Life Science
Worksheet

GRADE LEVEL: Third

Topic: Change Over Time

Grade Level Standard: 3-1 Distinguish physical and/or behavioral characteristics and traits that enable species to adapt or survive.

Grade Level Benchmark: 1. Explain how fossils provide evidence about the nature of ancient life. (III.4.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do scientists acquire evidence about the nature of ancient life?*** 1. "How Can You Make a Permanent Shell Imprint?" ★ 2. Create a diorama. 3. Guest speaker Geologist. 4. "Nippers, Rippers, and Grinders" ★ 5. "More Fossils" ★ ★ Activity is attached	
Process Skills: Observing, Classifying, Communicating, Formulating hypothesis	

New Vocabulary: Types of Evidence: fossil, extinct, ancient, modern life forms

HOW CAN YOU MAKE A PERMANENT SHELL IMPRINT?

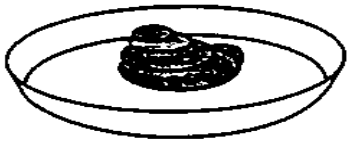
MATERIALS NEEDED

- Seashell
- Pie tin
- Petroleum jelly
- Plaster of Paris
- Water
- Paper towels
- Newspapers

PROCEDURE

1. Coat the bottom and sides of the pie tin with a thin layer of petroleum jelly so the plaster will release easily.
2. Coat your shell with a thin layer of petroleum jelly.
3. Lay your shell in the bottom of the pie tin. Place it with the rounded side up. (Figure 4.27-1)

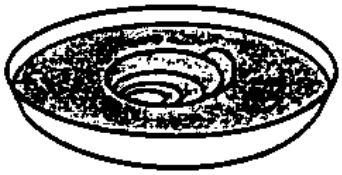
Figure 4.27-1
Shell, Rounded Side Up, in Pan



4. Mix plaster with water according to the instructions on the package. Prepare sufficient plaster to make a layer in the pan about 15 mm (at least ½ in.).
5. Pour the plaster carefully over the shell and let it harden (leave it at least one hour).
6. Turn the pie tin upside down on a table covered with newspaper and tap it lightly. The plaster case with shell should fall out onto the table.
7. Remove the shell, and handle the plaster cast very carefully. The plaster will be quite soft until it has had at least a day to cure (harden).
8. After at least one day of curing time, carefully wipe the excess petroleum jelly off the plaster cast with a paper towel. Then wash the rest off lightly with warm water.
9. You now have an imprint of the shell in plaster much like those often found in limestone and other sedimentary rock. (Figure 4.27-2) When found in rock, this imprint is called a fossil because it is evidence of an ancient animal.

Figure 4.27-2

Shell Imprint in Plaster



For Problem Solvers: Begin a collection of fossils, especially any that might be found in your area. Watch for opportunities to expand your collection. If you know a geologist or a rock hound, they will be able to help you get started. Find out what kind of fossils you have and what period of time they represent. What conditions do you think they lived in? Study about the fossils and find out if scientists agree with you. Encyclopedias will be very helpful. Share what you learn with others who are interested in fossils.

TEACHER INFORMATION

Plaster of Paris can be obtained at a local builder's supply store or hobby shop. It is easy to work with, and if students follow the directions, the project should be successful. As the plaster cures, it will become quite warm, then will cool. It should be allowed to cool completely before being removed from the mold (pie tin).

If you have an area nearby where fossils can be found, that would be an excellent field trip. Otherwise, perhaps a few fossil samples could be borrowed from a friend or purchased from a science supply house. The experience of making a "fossil" will make a more lasting impression on the minds of students if they can see just how similar their "fossil" is to the real fossil formed by nature.

The imprint resulting from the above activity is a negative imprint. If a positive image is desired, spread a thin layer of petroleum jelly on the entire surface of the plaster, wrap and tie a piece of cardboard around it to provide sideboards to hold plaster, and pour another layer of plaster on top of the first. After it has cured, remove the cardboard, separate the two pieces of plaster with a knife blade, and presto—you have both a positive and negative of the shell. Clean up the petroleum jelly after the plaster has cured thoroughly, as indicated above.

An imprint of a leaf can be made following the same steps.

INTEGRATING

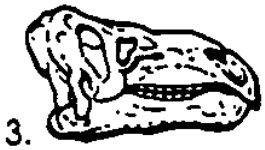
Reading, language arts, social studies

SKILLS

Observing, classifying, communicating, using space-time relationships, formulating hypotheses, researching

Nippers, Rippers, and Grinders

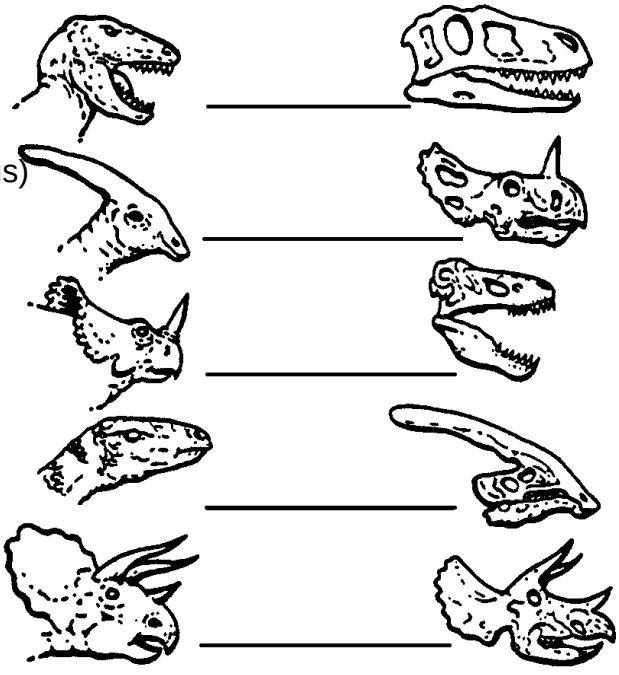
Name _____



Scientists tell us that some of the dinosaurs were meat-eaters and others were plant-eaters. But how do the scientists know? By looking at the teeth of certain dinosaur fossils, scientists can tell what those dinosaurs ate. Meat-eaters had sharp, saw-edged teeth (figure 1), for cutting and ripping flesh. Plant-eating dinosaurs had either peg-like teeth (figure 2), for nipping plants, or flat grinding teeth (figure 3), to munch tough twigs or leaves.

1. Match the dinosaur to its teeth by writing its name in the space provided.
2. Circle either "M" for meat-eater or "P" for plant-eater.

		Meat-eater or Plant-eater
Tyrannosaurus (tie-ran-o-SAWR-us)	_____	M P
Parasaurolophus (par-uh-sawr-uh-LOW-fus)	_____	M P
Monoclonius (mah-no-KLONE-ee-us)	_____	M P
Hypsilophodon (HIP-sil-ahf-oh-don)	_____	M P
Triceratops (try-SAIR-uh-tops)	_____	M P



Fantastic Fact

The **Tyrannosaurus,** whose name means "king of the tyrant lizards," was the largest meat-eater. It weighed over 8 tons and was over 15 meters long. Its teeth were over 15 cm long and had edges like a steak knife.

More Fossils

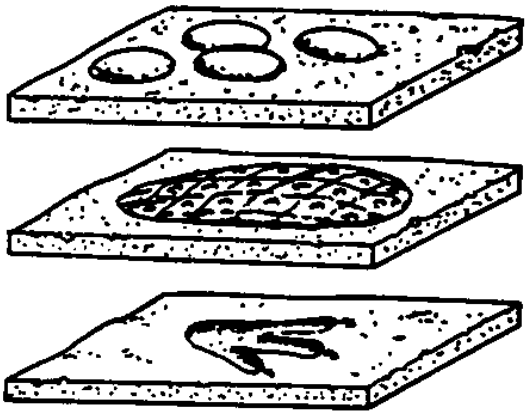
Name_____

Besides bone fossils, scientists have found other kinds of fossils. Below are the pictures of some of these other kinds of fossils. Draw a line from the description of fossil to its picture.

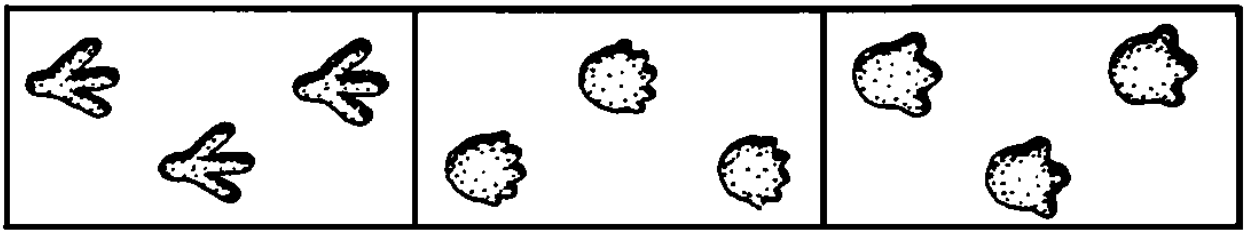
A dinosaur makes footprints in the soft mud. The mud hardens and turns into rock.

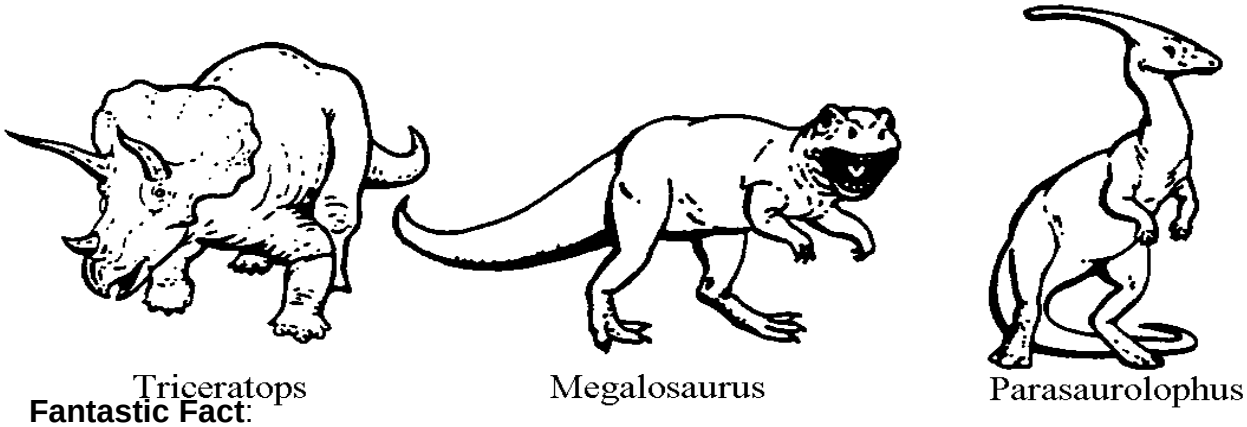
Sometimes the skin of a dinosaur is changed into a fossil.

The eggs of some dinosaurs have been changed into fossil eggs.



Carefully study these dinosaur footprints. Draw a line from the dinosaur to its footprints.





Triceratops Megalosaurus Parasaurolophus

Fantastic Fact:

Fossil eggs of the **Protoceratops** have been found with the skeletons of tiny baby **Protoceratops** inside (pro-toe-SAIR-uh-tops).

Assessment
Grade 3

CHANGE OVER TIME

Classroom Assessment Example SCI.III.4.E.1

The teacher will collect and redistribute cups, making sure that students do not receive their own cups. Students will open their cups by carefully tearing them down the sides. Students should carefully explore the shapes and patterns that were made by their casts. With a cautious approach, students may be able to keep the molds of their specimens intact. The teacher will ask students which specimens made a good impression or disintegrated, and which lived at an earlier time or lived later. Students will draw conclusions and present their findings based on their observations.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.4.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Identification of layers	Recognizes that objects were buried at different levels (layers).	Locates at least two distinct layers.	Locates all layers and finds evidence of fossils.	Locates all layers and explains that fragile materials disintegrate and therefore not all plants and animals from the past made fossils.
Demonstration of scientific methods	Preserves some evidence of the layers.	Preserves layers and some of the casts.	Preserves the layers and the casts.	Works meticulously like a paleontologist and identifies the specimens precisely.
Accuracy of relationships	Explains that some plants/ animals lived a long time ago.	Recognizes that fossils exist within layers of the Earth.	Describes the relationship between layers and the age of specimens.	Provides evidence that not all members of a species (i.e., dinosaurs) became extinct at once. -or- Links climate and other natural disasters with fossil findings

Life Science
Worksheet

GRADE LEVEL: Third

Topic: Change Over Time

Grade Level Standard: 3-1 Distinguish physical and/or behavioral characteristics and traits that enable species to adapt and survive.

Grade Level Benchmark: 2. Explain how physical and behavioral characteristics of animals help them to survive in their environments. (III.4.E.2)

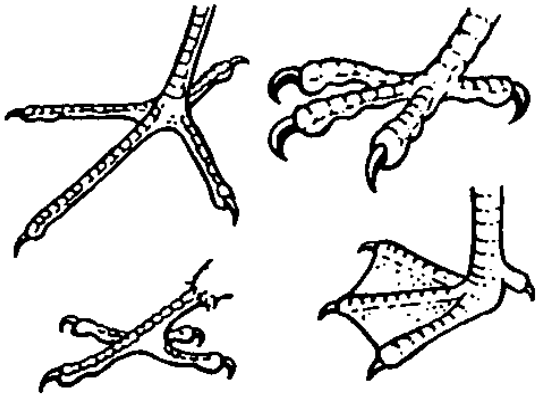
Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***In what ways are living things adapted (suited) to survive in their environment?*** 1. "Going Places" ★ 2. "The Thicket Game" ★ 3. "You've Changed" ★ 4. "The End of Dinosaurs" ★ ★ Activity is attached	
Process Skills: Analyzing, Observing, Describing, Application	

New Vocabulary: Characteristics: adaptation, instinct, learning, habit; Traits and their Adaptive Values: sharp teeth or claws for catching/killing prey, color for camouflage, behaviors

Going Places

Name _____

Looking at a bird's feet can tell you a lot about how they are used. Look at the bird's feet below. Unscramble the bird's name. Write the bird's name by the best sentence. Can you match the pictures with the names?



_____ "My webbed feet are great for swimming."

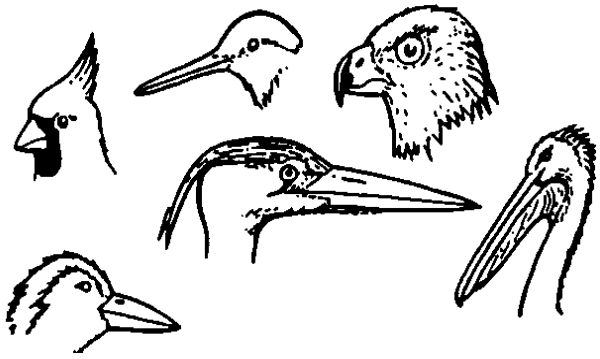
_____ "My feet are great for walking up trees."

_____ "I use my feet with long toes to wade in the water and mud."

_____ "I use my strong, powerful feet to catch small animals."

kawh _____ noreh _____ ckud _____ reckwoodep _____

Can the shape of a bird's bill tell you anything about what it eats? Look closely at the bills below. Unscramble the bird's name. Write the bird's name by the best sentence. Can you match the picture with the names?



_____ "I pound holes in wood to find insects."

_____ "I use my long bill to get nectar from flowers."

_____ "I use my strong bill to crack open seeds."

_____ "I stab at small fish with my sharp bill."

_____ "I scoop up large mouthfuls of water and fish."

noreh _____ reckwoodep _____ bumminghird _____ kawh _____

panicel _____ dinalcar _____

THE THICKET GAME

OBJECTIVES
Students will be able to: 1) define adaptation in animals; and 2) generalize that all animals make some adaptations in order to survive.

METHOD
Students become "predator" and "prey" in a version of "hide and seek."

BACKGROUND
Animals are adapted to their environment in order to survive. Animals may be adapted to changes in their habitats. For example, snowshoe rabbits have a white winter coat to blend with a snowy environment and a tan summer coat to blend with summer ground and vegetation colors. Chameleons change color to blend with their surroundings. The walking-stick insect can look like a twig or stick. Fawns have spotted hair that resembles dappled light on the forest floor.

The major purpose of this activity is for students to understand the importance of adaptation to animals.

NOTE: See "Seeing is Believing" and "Surprise Terrarium" for other elementary-age adaptation activities.

MATERIALS
Blindfolds: outdoor area like a thicket or other vegetated area where students can safely hide.

PROCEDURE
1. Take the class to a "thicket."
2. Blindfold one student who will be the "predator." The predator counts to 15 slowly while the others hide. The students hiding must be able to see the predator all the time.
3. After counting, the predator removes the blindfold and looks for "prey." The predator can turn around, squat, and stand on tip-toes—but not walk or change location. The predator should see how many students he or she can find, identify them out loud and describe where they are. When identified, they come to the predator because they have been "eaten." These prey now become predators.
4. When the original predator cannot see any more students, all the predators now put on blindfolds. The original predator counts aloud to ten. All the remaining prey are to move in closer, but still try to be "safe" and hidden. All the predators remove their blindfolds and take turns naming students they can see.
5. Repeat the process if several students are still hidden, have them stand up and identify themselves; it may be surprising how close these prey were to the predators—an example of successful adaptation

because of how well they blend with their environment in order to survive. Introduce the term “adaptation.”

6. Play the game again one or two times.
7. Discuss what would have made it easier to be the last one or get very close to the predators. Some ideas that may come out are: changing color (clothes); wearing clothing that doesn’t stick to plants; being of smaller size; climbing a tree.
8. Ask the student to summarize what they have learned. See if the students can think of other examples of adaptation in animals. Generalize that all animals are adapted to survive.

