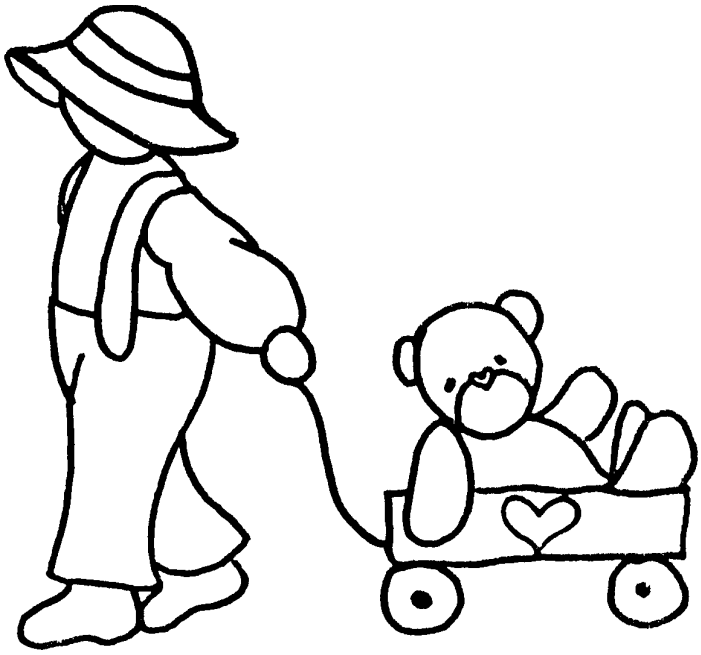
Applied Science

Our Technological World

KINDERGARTEN

PHYSICS



3 WEEKS
LESSON PLANS AND
ACTIVITIES

APPLIED SCIENCE
OVERVIEW OF KINDERGARTEN

SCIENCE AND MATH

WEEK 1.
PRE: *Describing and comparing nests, birds, and eggs.*
LAB: *Describing different shapes.*
POST: *Exploring shapes in nature.*
WEEK 2.
PRE: *Distinguishing different senses.*
LAB: *Discovering how to use the senses to find new things.*
POST: *Describing how senses feel.*
WEEK 3.
PRE: *Discovering components of the microworld.*
LAB: *Comparing a microscope to a hand lens.*
POST: *Identifying tools that help us observe.*

PHYSICS

WEEK 4.
PRE: *Deriving information from an observation.*
LAB: *Discovering changes in the night sky.*
POST: *Describing interactions of the physical world.*
WEEK 5.
PRE: *Exploring magnetism.*
LAB: *Discovering which objects repel or attract each other.*
POST: *Discovering how electricity is made.*

TECHNOLOGY

WEEK 6.
PRE: *Discovering technology.*
LAB: *Exploring different simple machines.*
POST: *Exploring how machines help people work.*
WEEK 7.
PRE: *Exploring inventions.*
LAB: *Discovering how to invent.*
POST: *Exploring how inventions may not be useful.*

BUILT ENVIRONMENT

WEEK 8.
PRE: *Recognizing the difference between artificial and natural.*
LAB: *Classifying objects in the classroom.*
POST: *Exploring living requirements of an environment.*

APPLIED SCIENCE - PHYSICS (KA)

Students are read a book to help them increase their observational skills.

PRE LAB

OBJECTIVES:

1. Observing the night sky.
2. Deriving information from an observation.

VOCABULARY:

moon
night
physics
sky
stars

MATERIALS:

Molly's Special Wish by R. Supraner or similar story

BACKGROUND:

Observing and then describing nature is difficult. Precise definitions are needed. If the observations create a pattern, scientists can develop a mathematical formulation, that would help predict results. Other scientists, then attempt to observe and verify the prediction, through experimentation. As each prediction is verified, an understanding of the physical world slowly evolves. Scientists must observe something before they can understand it. Observation is important.

Although *Molly's Special Wish* is fiction, it reflects how children view and interpret their world. Molly moves to a new place and takes the Moon with her to comfort her. Books like this can be used to illustrate the difference between illusion and fact. There are many additional books you can use to remind students there are many things we don't understand, but that is why we go to school.

