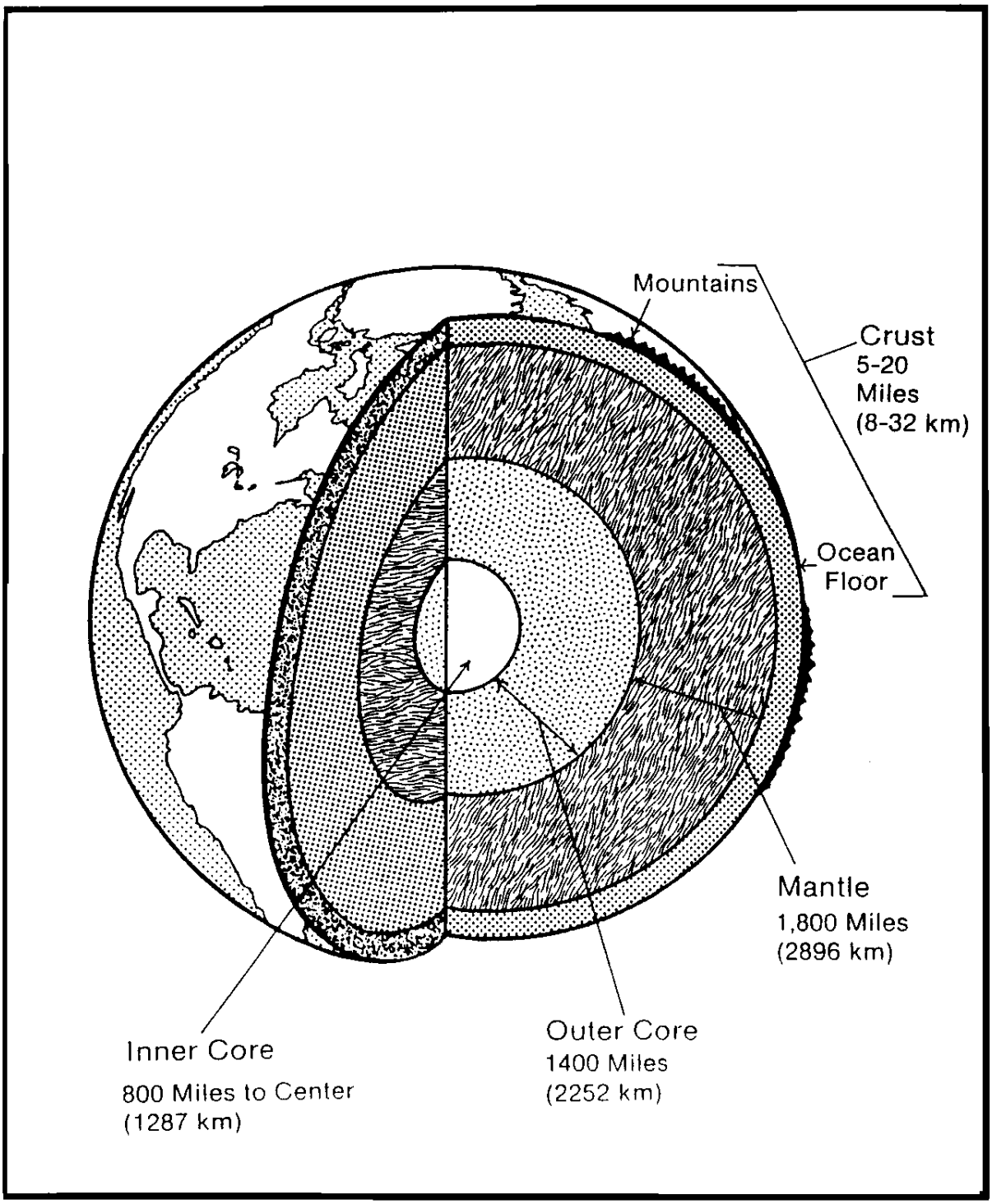
PRESENTATION

Present your research project to the students in the class.

GRADING

Neatness of poster	5 points
Correct spelling	5 points
Facts about your landform	35 points
Drawing of landform	35 points
Description of where the landform is found	10 points
Definition of landform	10 points
Total Points Possible	**100 points**

COMPOSITION OF EARTH



COMPOSITION OF EARTH

Earth is made of solids, liquids, and gases. Write the following words in the correct spaces below: tree, rock, soil, air, water, ocean, mountain.

Solid	Liquid	Gas

Earth's surface is covered by a thin layer of soil. If you dig down through the soil, you will find rock. Earth's outer layer of rock is called the **crust.** The crust is from 5-20 miles (8-32 km) thick. This is not very thick when you compare it with the distance to the center of Earth which is about 4000 miles or 6441 km. An oil-drilling machine can dig only several miles deep. The deepest hole ever made is not as deep as the highest mountain is tall.