EVALUATION

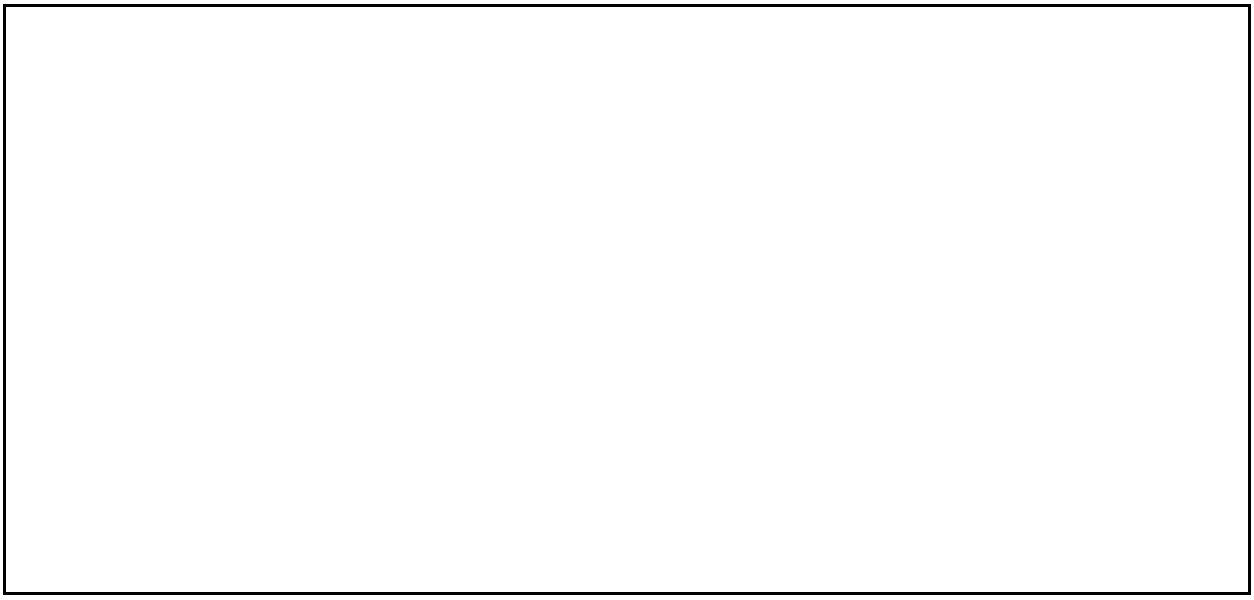
Describe the importance of adaptation to animals. Give at least two examples of animal adaptation.

Subjects: Science, Physical Education, Language Arts
Skills: analysis, application, description, discussion, generalization, kinesthetic concept development observation, psychomotor development
Duration: 30 minutes
Group Size: minimum of five students
Setting: outdoors
Key vocabulary: adaptation, predator, prey

Name _____

YOU'VE CHANGED . . . . . .

Directions: Put a baby picture of yourself in the frame below. Then answer the questions:



1. List at least five ways you've changed since that picture was taken.

   _____

   _____

   _____

2. What's something you can do well now that you couldn't do then?

   _____

   _____

3. Is there anything about yourself that you wish hadn't changed as you got older?

   _____

   _____

4. What about yourself do you most want to change in the future?

   _____

   _____

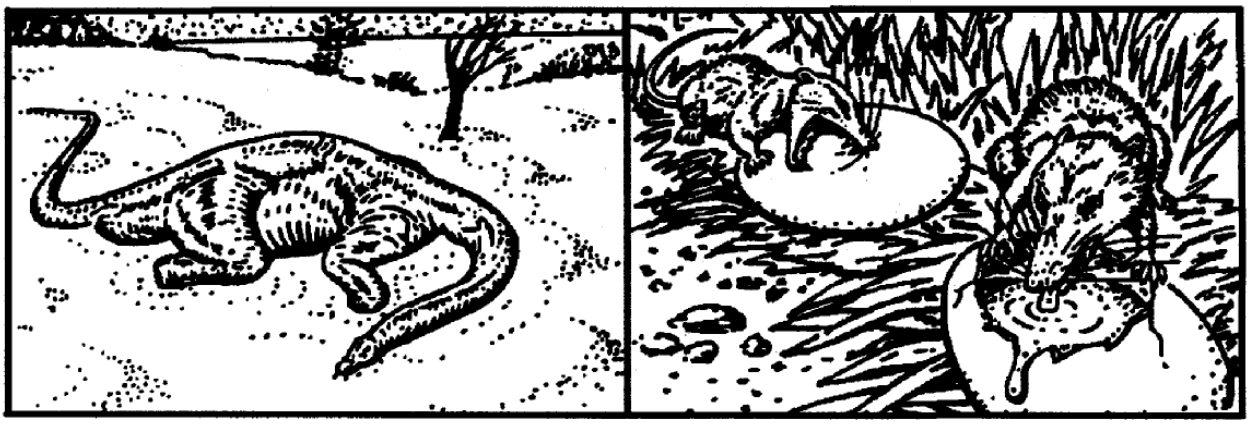
The End of the Dinosaurs

Name _____

What could have killed all the dinosaurs? Scientists are not really sure. They have many different theories, or explanations, for why the dinosaurs died out.

Several theories are listed below. Each theory has a cause and an effect. A cause is "a change that happened on earth" and an effect is "what resulted from the change on earth." Draw a line from each cause to its effect.

Cause	Effect
A huge meteor hit the earth, starting fires and making a thick cloud of dust and smoke that covered the earth.	Dinosaurs were cold-blooded and they couldn't find places to hibernate. They had no fur or feathers to keep them warm. They froze to death.
Small, fast mammals that liked to eat eggs quickly spread around the world.	The sunlight was blocked and plants couldn't grow. The dinosaurs starved to death.
New kinds of flowering plants started to grow on the earth. These plants had poison in them that the dinosaur could not taste.	Fewer and fewer baby dinosaurs were born.
When dinosaurs were living, the earth was warm all year long. Suddenly the earth became cooler with cold winter months.	The dinosaurs ate poison without even knowing it and they died.



TO THE TEACHER

Ecology is both interdisciplinary and intradisciplinary. It is interdisciplinary because it involves content from the biological, physical, and earth sciences, plus all areas of the social sciences. It is intradisciplinary because the ecologist attempts to use information from many sources to produce a unique field.

Many of the ecological problems we read about, see on TV, or hear on the radio are global in nature. Some are highly sensitive and fall in the political realm. National and international relations often deteriorate over ecologically-based issues. This section does not attempt to deal with moral, economic, or political issues. It deals with some basics of the science of ecology and attempts to help students realize their place, as individuals, in the ecological system.

The first portion of the area deals in very simple ways with nature's balance, food cycles, and food webs. They cycles of soil, water, and air are alluded to but not introduced formally. If you care to pursue these in greater depth, your library can provide ample resources.

People are introduced into an ecological system in this section. Liberties are taken with the term ecosystem to generalize it to apply to the student and his or her interaction with the immediate environment. Human interaction with the immediate environment becomes the focal point. Conservation, cooperation, and individual responsibility are emphasized. You may be tempted, as many are, to become preachy at this point; however, the effectiveness will be greatly increased if students are helped to discover these ideas on their own.

As is the case throughout the book, discovery/inquiry and verbal responses are emphasized. In this section, pictures, charts, and written work should be saved for a final, culminating activity.

Many of these activities could be enhanced by the use of movies on nature and wildlife. Teachers of young children should be aware that some movies show predators killing prey and portray life and death as they occur in a true ecosystem. Be sure to preview the movies and use only those you consider to be appropriate for your students.

Try to include as much art, music, poetry, and aesthetic experience as you can. Opportunities for enrichment are almost limitless.

Regarding the Early Grades

With verbal instructions and slight modifications, many of these activities can be used with kindergarten, first grade, second grade students. In some activities, steps that involve procedures that go beyond the level of the child can simply be omitted and yet offer the chid an experience that plants the seed for a concept that will germinate and grow later on.

Teachers of the early grades will probably choose to bypass many of the "For Problem Solvers" sections. That's okay. These sections are provided for those who are especially motivated and want to go beyond the investigation provided by the activity outlined. Use the outlined activities, and enjoy worthwhile learning experiences together with your younger students. Also consider, however, that many of the "For Problem Solvers" section can be used appropriately with young children as group activities or as demonstrations, still giving students the advantage of an exposure to the experience, and laying groundwork for connections that will be made at a later time.

Teachers of young children should be aware that some movies show predators killing prey and portray life and death as they occur in a true ecosystem. Be sure to preview the movies and use only those you consider to be appropriate for your students.

Assessment
Grade 3

CHANGE OVER TIME

Classroom Assessment Example SCI.III.4.E.2

Each student will invent an animal and design an environment (2D or 3D) that will support the invented animal. Students will develop and explain three physical adaptations and one behavioral adaptation that the animal uses to survive in the environment. Each student will then present the model in class with a two-minute presentation.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.4.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Design of environment	Designs (with teacher supper) an environment that partially camouflages the animal.	Designs (with teacher support) an environment that camouflages the animal.	Designs (without teacher support) an environment that camouflages the animal.	Designs (without teacher support) an environment that camouflages the animal in more than one way.
Design of physical adaptations	Designs one or two physical adaptations.	Designs three physical adaptations.	Designs and explains three physical adaptations.	Designs and explains more than three physical adaptations.
Explanation of behavioral adaptations	Explains a behavioral adaptation.	Develops a behavioral adaptation.	Develops and explains one behavioral adaptation.	Compares behavioral adaptation to real animals.
Effectiveness of oral presentation	Gives an oral presentation with teacher support.	Gives a two-minute oral presentation with organized information and teacher support.	Gives a two-minute oral presentation with organized information.	Gives a two-minute oral presentation with eye contact, appropriate volume, good posture, and organized information.

Life Science
Worksheet

GRADE LEVEL: Third

Topic: Ecosystems

Grade Level Standard: 3-2 Identify patterns of interdependence and interrelationships in various ecosystems.

Grade Level Benchmark: 1. Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web. (III.5.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How are parts of an ecosystem related and how do they interact?***	
1. "What is a Simple Plant-Animal Community?" ★	AIMS
2. "What is a Pond Community?" ★	
3. "What is a Simple Ecosystem?" ★	
4. "How is Energy Transferred in an Ecosystem?" ★	
5. "Where do People Fit into an Ecosystem?" ★	
6. Create a food chain/web poster. ★	
★ Activity is attached	
Process Skills: Observing, Communicating, Classifying, Predicting	

New Vocabulary: producer, consumer, predator, prey, decomposer, habitat, community

WHAT IS A SIMPLE PLANT-ANIMAL COMMUNITY?

MATERIALS NEEDED

- 24" x 36" labeled poster of Figure 5.1-1
- 8 ½" x 11" unlabeled copy of Figure 5.1-1 for each student
- Crayons
- Pencils

PROCEDURE

1. Compare your picture with the one on the bulletin board. This is a basic grassland community. It has six important elements. As your teacher explains the function of each, color it on your paper.

2. Energy from the sun in the form of heat and light is the very first ingredient. Without it, nothing else could happen. Label and color the sun.

3. Air must be present in order for life to exist. Since air is colorless, write "air" on a blank spot somewhere below the sun.

4. Moisture in some form must also be present. How do you think this grassland is getting moisture? Label and show it in some way on your picture.

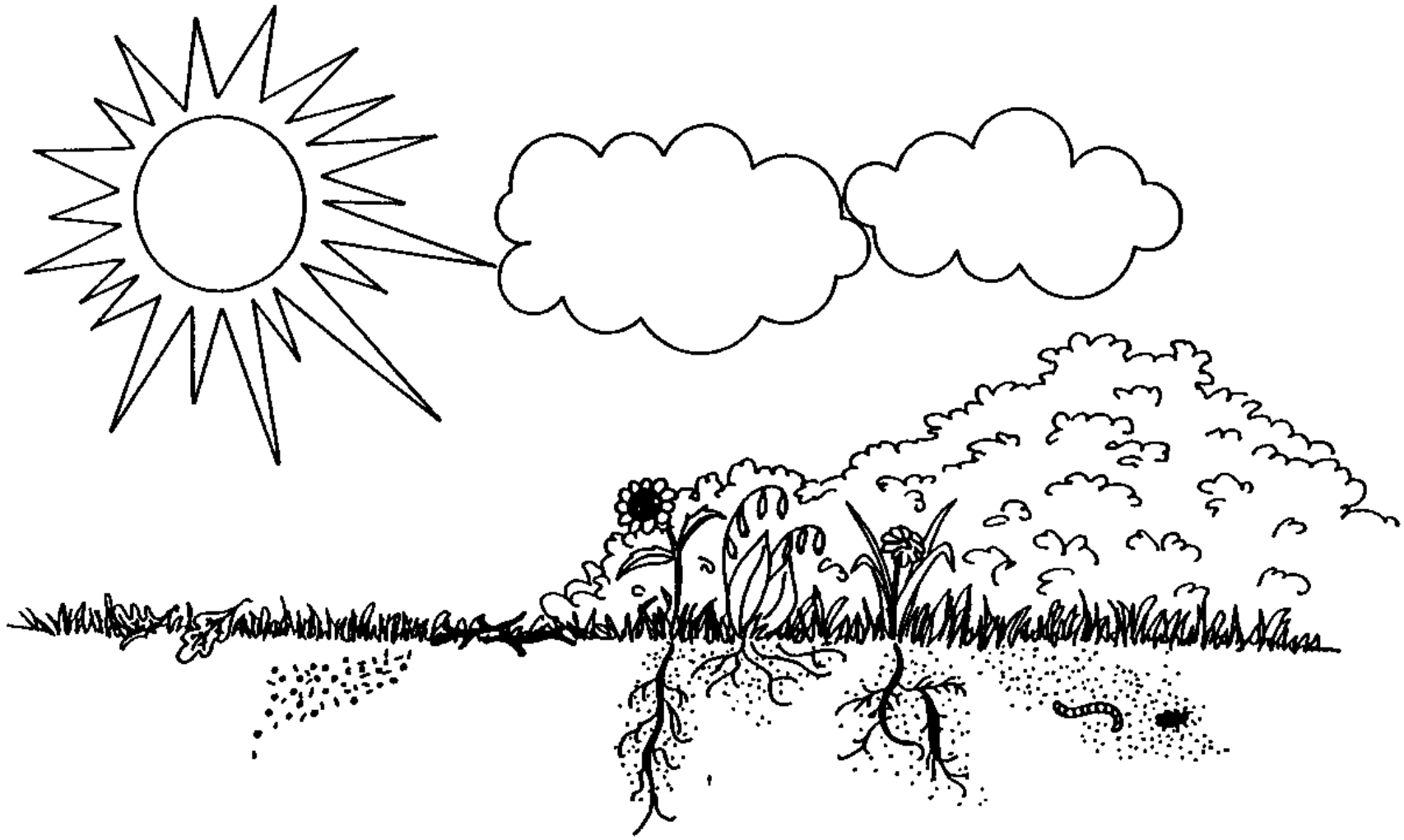
5. Good soil is necessary for grassy or woody plants. Soil has dead leaves and sticks (humus) in it. There are also small animals called *scavengers*, such as worms, bugs, and beetles. Scavengers feed on dead plant and animal materials in the soil and break it down into smaller parts. Tiny bacteria and fungi called *decomposers* further break down materials into minerals that plants need in order to grow. Color and label the humus, scavengers, and decomposers.

6. Plants of many kinds grow above the ground. They all depend on energy from the sun, air, moisture, and rich soil. In turn they remove carbon dioxide from, and release oxygen into, the air. They give off moisture. Most plants use energy from, and release oxygen into, the air. They give off moisture. Most plants use energy from the sun combined with moisture and rich soil to produce food. They are the *primary producers* of food on the earth. Without them, other forms of life could not exist. Color the plants and flowers in your picture.

7. Your grassland community is now working. Save it for use later on.

Figure 5.1-1

Profile of Grassland Community



TEACHER INFORMATION

In the study of this portion of ecology we will consider groups or types of living and nonliving things interacting with each other as *communities.* When we add animals as primary and secondary consumers, we will then have an *ecosystem*.

Ecosystems can be as simple as a balanced aquarium in a classroom or as complex as an entire region, or country, or the world. Our studies will be confined to small communities and ecosystems to provide simple examples with which the students can relate.

As people are introduced into the ecosystem, students will begin to understand how complex the problems can become.

SKILLS

Observing, communicating, comparing and contrasting, using space-time relationships

WHAT IS A POND COMMUNITY?