Molly's impression of the Moon is insightful. She realizes that because the moon is up in the sky at night, wherever one goes, the moon should be there. This is a good leap into critical thinking. When early astronomers viewed the Moon, they had to figure out why it was always there. The observation must be made first before you can discover how and why.

PROCEDURE:

1. Emphasize that the science of PHYSICS helps explain what is happening in the

world and universe. The events that we see every day from throwing a ball to driving a car is due to the world we live in. Sometimes we don't know how to explain it "scientifically." Observing "something" is the first step into understanding it.

2. You may want to ask a few questions about the book after you finish reading it. For example:

Where is the Moon? *In the sky, out in space.*
When can you see it? *Sometimes at night, but also LAB the day.*
Does the Moon always come up in the same direction? *Yes, in the east.*
At the same time? *No*
Does it always look the same? *No*

3. As an extension, have the students record what the Moon looks like for the next month. It takes 28 days before it goes through a complete cycle of change.

APPLIED SCIENCE - PHYSICS (KA)

LAB

Students observe stars moving using “night boxes.”

OBJECTIVES:

1. Discovering change in the night sky.
2. Comparing the night sky.

VOCABULARY:

change
movement
star

MATERIALS:

4 star boxes
or worksheet
flashlights

BACKGROUND:

Observational skills are important in understanding how the Universe works. Through many years of observation, the science of physics evolved as a science that helps explain phenomena that we see every day, but are not sure how it works. This lab helps students focus on observing the night sky and then discusses what might cause it.

Although children see stars in the night, they really have not observed the stars movement. The changes are subtle, but real.

PROCEDURE:

1. In this exercise, the students look at the star boxes to see if there are any changes. Students can use a flashlight to look in first, and then look in again to see the glowing images. For a large class, you can build several star boxes if you follow the specifications. See instruction at the end of the “Procedure” for more details on how to make them.

2. If you do not want to make star boxes, you might want to make a set of glow in the dark worksheets. Use the enclosed sheet and outline the black dots with either glow in the dark markers, or cut out the appropriate pieces from glow in the dark sheets that you can purchase. Have the students work in groups and have them observe the different pictures to observe what is happening. The star boxes are much more effective, but if you

have limited time and storage, this alternative works well.

2. We recommend that you use “GLOW IN THE DARK” stickers. Make sure you shine a light in the box before the students look inside. Have the students do this as part of the exercise. For your own information, this is called phosphorescence, the light has excited the atoms of phosphorous to stay bright just a little longer.

3. The logic behind students looking at 4 different boxes is for them to focus on the change in the star patterns. The children will have to look over and over again, to notice the changes. Make the patterns in the box similar, but different enough so they can see a difference.

4. At home, see if their parents will let them go outside at night to see if they can detect changes in the stars. Yes, the stars do seem to move. The Earth moves and makes the stars seem as if they move. Stars also rotate and revolve, but the movement we experience on Earth is mainly because the Earth rotates on its axis from east to west.

5. Point out that not all those points of light are one star. Many times they are many stars in a galaxy that we see on Earth as one point of light. Explain that "stars" are not really star-shaped. Stars really look like our Sun but we "see" a pointed polygon because our eyes see it "twinkle."

6. There are several star box patterns that you can use. In the directions below to make a star box, we use several examples. Basically, students should deduce that the stars remain stationary over the span of a night, but the Moon appears to move across the sky. Understanding why this happens includes learning that the Moon is attracted to the Earth because of gravity. A large mass like the Earth can control the movement of the Moon. The Earth and Moon together, revolve around the Sun, but the children are not seeing this during the night sky. The Earth is spinning on its axis as the Moon is revolving around the Earth. The end product is that the Moon looks like it is moving and we are not. However, we know that the Earth and Moon are both moving.

