FORMS OF ENERGY

All forms of energy fall under two categories

KINETIC

Kinetic energy is energy in motion

RADIANT ENERGY

Radiant energy travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays, and radio waves. Solar energy is an example of radiant energy.

THERMAL ENERGY

Thermal energy (or heat) is the internal energy in substances; is it the vibration and movement of atoms and molecules within substances. Geothermal energy is an example of thermal energy.

MOTION

The movement of objects or substances from one place to another is motion. Wind and hydropower are examples of motion.

SOUND

Sound is the movement of energy through substances in longitudinal waves.

ELECTRICAL ENERGY

Electrical energy is the movement of electrons. Lightning and electricity are examples of electrical energy.

POTENTIAL

Potential energy is stored energy

CHEMICAL ENERGY

Chemical energy is the energy stored in the bonds of atoms and molecules. Biomass, petroleum, natural gas, propane and coal are examples of stored chemical energy.

NUCLEAR ENERGY

Nuclear energy is the energy stored in the nucleus of an atom. It is the energy that holds the nucleus together. The nucleus of a uranium atom is an example of nuclear energy.

STORED MECHANICAL ENERGY

Stored mechanical energy is energy stored in objects by the application of a force. Compressed springs and stretched rubber bands are examples of stored mechanical energy.

GRAVITATIONAL ENERGY

Gravitational energy is the energy of place or position. Water in a reservoir behind a hydropower dam is an example of gravitational potential energy. When the water is released to spin the turbines, it becomes kinetic energy.

Energy

TV

Car

Girl

Raindrop

Corn

Energy makes change.

Light

Compact Fluorescent Light Bulb (CFL)

Sun

Flashlight

Candle

Light makes change. Light is energy.

From The NEED Project, Manassas, VA

Heat

Fire

Hairdryer

Iron

Grill

Heat makes change. Heat is energy.

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Motion

Sailboats
Racing

Playing soccer

Drill

Ant

Motion is change. Motion is energy.

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Sound

Drums

Phone

Radio

Bird

Sound is change. Sound is energy.

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Growth

Puppies

Baby

Child

Woman

Growth is change.
Energy makes things grow.

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1. WATER WHEEL

PURPOSE: To explore how water can be used to make energy.

QUESTION: What affect does a large stream of and small stream of water have on a water wheel?

PREDICTION: Read the procedure and make a prediction to answer the question.

PROCEDURE:

1. Pour water into the opening in the water wheel through the square hole (larger) and then through the round hole (smaller). Observe the speed of the water wheel.

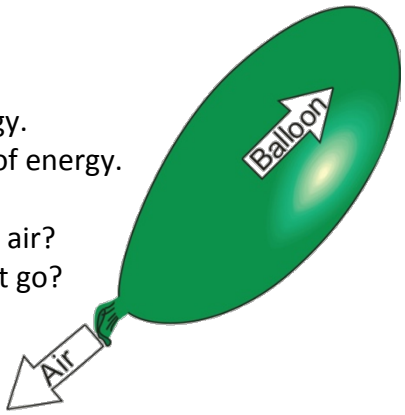
2. Is the speed of the water wheel constant over a longer amount of time when pouring the same amount of water into the square hole or the round hole? Use the second hand on the clock or on your watch to time each experiment.

	Number of seconds until wheel stops moving	Observations
½ bottle of water poured into large square hole		
½ bottle of water poured into small round hole		

CONCLUSION:

How did the water create energy?

2. LAUNCH THE BALLOON



PURPOSES: To explore how potential energy is converted to kinetic energy.
To explore how kinetic energy is converted into other forms of energy.

QUESTIONS: What happens to the energy in a balloon when you fill it with air?
What happens to the energy in a filled balloon when you let it go?

MATERIALS: Balloons, fabric tape measure

PROCEDURE:
1. Blow up a balloon to a circumference of about 20 cm and hold the end closed with your fingers.
2. Hold the balloon away from your face and let go of the end. Observe what happens.
3. Blow up the balloon to a circumference of about 30 cm, let it go, and observe.
4. Blow up the balloon to a circumference of about 40 cm, let it go, and observe.

