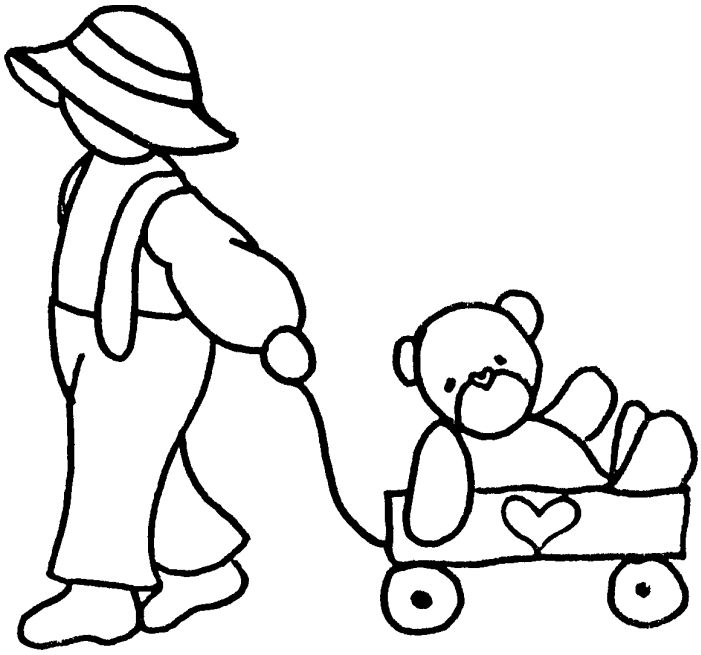
Applied Science

Our Technological World

SECOND GRADE

PHYSICS



3 WEEKS
LESSON PLANS AND
ACTIVITIES

APPLIED SCIENCE
OVERVIEW OF SECOND GRADE

SCIENCE AND MATH

WEEK 1.
PRE: *Exploring perception.*
LAB: *Experimenting and predicting volume, weight, and length.*
POST: *Estimating and gathering data.*
WEEK 2.
PRE: *Comparing and contrasting two and three dimensional objects.*
LAB: *Recognizing and comparing shapes.*
POST: *Exploring unit cells to create patterns.*
WEEK 3.
PRE: *Investigating symmetry.*
LAB: *Comparing symmetry in nature.*
POST: *Discovering tessellations.*

PHYSICS

WEEK 4.
PRE: *Describing the physical world.*
LAB: *Exploring the physics behind toys.*
POST: *Investigating how things work.*
WEEK 5.
PRE: *Comparing different forms of energy.*
LAB: *Investigating different forms of energy.*
POST: *Exploring nuclear, heat, and chemical energy.*

TECHNOLOGY

WEEK 6.
PRE: *Investigating everyday simple machines.*
LAB: *Investigating machines that produce work.*
POST: *Comparing machines that produce energy.*
WEEK 7.
PRE: *Exploring technology.*
LAB: *Investigating computer technology.*
POST: *Comparing technologies used in the entertainment industry.*

BUILT ENVIRONMENT

WEEK 8.
PRE: *Comparing different energy machines.*
LAB: *Investigating how solar energy produces power.*
POST: *Contrasting different forms of energy.*

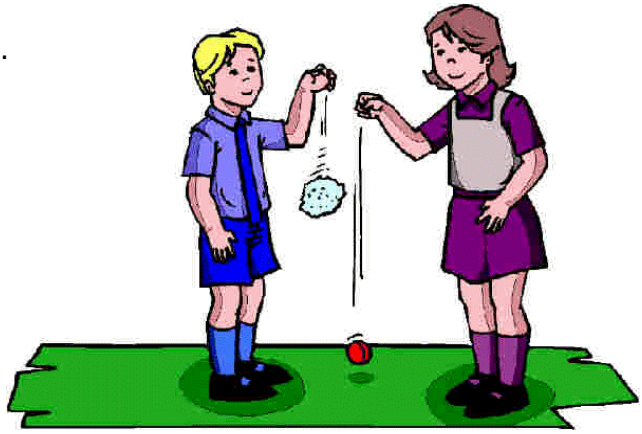
APPLIED SCIENCE - PHYSICS (2A)

PRE LAB

Students observe physics in the classroom.