7. Making Star Boxes for the classroom.

STAR BOXES

MATERIALS:

4 boxes with lids (suggest filing boxes or large shoe boxes)
glow in dark planet stickers
black construction paper
glue

DIRECTIONS:

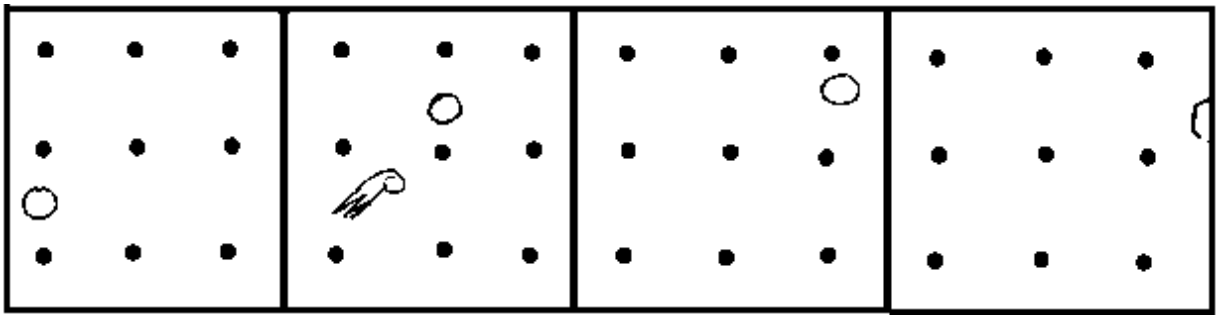
These are simple materials to make. Get 4 pieces of black construction paper and

glow in the dark planets. Make a scene of the night sky as it may look throughout the night. For instance at 9 pm the moon may be rising in the east. At 1 am the moon has moved to the west; at 3 am the moon is even closer to the western horizon and at 6 am the moon is no longer there.

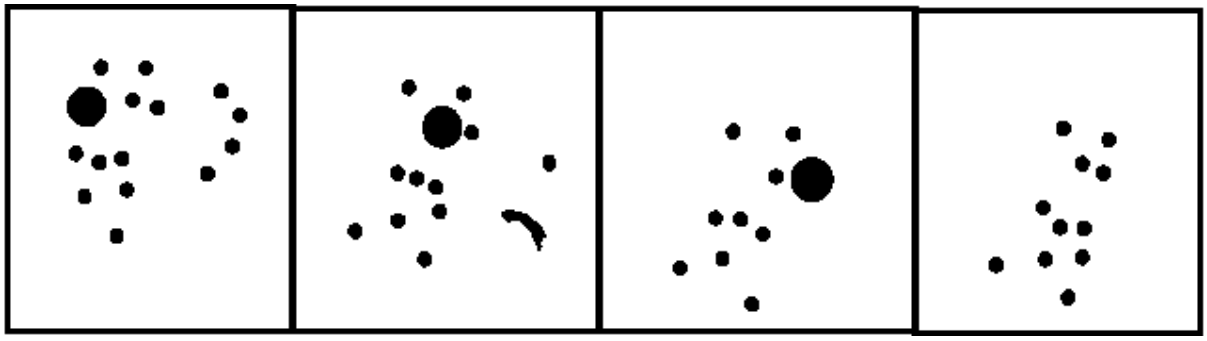
Although the stars do move (or actually the Earth moves); we have found that the students will not be able to recognize the movement. So we put a square grid of stars in the background, so that students can recognize the movement easily.