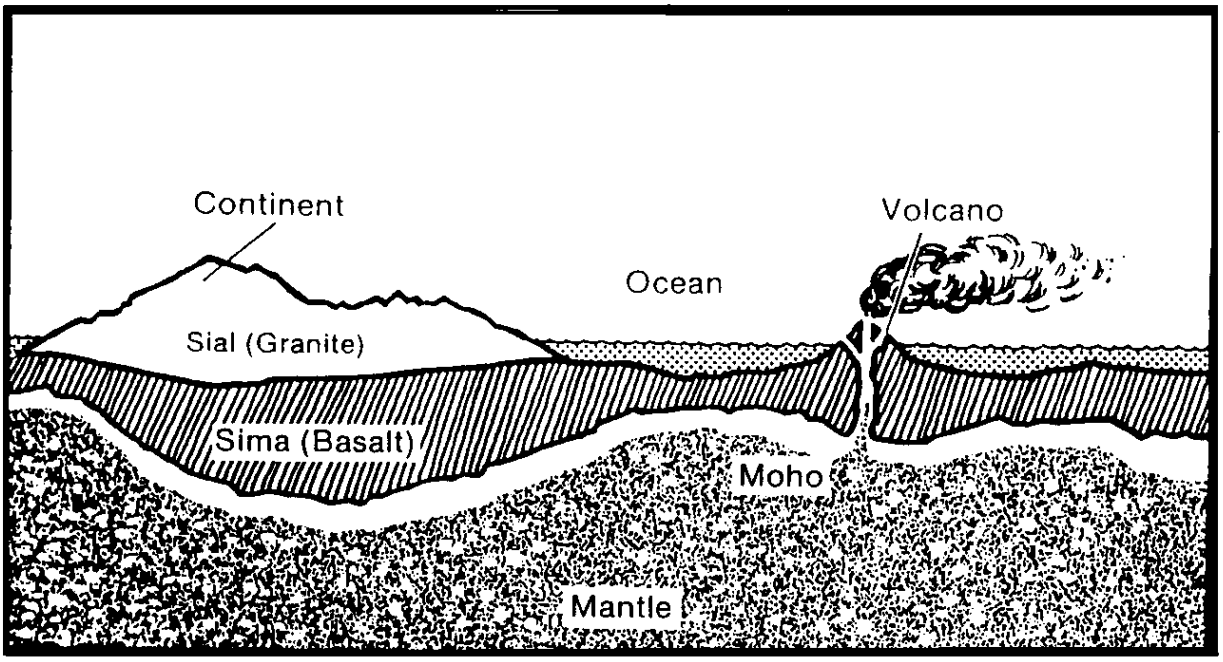
The **mantle** is Earth's next section. It is solid rock except for the part next to the crust, where it is a thick liquid.

The center part of Earth is called the **core**. The outer part of the core is liquid and the center is solid.

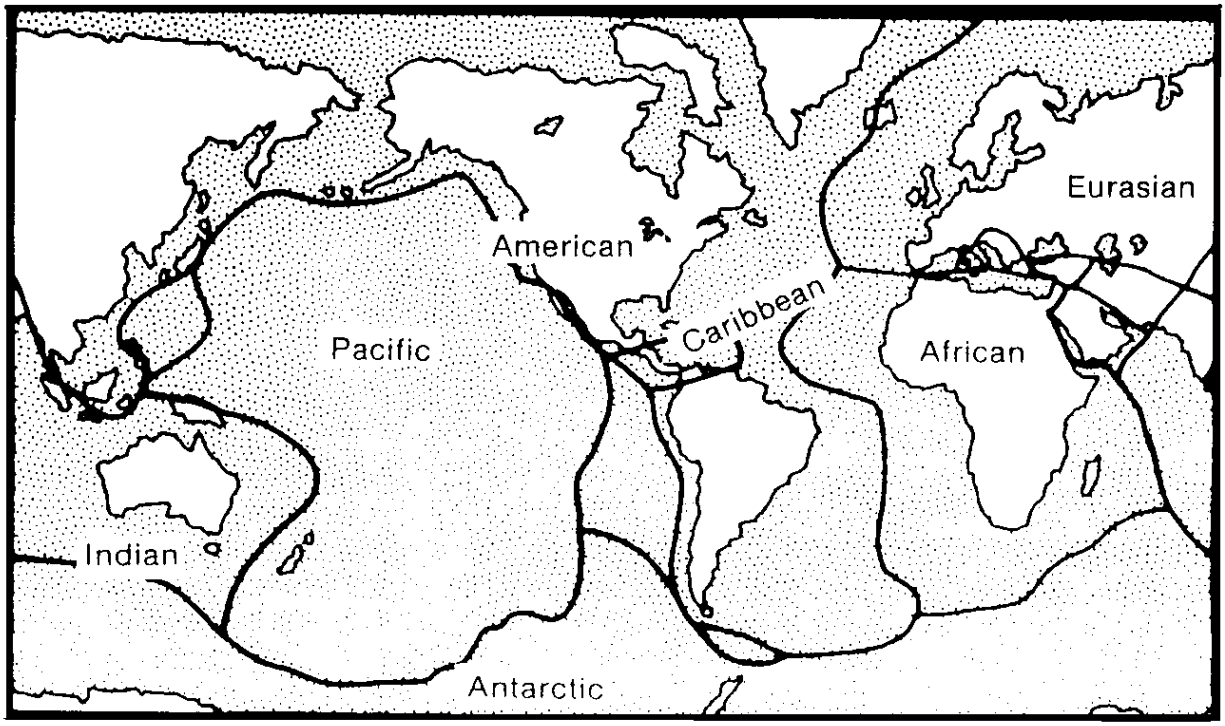
Temperature inside Earth gets hotter as you go deeper. It is around 9000°F (5000°C) in the center. (Your oven at home probably reaches 600°F). It is so hot inside the Earth that rock melts. This melted rock is called magma. It is called lava when it flows out to the surface.

1. Why would a person be unable to dig a tunnel all the way through the middle of Earth? _____
1. How much hotter is the center of the Earth than your oven at home? _____
2. Use an apple as a model of Earth, what would the skin be called? _____ What would the center be called? _____ What would the fruit be called? _____
3. It is 2800 miles (4505 km) across the United States. Is this farther than the distance from the surface to the center of Earth? _____

EARTH'S CRUST



PLATES



EARTH'S CRUST

Today we know Earth is shaped like a sphere. (An object that is round like a ball is called a sphere. Long ago, people thought the Earth was flat. Often Earth **does** appear to be flat when we look around us. Why is this so? Try this:

ACTIVITY

Roll a piece of paper into a tube about 3/4 inch (2 cm) across. Look through the tube at a globe or large ball. Hold the tube close to your eye and close to the globe. As you continue to look through the tube, slowly move the tube away from the ball. Did the globe look flat when you saw only one little section of it? _____ How does this help explain why people thought Earth was flat?