OBJECTIVES:

1. Defining physics.
2. Describing the physical world.



VOCABULARY:

physics
science

MATERIALS:

toys
balls
anything in your classroom to help illustrate physics

BACKGROUND:

Physics is the study of matter and energy and is the root of every field of science. It underlies the understanding of all phenomena. Specifically as a science, physics is related to the phenomena of motion, force, energy, matter, sound, electricity, magnetism, light, and the atom and nucleus. Physics is also an underlying part of both physical, geological, and biological sciences. Physics is the present day equivalent of what used to be called natural philosophy from which most of present day science arose. The study of these topics makes up that which is called physics.

The field of physics is generally broken into discrete categories of mechanics, heat, energy, sound, light, magnetism, electricity, optics and those of atomic or nuclear structure. These traditional topics reflect the historical development of physics throughout the years in search for a unified field theory. A unified theory which can explain how all these forces and energy, in the Universe, work together. The search of a grand unified theory of all matter, sometimes border on ingenuity than it does on concrete facts. Recent theoretical investigations point to symmetry as an underlying law of physics. This "supersymmetry" could have been broken as the Universe evolved. Physicists are now trying to put the symmetry back together. This almost sounds fun!

Throughout this program, students are exposed to different components of the physical world. Point out that physics is all around us. We see, feel, touch, and perform physics everyday. We just don't think about it! Physics explains what is being done. The more a child observes, the more that child understands what is happening. For example, children throw balls which seems a natural act, but explaining why the ball doesn't go into outer space requires a physical explanation. The Earth's gravity pulls the ball back to

Earth. Physics develops explanations why the world works the way it does.

PROCEDURE:

1. Ask students if they have heard the word "physics?" Instruct them to attempt to give a definition before you explain.

2. Show students examples of physics in everyday life. Listed below are some examples. Be a little dramatic by making a book smash on the floor and ask students why? (Gravity.) In many cases, answers are not as important as having the students ask questions about their physical surroundings. Below are a few words and examples you can use. In later grades, students will have developed the tools necessary to put together all the pieces of physics and develop a "unified theory."

MOTION - cars moving, flight, sailing
FORCE - throwing a baseball, hitting a home run, shooting a bullet
ENERGY - solar energy, heat, wind
MATTER - solids, liquids, gases
SOUND - bells with different sounds, telephones, talking
MAGNETISM - motors, magnets
ELECTRICITY - light, switches, batteries
LIGHT - rainbows, television
ATOM - elements (sulfur, oxygen, hydrogen)

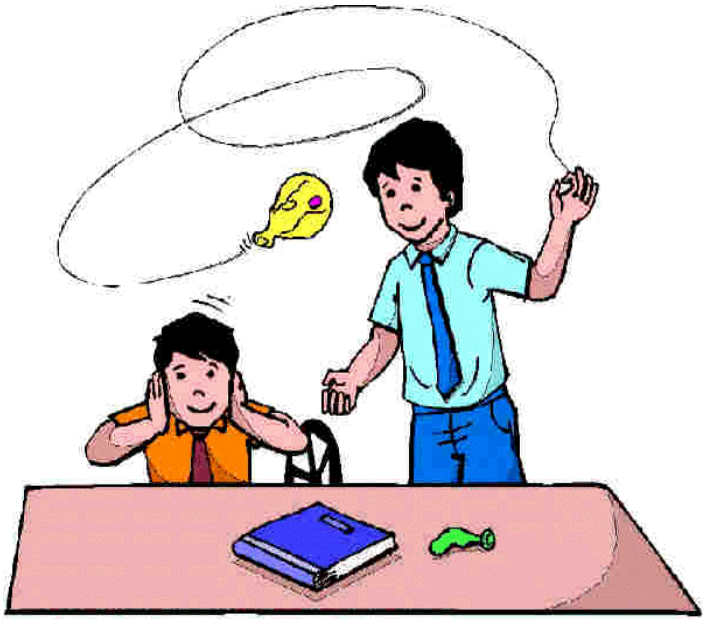
APPLIED SCIENCE - PHYSICS (2A)

LAB

Students discover the physics of toys.