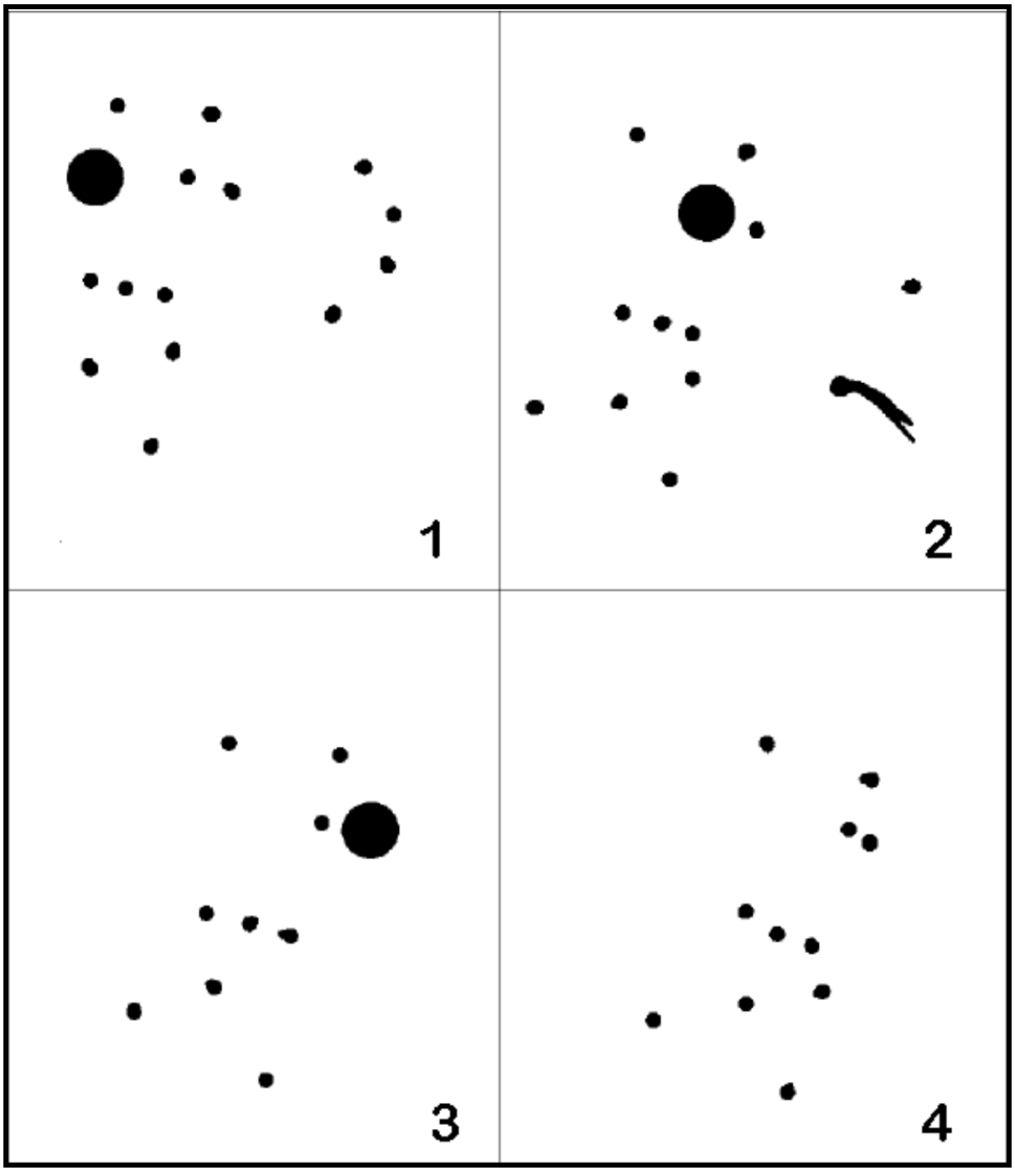
The grid recommended in the text reflects a movement of Orion. You may want to use different grids. Remember you can change the construction paper. If the students can detect the non-moving grid easily, you may want to try the more complex one. Below are examples of moving and non-moving grids.

EXAMPLE OF BACKGROUND THAT DOES NOT MOVE



EXAMPLE OF BACKGROUND THAT MOVES

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2
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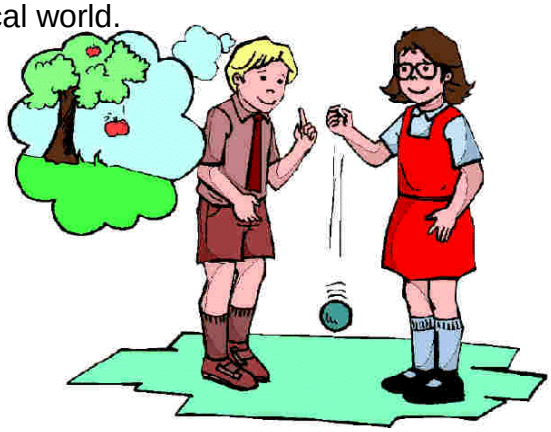
APPLIED SCIENCE - PHYSICS (KA)

POST LAB

Students explore physics through word games.