_____

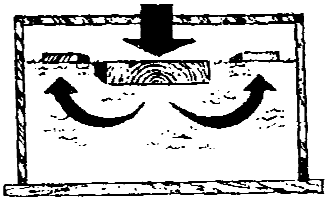
_____

_____

Earth's crust is broken into pieces called plates. These plates move very slowly. Scientists think the plates are floating on a layer of liquid rock that is below the crust.

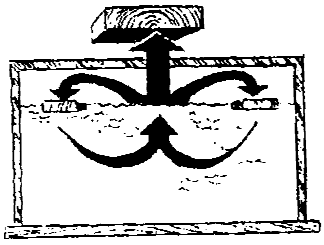
ACTIVITY

Add water to a large pan or aquarium so that it is about three-fourths full. Float a large block of wood and two small pieces of wood on top of the water.



Press down on the large block of wood. What happens to the small pieces?

_____



Lift the block out of the water. What happens to the small pieces?

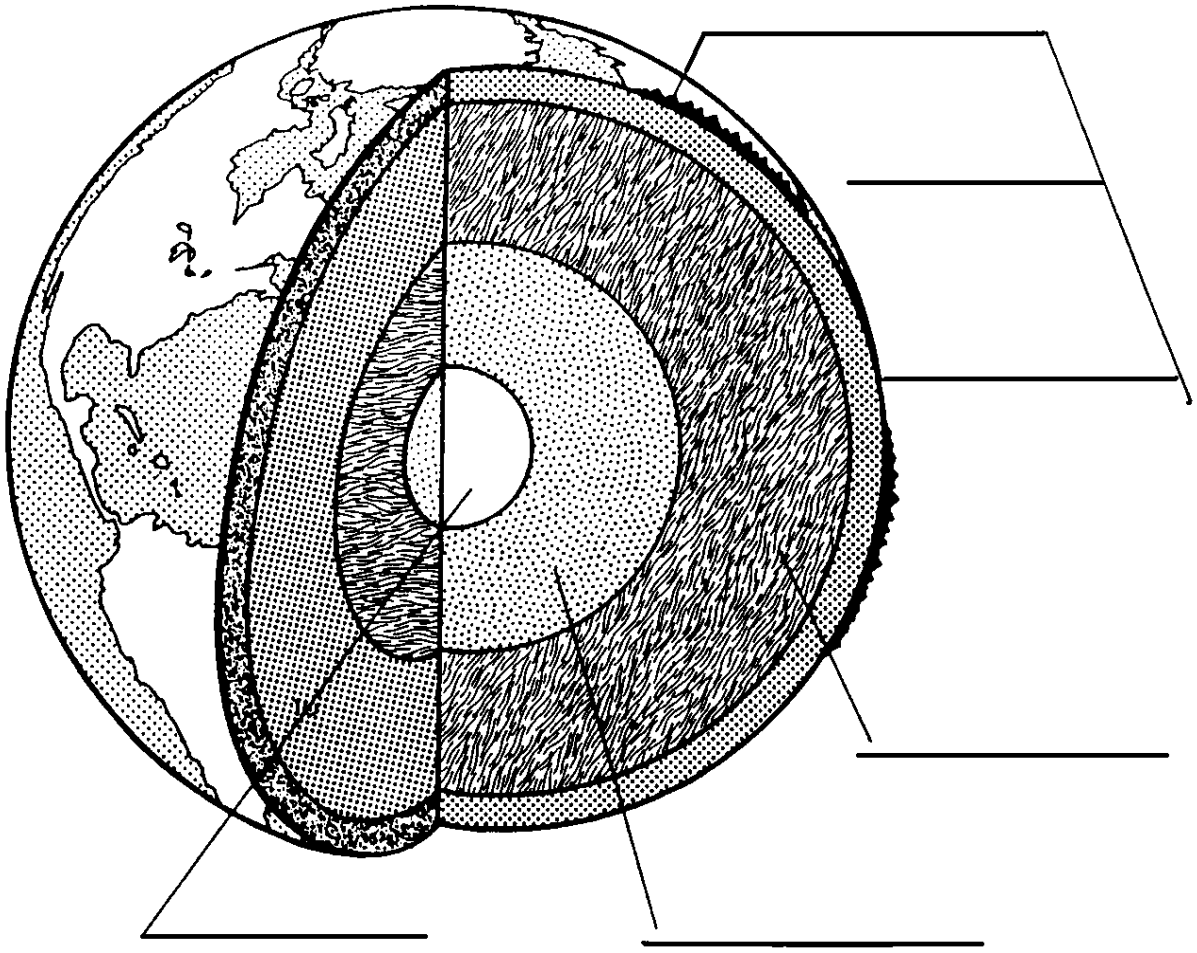
_____

When there is a downward movement in one place, there is an upward movement somewhere else.

NOTE There may be similar upward-downward movements in the Earth's crust.

EARTH'S COMPOSITION AND CRUST

Write the following labels on the diagram below: mantle, crust, inner core, outer core, ocean floor, mountains.



Use the following words in the blanks below: plates, basalt, granite, downward, continents, sphere, core. All the words will not be used.