OBJECTIVES:

1. Exploring the physics behind toys.
2. Discovering how toys work.



VOCABULARY:

electricity
light
magnetism
matter
motion
sound

MATERIALS:

prism
gliders
hand boiler
energy ball
jacob's ladder
magnetic marbles
bouncing ball
space wheel
density timer
or other appropriate substitutes

BACKGROUND:

Understanding physics is actually a two fold educational process. In addition to developing an accurate conceptual background, students then need to apply concepts to solve problems. It is important for children to learn the concepts before they can even understand why they are solving mathematical problems. Then, the focus of the student is operational, trying to find the mathematical definition that will solve the problem. If a child learns the major concepts first, each problem a child encounters will have a point to start solving the problem. That student becomes an expert problem solver.

Toys can help a child start their problem solving adventure. Toys are created to entertain. The entertainment factor is there because toys usually do something that is "odd." A child will tend to play with a toy longer, if they are trying to figure out what is going on. Even after they figure the physics behind it, it still will maintain the entertainment

value because the child then feels like they really understand the toy.

Common toys like magnets and toys that light up due to electricity, keep students wondering how this can work. Just creating a rainbow from a piece of clear plastic (prism) has magical properties. Gliders that soar through the air because they can “capture” air molecules is really an awesome idea.

Toys like the hand boiler operate on the force of pressure. The hand boiler appears to “boil” making the person reason that they are “hot.” The heat of the hand on the hand boiler changes the pressure in the glass chamber, pushing the liquid upward.

Toys like “the alien ball or energy ball” has two batteries inside, a circuit, bulb, and sound system. When you hold the ball the electrons flow from the battery and use your body as a wire. The ball lights up when you touch it. Accurately you are completing the circuit.

Almost a century ago, Jacob's Ladder was a novel toy parents bought to amuse their children. The toy is made of wooden blocks and cotton tape in such a way it gives the illusion of the wood blocks tumbling over each other and down the "ladder." The toy is also know as "clacker blocks" because of the rhythmic slapping sound the blocks makes while falling. The original name comes from the Bible where Jacob dreams of a ladder stretching down from heaven to Earth on which angels make their way up or down. Actually the design of Jacob's ladder takes into account friction and gravity. Without the exact placement of the cloth and without gravity pulling it down to earth, it would not work.

PROCEDURE:

1. Toys are a perfect example of physics used for pure enjoyment. In this exercise, students go to the different toy stations and record what they think the “physics factor” may be. Instruct students to choose from the following words: magnetism, motion, force, sound, electricity, light, and matter. (You can add more factors or change others). The lab allows students to begin developing reasons why certain phenomena occur. Students will not understand all the components of the toys, but they will start to associate words. Students do not yet have the background to "understand" what is happening. The important lesson is to recognize that physics can describe how toys work. This lab tries to familiarize students with the science of physics, not to explain all the different parts.

2. Each toy should be a separate station. Instruct the students to go from one station to the next after about 2-4 minutes. The more stations you have the less time you can allow for children to play. Play is important. Instruct students to “think” about how the toy is doing its trick.

3. Some of these toys have more than one principle in operation, however the point of this lab is to get the students familiar with the term PHYSICS. If the students can justify

why they labeled the toy a certain way, and the logic is justified, accept the answer. You may want to add different types of toys to create more stations.

4. The following are toys that fit the above scheme: (1) magnetism - magnetic marbles, space wheel; (2) motion - ball, glider, timer; (3) force - hand boiler, glider, Jacob's ladder; (4) sound - energy ball; (5) electricity - energy ball; (6) light - energy ball, prism; (7) matter - all of the toys are solids, the students can call the hand boiler liquid.

APPLIED SCIENCE - PHYSICS (2A)

PROBLEM: How can one explain how toys work?_____

LET'S INVESTIGATE! Use the following words when you describe the physics of toys: MAGNETISM, SOUND, ELECTRICITY, LIGHT, GRAVITY, MOTION, FORCE, MATTER