MATERIALS NEEDED

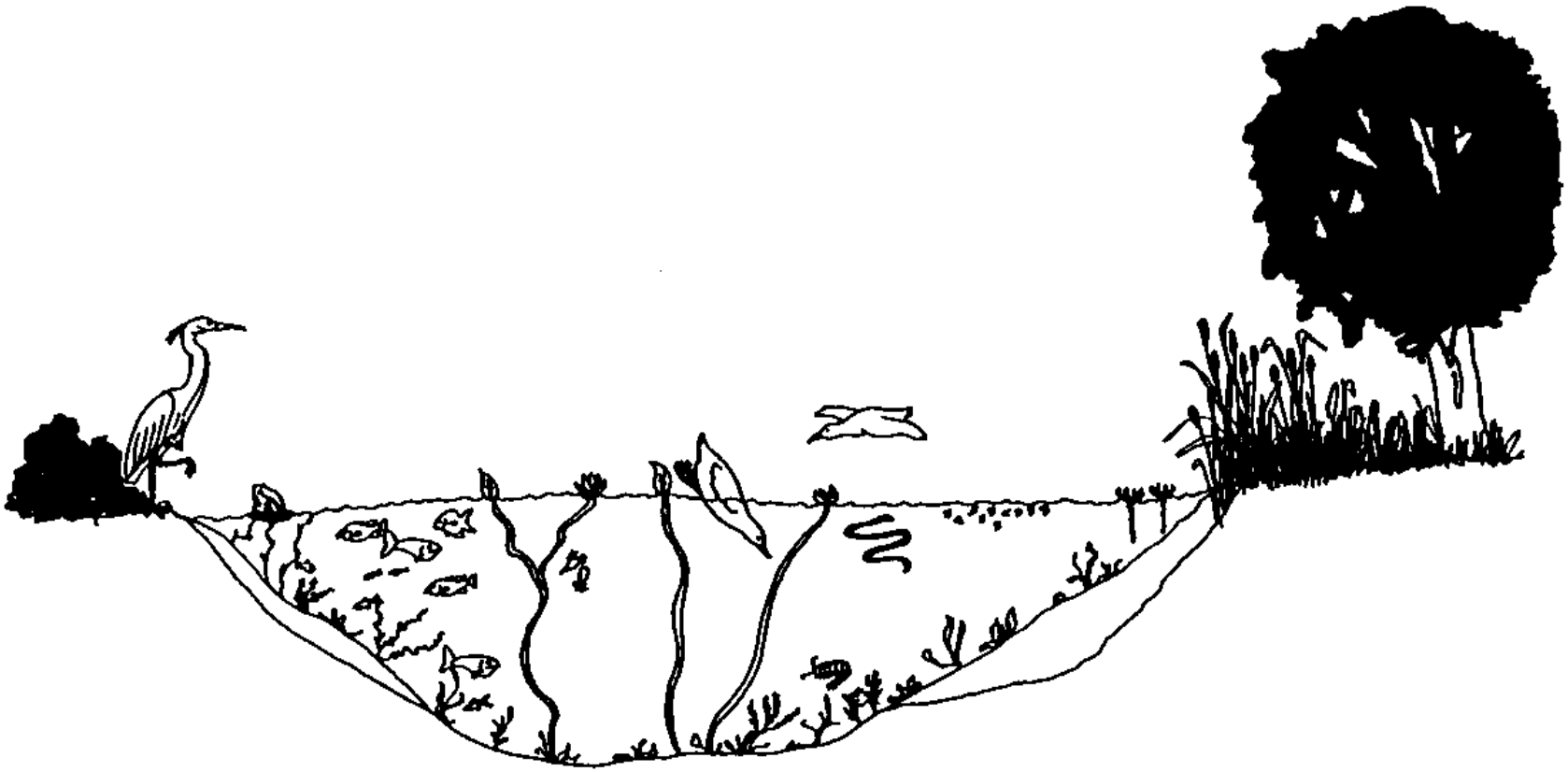
- Student copies of grassland picture from Activity 5.1
- Unlabeled copy of Figure 5.2-1 for each student
- Crayons
- Pencil

PROCEDURE

1. Compare the picture you made of the grassland community and the new picture you have.
2. This is a picture of a pond community. It is sometimes called an ecosystem. Label and color all the nonliving elements as you did in your last picture. If there are any new nonliving things, label and color them.
3. Use your picture from the last activity to label as many other similar things (grasses, scavengers, decomposers) as you can.
4. What new things are unlabeled and uncolored?
5. The animals in the picture do not produce food; they consume it. They are called *consumers*.
6. Animals that feed on primary producers (plants, grasses, and algae) are called *primary consumers*. Animals that usually feed on other animals are called *secondary consumers*.
7. In your picture, the small animals (shrimp, water flea, and snail) are primary consumers feeding on plants and algae. Label and color them.
8. The fish and frog are secondary consumers in this instance, since they feed on small primary consumers. Label and color them.
9. The snake is a higher-level secondary consumer that may eat either the frog of the fish. Label and color it.
10. The bird (in this case a blue heron) is an even higher level of secondary consumer because it may eat the fish, frog, or snake. Label and color it.
11. Whether an animal is a primary or a secondary consumer depends on what it eats, not on its size. The elephant is a primary consumer. A ladybug beetle is a secondary consumer.
12. Turn your paper over and draw a picture of the plants and animals in your classroom aquarium. Can you find both producers and consumers?

Figure 5.2-1

Pond Ecosystem



TEACHER INFORMATION

If you do not have a freshwater aquarium or a good terrarium and have not developed one earlier in the year, this would be an excellent time. As students learn more about ecosystems, they will be able to have first-hand experience with a simple model.

As we add primary and secondary consumers to the model, the system becomes far more complex. Up to this point, the terms *herbivore* (plant eater), *carnivore* (animal eater), and *omnivore* (eats both plants and animals) have not been introduced. They are not necessary to the understanding of ecosystems.

SKILLS

Observing, inferring, classifying, communicating, comparing and contrasting, using space-time relationships

WHAT IS A SIMPLE ECOSYSTEM?

MATERIALS NEEDED

- Picture of grassland community developed in Activity 5.1
- Pencil
- Crayons
- Pictures of animals shown in Figure 5.3-1, 5.3-2, and 5.3-3

PROCEDURE

1. Figures 5.3-1 and 5.3-2 show animals that might live in a grassland community. Some are primary consumers and some are secondary consumers. Draw the ground animals on your picture of a grassland community. Color them.
2. Some birds are primary consumers. They eat berries and seeds. Others are secondary consumers who prey on primary consumers. Can you tell which is which? *Hint*: Look at their beaks and claws.
3. Now that we have added consumers, our grassland ecosystem is complete. However, we have two new kinds of animals. The smaller bird is a migratory animal who joins the ecosystem for a period of time when certain seeds or berries are ripe and then moves on to another location. On your picture of a grassland community, draw a migratory bird. Color it.
4. The second, larger bird is a predator. It preys on smaller animals. Notice its large, powerful claws and sharp beak. Some predators are migratory but many are permanent residents, depending on the food supply. Draw the predator on your picture of a grassland community. Color it.
5. Figure 5.3-3 shows some larger animals that might be found in grassland community. Two are primary consumers. One is a predator, or secondary consumer. If you know what they eat, then you know which is a primary consumer and which is a secondary consumer. On your grassland community draw the new animals. Color them.
6. Now that you have developed both a pond and a grassland ecosystem, can you think of the reason why plants and animals live together and are dependent on each other?

TEACHER INFORMATION

As consumers and migratory animals are added to an ecosystem, it becomes increasingly complex. Younger children may need to see colored pictures similar to the pictures of the animals they are asked to color. (Otherwise you may get purple ground squirrels!)

The existence of an ecosystem is directly related to energy and its transfer. The sun is the major source of energy. Lower forms of plants and animals spend most of their lives in producing and consuming energy. Reproducing the species, in many cases, is the only other function they perform. Some more advanced species do spend time in play.

Figure 5.3-1

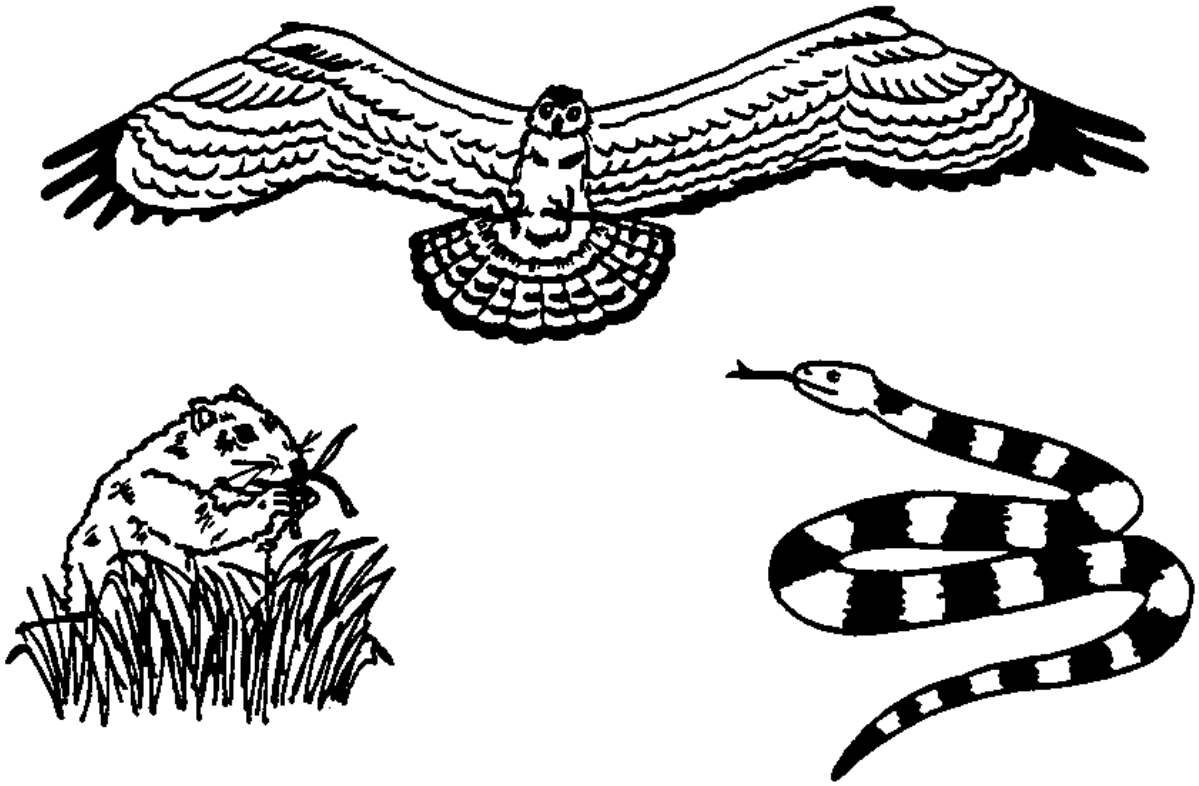


Figure 5.3-2

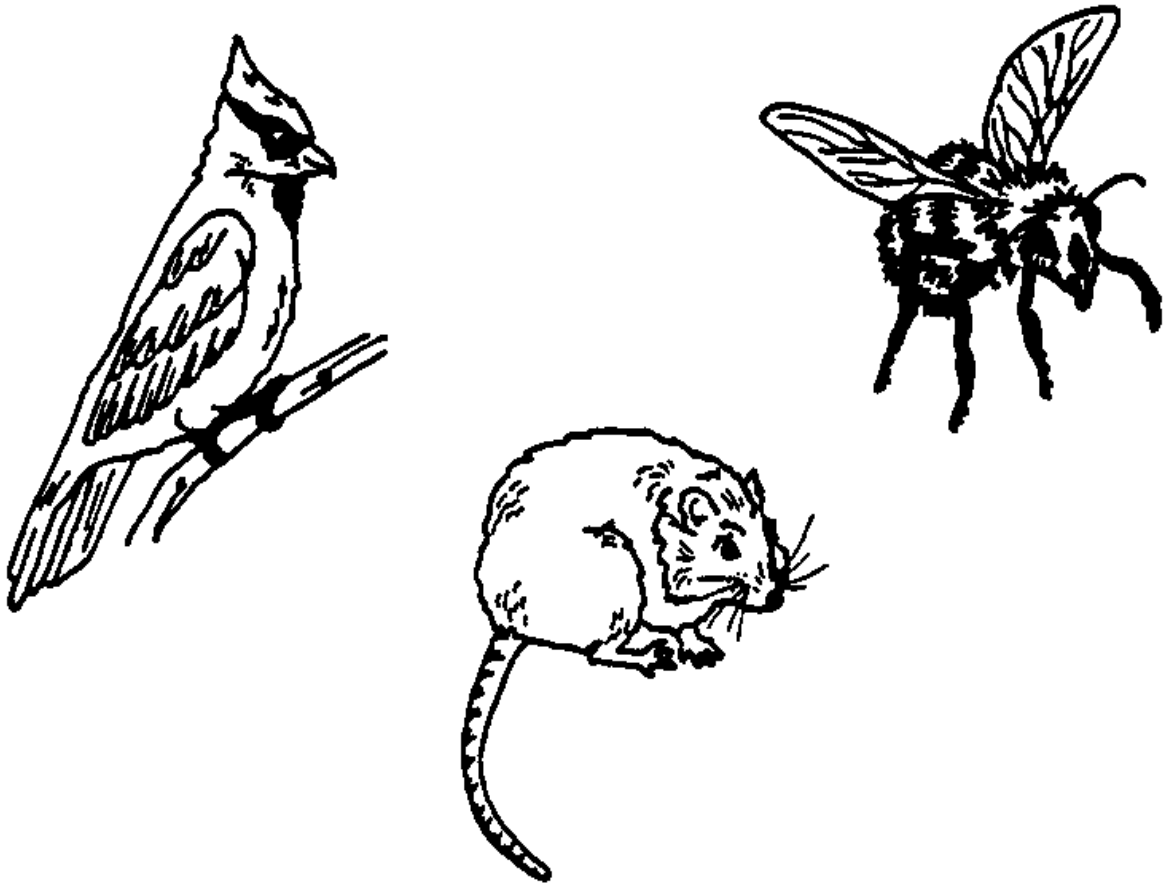
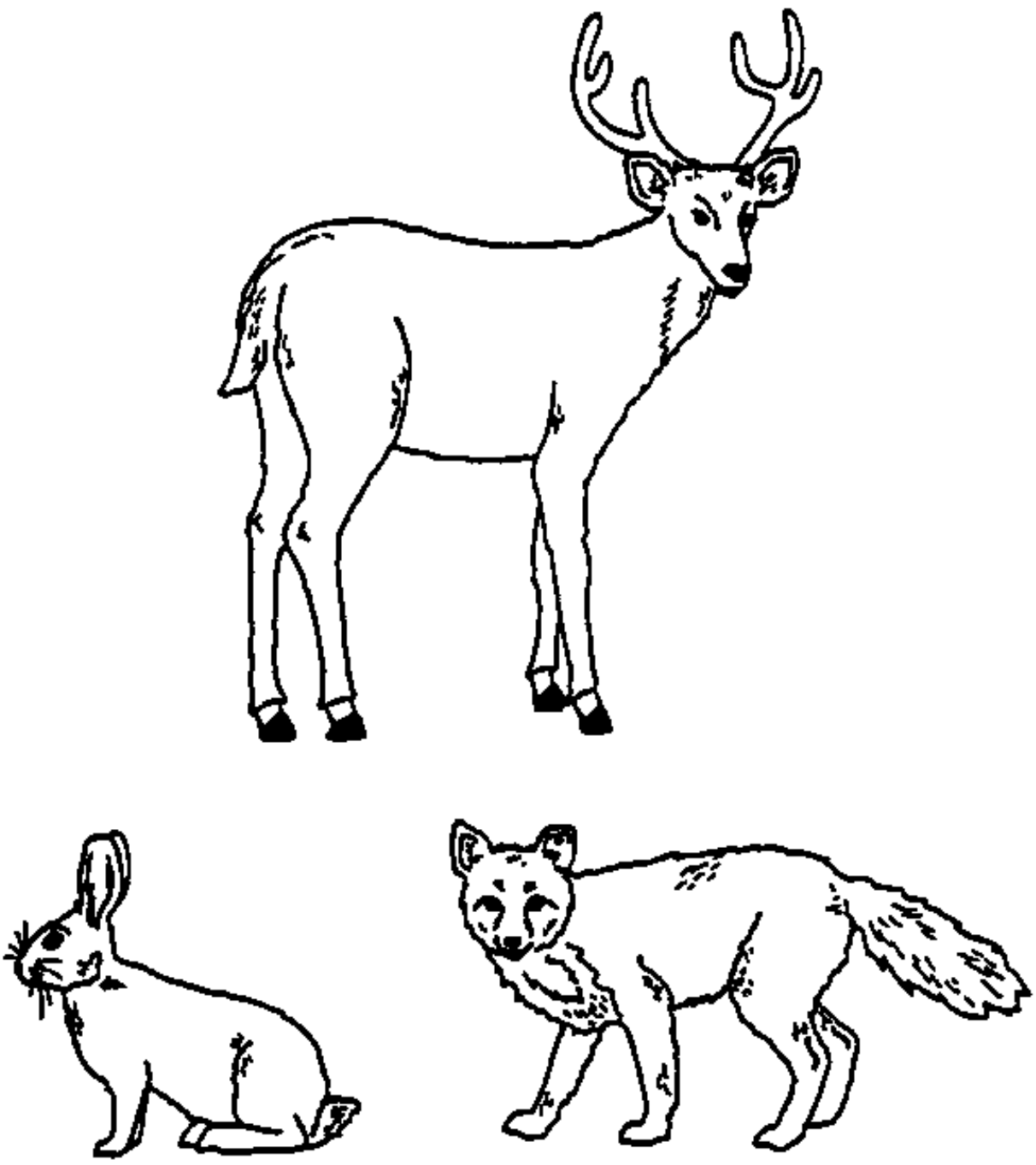


Figure 5.3-3



HOW IS ENERGY TRANSFERRED IN AN ECOSYSTEM?

MATERIALS NEEDED

- Complete grassland ecosystem from Activity 5.3
- Simple food chain chart (Figure 5.4-1)
- Simple food web (Figure 5.4-2)

PROCEDURE

1. Study the picture of the grassland ecosystem. Energy from the sun is the basis of life in the system. Why? Discuss this with your teacher and other members of the group.
2. Figure 5.4-1 is a diagram of a simple *food chain* showing how energy from the sun is used and stored in food molecules manufactured by the producers from nonliving materials. In turn, they are consumed by primary and secondary consumers. The waste products remains of dead animals and plants are returned to the soil, where the scavengers and decomposers complete the cycle so that it can begin again.
3. There are many different ways food chains can work. Some consumers eat only certain producers. Other consumers eat both primary and secondary consumers. Ecologists call these many variables the *food web*. Just as a spider spins a web one strand at a time, food webs are made up of many food chains. Compare the food web (figure 5.4-2) with the food chain (figure 5.4-1).