1. Earth's crust is broken into large pieces called _____.

2. Earth is shaped like a _____ .

3. Large areas of land that rise above the oceans are called _____ .

4. When there is an upward movement in one place on Earth there may be a _____ movement somewhere else.

5. The rock beneath the oceans is _____ .

Assessment
Grade 3

GEOSPHERE

Classroom Assessment Example SCI.V.1.E.1

Students will illustrate and write descriptions of six or more major features of the Earth's surface.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.V.1.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Number of illustrations	Illustrates four or fewer major features of the Earth's surface.	Illustrates five different major features of the Earth's surface.	Illustrates six different features of the Earth's surface.	Illustrates more than six different features of the Earth's surface.
Completeness of descriptions	Writes four or fewer descriptions of major features of the Earth's surface.	Writes five descriptions of major features of the Earth's surface.	Writes six accurate descriptions of major features of the Earth's surface.	Writes more than six descriptions of major features of the Earth's surface.

Earth/Space Science
Worksheet

GRADE LEVEL: Third

Topic: Geosphere

Grade Level Standard: 3-4 Compare and contrast the features, materials, history and changes of the earth's surface.

Grade Level Benchmark: 2. Recognize and describe different types of earth materials. (V.1.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How would you recognize the different natural materials found on the Earth's surface?***	
1. "What Are Rocks and Minerals?" ★ 2. "Igneous Rock Candy" ★ 3. "Sandstone Rock" ★ 4. "Fun, Yummy Rocks" ★ 5. "Crystal Clear" ★ 6. "Making Sedimentary Rock" ★ 7. "What Makes Soil?" ★ 8. "Pet Rock" ★ 9. Read: "What is Soil? Fossils. Molten Rocks and Fiery Gases. Volcanic Intrusions" ★ 10. "Michigan's Hidden Treasurers" ★ ★ Activity is attached	AIMS
Process Skills: Observing, Communicating, Classifying, Developing Models and Theories, Interpreting Data	

New Vocabulary: mineral, rock, boulder, gravel, sand, clay, soil

WHAT ARE MINERALS AND ROCKS?

Imagine you take a road up the side of a mountain. The road is cut into the side of the mountain. You would see different kinds of rocks as you take your trip. Rocks have different colors, shapes and sizes. However, all rocks are made of one substance: **minerals.** Every rock is made of one or more type of mineral. A *mineral is* a *nonliving, solid material that forms in the earth.* A mineral was never living. *Copper, Quartz, Diamonds* and *Gold* are examples of minerals. There are 2,500 known minerals on earth. Each mineral has unique physical properties. A mineral can be any color, shiny or dull, soft or hard.

Atoms in a mineral join together in a certain pattern to make crystals. A crystal has a definite shape. Minerals do not all have the same shape of crystals. The crystal shape of a mineral depends on how it formed.

Kinds of Rocks

Rocks form in different ways. The earth is hot deep inside the earth causing minerals to melt. Some rocks form from the melted minerals inside the earth. These rocks are called **igneous rocks.** Most of the earth's crust is made of igneous rock. Some igneous rocks are formed under the ground. *Granite* is an igneous rock formed underground. Other igneous rocks are formed above the ground. When melted rock (magma) pours out from a **volcano**, it is called **lava**. When lava cools on the surface of the earth, it hardens into igneous rock.

Some rocks are made from tiny pieces of rocks, sand, shells and other materials. These rocks are formed under water. Rivers and streams carry the pieces of rock, sand and shells into lakes and oceans. These materials sink to the bottom and form layers. These materials are called *sediment.* The top layers press down on the bottom layers. Over millions of years, the bottom layers harden into **sedimentary rocks**. Traces of plant and animals, called **fossils**, are often found in sedimentary rocks. The dead organisms were trapped in the layers of sediment. As the sediments hardened, the organisms' bodies decayed, leaving their traces in the rock.

Sometimes, igneous and sedimentary rocks change into another kind of rock called: **metamorphic rock**. Rock that is buried under layers of other rock is under pressure. This pressure causes heat. Over many years, the heat and pressure can change these rocks into metamorphic rocks. Marble is an example of a metamorphic rock. When limestone (a sedimentary rock) is exposed to millions of years of heat and pressure inside the earth, it changes into marble.

IGNEOUS ROCK CANDY

Need: 1 cup granulated sugar
1 cup dark corn syrup
1 tablespoon vinegar
2 teaspoons vinegar
1 hot plate
heavy 3 quart sauce pan
candy thermometer
2 lightly greased aluminum foil pans

Combine sugar, corn syrup, and vinegar in a sauce pan. Stir and heat to 150°C. Pour half of contents onto chilled pan (forms "obsidian"). Quickly stir soda into mixture remaining in the sauce pan and pour onto other pan (forms "pumice"). Let cool. Discuss similarity of candy to pumice and obsidian.

SANDSTONE ROCK

Need: paper cups
sand and gravel
school glue thinned with water

Each student mixes together sand and gravel in a paper cup. Mix in thinned glue to moisten. Let harden 2-3 days. Tear cup away from "rock."

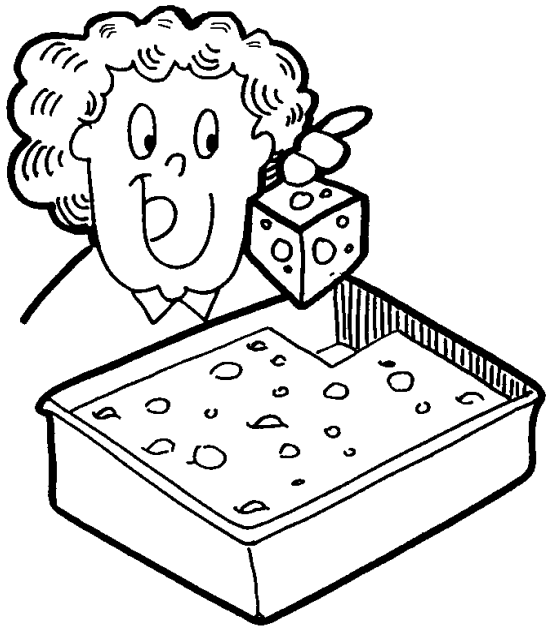
Compare to real rock. How is it like a real rock? How is it different?