TOY	DESCRIBE

CONCLUSION: How do toys work?_____

_____

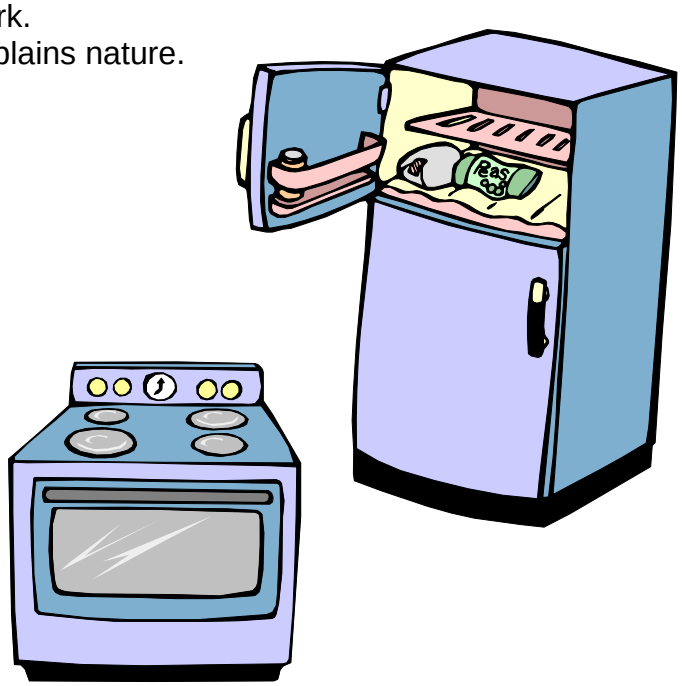
APPLIED SCIENCE - PHYSICS (2A)

POST LAB

Students explore everyday objects and how they work.

OBJECTIVES:

1. Investigating how things work.
2. Discovering that physics explains nature.



VOCABULARY:

electricity
energy
force
friction
gravity
magnetism
physics

MATERIALS:

Internet
reference material
worksheet

BACKGROUND:

Everywhere you look there are mechanical objects being used in our everyday lives. A pair of scissors, a can opener, a key alarm, or a lock are common. We have so many products now-a-days, that we sometimes forget to ask ourselves," How did that work?"

The science of physics with its explanation of electricity, magnetism, heat, mechanics, and other phenomena is very helpful in understanding these everyday objects. For instance, an ordinary lever keeps you safe at night (lock) or a simple wedge stops your pants from falling (zipper).

Children use everyday appliances and sometimes don't even think about how it works. We have so many gadgets in our society, that even if a child asks a parent how something works, they might not get an answer. Formulating the question, however is a first step in trying to find the answer.

PROCEDURE:

1. For homework instruct students to find out how something at home uses “physics” to work. Use the enclosed worksheet to help the student work with a responsible person at home to derive an answer. This lab will generate many questions about how things work.

2. Have students make a list of items from home. They should be simple items so the students can learn how they work. Give students ideas such as: How does a pair of scissors, or a nut and bolt work? What happens inside the shiny box of a dishwasher? What happens in an electric light bulb when you flick on the switch?

3. Don't feel you have to know how an object works, ask people. It is so important for children to understand that if one person doesn't know the answer, they should keep asking until they find one who does. If you can't find someone who knows the answer, the child should start developing a "theory" of their own as to how the object might work. Someday, somewhere, the child will find the answer.

4. You may want to use a children’s search engine on the internet to find out how things work.

APPLIED SCIENCE - PHYSICS (2A) POST

HOMEWORK: Find one item outside of school that uses the "Principles of Physics" to operate.

To responsible adult: Your student has learned about how the forces of physics are found in our everyday life. Help your child learn how one thing works at home. It could be as complicated as a car or as simple as a can opener. Use the Internet or just ask your neighbors.

ITEM:_____

HOW DOES IT WORK?

_____

_____

_____

_____

_____

_____

_____

_____

DRAW A PICTURE OF THE ITEM.

APPLIED SCIENCE - PHYSICS (2B)

PRE LAB

Students observe the energy created by a slinky.

OBJECTIVES:

1. Defining energy.
2. Comparing different forms of energy.

VOCABULARY:

energy
kinetic
potential

MATERIALS:

Slinky

BACKGROUND:

The major types of energy are chemical, mechanic, light, heat, nuclear, and sound. However, many other items can be considered as "energy". There is also another way to describe energy: at rest and on the move. This activity concentrates on energy at rest (potential) and energy on the move (kinetic). These words seem difficult, but students love to say them because they can then describe energy.

PROCEDURE:

1. Go over the vocabulary. Define energy as "something" that takes on several familiar forms. It can be the energy of motion, chemical energy, or nuclear energy. In other words, energy moves "stuff". We cannot see, feel, taste, or smell energy. Energy is abstract and is used in many ways. Have students try and define energy in their own terms.