Figure 5.4-1

Food Chain

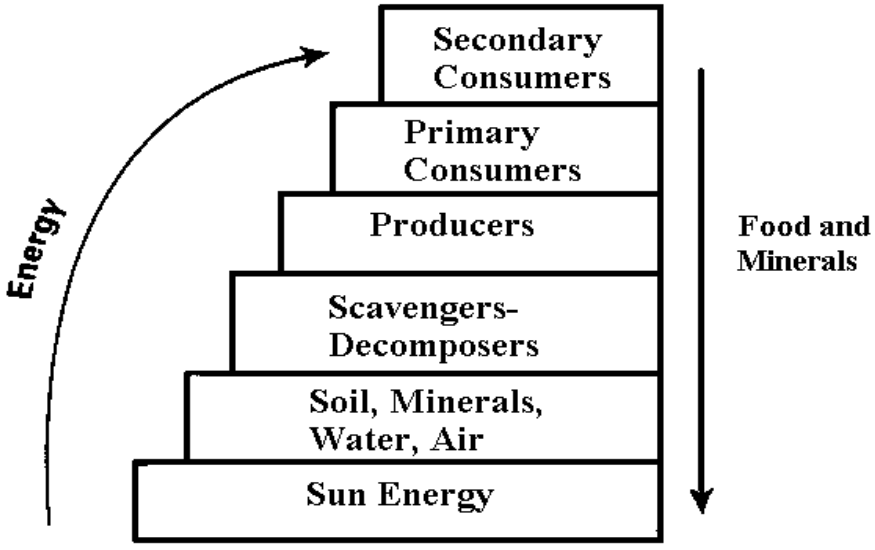
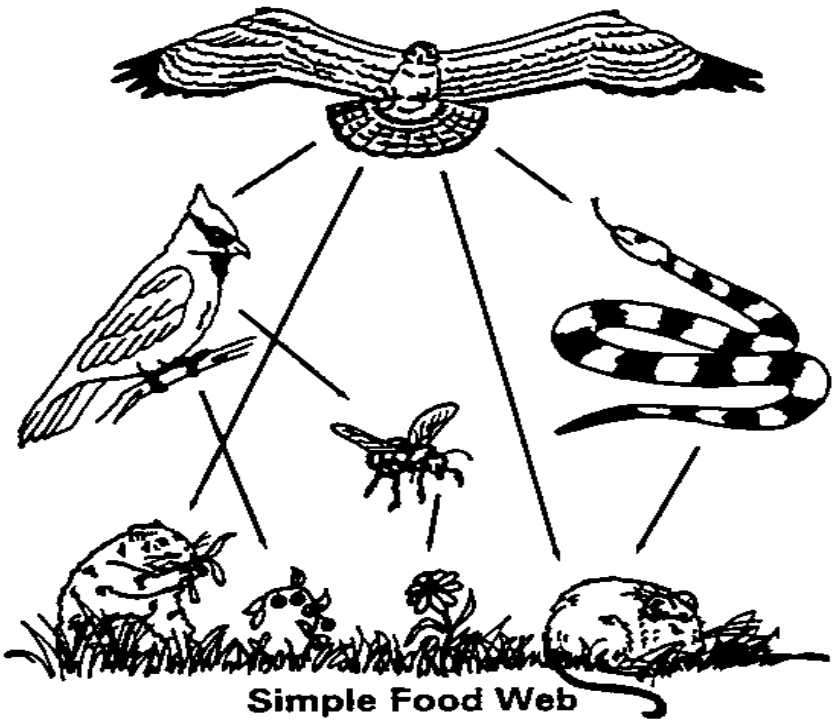


Figure 5.4-2
Food Web



4. Weather and chemicals produced from the nonliving portions of the ecosystem (air, water, soil) influence the conditions within the system. Can you think of other factors that might change the food web? What would happen if there were no mice?
5. Ecosystems are very complex. Can you see why ecology is an interesting and exciting science?

TEACHER INFORMATION

Figures 5.4-1 and 5.4-2 are simple, but should still give students a feeling for the highly complex interrelationships that occur in nature. Also, chance is always a part of the interplay.

Using charts may convey a feeling of static process. Ecosystems are actually highly dynamic, with countless variables. Students may need additional experience in constructing ecosystems and applying them to life situations. Later in the section, parks, vacant lots, and even back-alley ecosystems will be discussed.
The next activity introduces the most complex variables in ecology-people.

SKILLS

Observing, inferring, classifying, communicating, comparing and contrasting, using space-time relationships.

WHERE DO PEOPLE FIT INTO AN ECOSYSTEM?

MATERIALS NEEDED

- 3' x 6' poster of Figure 5.5-1
- Cutouts of plants and animals, such as Figure 5.3-1, 5.3-2 and 5.3-3
- Colored pencils
- Pictures of people, houses, stores, domestic animals, and so on
- Thumbtacks
- Drawing paper

PROCEDURE

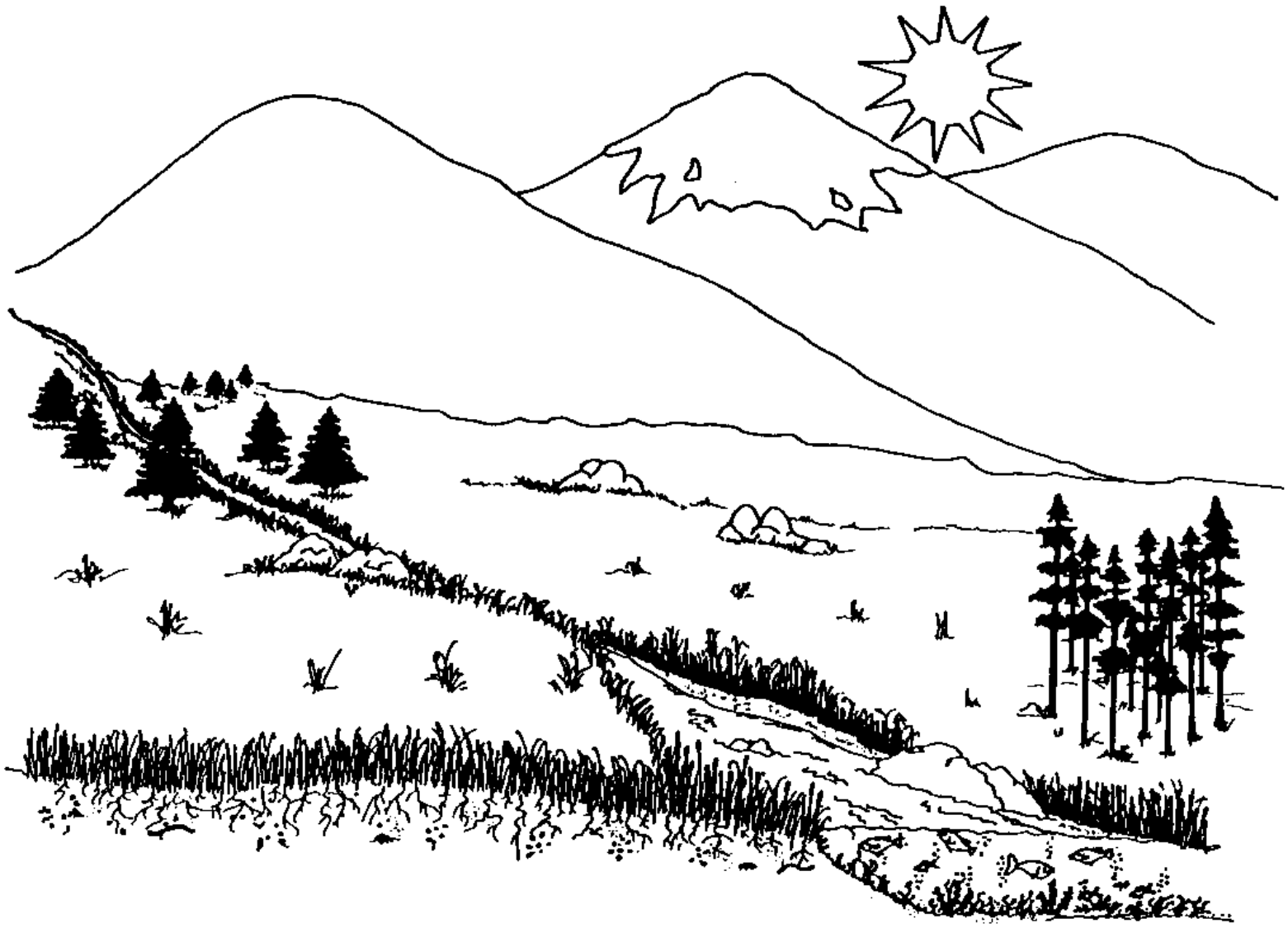
1. Study the picture on the large bulletin board. This is the way your community may have looked before the settlers came.
2. Identify the nonliving and living elements that make up the ecosystem.
3. Add a family to the system. What will they need to survive? Where will they get what they need?
4. Put a house and yard in the picture. Add a barn and barnyard. What animals will live in the barnyard? Where will the people get food? Where will they plant crops?
5. Add a second family with all the things the first family has.
6. What is happening to the ecosystem?
7. Add a third house, family, and barn.
8. Build a general store, church, school, and post office near the homes.
9. Is this still an ecosystem?
10. What changes could you make it? Discuss planning as part of urban and suburban change.

For Problem Solvers: How has the ecosystem of your community changed with time? Do you know how and when your town or city actually began? What was the area like before that? What animals and plants were common in the area? Which of these are no longer found there? Which ones were forced out of the ecosystem because of loss of nature habitat? Was it covered by forest, grassland, marshes, or what? Why did people settle in this area? Do you know anyone who has been there for many, many years? If so ask them to tell you what they know about the early days of this community. Think of some questions you want to ask before you begin and write them down. Perhaps you could record the interview and share the information with your class. Ask the public library for information about the story of your town.

Before you begin your search for information about your town or city, write a brief description of what you think the area might have been like, who you think the first settlers might have been, and why you think they came. Draw a picture showing what you think it might have looked like at that time. Compare your picture with what you learn about the way it really was.

Figure 5.5-1

Grassland-woodland Ecosystem



MANAGEMENT SUGGESTIONS

1. Find an area with well defined boundaries for this outdoor activity.
2. Stress safety and demonstrate the proper way to tag. Make sure students understand the rules before going outside.
3. Use the activity sheet after the final round of play.

PROCEDURE

1. Discuss food chains and feed webs. Refer to science texts or study prints to illustrate this idea. Discuss predator/prey relationships.
2. Tell the students they are going to play a tag game that will simulate a natural food chain and illustrate a biomass pyramid.
3. Divide the class into 3 even groups. Each group will be assigned a different color of yarn. Pass out the yarn and have each student tie the yarn around his or her wrist in a bow, so that they are easy to remove at the end of the game.
4. The animals the students simulate are represented by the colors of yarn.
   brown = grasshoppers yellow = lizards red = hawks
5. Explain the predator/prey relationships in this chain.
   Hawks hunt only lizards.
   Lizards hunt only grasshoppers.
   Grasshoppers eat only grass (which is represented by the popcorn)
6. Pass out a baggie to each student which will be used as a stomach. The students playing grasshoppers will put popcorn gathered from the ground into their baggies. The students playing lizards will try to tag the grasshoppers. If they are successful, the grasshopper is “dead” and the contents of the baggie are emptied into the lizard’s bag (the empty baggie stays with the grasshopper to be used again in the next round). Lizards and hawks may not pick up popcorn from the ground. Hawks may only tag lizards and if successful, get the contents of the lizards’ baggies.
7. For the animals to survive, they must not be tagged during the game and their stomachs (baggies) must be filled as follows by the game’s end.

grasshoppers	1/3 full
lizards	2/3 full
hawks	full

8. Go outdoors and select an area to be the ecosystem. For the first round, the area should be small, so that the students can experience the effects of crowding on animal populations. Students may not leave the area during the game.
9. Set up two or three safe zones within the area. Animals may not prey on each other in these zones. Select an area for the “dead” animals (those who are tagged) to wait for the next rounds.
10. Spread out a large bag of popped popcorn over the ecosystem.

11. Signal the primary consumers, the grasshoppers, to begin eating grass (gathering popcorn). After 30 seconds, allow the lizards to enter the area. After 30 more seconds, allow the hawks to enter the ecosystem. Allow the students to play for several minutes or until there are no more prey. At the end of play all remaining animals must have the right amount of food in their baggies, or they too are dead. Note the length of time the game lasted.
12. After round one, ask why the game only lasted a few minutes. Discuss crowding and the number of predators vs. number of prey. Write down the number and kinds of animals that are still alive.
13. The second round can be played in the same area as round one, with the following changes, half the students will play grasshoppers (brown), the other half should be divided so that two-thirds of them are lizards and one-third are hawks. Play the game again. Discuss the effects of changing the population numbers had on the time the game lasted.
14. For the third round, leave the animal populations as they were in round two but greatly enlarge the area in which the game is played. Discuss the effects of the larger area on the time the game lasted.
15. Return to the classroom. Use the activity sheet to illustrate the numbers of predators and prey in an ecosystem and to make a biomass mobile. Discuss the energy flow from the producers to the higher level consumers. Emphasize that the energy in a food chain originates from the sun. A biomass pyramid could also be made by centering and gluing the pieces, one on top of another.

DISCUSSION QUESTIONS

1. Why did the game end? How long should it last?
2. What numbers of predators and prey worked the best?
3. How does an area affect predator/prey relationships?
4. How is this game related to a real ecosystem?
5. Create a food chain and discuss.
6. Where does grass get energy?
7. How is the biomass mobile related to the predator/prey game? Why are green plants so important to the food chain?

EXTENDED ACTIVITIES

1. Mix some cheese popcorn with the large bag. Have it represent a pesticide. Do not point this out to the students until the end of the game. An animal with three or more cheese corn kernels in their stomach would have died from toxic poisoning.
2. Create a variety of food chains using other animals.
3. Play the game introducing predator/prey behaviors such as camouflage, hunting techniques, decoying, running speed, freezing and playing dead.

CURRICULUM COORDINATES

Geography

Research various geographical areas and list several food chains.

Art

Design a poster illustrating food chains and food webs.

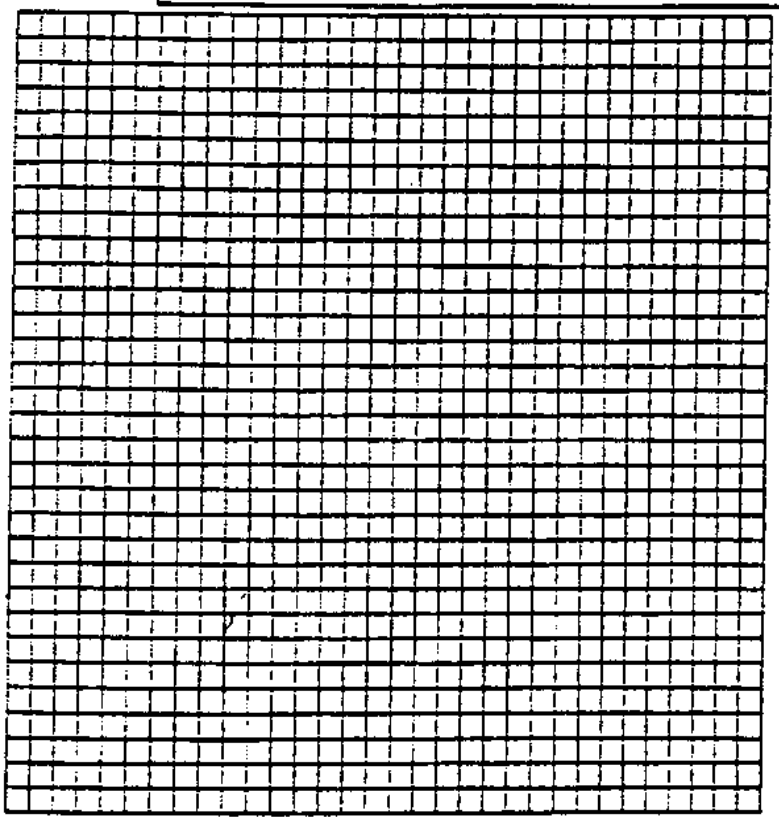
CATCH ME IF YOU CAN...

Square	Length	Width	Area
A	x	=	
B	x	=	
C	x	=	
D	x	=	

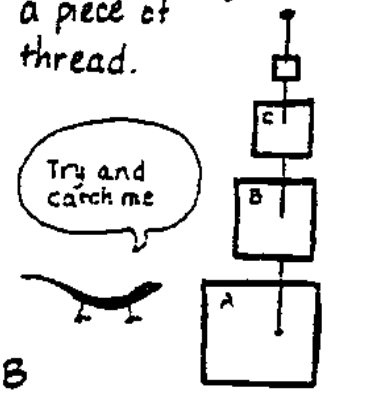
1. Find the area of each square.
2. Imagine that the squares below are part of an ecosystem that includes grass, grasshoppers, lizards and hawks. Think about the numbers of living things in a balanced ecosystem and color the squares according to the key below.

A

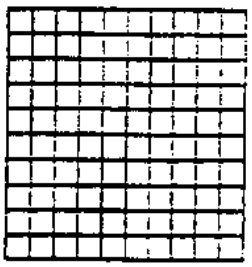
grasshoppers = brown lizards = yellow grass = green hawks = red



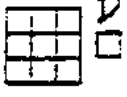
3. Make a mobile by cutting out the squares and connecting them with a piece of thread.



B

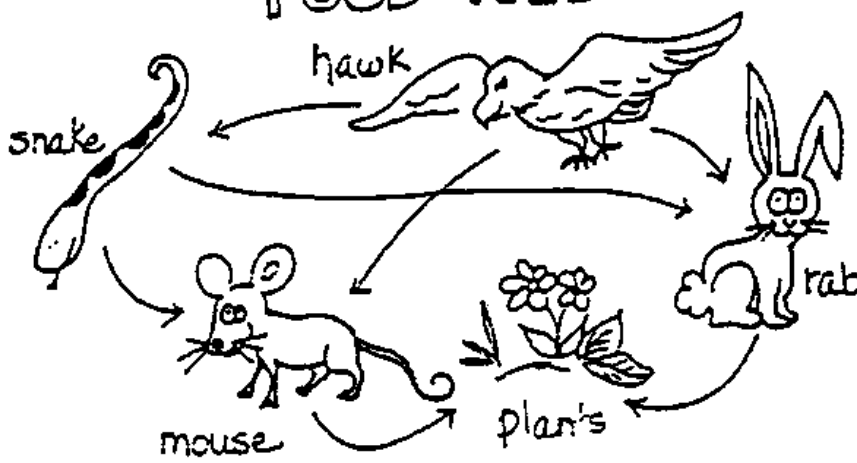


C



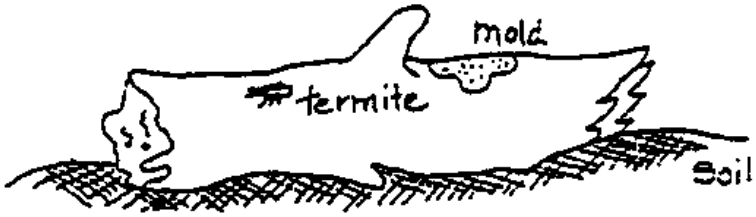
D

FOOD WEB

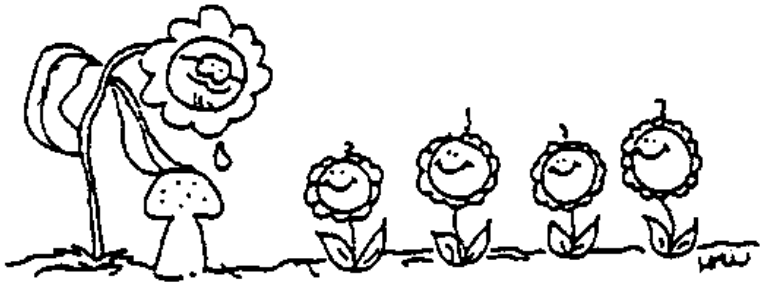


How many food chains can you make from this food web?