OBJECTIVES:

1. Exploring the elements of physics.
2. Describing interactions of the physical world.



VOCABULARY

physics

MATERIALS:

worksheet

BACKGROUND:

Physics describes how objects interact with each other. It is difficult to explain magnetism, heat, light, weight, mass, density, temperature, and many other properties we use to describe objects. Many of these terms are used in our modern day language, but their definitions are difficult to illustrate.

For instance, many students think heat and temperature are the same. Energy (heat) can be created when ice is melting. Temperature however, is a measured quantity of coldness and hotness. Children also confuse weight and mass. Weight is dependent on the field of gravity one is in (the weight of a person on the Earth is more than their weight on the moon). However, their mass is the same in both places (or the same amount of matter within a given area).

Physics helps explain the picture on the left. If you twirl water in a bucket, centrifugal force will "push" the water to stay in the bucket. Physics explains many things.

PROCEDURE:

1. Introduce to students that "physics" is all around them. Physics helps humans understand what has been going on for billions of years. For example, ask the students why they are standing up and not floating around. They might answer that they are heavy or they have legs. However, it's because of gravity or the attraction of our mass to the

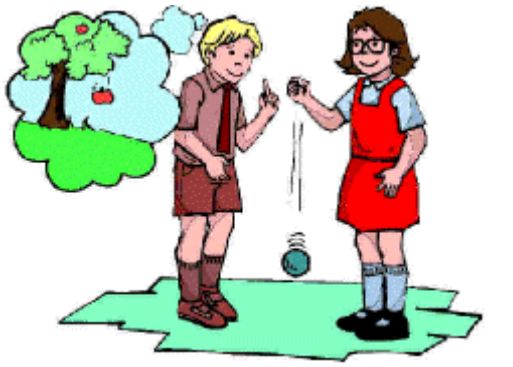
surface of the Earth. We observe gravity all the time, like throwing a ball up into the air and it comes down, but we don't fully understand it. Understanding gravity is "physics."

2. Electricity, magnetism, and light are related. However, we did not know that until people who study physics made that connection. It is difficult to understand how they are connected, but they are. Tell students that as they grow older they will find this out.

3. Remember that many of these terms can mean more than one thing. For instance, light can mean "light" with respect to density. Students might give you the words airy, delicate, feathery, or weightless. However, light also refers to brilliance, illumination, shine, flicker, glimmer, beam, or ray.

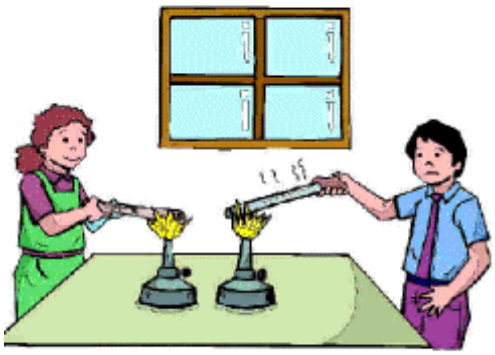
4. Go over the words in the worksheet, making sure that students understand they are part of understanding the world of physics.

WORDS OF PHYSICS

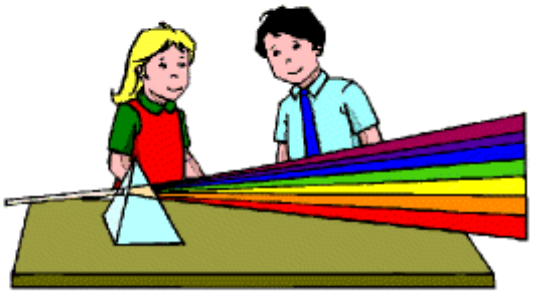


GRAVITY

MAGNETISM



HEAT



LIGHT

SOUND

ENERGY

APPLIED SCIENCE - PHYSICS (KB)

PRE LAB

Students learn about repel and attract.

OBJECTIVE:

1. Exploring magnetism.
2. Discovering repel and attract.

VOCABULARY:

attract
magnetism
repel

MATERIALS:

worksheet
crayons

BACKGROUND:

Magnetism is a mysterious phenomenon to children. They can see the results of the repulsion and attraction, but the reason why it happens is very confusing. The word magnetism may be new to students, but the only way you can define magnetism is to have the students play with the "force."