CONCLUSIONS:
1. What form of energy was in the blown up balloon?
2. What happened to the air in the balloon when you let it go?
3. What happened to the balloon when you let it go?
4. How did the amount of air in the balloon affect its behavior when you let it go?
5. Into what other forms of energy was the balloon's energy converted when you let it go?
6. How could you use the energy in a blown up balloon to do work?

CIRCUMFERENCE OF BALLOON	OBSERVATION	
	Balloon 1	Balloon 2
Balloon – 20 cm circumference		
Balloon – 30 cm circumference		
Balloon – 40 cm circumference		

3. CAPTURING THE WIND

PURPOSE: To observe how pinwheels capture the energy in the wind.

QUESTIONS: How does the amount of wind affect the speed that a pinwheel spins?

Which way will your pinwheel turn – clockwise or counterclockwise?

PREDICTION: Read the procedure. Make predictions to answer the questions on a separate piece of paper.

MATERIALS: 1 large pinwheel, 2 smaller pinwheels, fan

PROCEDURE:
1. Hold the pinwheel 30 cm in front of the fan on slow speed and observe the speed of the pinwheel.
2. Hold the pinwheel at 60 cm away and observe.
3. Turn the fan on high speed and repeat Step 2.

CONCLUSIONS:
1. How does the distance from the fan affect the spin speed of the pinwheel??
2. How does the speed of the fan affect the spin speed of the pinwheel?
3. How does the size of the pinwheel affect the speed it spins?

4. RADIOMETER (COMBINE WITH STATION 5)

PURPOSE: To explore how a radiometer works.

QUESTION: How does a radiometer turn the sun's energy into motion?

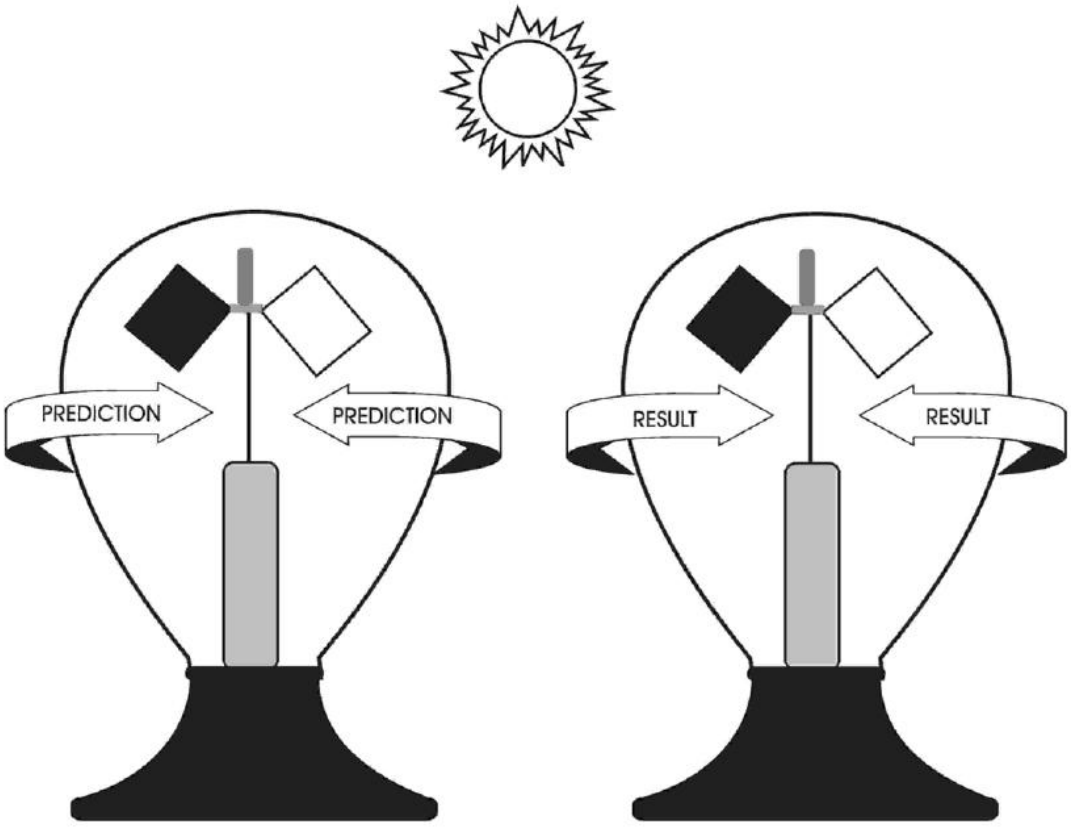
PREDICTION: Examine the radiometer and predict which way the vanes will spin when it is placed in the sun. Color the PREDICTION ARROW that shows the direction you think the vanes will spin.