Decomposers are an important link in a food chain or web. They are microorganisms that are able to break down large molecules into smaller parts.



Decomposers can be found at any link of a food chain. They return the nutrients that are in a living thing to the soil. Without decomposers, future generations of plants would not have the nutrients they need to grow.



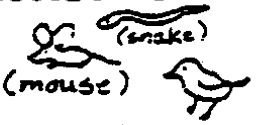
Food Chains

Living things need food to give them energy. A food chain is the path by which energy passes from one living thing to another. Green plants use energy from the sun to make food. Green plants are called producers because they are responsible for making the food that the higher level animals (consumers) eat.

Consumers that only eat plants are called herbivores. 

Those that eat only meat are called carnivores, 

and those that eat plants or meat are called omnivores. 

A food chain is a simplified way to look at the energy that passes from producers to consumers. A food web is a more realistic way of looking at the relationships of plants and animals in an environment. A food web is created when several food chains are linked together. Predators eat a variety of prey. It is likely that a predator from one food chain would be linked to the prey of a different chain. 

Assessment
Grade 3

ECOSYSTEMS

Classroom Assessment Example III.5.E.1

Give each student a poster (teacher-created using words or pictures) with six organisms circled. At least one of each of the following is represented on the poster: producer, consumer, predator, and decomposer.

Using his or her poster, each student will choose four out of the six organisms and use them to construct a food chain. Each student will explain the feeding relationship within the new chain.

Place students in groups of three. Each student will contribute the four organisms from his or her food chain for a total of twelve organisms. Each group will then create a food web showing the interrelationships of the food chains.

Next, each student will choose one organism from his or her group's web to eliminate. Each student will write a list of predictions about what will happen to the food web if the chosen organism is eliminated. (For example, if a hawk is eliminated from the "corn, field mouse, red-tailed hawk" food chain, the mouse population will increase and the amount of grain will decrease, because more grain will be consumed by the mice, making less available for consumption by livestock and humans…) Students will share their predictions and the reasons for each prediction with the entire class.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.5.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Identification of feeding relationships	Recognizes that there are feeding relationships between organisms, but does not identify them specifically.	Identifies one or more feeding relationships.	Identifies at least three common feeding relationships.	Identifies common feeding relationships and also provides evidence of lesser known relationships.
Accuracy of predictions	Writes one prediction/ consequence but is unclear on the sequence of events/the reasons.	Writes one or two predictions/ consequences and accurate reasons.	Writes three predictions/ consequences and accurate reasons.	Writes four or more predictions/ consequences and provides accurate reasons.

Life Science
Worksheet

GRADE LEVEL: Third

Topic: Ecosystems

Grade Level Standard: 3-2 Identify patterns of interdependence and interrelationships in various ecosystems.

Grade Level Benchmark: 2. Describe the basic requirements for all living things to maintain their existence. (III.5.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How is energy distributed to living things in an ecosystem?*** 1. Study/describe a rotting log. 2. Study/describe backyard.	
Process Skills: Observing, Classifying, Predicting, Theories	

New Vocabulary: food, habitat, water, shelter, air, light, minerals

Assessment
Grade 3

ECOSYSTEMS

Classroom Assessment Example SCI.III.5.E.2

Create a labeled drawing of an animal in its habitat. Use arrows labeled with food, water, shelter, air, light, or minerals to connect those life requirements to the animal. Then eliminate one plant or animal from the picture and predict the consequences of that action. Write the prediction and the reasons for it in a science journal.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.5.E.2

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of habitat drawing	Draws an animal in its habitat with three or more labels missing.	Draws an animal in its habitat with two or fewer labels missing.	Draws and labels an animal and each item in the picture of the habitat.	Draws and labels an animal and each item in the picture of the habitat, featuring more than one example of any of the life requirements.
Completeness of relationships	Places four or fewer labeled arrows correctly.	Places five labeled arrows correctly.	Places six labeled arrows correctly.	Places more than six labeled arrows correctly.
Accuracy of predictions	Writes one prediction but reasons are incomplete.	Writes one prediction but prediction is inaccurate or reason is inaccurate.	Writes more than one prediction and reasons are accurate.	Writes two or more predictions and reasons are accurate.

Life Science
Worksheet

GRADE LEVEL: Third

Topic: Ecosystems

Grade Level Standard: 3-2 Identify patterns of interdependence and interrelationships in various ecosystems.

Grade Level Benchmark: 3. Design systems that encourage the growing of particular plants or animals. (III.5.E.3)

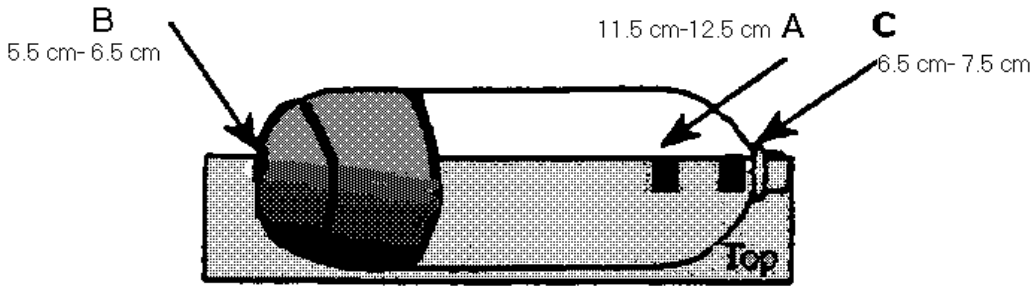
Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***In what ways are various kinds of living things adapted (suited) to survive in their environment?***	
1. Create an aquarium and/or terrarium.	AIMS
2. Aquatic/land ecosystem project. ★	
★ Activity is attached	
Process Skills: Observing, Classifying, Predicting, Developing models/theories	

New Vocabulary: food, habitat, water, shelter, air, light, minerals

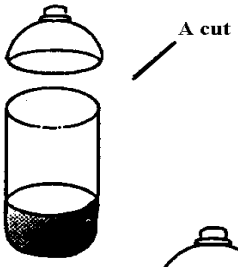
ECOSYSTEM PROJECT

Making and Cutting Bottles

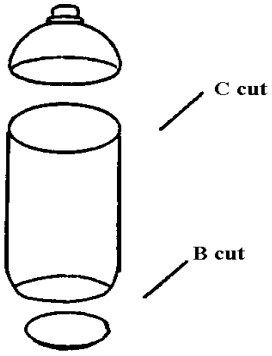
1. Mark bottles by turning them in a circle while holding a permanent pen in the cardboard boxes' pre-cut slot.

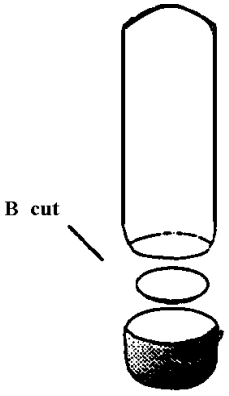


Bottle 1-Aquarium
This bottle is marked with slot A. Write A bottle, mark with pen, and cut.



Bottle 2–Connector
This bottle with the base removed is marked with a slot C and B. Write C on the bottle, mark and cut twice.





Bottle 3–Terrarium
This bottle with the base removed is marked with slot B. Write T on the bottle, mark and cut. Keep the base to cover the terrarium.

Completed Ecocolumn
Insert bottles A, C, and T. Use a small piece of tape to secure the parts together.

SETTING UP PLANTS FOR THE AQUATIC ECOSYSTEM

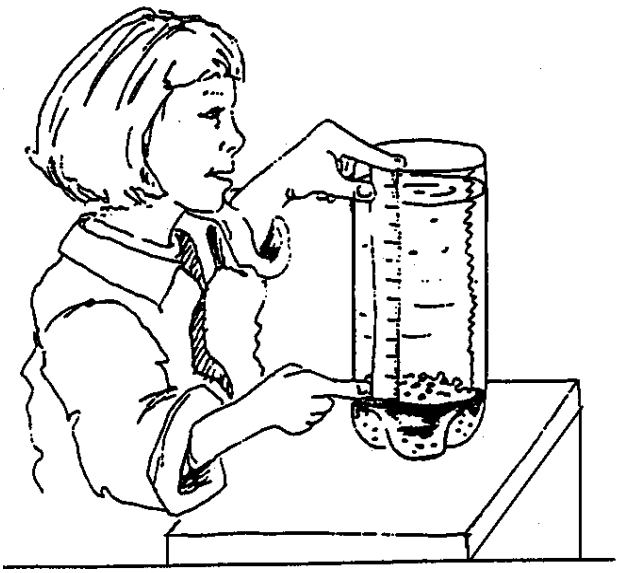
1. Obtain the bottle marked A. The base is attached.

2. Place one cup of gravel in the bottle. This becomes the floor.

3. Add water to the bottle until it is about 8 centimeters (cm) from the top. Measure the number of cms from the gravel floor to the top of the waterline. (If you use tap water, fill a water container the night before and let stand, or use tap water conditioner that removes chlorine; it can be purchased at most pet stores.) Record this data in your journal.

4. Add plant life. Three kinds of plants are:
   - 2 sprigs of Elodea
     Measure the size of each sprig. Record the measurements. Place in Aquatic Ecosystem bottle.
   - 10-15 Duckweed plants
     Scoop out the plants and record the number. Place in Aquatic Ecosystem bottle.
   - 4 droppers of algae
     Record what the algae looks like.

5. Compare the plants and record the data on the Aquatic Ecosystem on the sheet provided. Use a hand lens to “get close up.” Record observations in your journal.



ADDING ANIMALS TO THE AQUATIC ECOSYSTEM

1. Fill a clear plastic cup about ½ ful of water from the holding tank.

2. Spoon two snails into your cup.

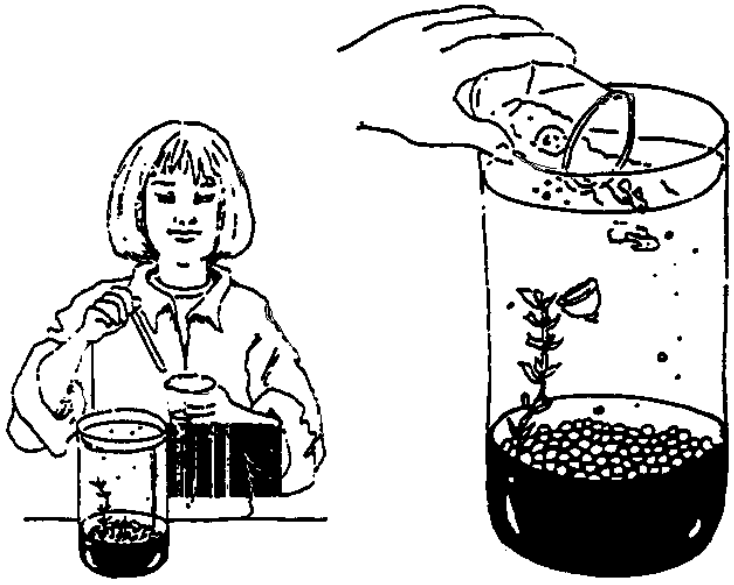
3. Net two guppies and place them with the snails. (Don't dump the animals into the ecosystem until completing step 4 and 5).

4. Use the hand lens to observe how the animals look, their movement, and how they act.

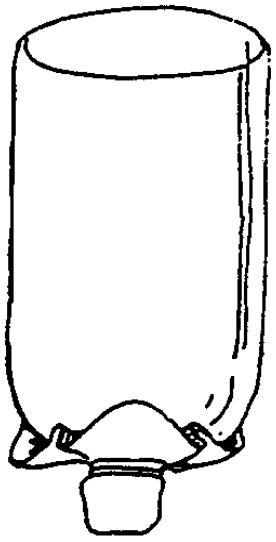
5. Use a dropper to slowly add water from your ecosystem to the plastic cup. Fill the dropper up and add the water until about half full. This slowly changes the water the animals aren't put into shock.

6. Gently pour the animals into the bottle.

7. Draw and label the parts of your Aquatic Ecosystem on the sheet provided. Make certain to show the details of the plant life. Use a hand lens to "get a close up." Record observations in your journal.



SETTING UP THE LAND ECOSYSTEM



1. Use part T for the land ecosystem. Bottle C with a base can be used as a stand.

2. Remove the cap from part T. Rubber band a square of nylon to cover the bottle mouth.

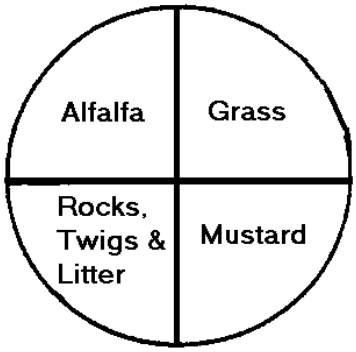
3. Place part T with neck down in part C. Add two cups of soil. Don't muddy the sides.

4. Divide the soil surface into four equal parts (see picture below). Use toothpicks to set up grid.

5. In three of the parts, seeds are to be planted.
   - To begin with, count out 20-30 seeds and record the number of alfalfa seeds. Drop the seeds evenly on to the surface of the soil. Next, with your toothpick, spread the seeds and press them into the soil.
   - After the alfalfa is planted in the proper section, do the same with the grass and mustard seed.
   - To wet the soil use the water dropper. Count the drops of water added to the soil. Do this until it begins to leak from the bottom. Then replace the cap. Every time water is added, record the number of drops before it runs out the bottom.

6. In the last section add material such as a small rock, leaves, twigs, or other plant litter.

7. Draw and label the parts of your Land Ecosystem in your journal. Make certain to show the details of where sown, the plant materials added, etc.



ADDING ANIMALS TO THE LAND ECOSYSTEM

ISOPODS

1. Scoop up two isopods into a plastic cup. Watch them in the cup for about five minutes. Record observations in your journal. Draw the isopods. Include color, shape, body parts, etc.

2. Place the isopods into the vegetation growing in the top of the land bottle. Watch them for a few minutes and record your observations.

CRICKETS

1. Capture two crickets and place them in a plastic cup.

2. Cover the cup with an index card. Take the cricket to a comfortable place to observe with a hand lens.

3. Write down any questions that you might have about the cricket. Record your observations in your journal. Include color, shape, body parts, etc. Draw the cricket.

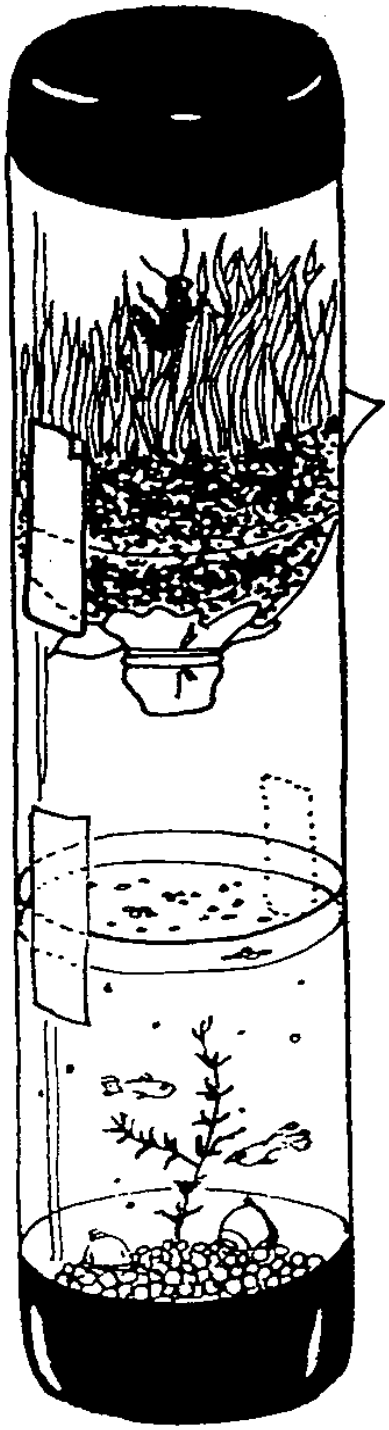
4. Place the crickets in the Land Ecosystem. Cover them quickly. Observe their behavior for three minutes. Record your observations.

PUTTING THE AQUATIC AND LAND ECOSYSTEM TOGETHER TO FORM AN ECOCOLUMN

1. Remove the cap from the base of the land column. Get four strips of tape.

2. Stack the bottle/columns together.

3. Use two pieces of tape on each section as shown. Fold the top of one piece of tape over so that the two sticky sides touch. This will allow you to re-enter your column if necessary.



ECOSYSTEM PROJECT

Look at the pictures of the animals from the two ecosystems. Answer the questions below.

Guppy in an Aquatic Ecosystem

Cricket in a Land Ecosystem

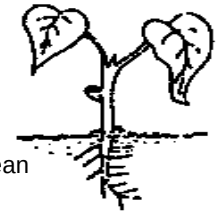
1. How are these two animals alike?

2. What non-living things do these animals need to live? (List as many as you can)

3. What do these animals give to their ecosystem?

By observing the two plants below, answer the following questions.