Macmillian/McGraw-Hill, Earth Beneath Your Feet, 1993.

FUN, YUMMY ROCKS

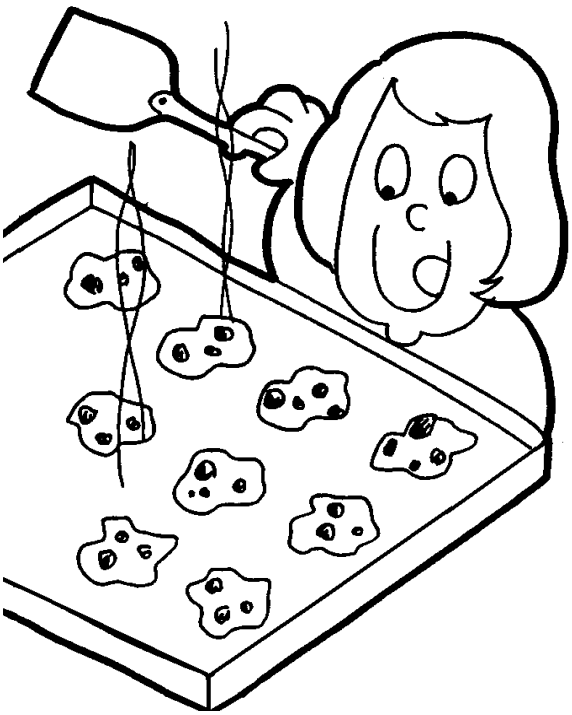
. . . stretch that imagination and make treats that resemble rocks.

Igneous



1 6 oz. can of evaporated milk
1 ½ c. sugar
¼ tsp. sugar
½ c. chopped nuts
1 ¼ c. tiny marshmallows
1 ½ c. semisweet-chocolate pieces
1 tsp. vanilla

1. Grease a 8 x 8 x 2 inch or 9 x 9 x 1 ¾ inch pan.
2. Combine evaporated milk with sugar and salt in a saucepan. Bring to a boil. Reduce heat and simmer, stirring, for 5 minutes.
3. Remove from heat. Add remaining ingredients.
4. Pour into prepared pan. Let cool.



Metamorphic

½ c. shortening or margarine
1 c. brown sugar
½ tsp. vanilla
½ c. dates or raisins
½ c. chopped nuts
½ c. well-drained crushed pineapple
1 egg, beaten
1 c. whole wheat flour
1 c. flour
1 tsp. salt
1 tsp. soda

1. Cream shortening and sugar.
2. Add the beaten egg and vanilla.
3. Add the dry ingredients. Mix.
4. Stir in the fruit and nuts.
5. Drop teaspoonfuls onto a cookie sheet.
6. Bake for 7 minutes at 375°F.

* Add chocolate chips, wheat germ, currants, coconut. . .

Sedimentary

1 ½ c. crushed cornflakes or other “flaky” cereal
3 TB sugar
1 c. margarine

1. Melt margarine.
2. Mix with the cereal and sugar.
3. Press into an 8 x 8 x 2 inch or 9 x 9 x 1 ¾ inch pan.

1 c. semisweet-chocolate or butterscotch pieces
1 ¼ c. coconut
1 c. chopped nuts
1 14oz. Can sweetened condensed milk

1. Sprinkle chocolate chips over cereal layer.
2. Sprinkle coconut over chips.
3. Sprinkle nuts over coconut.
4. Pour condensed milk over the layers.
5. Bake for 25 minutes at 325°F.

Fossils

Jell-O (at least four different flavors/colors)
clear, plastic cups
fruit (pineapple, apples, strawberries, bananas, grapes, kiwi, papaya, mandarin oranges, etc.) nuts

1. Follow the directions on the package to make one flavor of Jell-O.
2. Pour into cups.
3. Add one or two types of fruit or nuts for fossils.
4. Let set.
5. Repeat using different Jell-O flavors, fruits, and nuts for each layer.
6. Draw and label the stratified layers on a sheet of construction paper. This treat shows how the bottom layer is the oldest and the top layer is the youngest. Make predictions about the disappearance of apple chunks after the lime/grape era. Have fun!

Mix some flavors!
Brainstorm other foods that characterize various rock types.

CRYSTAL CLEAR

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

CI: Generate reasonable questions about the world, based on observation.
C2: Develop solutions to unfamiliar problems through reasoning, observation and/or experiment.
EG2: Recognize and describe different types of earth materials.

THINK QUESTION

How is a crystal formed from a liquid?

BACKGROUND

When molecules of a material are all the same shape, they fit together in a solid, many-sided, flat, smooth surface called a crystal. Each type of crystal has its own unique form.

Hundreds of different kinds of crystals are formed in nature. A snowflake is a crystal. Most of the minerals on earth are also crystals. Billions of years ago the materials that made up the earth were so hot they melted. When this rock solution cooled, the minerals crystallized. These crystals formed unique colors, shapes, and textures of rocks.

ACTIVITY

Observing how minerals formed on the earth.

NEW VOCABULARY

mineral

SCIENCE PROCESSES

experimenting, observing

OBJECTIVES

Students will I) understand that crystals make up minerals and 2) make different crystals from common materials.