MATERIALS: radiometer, lamp (if no sun), pencil

PROCEDURE:
1. Put the radiometer in bright sunlight (or under lamp) and observe the radiometer's vanes.
2. Record your results. Color the RESULT ARROW that shows the direction the vanes are spinning.

CONCLUSION:
1. Explain how the radiometer turns the sun's energy into motion.

EXTENSIONS:
1. Will the radiometer work in artificial light?
2. Will the vanes of the radiometer spin faster if the light is brighter (or lamp is closer)?



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5. GLOW TOYS (COMBINE WITH STATION 4)

GLOW TOYS: Glow toys are made of a special material that can store radiant energy. When light hits the electrons in a glow towy, they absorb some of the energy and jump to a higher energy level. After a while, the electrons return to their original energy level, and emit the extra energy as light.

PURPOSE: To explore glow toys.

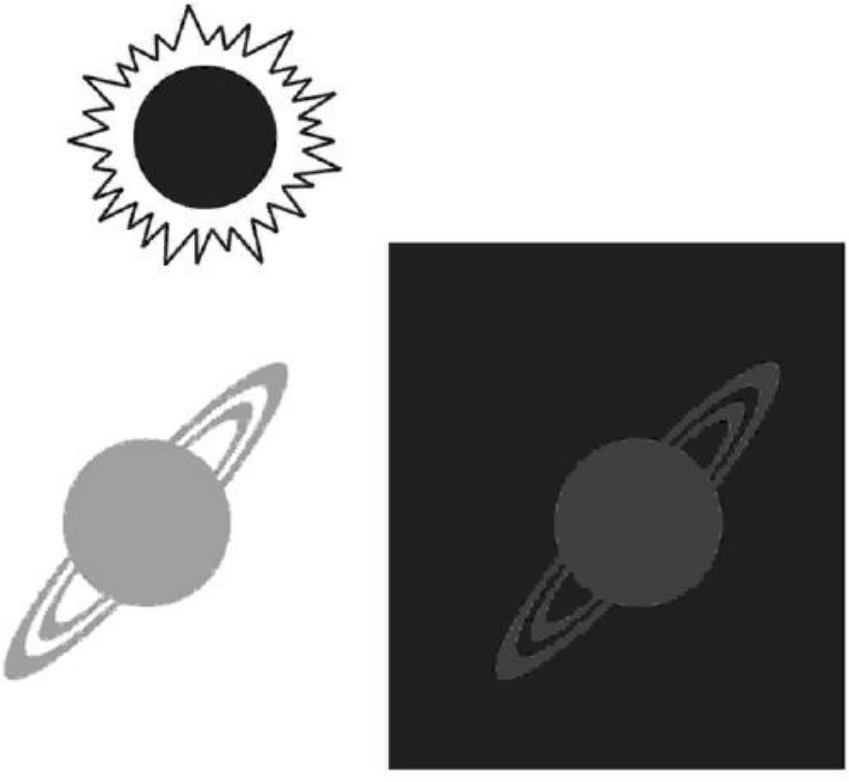
QUESTION: How does sunlight affect a glow toy?

PREDICTION: Read the procedure and make a prediction to answer the question.