Duckweed

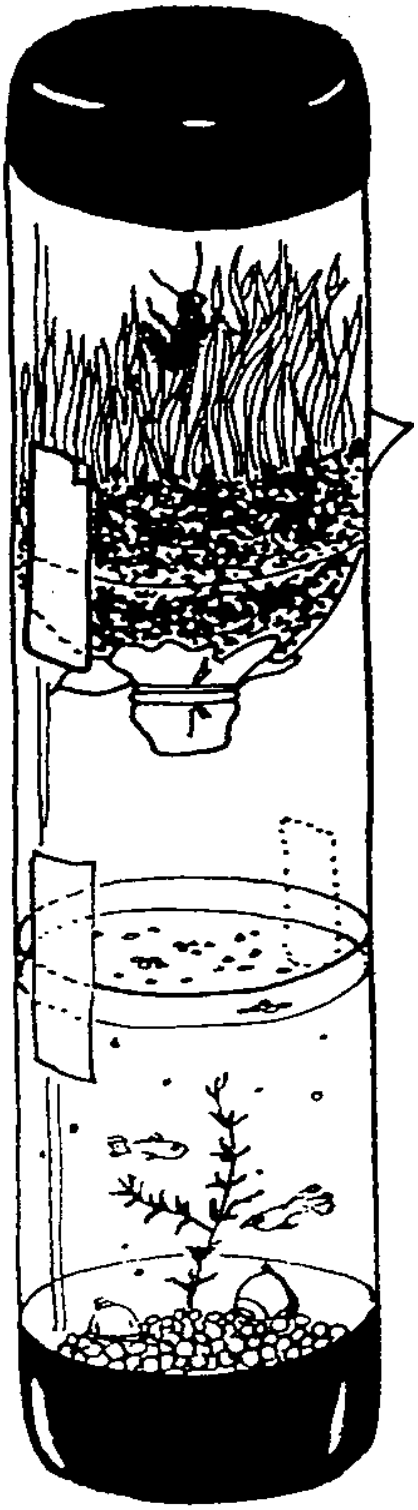


Bean

4. To live, what do the plants need? (List at least four things)

5. How do they contribute to their ecosystems?

6. Based upon the aquatic and land ecosystem combination and the drawing below, answer the following.



a. Explain three things that might happen if the producers in the ecosystem did not get sunlight. Explain.

b. What do the algae, duckweed and Elodea compete for? **Circle Two.**

1. light
2. space
3. snails
4. guppies

c. What is the original source of energy for all the living things in the ecosystem?

1. water
2. air
3. soil
4. sunlight

d. Water, air, and sunlight are all examples of?

1. living things
2. nonliving things
3. food
4. once living things

e. Which from the ecosystem is a producer?

1. snail
2. algae
3. soil minerals
4. leaf litter

7. Draw a picture of a land ecosystem that you know of. Then, answer the questions below based on your drawing.

Drawing:

a. Draw a food chain found in your ecosystem.

b. List three nonliving things found in your ecosystem.

c. List the producers and consumers found in your ecosystem.

Assessment
Grade 3

ECOSYSTEMS

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

Research the ecosystem needed to support life for a specific plant or animal. Design an ecosystem that will include everything needed to sustain life for that specific plant or animal. Then present a model of the environment with a written report that includes the seven needs of life (see Key Concepts). This report may include information about the environmental studies of Rachel Carson, Grace Chow, Aldo Leopold, or another field biologist.

(Give students rubric before activity.)

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

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of ecosystem model	Identifies few needs of life.	Identifies some needs of life.	Identifies all needs of life.	Portrays all needs of life with many details.
Accuracy of scientific information	Includes at least one fact related to the scientist who was researched.	Includes at least two facts related to the scientist who was researched.	Includes at least three facts related to the scientist who was researched.	Includes at least four facts related to the scientist who was researched.
Correctness of format	Writes a report with many grammatical errors that interfere with the interpretation of content.	Writes a report with few grammatical errors that interfere with interpretation of content.	Writes a report with few grammatical errors that do not interfere with the interpretation of content.	Writes a report using complete sentences and no errors in capitalization, punctuation, spelling, or indentation.
Completeness of presentation/ replica	Reflects research and some life needs.	Reflects research and most life needs.	Reflects research and all life needs.	Reflects research and all life needs, as well as a clear explanation of their relationship in the ecosystem.

Life Science
Worksheet

GRADE LEVEL: Third

Topic: Ecosystems

Grade Level Standard: 3-2 Identify patters of interdependence and interrelationships in various ecosystems.

Grade Level Benchmark: 4. Describe positive and negative effects of humans on the environment. (III.5.E.4)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do communities of living things change over a period of time?***	
1. Use resources from the local waste water plant to describe and diagram process of water treatment and waste process. 2. "What are Some Environmental Problems which are Caused by Man?" ★ 3. Discussion of household wastes/school wastes. 4. "Every Breath You Take" ★ ★ Activity is attached	Waste water Plant Information (front local plant)
Process Skills: Observing, Inquiring, Predicting, Communicating, Classifying	

New Vocabulary: garbage, habitat destruction, land management, renewable and nonrenewable resources

WHAT ARE SOME ENVIRONMENTAL PROBLEMS WHICH ARE CAUSED BY MAN?

SUBJECT

Ecology
Non-biodegradable materials

GROUP SIZE

2-4 students

TIME

Motivator: 30 minutes
Procedure: five weeks for 30 minutes each

TEACHING STRATEGIES

Game
Guided Practice
Observation
Laboratory Experiment

VOCABULARY

biodegradable, decompose, litter, organic compounds, recycling, solid waste

CONCEPTS/OUTCOMES

Man-made, litter is an environmental problem. Litter, which is made on non-biodegradable materials, decomposes more slowly, if at all.

PROCESSES

Observing, Sequence/Ordering, Measuring, Predicting, Interpreting Data, Controlling Variables

SAFETY TIP

Use forceps to pick up samples to prevent injury to fingers.

CAREERS

Sanitation Engineer, Ecologist, Environmentalist

RESOURCES

1. Our Land Needs Your Help, University of Arizona. $9.25 rental, grades 3-7, 16mm.
2. The Balance of Nature, Creative Learning Filmstrip, Color, Sound, grades 1-6.
3. Pollution, Creative Filmstrip, Color, Sound, grades 1-6
4. Operation Salvage: Paper as a Reusable Resource. American Forest Institute. Color filmstrip, 17 minutes. $26.00 with record.

GENERAL OBJECTIVES

The learner will know that the Earth's environmental balance can be easily disturbed.

OVERVIEW

Man's environment is being endangered by man himself. Landfills with materials which cannot be recycled or will not break down (non-biodegradable) are causing many problems. To heighten the awareness of the various types of trash left by man, a random survey of school yard litter will be conducted. To understand the concept that man-made products decompose more quickly, a tiny "landfill" will be developed. Students will observe the quickness with which natural (organic) products decompose over some man-made items.

SOME KEY DEFINITIONS ARE

1. Decompose – a chemical reaction which splits up a substance into simpler substances.
2. Organic compounds - carbon containing compounds.
3. Recycling – to extract useful material from garbage or waste.

LESSON OBJECTIVES

The learner will:

1. Understand about the various kinds of litter found in a school yard.
2. Design an experiment which will demonstrate the rate at which materials decompose.
3. Develop an appreciation for the concept of recycling vs. use of landfills.

MATERIALS FOR MOTIVATOR

gram scale or bathroom scale, stop watch, plastic garbage bags.

MOTIVATOR

Announce that students are to collect as many different kinds of litter as they can in ten minutes. The team which collects the most items will be declared the winter. The second type of winner is the team with the greatest weight of items. Tell them that they are not cleaning the school year, but collecting data for an experiment.

Take students out into the school yard. Give them a plastic bag for their collections. The students will have ten minutes in which to pick up as much and as many types of litter as possible. (No fair getting anything from the dumpster!) At the end of ten minutes, weigh each team's bag and declare a winner. Students should then bring their collections back into the room and:

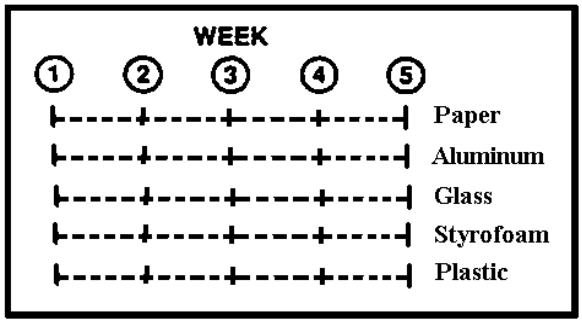
1. Take five small sample squares of various types of litter (25 total samples) to be used in the general procedure. Students may sweep materials to make a better sampling population.
2. Materials may include any or all of the following: wax coated cups, Styrofoam cups, fast food boxes, candy wrappers, cigarette packages, notebook, paper, plastic utensils, gym socks, nylon hose, pencils, bottle caps, etc.

MATERIALS FOR PROCEDURE

plastic bag, 18" x 24" paper to make chart, 1 growing tray with drain holes or a shoe box lined with plastic bag, water, soil sufficient to fill the "growing" container to a depth of 2 inches, scissors, forceps (tweezers), glue

PROCEDURE

1. Place 2 inches of garden soil (do not use commercial products such as potting soil or manure, as they tend to be sterile and will not work) on the bottom of the box or tray.
2. At one inch intervals, “plant” your 5 samples of litter 1 inch deep in rows.
3. Label the front of the rows with the name of the material.
4. Cover the samples with soil and water to keep it from drying out.
5. Every week for five weeks, ask the students to “unbury” one of their samples from each row and paste them on a chart. Label the five weeks across the top of the chart and label the item down the left side. Place the sample in the correct square.



EXTENSIONS/FOLLOW-UP/HOMEWORK

1. At the end of 5 weeks, students will have a chart which demonstrates the effects/non effects of soil and water on the decompostion of littered materials.
2. Visit the local land fill or disposal plant and discuss with the sanitation manager how the trash is handled; the recycling program associated with it; rates of decomposition; scavenger problems, rodent control, etc. Ask the students to take notes for discussion in the classroom.
3. Questions:
   a. What was the most commonly found litter form?
   b. What was the least commonly found litter form?
   c. Which litter forms decomposed the greatest in 5 weeks?/ the least?
   d. What effects would massive amounts of decomposing matter have on the soil, air, pest population?
   e. Should a landfill or disposal plant be classified as an environmental problem? Why or why not?

APPLICATION

1. Have students visit a landfill or disposal plant.
2. Collect data on solid waste at school. Determine its composition and source. Determine each person’s contribution. Determine where it goes. Discuss what problems it may cause. Discuss how it can be reduced or recycled.
3. Why has the plastic industry developed biodegradable materials?

STUDENT ACTIVITY SHEET

Name _____ Class _____ Period _____ Date _____

WHAT ARE SOME ENVIRONMENTAL PROBLEMS WHICH ARE CAUSED BY MAN?

CONTINUATION FROM MOTIVATOR

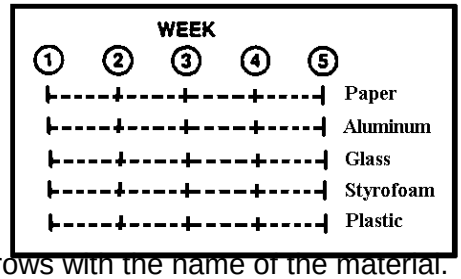
1. Bring your collections into the classroom and choose 5 items to be tested.
2. Take five sample squares from each item. These squares will be used in the PROCEDURE. Before taking the samples, make sure that you have enough of each type to conduct the experiment. You may swap materials with other students to make a better sampling.
3. Materials may include any or all of the following: wax coated cups, Styrofoam cups, fast food boxes, candy wrappers, cigarette packages, notebook, paper, plastic utensils, gym socks, nylon hose, pencils, bottle tops.

MATERIALS FOR PROCEDURE

plastic bag, 1 pc. 18" x 24" art paper, Elmer's glue, paste, markers, crayons, 1 growing tray with drain holes or a shoe box lined with plastic bag, water, soil sufficient to fill the "growing" container to a depth of 2 inches, scissors, forceps (tweezers).

PROCEDURE

1. Place 2 inches of garden soil (do not use commercial products such as potting soil or manure, as they ten to be sterile and will not work) on the bottom of the box or tray.
2. At one inch intervals, "plant" your 5 samples of litter 1 inch deep in rows (see drawing).



3. Label the front of the rows with the name of the material. Example: Styrofoam, nylon, waxed paper, etc.
4. Cover the samples with soil. Water the soil to keep the soil from drying out.
5. Every week for five weeks, "unbury" one of your samples from each row and paste them on a chart. Label the five weeks across the top of the chart and label the item down the left side. Place the sample in the correct area on the chart.

EXTENSION/FOLLOW-UP/HOMEWORK

1. At the end of 5 weeks, your chart will demonstrate the effects/non effects of water on the decomposition of littered materials.
   a. Which items decomposed the most?
   b. Which items decomposed the least?
   c. Which items did not decompose at all?

Every Breath You Take

I. Topic Area
Ecology

II. Introductory Statement
Each year over 330 million (330,000,000) tons of air pollution is put into our air.

III. Math Skills
Estimating, Weighing, Multiplying

Science Processes
Observing, Generalizing

IV. Materials
Student Worksheet, (page 14), White athletic sock (optional), Large clear plastic garbage bag, Rubber bands, Automobile

V. Key Question
How much air pollution do you think a car produces in one minute?

VI. Background Information
Each year 165,000,000 tons of air pollution is produced in the United States and deposited in our atmosphere. On a worldwide basis 331,000,000 tons of pollutants are put into the air each year. 65% of this pollution comes from automobiles. Other source plants, and to a lesser degree, household heating, cooking, and burning trash.

Four-fifths of all air pollution is invisible. Most of it is odorless. Burning gasoline in automobiles produces carbon monoxide (a deadly poisonous gas), benzypyrene (a cancer causing agent), nitrogen oxide (a cause of chronic lung disease), and lead. Burning coal from industry and power plants adds sulfur dioxide to the air.

Besides being unhealthy, air pollution is expensive. Air pollution costs Americans about $ 16 billion each year in sickness, lost work time, extra laundry, and drycleaning charges, damage to vegetation, crops, and livestock, damage to homes, buildings, car finishes and other materials, and lowered real estate values.

So what can we do to help? Walk, or ride a bike on short trips, organize car pools, use public transportation, keep our cars tuned up and running properly, drive smaller cars, recycle cans, bottles, and newspapers, turn off lights when not using them, and support clean air legislation. By caring we can ll breathe a little easier.

VII. Management Suggestions

Estimated time for investigation is about 20 minutes. You will want to allow more time for discussion.

VIII. Procedure

1. Ask key question.
2. Weight empty garbage bag.
3. Attach empty garbage bag to exhaust pipe of car with heavy rubber band. Wrap some clothing around tailpipe prior to attachment to prevent bag from melting.
4. Start car and time how long it takes to fill bag with exhaust. A clear bag is dramatic, as children can actually see the pollutants.

IX. What the Students Will Do

1. Subtract weight of empty bag from weight of pollutant-filled bag to determine weight of pollutants.
2. Divide time needed to fill bag into 60 seconds, then multiply times weight of pollutant produced per minute.
3. Count how many cars pass in one minute.
4. Multiply number of cars per minute times weight of pollutants produced in one minute.
5. Multiply by 60 to determine weight of pollutants per hour.
6. Multiply by 24 for pollutants per day.
7. Multiply by 365 for pollutants per year.
8. Covert grams to pounds by multiplying grams by .0022.

X. Discussion

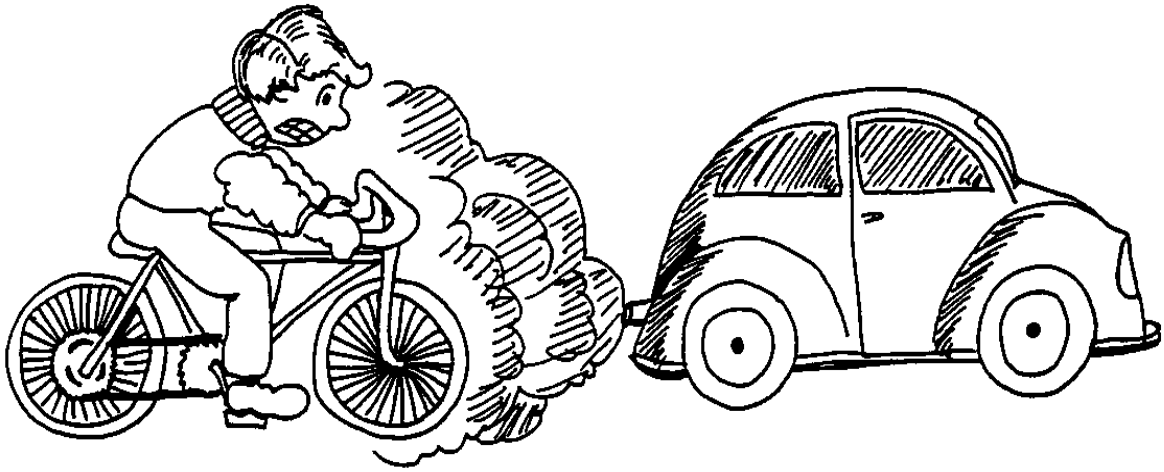
1. What was produced in the bag?
2. What effect did seeing the pollution have on you? How did you feel? What effect did weighing it have on your attitudes?
3. How does this pollution affect our health? Our property?
4. What can we do about air pollution?

XI. Extension

1. Brainstorm for pollution solutions.
2. Write letters to government officials concerning air pollution.
3. Make pollution traps from cotton balls or waxed paper or heavy paper coated with Vaseline and place around the school or community.
4. Role play a problem-solving situation with students acting as representatives of the automobile industry, motorists, environmentalists, physicians, and government.
5. Attach a white athletic sock to the car exhaust pipe with a rubber band and allow the car to run for a specific length of time. Compare this demonstration with the results of the garbage bag investigation.

XII. Curriculum Coordinates

1. Health - research the effects of air pollution on health.
2. Language - write letters to government and industry; debate the issue of air pollution.
3. Social Studies - design a community where there would be no need for automobiles; conduct a community air pollution survey



Every Breath You Take

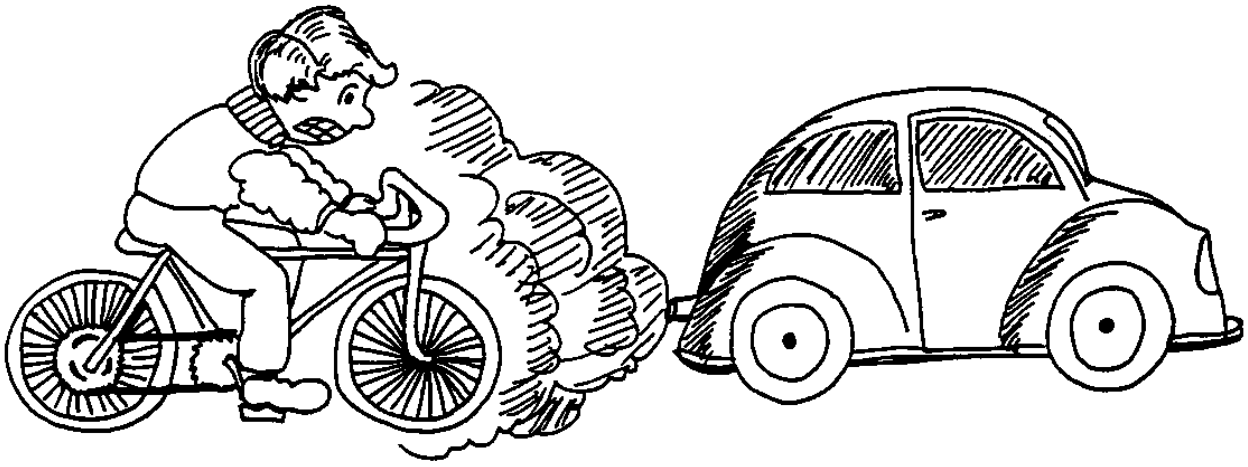
Name _____

How much air pollution does a car produce in one minute?