2. To develop your student's understanding of the words, go over simple examples. Put a book in front of you. State that this book has the potential of getting their attention. Ask them how? Tell them, by making kinetic energy from this potential. Ask them if they know what you mean? If not, drop the book; kinetic energy has been accomplished. (Did you get their attention?) Ask them if you could have gotten more kinetic energy out of the book. Then ask them what would happen if you threw the book off a tall building. Would there be more kinetic energy? Yes, we made the book do more work and produce more kinetic energy because it was dropped from a higher source.

Use the example of a pebble in water; the waves generated are a release of energy.

The higher the pebble (more potential) thrown over the water, the more energy is produced (kinetic).

3. Give pairs of students a slinky and ask them to design an apparatus to give the slinky more kinetic energy. (You may need lots of books and boxes). Students will discover that if you allow the slinky to "step" down from a high place, (potential) the slinky will produce more kinetic energy. Beware! Students like to design exotic steps. Keep reviewing the terms: potential is when the slinky is at rest; kinetic is when it moves.

APPLIED SCIENCE - PHYSICS (2B)

LAB

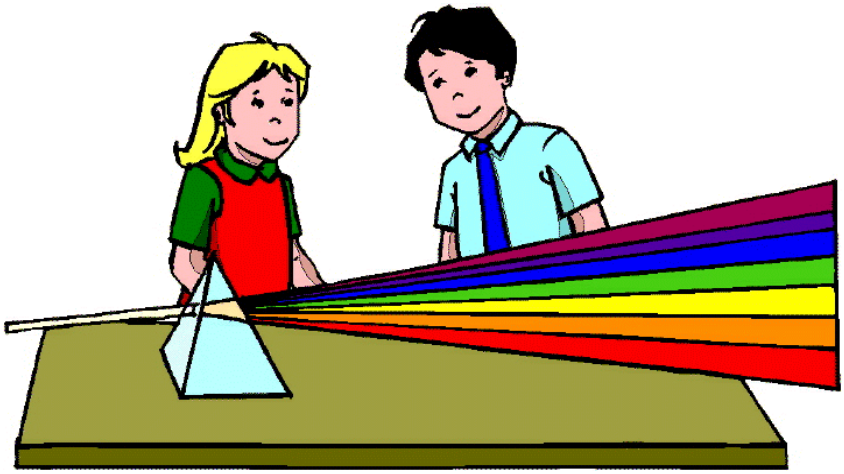
Students experience different ways to make energy.

OBJECTIVES:

1. Comparing and contrasting forms of energy.
2. Investigating different forms of energy.

VOCABULARY:

energy
light
mechanical
sound



MATERIALS:

hand lenses
potato peelers
bells
balance balls
radiometers
flip-flop tops
puddle jumpers
prisms

BACKGROUND:

We use energy to do work. Energy lights our cities. Energy powers our vehicles, trains, planes and rockets. Energy warms our homes, cooks our food, plays our music, gives us pictures on television. Energy powers machinery in factories. Energy is defined as "the ability to do work."

When we eat, our bodies transform the food into energy to do work. When we run or walk, we "burn" food energy in our bodies. When we think or read or write, we are also doing work. Cars, planes, trolleys, boats and machinery also transform energy into work.

The word energy is used in many different ways. In this lab we will look at how energy can be created by different ways.

PROCEDURE:

1. Discuss the meaning of energy. Emphasize that energy is difficult to describe but can be derived from many things. In this lab, students look at different "energy makers" and try to establish the type of energy they produce. This lab looks only at light,

mechanical, and sound energy. This is only an introduction and students should not be expected to understand the physics of the items. Have students go to the appropriate stations.

2. *Light energy* - Light energy is created when light is used. Solar batteries and solar heating create energy from light. There are differences between light energy and heat energy. Light does not always have to get hot; for instance, solar batteries.

3. *Mechanical energy* - Simple machines create mechanical energy. It is energy created when it is physically easier to move an object.

4. *Sound energy* - There is energy created when air molecules are disturbed. Ask students if sound can hurt your ear drums. Yes, loud noises can rupture the drum of your ear.