MATERIALS

- petri dishes
- string
- salt
- hand magnifiers
- mineral, Copper
- mineral, Quartz
- worksheet, Michigan's Hidden Treasures
- worksheet, What are Rocks and Minerals?
- worksheet, Crystal Clear

- alum
- tablespoons
- beakers

Teacher Provided:
- masking tape
- hot water

TIME

30-45 minutes set-up: 20 minutes observation

PROCEDURE

Anticipatory Set:

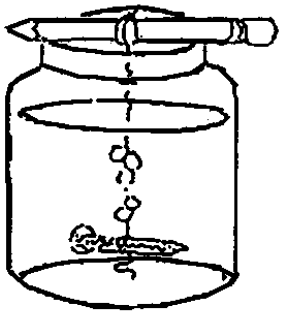
1. Ask: What is a mineral? Discuss their ideas.
2. Read and discuss the worksheet, Rocks and Minerals.
3. Ask: Where have you seen minerals? Explain that the gems in jewelry (diamonds, rubies, emeralds) are minerals.
4. Show the students the two minerals provided in the kit.
5. Discuss how minerals are made up of crystals. Ask: Where have you seen crystals? Note: sugar and salt are common crystals to the students. Give each student a small amount of each. Have them observe the physical characteristics of both.
6. Explain that the students will be growing crystals to observe how they were formed on the earth billions of years ago.

Input:

1. Divide the class into 6 teams. Explain that the teams will be growing two different types of crystals.
2. Give each team a copy of the activity worksheet.
3. Have 3 teams grow crystals from salt and 3 teams grow them from alum.
4. Follow the directions for making the crystals on the worksheet.
5. Students can use hand magnifiers to observe their crystals up close.
6. After the crystals are grown, compare the two different ones. How are the salt and alum crystals alike? How are they different?
7. **Optional:** You can also grow crystals from borax. Follow the same directions for these crystals.

DISCUSSION

1. How do crystals make minerals unique?
2. How do minerals make rocks unique?
3. What minerals can you find in Michigan?
4. What are minerals used for?



CLOSURE

Have the students find out what minerals are mined in Michigan and what they are used for. The worksheet, Michigan's Hidden Treasures, explains some rocks and minerals and where they are mined.

EXTENSIONS

- Build a crystal garden. Scatter several pieces of charcoal briquette in a shallow, glass container. Fill a measuring cup with 1 cup of boiling water. Stir in salt until no more dissolves. Add two tablespoons of vinegar to the salt solution. Pour the mixture over the briquette pieces. The charcoal should still stick up out of the mixture.
- Put several drops of food coloring (variety of colors) over the briquette pieces. Put the container where it won't be disturbed by the students, but is visible to them. In a few weeks, you will have a colorful crystal garden. The crystals are very fragile so do not try to move the container. ***Do not eat or taste the crystals.***
- Make rock candy. You will need a piece of string, sugar (250 ml), hot water (125 ml), a jar, a nail or paper clip and a pencil. See the diagram. Fill the jar with the hot water and slowly stir in the sugar until it no longer dissolves. Attach a nail or paper clip to one end of the string. Wrap the other end of the string around a pencil. Rest the pencil on the edge of the jar and let the string hang into the sugar water solution. Do not let the nail or paper clip rest on the bottom. Place the jar in a warm place. Cover the jar loosely with a piece of paper to keep out the dust. After a few days, the water evaporates and the crystals form on the string. This happens because the water molecules move slowing into the air. As it evaporates, the sugar atoms draw close together, forming cube-shaped crystals. When the water is gone, the crystals remain.

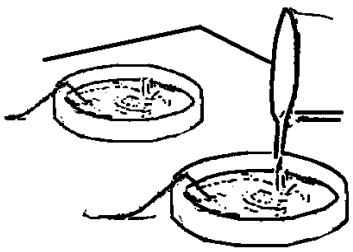
NOTES FOR REVISION

CRYSTAL CLEAR

Growing Crystals in the Classroom Activity Worksheet

MATERIALS NEEDED

- alum or salt
- petri dish
- string
- hot water
- beaker
- magnifying glass
- masking tape
- tablespoon



DIRECTIONS

1. What type of crystal is your group growing? salt or alum

2. Label your petri dish with the name of your crystal. Use a piece of masking tape.

3. Fill your beaker with 125 ml. of hot water.

4. Dissolve about 2 tablespoons of your substance in hot water. Keep adding small amounts of your substance until the hot water does not dissolve any more.

5. Pour a small amount of the solution into your petri dish. Add just enough to cover the bottom of the dish.

6. Place a small piece of string in the solution and let it hand over the edge of the petri dish. See the diagram above.

7. Allow the solutions to evaporate for a few days. It might take up to a week for all the water to dissolve.

8. **Predict**: What will happen to the salt or alum that was mixed with the water? _____

9. Watch your petri dish. At the end of the week, observe the dish and string with a magnifying glass.

10. Draw a picture of what your dish looked like after one week.

Petri Dish After 1 Week

MAKING SEDIMENTARY ROCKS

Experiment

Over millions of years, loose sediment turns into solid rock, a process called “lithification.” But you can make layers of sedimentary rock in a few days with sand, food coloring, and plaster of paris. The plaster of paris cements the grains of sand together, just as minerals like calcite do in real rocks. You can even put a “fossil” shell in between the layers.