MATERIALS: 2 glow toys, black construction paper, scissors, and tape

PROCEDURE:
1. Make a pouch of black construction paper and put one of the glow toys inside.
2. For five minutes, put the pouch in the sun along with an uncovered glow toy.
3. Take the glow toy and the pouch into a darkened room. Observe the glow toy. Look into the pouch and observe the other glow toy.

CONCLUSION:
1. How does energy from the sun affect a glow toy?



6. CHEMICAL REACTIONS: BAKING SODA / TEMPERATURE

BACKGROUND: All substances contain heat energy. When two substances are mixed, a chemical reaction can occur to produce a new substance. Some chemical reactions absorb heat, others produce heat. Chemical reactions that absorb heat are called ENDOTHERMIC. Chemical reactions that produce heat are called EXOTHERMIC.

PURPOSE: To explore a chemical reaction between vinegar and baking soda.

QUESTION: Does the chemical reaction between vinegar and baking soda produce heat or absorb heat?

PREDICTION: Make a prediction to answer the question: _____

MATERIALS: 1 thermometer, 15 ml (milliliter) of vinegar, 15 cc (cubic centimeter) of baking soda, 1 zip lock bag, 2 measuring cups, clock

MEASUREMENT: cc = ml
cc = cubic centimeters are used to measure the volume of solids
ml = milliliters are used to measure the volume of liquids

PROCEDURE:

1. Pour 15 ml of vinegar into a clean empty Ziploc bag. Feel the vinegar through the bag to observe its temperature.

   OBSERVATION: _____

2. Carefully place the thermometer in the bag with the thermometer's bulb in the vinegar and record the temperature of the vinegar. Leave the thermometer in the bag.

   VINEGAR:_____°F _____°C

3. Carefully pour 15 cc of baking soda into the zip lock bag. BE CAREFUL! The chemical reaction will foam up and fill the bag.

4. Wait 30 seconds and record the temperature of the mixture. Remove the thermometer from the bag and zip the bag closed.

   VINEGAR & BAKING SODA MIXTURE: _____°F _____°C

5. Feel the mixture through the bag and observe its temperature.

   OBSERVATION: _____

CONCLUSIONS:

1. Is the chemical reaction between vinegar and baking soda endothermic or exothermic?

2. Can you think of a way you could use an exothermic reaction?

7. LIGHT TO HEAT (OPTIONAL)

PURPOSE: To compare how different colors absorb energy from the sun.

QUESTION: Which color paper – white or black – will absorb more energy from the sun?

PREDICTION: Read the procedure. Make a prediction to answer the question. Draw an X in your prediction spot.

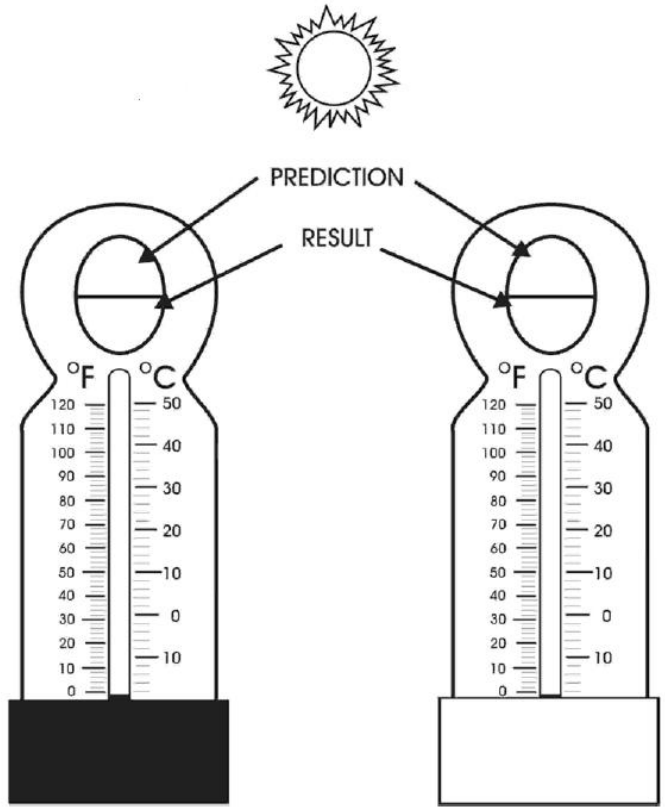
MATERIALS: 2 thermometers, scissors, one sheet each of black and white construction paper, and colored pencils, clock

PROCEDURE:

1. Put the thermometers in the sun. Cover one bulb with black paper and the other with white paper.
2. Observe the thermometers for three minutes. Record your results by coloring the thermometer tubes.
3. Look at the results and mark an X on the thermometer that was hotter.