Weight of Bag	Weight of Bag & Pollution	Weight of Pollution	Time Required to Fill Bag	Pollution Per Minute
g	g	g		

Pounds = Grams X .0022

	Number of Cars	Pollution in Grams	Pollution in Pounds
Per Minute	_____	_____ x .0022 =	_____
Per Hour	_____	_____ x .0022 =	_____
Per Day	_____	_____ x .0022 =	_____
Per Year	_____	_____ x .0022 =	_____



Assessment
Grade 3

ECOSYSTEMS

Classroom Assessment Example SCI.III.5.E.4

Working alone, students will evaluate areas of their community suitable for a park, select a site, and create a map. In writing, students will justify their area and evaluate environmental influences in a multi-media presentation to the class. The class will vote for the most suitable plan and will present it to the local city council or another appropriate community governmental unit.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.III.5.E.4

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of habitat map	Draws map with no key and no title.	Draws map that includes an incomplete key and/or an incomplete title.	Draws map that includes a complete key and a complete title.	Draws map that includes a complete key, a complete title, and an accurate scale.
Justification of area selection	Writes one reason without supporting data.	Writes one reason with supporting data.	Writes two reasons with supporting data.	Writes three or more reasons with supporting data.
Explanation of influences	Explains an influence without distinction of positive or negative.	Explains a positive or negative influence.	Explains one positive and one negative influence.	Explains two or more positive and two or more negative influences.
Accuracy of presentation	Presents written and oral reports inaccurately.	Presents written and oral reports with one technology enhancement accurately.	Presents written and oral reports with more than one technology enhancement accurately.	Presents written and oral reports with more than one technology enhancement. Uses color and pictures accurately.

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: 1. Describe or compare motions of common objects in terms of speed and direction. (IV.3.E.1)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do speed and direction affect the motion of objects?*** 1. "Changing Motion" ★ 2. "Rolling Along" ★ 3. Communicate how to find a hidden object and describe its position by writing specific directions. 4. "Slow Down" ★ 5. "What is Motion?" ★ ★ Activity is attached	
Process Skills: Observing, Recording data, Communicating	

New Vocabulary: east, west, north, south, right, left, up, down, fast, slow, faster, slower

CHANGING MOTION

What do you have to do to change the movement of an object? In this activity, you will explore what is necessary to change motion.

MATERIALS

Masking Tape, Paper Clips, Scissors, String, Washers

WHAT TO DO

1. Cut four pieces of string that are as long as the width of your desk. Knot the ends of the four strings together so the strings make a big X. Tie a paper clip to the loose end of each string. Bend each paper clip to make a hook.
2. Mark the center of the desk with a small piece of masking tape. Place the big knot in the middle of the desk with one string hanging off each edge of the desk.
3. Have one person hold the center knot in place while another person hangs two washers on one paper clip. Predict what will happen if you let go of the center knot. Then test your prediction.
4. Take the two washers off. Make sure the knot is back in the center. Hold the knot in place. Add one washer to each of the four paper clip hooks.
5. Mark the starting position of the center knot on the diagram on your desk. Record how many washers are on each paper clip. Predict what to do to move the center knot near one corner of the desk.
6. Test your prediction. Hand one washer at a time on a paper clip. After you place each washer, mark the new position of the center knot with tape. Record the knot position and the number of washers on each clip on the diagram. Do this until you have moved the knot to one corner of the desk.

WHAT HAPPENED?

1. How did the position of the center knot compare when there were two washers on each paper clip?
2. Why did the center knot move when you added the first washer? Why didn't the center knot move when you added a washer to each paper clip?

WHAT NOW?

1. How many washers were needed to move the center knot to a corner? Where were they placed? Compare results with another group. How were they alike? Different?
2. Why do you think the center knot move to a corner?
3. How could you move the knot back to the middle?

ROLLING ALONG

WHAT YOU NEED

table tennis ball

Using a force, you can change the direction of motion. Roll a table-tennis ball across your desk. While the ball is rolling, have another person blow on it from the side. Make a drawing of what happens. Now, roll the ball again and blow from the front and then the back. What happens? Record your observations.

McMillian/McGraw Hill, Pushes and Pulls

SLOW DOWN!

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1 : *Generate reasonable questions about the world, based on observation.*

PMO 1: *Describe* or *compare motions of common objects in terms of speed and direction.*

PMO2: *Describe how forces (pushes or pulls) speed up, slow down, stop, or change the direction of a moving object.*

KEY QUESTION

How do different surfaces affect the motion of objects?

TEACHER BACKGROUND

Friction is a force that slows down or stops moving objects. When two surfaces come in contact with each other, the forces between the particles on the surfaces pull the objects together. The more the surfaces are pushed together, the greater the force of friction. Also, the rougher the surface, the greater the force of friction. Friction can be reduced by increasing the smoothness between the two surfaces. Lubricants are commonly used to reduce friction. Lubricants fill in the rough spots between the two surfaces, decreasing the contact between the rough edges which decreases the friction.

Friction is not a force you always want to reduce. Friction is necessary when you want to remove a lid from a jar, move a car on ice or start walking on the sidewalk. It would be impossible to move objects without friction.

OBJECTIVE

To observe and compare motions of objects on different surfaces.

SCIENCE PROCESS SKILLS

Observing, Communicating, Experimenting, Comparing

KEY TERMS

motion, direction, speed

MATERIALS

- wooden blocks
- rulers
- sandpaper
- wax paper
- worksheet, Slow Down!

<u>Teacher Provided</u>

- construction paper
- masking tape
- textbooks

TIME

30-45 minutes

PROCEDURE

1. Ask the students to lightly rub their hands together. Then, have them rub their hands together while pressing down firmly. Ask: What differences did you notice? (it is harder to rub hands when pressing down firmly)

2. Ask: How is sliding down a hill similar to rubbing your hands together? (two surfaces are rubbing against each other) Write their ideas on the board.

3. Divide the students into teams of 2-3 students. Give each team a piece of construction paper, wax paper and sandpaper (about the size of the front of a textbook). Ask the students to feel the texture of each material. Have them predict which material they think an object will slide on most easily.

4. Give each team a piece of masking tape, a wooden block, a ruler, and a textbook. The students will test each surface type to observe how the surface type affects the movement of objects. Surfaces to test: *plain textbook cover, construction paper, sandpaper* and *wax paper.* Tape one surface on the front of the textbook. Place the block on the top of the book. Lift one end of the book slowly until the block starts to move. Have them measure the distance between the raised end of the book and the top of the table. Have them record the distance in the chart on the worksheet Slow Down!

5. Repeat step #5 for all four surfaces. Discuss the results.

DISCUSSION

1. What surface allowed the block to move the easiest? hardest?
2. What other surfaces could make the block move easily?
3. How is an object's motion affected by the surface it moves on?
4. How did the different surfaces change the direction of the moving block?
5. Why did raising one end of the book cause the block to move?
6. Do you think that the size of the block could affect its movement? (yes, the different weight of each block pushes with differing amounts of force)

SLOW DOWN!

Test the movement of the wooden block for each surface listed below. Measure the distance between the top of the raised book and the table. Record your measurements in the chart below.

Surface Type	Distance Between the Top of Book and the Table (cm.)
Cover of the textbook	
Sandpaper	
Construction paper	
Wax Paper	

Which Surface allowed the block to move the easiest? Explain your answer.

_____

_____

_____

_____

WHAT IS MOTION?

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1: *Generate reasonable questions about the world, based on observation.*

PMO 1 : *Describe* or *compare motions of common objects in terms of their speed and direction.*

PMO2: Describe how forces speed up, slow down, stop, or *change the direction of* a *moving object.*

KEY QUESTION

What is motion?

TEACHER BACKGROUND

Without motion, all objects would be stuck in the same place. Without motion, cars would not move, the earth would not rotate, and birds could not fly. Machines require motion to do work.

OBJECTIVE

To observe and compare moving objects.

SCIENCE PROCESS SKILLS

experimenting, observing, comparing, communicating

MATERIALS

- Hot Wheels vehicles
- ping pong balls
- marbles

TIME

15-20 minutes

PROCEDURE

1. Divide the students into teams of 4 students. Give each team one marble, ping pong ball and toy car. Let the objects sit on the table. Ask: Are your toys moving?
2. Next, ask the teams to start moving their toys. Ask: What makes the toys move? Lead the students into telling you that they either pushed or pulled the toys to get them moving.
3. On the board, write down some of the movements of the toys. Use descriptive movement terms.

DISCUSSION

1. Did any teams move their toys the same way? If so, what ways were similar?
2. What evidence do you have that the toys moved? (They were found in a different place)

JOURNAL ENTRY

Have the students write about the motions of the toys. Encourage them to use direction words such as: up, down, turn, left, right, slow, fast, etc.

Assessment
Grade 3

MOTION OF OBJECTS

Classroom Assessment Example SCI.IV.3.E.1

Students will describe the motion of a ball that has been kicked, rolled, and thrown in terms of speed, direction, and change of direction using precise description. Each student will draw a picture of the motion with labels or arrows to show the descriptions. Vocabulary should include the following: fast, faster, slow, slower, left, right, up, down, north, south, east, and west. Students will compare their pictures in small groups and discuss differences they observe.

Each student will choose two pictures of the same motion that show different labels and arrows. Then the student will write a paragraph explaining the differences and identifying which description is the most accurate.

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.3.E.1

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of picture	Creates incomplete pictures; missing many labels and arrows showing speed and direction.	Creates incomplete pictures; missing some labels and arrows showing speed and direction.	Creates incomplete pictures; missing a few labels and arrows showing speed and direction.	Completes pictures; missing no labels or arrows showing speed and direction.
Accuracy of evaluation	Evaluates pictures of motion using either direction or speed vocabulary.	Evaluates pictures of motion using both direction and speed vocabulary, but uses few accurate details in describing differences.	Evaluates pictures of motion using both direction and speed vocabulary, and uses some accurate details in describing differences.	Evaluates pictures of motion using both direction and speed vocabulary, and uses many accurate details in describing differences.

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: 2. Explain how forces (pushes or pulls) are needed to speed up, slow down, stop, or change direction of a moving object. (IV.3.E.2)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***What forces are needed to impact the motion of a moving object?***	
1. "Changing Speed and Direction" ★ 2. "What is Force?" ★ 3. Tug of War Games. (Balance pencil on finger)	Pushes and Pulls MacMillan/McGraw Hill
★ Activity is attached	
Process Skills: Observation, Communication, Predicting	

New Vocabulary: Changes in motion: speeding up, slowing down, turning; Common forces: push, pull, friction, gravity

CHANGING SPEED AND DIRECTION

MICHIGAN ESSENTIAL GOALS AND OBJECTIVES

C 1: *Generate reasonable questions about the world, based on observation.*

PMO 1: *Describe or compare motions of common objects in terms of speed and direction.*

PMO 2: Describe how forces (pushes or pulls) speed up, slow down, stop, or change the direction of a moving object.

KEY QUESTION

How do moving objects change speed and direction?

OBJECTIVE

To observe and compare motions of objects.

SCIENCE PROCESS SKILLS

observing, communicating, experimenting, comparing

MATERIALS

- marbles
- straws

Teacher Provided

- pencils

TIME

20-30 minutes

PROCEDURE

1. Discuss the different directions objects can move. Make a class list of words that describe motion: fast, slow, left, right, up, down, etc.
2. Explain that the students will be using materials to observe motions of objects. Divide the class into teams of 2. Give each team two straws, a pencil, a 12" piece of yarn and a marble.
3. Have the students roll their marble slowly across the floor or a desk. They should try to change the motion of the marble using a pencil (their hands should not be used to move the marble during this activity). The teams should use the pencil to make the marble move slower, faster, and change the direction of its motion.
4. The teams should repeat step #3 by blowing air through a straw instead of hitting it with the pencil.

DISCUSSION

1. What directions did the marbles travel? How did you make the marble slow down? speed up? turn?
2. What is needed to change the speed and direction of a moving object? (a push or pull is needed to change an object's motion)

WHAT IS FORCE?

A **force** is any push or pull. A force changes the way objects move. Changing the direction of the forces causes objects to move in different directions. Forces can change the **speed** of an object. An object will move faster if you use more force.

You need different amounts of force to move different things. The heavier the objects, the more force you need to move it. Would you need more force to move a book or a desk?

What happens to objects if you throw them in the air? They are pulled to the ground. What force pulls all objects down? The earth's **gravity** is a force that pulls objects towards the center of the earth.

Another kind of force is **friction**. Imagine rolling a ball across the floor. How would the ball stop moving? Friction is the force that makes all moving objects slow down or stop. Two objects rubbing against each other cause friction. The friction between the ball and floor would make the ball stop moving.

FORCES

Activity Cards

A batter hitting a baseball.	A tennis player hitting a tennis ball.
A person pushing a door shut.	A person pulling a door open.
A person pushing a bike.	A game of tug-of-war.
Pulling a wagon.	A person hitting a golf ball with a golf club.

Assessment
Grade 3

MOTION OF OBJECTS

Classroom Assessment Example SCI.IV.3.E.2

Using the data from the Instructional Example, students will write answers to the following questions:

1. Which surface required the most force? Why?
2. Which force (push or pull) took less effort in the sand?
3. If you were pulling a heavy load, which surface would you like to travel on? Why?
4. Why are bowling alleys smooth and hard?

(Give students rubric before activity.)

Scoring of Classroom Assessment Example SCI.IV.3.E.2

This is pass/fail. If the student answers three of the four questions correctly, then he or she passes:

1. The answer to Question #1 reflects the need to include sand and more friction.
2. The answer to Question #2 reflects the need to include pull.
3. The answer to Question #3 reflects the need to include concrete as well as reduced friction and force.
4. The answer to Question #4 reflects the need to include less force and very little friction.

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: 3. Describe the patterns of interaction of magnetic materials with other magnetic and non-magnetic materials. (IV.3.E.3)

Learning Activity(s)/Facts/Information	**Resources**
Central Question: ***How do magnetic objects interact with other magnetic or non magnetic material?*** 1. "Amazing Magnets Unit" ★ a. Magnetic hunt. b. What can a magnet attract? c. Magnetic forces field. d. Magnet strengths. e. Attraction/repulsion. f. Magnetism travels through objects. g. The earth's core is magnetic. h. Finding the earth's magnetic pole. i. Making/using a compass. j. How do we use magnets every day. ★ Unit lessons attached	What Makes a Magnet? Branley, F.M. Harper Collins Publishers
Process Skills: Hypothesizing, Predicting, Observing, Classifying, Interpreting data, Drawing conclusions	

New Vocabulary: magnetic poles, magnetic attraction and repulsion, magnetic compass

AMAZING MAGNETS!

Presented By: Rona Brown-Smith and Sally Crescioli, Templeton Elementary School

Length of Unit: 11-13 sessions

ABSTRACT

The overall goal of this unit is to provide students with hands on experiences, while learning about magnets. This unit shows you how to engage students in experiments which explore magnet force and compass use. Using constructive techniques, this course of study focuses on asking thoughtful, open-ended questions which, in turn, encourage students to ask questions of each other.

OVERVIEW

Science skills to be taught: Hypothesizing, predicting, observing, classifying, comparing and contrasting, interpreting data, drawing conclusions.

Student learning goals: As a result of this unit, students will demonstrate a deeper understanding of magnets and properties of magnetism, knowledge of the earth' s magnetic field and how a compass works, and practical uses of magnets in today's world.

BACKGROUND KNOWLEDGE

1. Hirsch, E.D., Jr. *The Dictionary of Cultural Literacy.* Houghton Mifflin Company, 1993. ISBN 0-395-65597-8
2. Hirsch, E.D., Jr. *What Your Second Grader Needs to Know.* Dell Publishing, 1991 ISBN 0-385-31027-7
3. Kapit, Wynn. *The Geography Coloring Book.* Harper Collins Publishers, 1996. ISBN 0-06-043482-1
4. *Science Framework.* California State Board of Education, 1990. ISBN 0-8011-0870-5

RESOURCES

1. Branley, Franklyn M. *What Makes a Magnet?* Harper Collins Publishers, 1996. ISBN 0-06-026441-1
2. Feravolo, Rocco V. *Junior Science Book of Magnets.* Garrard Publishing Company, 1960.
3. Freeman, Mae. *The Book of Magnets.* Four Winds Press, 1967.
4. Haduch, Bill. *Magnetude, Hours of Sticky Fun Without the Gooey Mess.* Scholastic Company, 1996. ISBN 0-590-96835-1
5. Smith, Norman F. *How to do Successful Science Projects.* Julian Messner, 1982 ISBN 0-671- 70685-3
6. Van Cleave, Jancice. 200 *Gooey, Slippery, Slimy, Weird and Fun.* John Wiley and Sons, Inc., 1993. ISBN 0-471-57921-1
7. Whalley, Margaret. *Experiment With Magnetism and Electricity.* Scholastic, Incorporated, 1992. ISBN 0-590-46090-0
8. *Hands on Science.* Instructional Fair, Inc., 1989.
9. *Adventures in Science Series: Magnetism.* (Kit) Educational Insights, 1988.