YOU WILL NEED

spoon, plaster of paris, food coloring, scissors, sand plastic bottle, shells, bowl, petroleum jelly

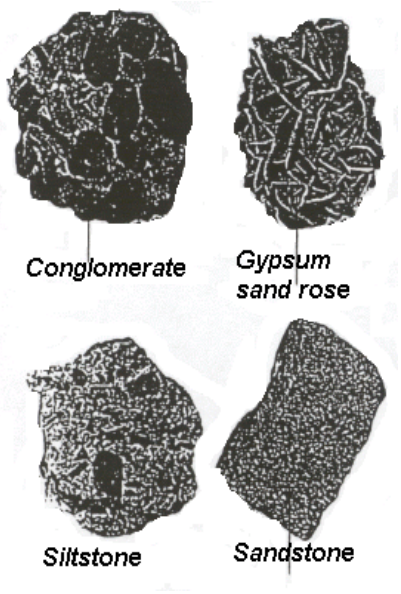
1. MIX FOOD COLORINGS with damp sand and plaster of paris. Build layers in the bottle and put in greased shells.
2. LEAVE YOUR “ROCK” to harden for a few days. Then carefully cut away the bottle with scissors.
3. IF YOU WISH, you can break apart the layers to reveal the shell “fossil” and its imprint in solid rock.

Layer cake

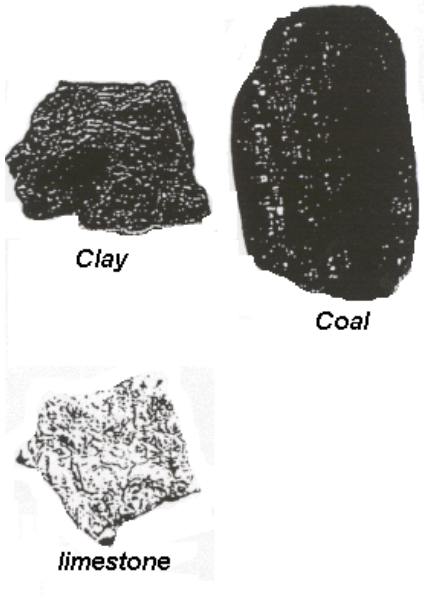
As the nature of sediments changes over a period of time, sedimentary rocks are always clearly stratified into layers (strata) of different rocks. You can often see this stratification in cliff faces.

Sedimentary rocks

The most common clastic rocks are conglomerate, sandstone, siltstone, and shale. Conglomerate is a solid mass of rounded pebbles, probably formed from beaches. Sandstone is made from grains of quartz sand held together by silica or calcite. Siltstone is made of even finer grains, while shale is a smooth rock made from brittle flakes of compacted clay.



The most common organic and chemical sedimentary rocks are limestones, so called because they are rich in calcium compounds. These include shell limestones, made from fragments of seashells, and chalk, made from the skeletons of microscopic sea creatures called coccoliths. Coal is made from the squashed remains of the swampy forests that covered much of North America, Asia, and Europe 300 million years ago.



WHAT MAKES SOIL ?

TOPIC AREA

Soil composition

INTRODUCTORY STATEMENT

Students will explore the components of different soil samples.

MATH SKILLS

Measuring mass
Comparing
Estimating

SCIENCE PROCESSES

Observing/classifying
Gathering/recording data

MATERIALS

Each group of 3-5 students will need:
- magnifying glass or hand lens
- balance scale and metric masses
- 3 soil samples in plastic sandwich baggies

KEY QUESTION

How are soils from different sources alike?

BACKGROUND INFORMATION

Texture is an important characteristic of soil. Soil texture refers to the size of the particles found in the sample. These particles may vary in size from large, such as gravel, to medium, such as sand, to small such as clay. Most soils contain a mixture of these various types of particles. Sandy soil contains at least 50% sand and clay soil contains at least 50% clay.

MANAGEMENT

This activity works well if class is divided into teams of 3-5 students.

Each student should be responsible for bringing a small fistful of soil in a plastic sandwich baggy. Encourage students in a single group to bring in different soil types. Students will probably not be knowledgeable in identifying soil types so it may be simpler to identify each soil sample by naming the location from which it came. For example, play ground, garden, beach, river bank, park, etc.

PROCEDURE

1. Place a small amount of each of three soil samples on a piece of white paper.
2. Examine carefully. Use a hand lens. Can you find any bits of rock?
3. What color is the soil?
4. Rub a pinch of soil between your thumb and forefinger. Describe how it feels.
5. Hold the sample close to your ear and rub. If you hear a scratchy sound, it usually means that sand may be present.
6. Sprinkle water on your sample. Does the soil hold its shape? Can you form it into an object?
7. Measure out 50 ml of soil and estimate its mass. Use the balance and weigh and record the actual mass.

WHAT THE STUDENTS WILL DO

1. Collect and examine three soil samples.
2. Describe the soil sample by color, composition, and texture.
3. Estimate and measure the mass of soil samples.
4. Compare soil samples.

DISCUSSION

1. Describe the color of the soil. Is it one color or many colors?
2. How does the soil feel? Describe its texture. Does it feel gritty like sand or wet and sticky like clay?
3. How does it act when you sprinkle water on it? Does it hold its form or shape?
4. In what ways are soils alike? How are they different?
5. Compare the mass of equal volumes of soil. Sequence the soil samples from light to heavy. How do you account for the differences in masses or weight?

EXTENSION

Study different soil layers. Dig a deep hole, perhaps a meter deep. Or visit a road bank where you can see the soil at least a meter deep. Scrape up and won with a shovel and observe and describe the soils at different depths.

Name _____ **Date**_____

WHAT MAKES SOIL ?

	My Discovery About What Makes Soil				
	Kinds of Soil	***Color***	***Things in the Soil***	***How it Feels***	***Weight of Sample***
# 1					
# 2					
# 3					

PET ROCK

AREA
Earth Science

SUBJECT
Geosphere, Obj. 1, 2, 3
Reflecting on Scientific Knowledge, Obj. 2, 4
Constructing Scientific Knowledge, Obj. 1, 3, 4

GRADE LEVEL
3-4

TAKEN FROM
AIMS Education Foundation

TOPIC AREA
Geology—rocks

INTRODUCTORY STATEMENT
Students will become familiar with some of the characteristics of rocks.