CONCLUSION:

1. What colored shirt should you wear to play outside on a hot, sunny day?



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8. CHEMICAL REACTIONS: HANDWARMER

BACKGROUND: All substances contain heat energy. When two substances are mixed, a chemical reaction can occur to produce a new substance. Some chemical reactions absorb heat, others produce heat. Chemical reactions that absorb heat are called ENDOTHERMIC. Chemical reactions that produce heat are called EXOTHERMIC.

A hand warmer is a sealed plastic pouch containing small pieces of iron, called iron filings.

PURPOSE: To explore a chemical reaction between iron and oxygen.

QUESTION: Does the chemical reaction between iron and oxygen produce heat or absorb heat?

PREDICTION: Make a prediction to answer the question: _____

MATERIALS: 2 hand warmers, 2 zip lock bags, 2 student thermometers, scissors

PROCEDURE:

1. Cut open the hand warmer pouches and pour the contents of each one into a separate zip lock bag. Immediately place a thermometer into each bag and record the temperature of the iron filings. Feel the bags to observe the temperature of the iron filings.

   BEGINNING TEMPERATURES:

   BAG 1: _____°F _____ °C BAG 2: _____°F _____ °C

   OBSERVATION: _____

2. Remove the thermometers. Zip Bag 1 closed and leave Bag 2 wide open. Wait for 5 minutes. Feel the bags again and observe the temperature of the iron filings. Put the thermometers in the bags and record the temperature of the iron filings.

   TEMPERATURES AFTER 5 MINUTES:

   BAG 1: _____°F _____ °C BAG 2: _____°F _____ °C

   OBSERVATION: _____

3. Remove the thermometers and seal Bag 1 again, leaving Bag 2 wide open. Wait for 5 minutes. Feel the bags again and observe the temperature of the iron filings. Put the thermometers in the gabs and record the temperature of the iron filings.

   TEMPERATURES AFTER 10 MINUTES:

   BAG 1: _____°F _____ °C BAG 2: _____°F _____ °C

   OBSERVATION: _____

CONCLUSIONS:

1. Is the chemical reaction between iron and air endothermic or exothermic?
2. How can you use what you have learned in this experiment?

Putt Putt Boat Energy Flow

GROUP MEMBER NAMES/OR INDIVIDUAL NAME:_____

The Problem: Transform chemical energy to move the Putt Putt boat through the water

BACKGROUND INFORMATION:

- Energy is the ability to do work or change something.
- There are nine forms of energy including chemical, thermal, radiant/light, gravitational, motion, sound, electrical, stored mechanical, and nuclear.
- Energy cannot be created or destroyed. It merely changes form.
- The transformation of energy can be depicted with an energy flow diagram.
- Almost all energy can be traced back in a flow diagram to nuclear energy in the sun.

CRITERIA: Using the materials provided and what you know about energy forms and transformation, get the Putt Putt boat to move through the water in the pie tin under its own power.

BACKGROUND RESEARCH:

_____

_____

MATERIALS: (LABEL * ON YOUR DRAWING)

- Tin Putt Putt boat*
- Fuel holder*
- Exhaust pipes*
- Wax candle*
- Match or lighter

DESIGN:

Assemble your Putt Putt Boat and sketch the design before you test it.
Draw it to scale using graph paper. 1 sq = 1 cm

TEST YOUR FUEL DESIGN. If necessary, redesign and revise your sketch on graph paper.

DRAW AN ENERGY FLOW DIAGRAM below showing the different forms of energy transformation starting with the sun's radiant energy and ending with boat's motion energy.