Nature has different forces that act on objects, and magnetism is a force that only certain metals have like iron, cobalt, and nickel.

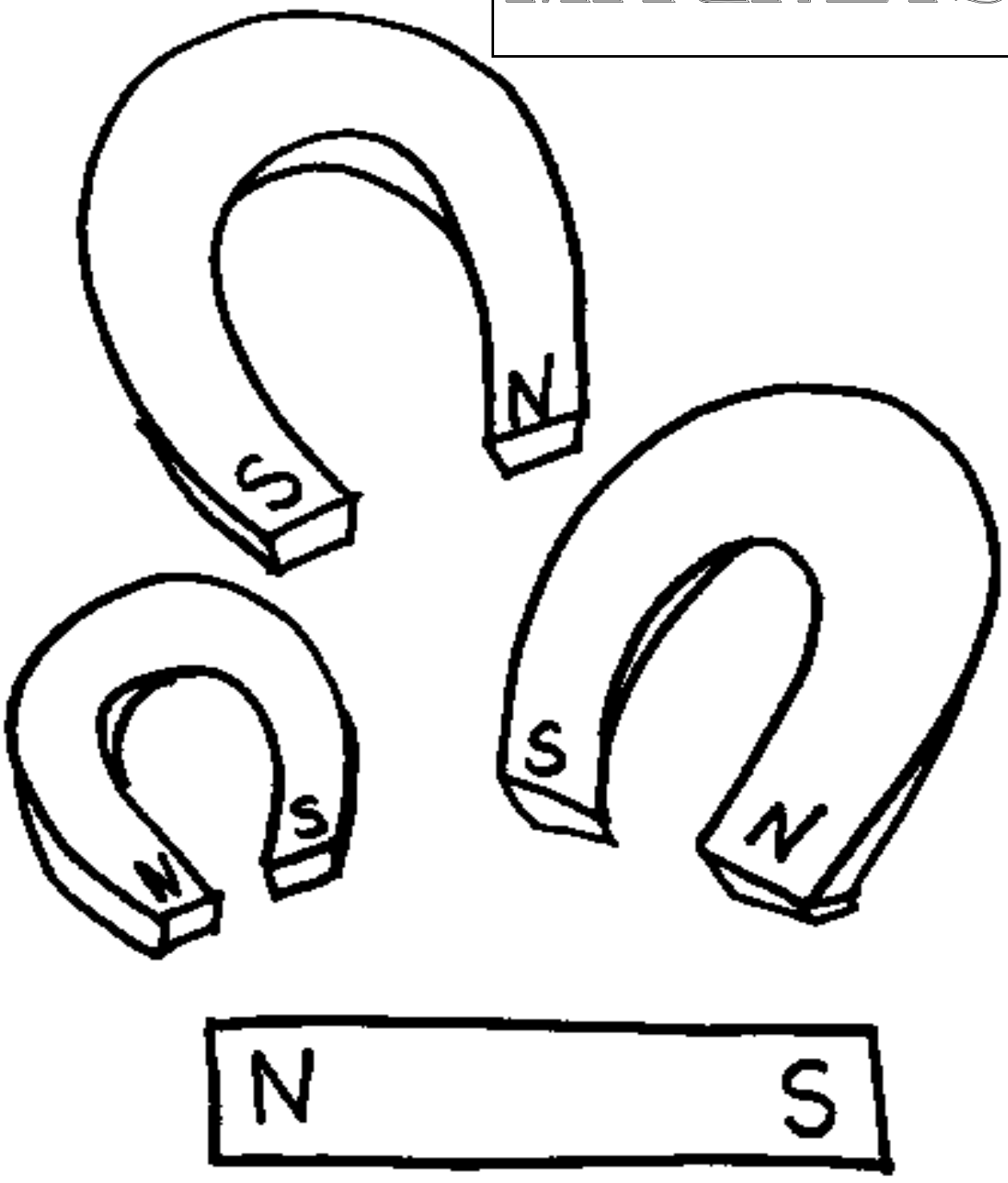
PROCEDURE:

1. Use the coloring exercise to emphasize that there is a north pole and a south pole, just like the Earth. When a north pole and a north pole meet, they REPEL. When a magnet's south pole and a north pole meet, they ATTRACT.