MATH SKILLS
Measuring
Estimating
Attributes
Venn Diagram

SCIENCE PROCESSES
Observing
Predicting
Gathering/recording data
Classifying

MATERIALS
Per student:
each brings one rock
For class:
two or more metric sticks
two or more scales with gram weights
two or more copper pennies
two or more steel nails
water container
100 ml or less of vinegar
eyedropper
yarn for Venn Diagram
magnifying glasses (optional)

KEY QUESTION
What characteristics make your rock unique among all the pet rocks in our class?

BACKGROUND INFORMATION

Rocks and Minerals

There are over 2,000 minerals in the earth, but ten from 99% of the earth's rocks. Geologists measure the hardness of minerals by giving them a number from one (soft) to ten (hard).

How are rocks and minerals different? Minerals are relatively pure and chemical formulas can be written for them. Rocks are usually a mixture of minerals. Some minerals, but not all, form rocks. Some of these rock-forming minerals are listed below.

Mohs' Scale of Hardness of Minerals

HARDNESS	EXAMPLE	SCRATCH TEST
1	talc (talcum powder)	fingernail scratches
2	gypsum (chalk, plaster of paris)	fingernail scratches
3	calcite (limestone)	copper penny scratches
4	fluorite	knife scratches
5	apatite	knife scratches
6	feldspar (granite)	metal file scratches
7	quartz (amethyst, agate, onyx)	scratches glass
8	topaz	scratches quartz
9	ruby, sapphire	scratches topaz
10	diamond	scratches others, only scratched by diamond

Hardness of common materials: fingernail—2.5; copper penny—3.0; steel knife—5.5 - 6.5.

KINDS OF ROCKS

Sedimentary - The word comes from Latin and means "settle." Sediment such as sand, clay, and gravel can be cemented together by water pressure, forming sandstone, shale, and conglomerates respectively. Sedimentary rock is also formed from living things such as plants (coal). A third formation is caused by chemical change (many forms of limestone). Fossils are common in sedimentary rock, particularly near the ocean.

Igneous - This group of rocks is formed from hot, liquid magma. Coarse-grained rocks such as granite are produced by slowly cooling underground. The Sierra Nevadas are granite. Others such as basalt, obsidian, and pumice cool quickly on the surface.

Metamorphic - Rock that changes from its original form due to pressure, heat, gas, or water is called metamorphic. Crystals may grow, bands of minerals may form, layering may develop, etc. Slate can develop from shale and marble from limestone.

MANAGEMENT

1. Ask each student to bring a rock bigger than their thumb and smaller than their fist. Encourage them to bring interesting and unusual specimens; perhaps collected on a vacation.
2. If possible, bring in samples of soft rocks, lava, and pumice for comparison.
3. Set up the following comparisons:
   Length—metric rulers
   Mass—scales and weights
   Scratch—copper pennies, nails
   Vinegar—vinegar, eyedropper, paper towel
   Float—water in container, paper towel
4. The top half of the worksheet will be done individually. After making predictions, student groups of four to five will move from center to center performing tests; some may need to wait until a center is available.
5. Day 1: Allow about 60 minutes to make predictions, gather data, and write descriptions.
6. Day 2: Allow 45-60 minutes for guessing game and Venn Diagrams.

PROCEDURE

1. Decide if students should round to the nearest cm or nearest half cm when measuring length.
2. Before handing out the worksheet, have students study their rocks and write down at least five observations. Optional--use magnifying glasses.
3. Scratch Test: A scratch is defined as a small crevice. Pressure should be applied. Traces of metal left on a rock are not scratches. Try the scratch test in this order: fingernail, penny, nail. See Background Information to relate to the scale of hardness.
4. Vinegar Test: Use an eyedropper to place a few drops of vinegar in a scratch or on the surface. If it bubbles, calcium carbonate found in limestone, marble, etc. is present.
5. Float Test: Place the rock gently in water and see if it will float. Try pumice, it will.

WHAT THE STUDENTS WILL DO

1. Bring a rock and give it a pet name.
2. Record answers on top half of worksheet. Then draw a side view of the rock.
3. Estimate length (cm) and mass (g).
4. Predict which material will scratch the rock and the results of the vinegar and float tests.
5. Travel from center to center in groups, measuring length/mass and doing the scratch, vinegar and float tests.
6. Make a list in sentence or paragraph form describing the rock's characteristics. During the guessing game, evaluate whether the statements are complete and lead to identification.
7. Playing a guessing game: Gather the rocks together and collect student descriptions. Slowly read their statements and see if the rock can be identified from the pile.

8. Venn Diagram: Make two yarn circles on the floor or table. Gather the class around and have them divide rocks by color, size, or other tests. Paper strips labeled smooth/rough; more than/less than 100 grams; one color/many colors; bubbles/doesn't bubble, etc.

DISCUSSION

1. Use rock identifying books along with data collected to determine whether the rock is sedimentary, igneous, or metamorphic.
2. Streak Test: Scratch the rock against an unglazed porcelain tile (back of kitchen tile). Color will help determine minerals present. Find information on mineral colors.

CURRICULUM COORDINATES

Language Arts

1. Write directions for taking care of your pet rock.
2. Write a cartoon or story about your rock's adventures.
3. Read Sylvester and the Magic Pebble by William Steig.
4. Research ways rocks are used.

Computer

1. Create a simple data base on rock characteristics.

Creative Thinking

1. Make a list of new/interesting/unusual ways to use rocks.