MAGNETIC HUNT

LESSON ONE

OBJECTIVES/GOALS

To illustrate that magnets produce an invisible force, and that some things respond to magnetic force or pull, others do not

MATERIALS

Chart paper and markers
10 to 15 horseshoe magnets
Science journals

KEY VOCABULARY

Magnet
Magnetic Force

PROCEDURES/ACTIVITIES

1. Introduce the unit of study. Display chart paper with the heading, "What we already know about magnets. " As students offer responses, record them on the chart. Do not correct the students' inaccurate responses. This will be helpful in ascertaining the students' prior knowledge, including accurate and inaccurate assumptions. This chart can be referred throughout the unit of study as a way for students to reflect upon their learning and to rethink inaccurate ideas.

2. The study of magnets begins with an open exploration of magnetic and nonmagnetic objects. Provide each pair of students with a horseshoe magnet. Have the students work with a partner to go on a "magnetic hunt. " They explore the room, predicting what objects are magnetic and what objects are not magnetic. As they test their hypotheses, they record their findings in their science journals. **IMPORTANT: It might be a good idea to tell students which objects they should not test with magnets, i.e., computer screens, computer disks, audio cassette tapes, etc.

3. Have students come back together to share their findings. Discuss any objects the students found in common. Allow students to share any other observations or things they noticed in experimenting with the magnets.

4. Evaluation/ Assessment: Teacher evaluates student responses and science journals.

WHAT CAN A MAGNET ATTRACT?

LESSON TWO

OBJECTIVES/GOALS

1. To illustrate that magnets produce an invisible force and that some things respond to magnetic force or pull; others do not
2. To classify objects and formulate hypotheses regarding materials and their magnetic properties

MATERIALS FOR EACH COOPERATIVE GROUP

1. A bag of objects containing: a pencil, eraser, paper clip, butter knife, keys,
2. coins, piece of cloth, piece of paper, small comb or other plastic object, nail, an aluminum can, tin can, marble
3. A bar magnet
4. Two pieces of construction paper, different colors, labeled "Magnetic" and "Non-Magnetic"
5. For each student: science journal

PRIOR KNOWLEDGE FOR STUDENTS

Magnetic, Hypothesis, conclusion

KEY VOCABULARY

Magnetic, Hypotheses, Conclusion

PROCEDURES/ACTIVITIES

1. Pass out bags of materials to each group. As a class, ask students to predict which objects will be attracted to the magnet. Record their predictions on the board or chart paper. From these predictions, ask the students to formulate a hypothesis, i.e., "Metal objects are attracted to magnets." Also record the hypothesis on the board so that it may be referred to at the end of the lesson.
2. Each group experiments with the objects in the bag to determine if they are magnetic or not. As each item is tested, students sort the objects into two groups by placing them on the appropriately labeled construction paper.
3. As each object is classified, the students record the results in their science journals. The students then record what material the object is made of (wood, plastic, metal, glass, etc.).
4. After the groups have completed the activity, bring the class together for discussion: Were more objects magnetic or nonmagnetic? Were there any objects that surprised you? Why? Do you see anything in common among the objects that are magnetic? Were all the metal objects magnetic? Was our hypothesis correct? What conclusions can we draw from our observations?
5. Following discussion, have the students write about the conclusions they can make from their observations.

EVALUATION/ASSESSMENT

Teacher evaluates student responses and science journals.

MAGNETIC FORCE FIELD

LESSON THREE

OBJECTIVE/GOALS

To illustrate: magnetic pull is greatest when the object is closest to the magnet; magnetic power passes through objects it attracts, however the magnetic force decreases with distance; a magnetic force can hold a limited amount of weight.

MATERIALS

For each pair of students: a horseshoe magnet, straight pins, steel ball bearings, paper clips, hairpins, staples

For each student: Science journal

KEY VOCABULARY

Magnetic force field

PROCEDURES/ACTIVITIES

1. Introduce the lesson by asking students to consider how far magnetic force reaches, and introduce the vocabulary, "force field." Model the procedure for the lesson. Ask students to predict which items the magnet will be able to hold the most (straight pins, ball bearings, paper clips, hairpins, or staples). Ask students to explain their hypotheses for their predictions (explain why they made that prediction). Have students record their own hypothesis in a personal science journal.
2. Each pair of students works together to explore the strength of the horseshoe magnet by picking up a straight pin with the end of the magnet. Then add another pin to the first, then another and another. Then keep adding pins in a dangling string from the magnet until the last one no longer sticks. How many pins could the horseshoe magnet hold? They record their findings in their science journals.
3. The students repeat the procedure with each of the objects, recording their findings.
4. When students have completed their experimentation, bring the class together to discuss their findings: Which object did the magnet hold the most? The least? Were our predictions correct? Were our hypotheses correct? Did everyone get the same answers? Why did the magnet hold more (staples) than (ball bearings)? What conclusions can we make?
5. Have students write their conclusions in their science journals.

EVALUATION/ASSESSMENT

Teacher evaluates student responses and science journals.

MAGNET STRENGTHS

LESSON FOUR

OBJECTIVES/GOALS

To illustrate: Magnets come in many different shapes and sizes; magnets possess varying degrees of strength.

MATERIALS

For each pair of students: horseshoe magnet, disk magnet, bar magnet, a paperclip
For each student: science journal

PRIOR KNOWLEDGE FOR STUDENTS

Lessons One through Three

KEY VOCABULARY

horseshoe magnet
disk magnet, bar magnet

PROCEDURES/ACTIVITIES

1. Discuss the concept that magnets come in different shapes and sizes. Introduce the three different types of magnets that the students will be using in the activity.
2. Ask students to predict which magnet they think is the strongest and hypothesize why they made that prediction. Have students record their hypothesis in their science journals.
3. Students experiment with a partner to determine which magnet has the strongest magnetic pull. Students record their results in their science journals.
4. Bring the class together to discuss and compare results: Which magnet was the closest when it "grabbed" the paperclip? Which magnet was the farthest when it "grabbed" the paperclip? What conclusions can we make? (Which magnet was the weakest? Strongest?)
5. Have students record conclusions in science journals.

EVALUATION/ASSESSMENT

Teacher evaluates student responses and science journals.

ATTRACTION AND REPULSION

LESSON FIVE

OBJECTIVE/GOALS

To illustrate that every magnet has a north pole and south pole; unlike poles attract each other; like poles repel each other.

MATERIALS

For each pair of students: two bar magnets with poles marked, 12-inch piece of string, two 2-inch strips of electrical tape
For each student: Science journal

PRIOR KNOWLEDGE FOR STUDENTS

Lessons One Through Four

KEY VOCABULARY

Poles
Attract
Repel

PROCEDURES/ACTIVITIES

1. Introduce the vocabulary. Demonstrate the north and south poles on a bar magnet.
2. Ask students to form a hypothesis: What will happen when two like poles are put together? What will happen when two unlike poles are put together? Have students write their hypotheses in their science journals.
3. Demonstrate how to set up the experiment (without actually demonstrating the results; this is for the students to discover): Tie the string around the center of one of the bar magnets. Hold the string in the air, so that the magnet dangles below. Have your partner take the other bar magnet and move the north pole towards the north pole of the dangling magnet. What happens? Tell the students to experiment in this way; also try the unlike poles, putting together a south pole and a north pole.
4. Have students record results in their science journals.
5. Bring the class together for discussion: What happened? Were our hypotheses correct? What conclusions can we make? (Unlike poles repel, while like poles attract).
6. Have students write about their conclusions in their science journals (Appendix G).
7. Next, with this new knowledge, have students cover the poles of one of their bar magnets with the strips of electrical tape. Have them experiment with the magnets to see if they can predict which is the north pole and which is the south pole. After, they can remove the tape to check their predictions.

EVALUATION/ASSESSMENT

Teacher evaluates student responses and science journals.

MAGNETISM TRAVELS THROUGH OBJECTS

LESSON SIX

OBJECTIVES/GOALS

To demonstrate that magnets can exert force through various materials; thicker materials lessen the magnetic force.

MATERIALS

For each cooperative group: Paper plate, Plastic margarine tub, Playing card, Piece of cardboard, Piece of flat cork board, Magazine, Plastic lid (to coffee can), Thin sheet of plywood

For each student: a science journal

KEY VOCABULARY

Review of previously learned terms

PROCEDURES/ACTIVITIES

I. Ask students whether they think magnetic force can travel through objects.

2. For example, if a magnet is placed on top of a paper plate, will another magnet held on the underneath side be able to move it? Ask students to write their hypotheses in their science journals.

3. Pass out materials to cooperative groups and have students work together to.

4. Test their hypotheses with the variety of objects. Students record observations in their science journals.

5. Bring class together to share observations: What happened? Did each group get the same results? Why? Why not? Were our hypotheses correct? What conclusions can we make?

6. Students record conclusions in their science journals.

EVALUATION/ASSESSMENT

Teacher evaluates student responses and science journals.

THE EARTH'S CORE IS MAGNETIC

LESSON SEVEN

OBJECTIVE/GOAL

1. To emphasize prior knowledge about the Earth.
2. To illustrate that the Earth's core generates a magnetic field

MATERIALS

Journal, Magnets, Tissue paper, Newspaper, Starch and paint (optional)

PRIOR KNOWLEDGE FOR STUDENTS

1. Lodestones are rocks which are naturally magnetic.
2. Knowledge about magnets and magnetic pull as learned in earlier lessons.

KEY VOCABULARY

Core
Layers
Magnets
Earth

PROCEDURES/ACTIVITIES

1. Children are questioned on prior knowledge about the Earth learned in first grade.
2. A magnet is handed out to each child.
3. Explain to the children that the Earth's core generates a magnetic field like the bar magnet.
4. Hand each child a piece of tissue paper.
5. Imagining that the bar magnet represents the core of the Earth, ask the children how they could use the tissue paper to create a layer of Earth to cover the core.
6. After they have found they could wrap the magnet in the tissue paper, pass out 10 more pieces to continue layering the "core." Walk around and question each child to find out if they understood the concept of core and layers of the Earth.
7. Again reviewing, ask children what they know about the top layer of the Earth, i.e., 75% of the earth's surface is water, the differing habitats (1st grade Core Knowledge), etc.
8. Demonstrate a top layer of the Earth by taking strips of newspaper dipped in starch to cover the tissue layers of the Earth (if time permits, painting the paper-mache Earth once it has dried would make an excellent art project).
9. After each child has completed the activity, have them draw an Earth on the back of Appendix H, labeling the core, differing layers and top layer of the Earth.
10. Pull the children together in a circle for discussion. Ask questions such as "Were you surprised the Earth's core is magnetic? Why or why not. Have you ever had an experience seeing the different layers of the Earth? What have you noticed about the top layer of the Earth? What conclusions can you draw from this activity? Do you have any predictions about tomorrow's lesson which will focus on the Earth's North Pole?"

EVALUATION/ASSESSMENT

Teacher evaluates students' participation in discussion and reviews work in the science journal.

FINDING THE EARTH'S MAGNETIC POLE

LESSON EIGHT

OBJECTIVES/GOALS

Students will use a bar magnet to find the direction of the Earth's magnetic north pole.

MATERIALS

A bar magnet, thread, several heavy books, tape, ruler and chart paper, globe, map

KEY VOCABULARY

Pole, balanced, force

PROCEDURES/ACTIVITIES

1. Review the knowledge of magnetism gained through lessons 1-7 by asking open-ended questions.
2. Ask students if they know where the North Pole is. Allow students time to look at a map or globe to find their answers. Tell students there is also a magnetic north pole, and ask for predictions of what that might mean. Write their predictions on a piece of chart paper. Tell students they will find the magnetic north pole by the end of this lesson.
3. Have students mark the north pole of the magnet using information from Lesson Five. Finding the middle of the magnet, have students wind a 7"-8" piece of thread around the magnet and tie into a knot. When the children hold the other end of the thread, the magnet should be balanced and parallel to the ground. Take the free end of the thread and tape it to the end of the ruler.
4. Place five books on the edge of a counter, sliding the ruler between the top two books. The magnet will be hanging down and able to move about.
5. Once the magnet comes to rest, where does the north pole of the magnet point? Move the magnet again to find if it settles in the same spot. Move about the room as well as outside. Does the pole continually point the same direction?
6. Allow ample time for students to experiment then gather in a group. What did the student's experiments find? Were their results consistent?

EVALUATION/ASSESSMENT

Students record their findings in Appendix I, teacher evaluates students' findings.

MAKING AND USING A COMPASS

LESSON NINE

OBJECTIVES/GO ALS

1. Students will create their own magnetized compass.
2. Students will be able to use their created compasses and find the directions of north, south, east and west.

MATERIALS

Horseshoe magnet, Sewing needle, Iron filings, Flat piece of cork, Plastic bowl with water, Tape, Chalk, Paved area, Journals, Pencil and real compass

KEY VOCABULARY

Compass

PROCEDURES/ACTIVITIES

I. Stroke the needle on the north pole of horseshoe magnet from the center to the tip, always moving in one direction. Stroke the needle up to 30 times. Repeat these directions going from the center of the needle to the eye of the needle on the south pole of the magnet. Check its magnetism with iron filings. If the needle picks the filings up, it is magnetized.

2. Tape the center of the needle to the flat piece of cork and place it in a plastic bowl filled with water. What happens to the needle? Move the cork; what happens to the needle now?

3. Have students write in their journals, and hypothesize why the needle is continuing to turn in a north/south direction. Students should remember in Lesson Five that opposite poles attract, therefore, the north pole of the compass will face the South Pole of our Earth and the south pole of the magnets will face North Pole of our Earth.

4. Allow plenty of time for students to experiment with their compasses and write in their journal. Once each child has completed the above, bring the class outside to an open area. Using a real compass, mark north, south, east and west on the pavement with chalk. Encourage students to find northeast, southeast, northwest and southwest.

5. Have student’s try their created compasses with the "pavement compass."

6. What happens when they stand in the middle with their needle compasses? Have students write about their findings in their science journals.

7. Students should be given enough time to experiment with their compass and the real compass. Students should be able to record north, south, east and west in their journals.

EVALUATION/ASSESSMENT

Teacher reviews journals and assesses their performance for understanding.

FIND THE MAGNETIC NAIL

LESSON TEN

OBJECTIVES/GOALS

To magnetize a nail and compare its properties to nonmagnetized nails.

MATERIALS

Horseshoe magnet
Nails
Paper clips
Tacks

KEY VOCABULARY

Prior vocabulary

PROCEDURES/ACTIVITIES

1. Each child magnetizes a nail as learned in Lesson Nine.
2. Each child also has three nails which are not magnetized.
3. Children test the nails with paper clips to assure their nail has become magnetized.
4. Students put their four nails on their desk and mix them up.
5. Ask students if they can tell by looking which nail is the magnetized nail. Ask students how they can figure out which nail is magnetized.
6. Students trade places with another student and try to find the magnetized nail.
7. When students have tried this with a variety of partners, students gather together in a group to discuss their findings: Did the magnetized nails look different from the nonmagnetized nails? Did they feel different? How could you tell the difference between the magnetized and nonmagnetized nails? (Only by testing them with a magnetic material, because magnetism, like gravity, is a force that cannot be seen).
8. Students may be invited to create a game they could play with a partner using magnetized and nonmagnetized materials. Students may document this game in their journals, Appendix J .
9. If time permits, allow students to play their game with a partner, or save it for another period of time.

HOW DO WE USE MAGNETS EVERY DAY?

LESSON ELEVEN

OBJECTIVES/GOALS

To expose students to the roles magnets play in our everyday life.

MATERIALS

Journal, pencil, chart paper, objects (or pictures of objects) that utilize magnetism: refrigerator magnets, can opener, computer diskettes, cassette recorder and tape, speakers, VCR and VCR tape, clothes dryer, refrigerator, etc.

KEY VOCABULARY

Prior vocabulary

PROCEDURES/ ACTIVITIES

1. Students gather together in a group. Teacher begins discussion. *We have learned a lot about magnetism. What can you tell me that you have learned?* Teacher writes on a chart paper headed with "What we have learned about magnets. " This paper should be posted next to chart paper completed in Lesson One. After completing, discuss with students the similarities and differences of their responses then and now. Why have some theories changed? Allow students to lead the discussion and question each other.
2. Ask students, now knowing what magnets are and what they attract, to brainstorm (on chart paper) ways we use magnets every day. Allow all thoughts to be put on paper.
3. Now show students items or pictures (can opener, diskettes, etc.). As you display each item, ask students to predict whether or not that item utilizes magnetism to work.
4. After all items have been displayed, point out that all these objects use magnetism in one way or another.
5. Students write and draw in journals, Appendix K, explaining ways in which magnets are used every day.
6. Students are directed to take home journals and find at least two more ways they use magnets at home.

EVALUATION/ASSESSMENT

Teacher will assess student's understanding based on contributions to class discussions and journal entries.

OTHER SUGGESTED ACTIVITIES

CENTERS

1. The study of magnets lends itself to many hands-on center activities that the students can work on independently. Refer to resources for great center ideas.

CULMINATING ACTIVITY

The culminating activity of this unit is the student's own creation using magnets. Their creation must reflect knowledge attained from Lessons 1-10 of the magnet unit. Students should be given plenty of time and materials to create an invention. Partner or group work is acceptable as long as all children have participated equally. This process may take one to three sessions of science. This activity may also be done as a take home assignment.

Assessment
Grade 3

MOTION OF OBJECTS

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

Using marked magnets, students will arrange magnets in different patterns. Each student will circle his or her predictions on the chart and then test each prediction. Each student will circle the result of each test on the chart.

Magnets		**Prediction**		**Tests (circle one)**	
Bar 1	Bar 2	Attract	Repel	Attract	Repel
NS	NS	Attract	Repel	Attract	Repel
SN	SN	Attract	Repel	Attract	Repel
SN	NS	Attract	Repel	Attract	Repel
NS	SN				

Each student will write a paragraph describing the patterns created when two magnets react to each other.

(Give students rubric before activity.)

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

Criteria	**Apprentice**	**Basic**	**Meets**	**Exceeds**
Completeness of chart	Creates an incomplete chart with many inaccuracies.	Creates a complete chart with some inaccuracies.	Creates a complete chart with few inaccuracies.	Creates a complete chart with no inaccuracies.
Accuracy of description	Does not describe the patterns formed by magnets.	Describes the patterns formed by magnets with some inaccuracies.	Describes the patterns formed by magnets with a few inaccuracies.	Describes the patterns formed by magnets with no inaccuracies.