2. Introduce the idea that magnets will pick up things that are made of some metals. Emphasize that magnets near computers or televisions can cause damage to that piece of electronic equipment.

3. Arrange students into two lines and have them face each other holding hands. Tell students to take one step toward their partner. This is attraction. Now have them move one step back. This is repulsion. Do this several times with the students, almost singing the terms: Attract (move together) and Repel (move apart).

MAGNETS



APPLIED SCIENCE - PHYSICS (KB)

LAB

Students play with magnets.

OBJECTIVE:

1. Discovering which objects repel or attract each other.
2. Exploring magnetism.

VOCABULARY:

attract
magnet
metal
repel

MATERIALS:

Applied Science - Physics (KB)
pencils

BACKGROUND:

There are only 3 metals that are naturally magnetic including nickel, cobalt, and iron. Many other metals are attracted by magnets. The magnets that are included in the kit are made of Alnico (aluminum, nickel, and cobalt, which are considered permanent magnets (i.e. does not lose its magnetism).

The more time you allow the children to discover magnets, the more they will understand on their own about the magic. Magnetism is a force that must be experienced in order to discuss it in later grades. They can now understand the power of magnetism by feeling the power of the magnets.

PROCEDURE:

1. In your module you have 30 magnetic wands, 30 magnetic rings, and 30 magnetic marbles. If you do not have the module, you can substitute different items.

2. Give each child one of each magnet, and have them discover the power of magnetism. First let them play with the items by themselves for about 10 minutes. Then let them work with a partner. Emphasize keeping the magnets away from a computer or television.

3. After they play for about 20-25 minutes, bring them together and discuss what they have discovered.

4. Hopefully students will have discovered:

a. The magnetic wands are the most powerful. You can pick up the rings and marbles with the wand.

b. If you put rings on a pencil in the correct way the rings will appear to float.

c. You can play a "game" of moving the rings around by using the wands and not touching the rings.

d. You can balance a ring on the thin side of the wand and it moves very quickly.

e. Magnetic marbles have to be arranged in a certain way to balance a stack.

5. We do not recommend the use of magnetic iron files. Since they are iron and very small they can easily get into student's eye, especially if you have an unruly class. You can use iron files if you put them into a plastic bag (4 ml) and have students use them in the bag. However, iron clips, small pieces of metal, or other magnets are much safer.

APPLIED SCIENCE - PHYSICS (KB)

POST LAB

Students are read a book on electricity.

OBJECTIVE:

1. Exploring electricity.
2. Discovering how electricity is made.

VOCABULARY:

electricity
electron

MATERIALS:

Switch on, Switch off by Melvin Berger

BACKGROUND:

Light switches can be found anywhere in the house: in kitchens, bedrooms, hallways, and even cellars. See if your students know what a light switch does? If you flip a switch up, a light comes on. When you flip the switch down, the light goes off. It almost seems like magic, but it's not. It's electricity.

PROCEDURE:

1. *Switch on, Switch off* (Harper Collins) is an introduction to the topic of electricity and shows how magnetism is related to electricity. It explains about circuits, generators, light bulbs, and plugs. The book also shows students how to make electricity with the use of a magnet. (This may be difficult for kindergarten students and we recommend you skip this portion of the book.)

2. Illustrate how electricity works by telling students that all substances are made up of electrons, protons, and neutrons. Electricity is when electrons all move together in the same direction. You can do the following with your class to illustrate this point. Go outside with students and tell them that electrons are all around. Have students each stand in one place and act like an electron minding its own business. Don't let them interact with each other. When you say "Switch On", have the students walk in the same direction, like in a parade. The flow of electrons will now cause electricity. "Switch Off", and the students should go back to being solitary electrons. Repeat the exercise until students get the idea that electrons moving in the same direction create electricity.

3. Remember that neither you nor your students have to understand electrons to introduce the term.