5. ANSWERS:

a. Flip-flop top (mechanical/moves)
b. Bells (sound/different tones)
c. Prism (light/breaks up)
d. Hand Lens (light/concentrates)
e. Peeler (mechanical/lever)
f. Radiometer (light/makes energy) [The vanes, or wings in the radiometer are alternately dark and light in color. When light strikes these wings, heat is transferred to each one, but not to the same degree. The light wings reflect the rays, and the dark wings absorbs the rays. When the freely moving particles of air inside the radiometer strike the light reflective vanes, they absorb very little energy and do not bounce off very fast. When the atoms strike the dark vanes, they absorb a great deal of energy and rotate at a terrific speed.]
g. Force Machine (mechanical) [Pick up one ball and let it go - it will hit the other balls. The energy will go through the balls and release a certain amount of energy. For every action there is a equal and opposite reaction.]
h. Puddle-jumper (mechanical/moves)

APPLIED SCIENCE - PHYSICS (2B) LAB

PROBLEM: Can a person distinguish the different forms of energy?

PREDICTION: _____

PROCEDURE: Look at the items at the different stations and "play" with them. See if you can determine the types of energy produced. Circle your answers.

1. slinky	mechanical or heat moves or makes noise
2. bells	light or sound different tones or all the same
3. prism	heat or light breaks up light or concentrates light
4. hand lens	sound or light breaks up light or concentrates light
5. peeler	mechanical or sound lever or screw
6. radiometer	heat or light makes energy or loses energy
7. force machine	mechanical or light a. pick up one ball, let it go b. pick up two balls, let them go c. pick up three balls, let them go
8. puddle jumper	mechanical or heat moves or makes noise

CONCLUSION: How many forms of energy did you observe? _____

_____

_____

APPLIED SCIENCE - PHYSICS (2B)

POST LAB

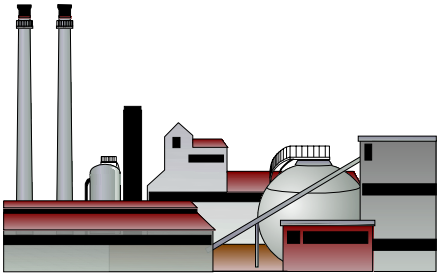
Students explore different types of energy.

OBJECTIVES:

1. Exploring nuclear, heat, and chemical energy.
2. Discovering sources of energy.

VOCABULARY:

chemical
heat
nuclear



MATERIALS:

worksheet
vinegar and baking soda are optional

BACKGROUND:

Energy takes on different forms. Students have learned about some forms of energy. Below is information on 3 other types of energy generating processes.

HEAT ENERGY - Energy that produces heat is due mainly to electricity and gas. Many items can cause heat energy. Examples are gas stoves, water heaters, and gas heat for many homes.

NUCLEAR ENERGY - The inside of matter (atoms and molecules) are held together by "glue". When this glue is broken or added to, an enormous amount of energy is created. Discuss nuclear bombs or nuclear reactors. Nuclear bombs are created when atoms split (fission) or when atoms come together (fusion). The energy of an atom is the greatest way to generate energy. However, the release of some of the energy can be very harmful. Nuclear reactors control the release of nuclear energy for use in society.

CHEMICAL ENERGY - Chemical Energy is caused when two chemicals react when combined. Show students the baking soda and vinegar reaction. This is the release of chemical energy. Another good example is a battery. Energy is released because the chemicals inside are reacting to produce electrons needed to create electricity.

PROCEDURE:

1. The worksheet instructs students to draw an example of nuclear, heat, and chemical energy. They can only do this exercise if you discuss the above material. This may be a homework assignment.

2. Ask students to name a few items that produce heat. Energy created by electricity includes electric blankets, hair driers, and electric stoves. Gas, when on fire, releases heat.

3. Have students rub their hands together to produce heat. This is caused by friction. Friction does not usually generate enough energy to be useful to a city, but can cause trouble if an engine overheats. Oil is needed to prevent metal from rubbing together. This reduces the friction.

4. If you want to illustrate a chemical reaction, use vinegar and baking soda. When you put a small amount of baking soda (about 1 ml) and then put a few drops of vinegar. You will produce a “fizz” of carbon dioxide gas being released.

APPLIED SCIENCE - PHYSICS (2B) POST LAB

ASSIGNMENT: Draw an example of the following type of energies. For example, a battery produces chemical energy.

CHEMICAL
HEAT
NUCLEAR