



IMPORTANT:

Read all instructions before proceeding

HOT, HOT, HOT

OVERVIEW: To introduce students to the scientific concept of six different forms of energy through the use of multiple presentation and hands-on experiments.

OBJECTIVE: To explore mechanical energy, electrical energy, magnetic energy, radiant energy, and chemical energy and how heat is produced and measured in each

GRADE LEVEL: 3-5

OHIO STANDARDS: PS3, PS4

Grade 3 Physical Science: Heat, electrical energy, light, sound and magnetic energy are all forms of energy

Grade 4: PS – Energy can be transformed from one form to another or can be transferred from one location to another

TIME: 45 minutes

VOCABULARY: energy, mechanical energy, magnetic energy, electrical energy, chemical energy, nuclear energy, radiant energy, radiation, heat energy, temperature, thermometer

MATERIALS: (per group of 3-4 students)

- *Emory cloth
- *Large nail
- *Light bulb with reflector
- *Electric wire
- *Battery
- *Wire Stripper
- *Paper clips (steel)
- *Calcium Chloride (Pre-measured in glass jars)
- *Water
- *Plastic Beakers (2)
- *Thermometers (2)
- *Effervescent Antacid Tablets
- *Matches
- *Melting Blocks
- *Ice
- *Rubber rings

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PROCEDURE:

What is energy? Energy is the ability to do work or to cause activity.

SIX DIFFERENT KINDS OF ENERGY:

1. MECHANICAL: Matter which is moving or matter that is not moving because it is being held back
 2. MAGNETIC: A form of energy, similar to electrical energy, found in magnets that causes a force to act on certain kinds of objects
 3. ELECTRICAL: A form of energy, similar to magnetic energy, that causes forces to act on objects; also, the energy that causes electricity to flow through electric wires
 4. CHEMICAL: A form of stored energy that is released, often as heat and light, during a chemical change
 5. NUCLEAR: The forms of energy (like visible light) that are given off by radiation. Radiation is the moving outward of energy from an object in the form of rays, waves, or particles.
- C. We can study matter in several ways—by its FORM and by its REACTIONS

What is important to understand is that HEAT is a form of energy that can be used to do work, but which is only given off when another form of energy is also present. Heat is the energy transferred between materials or parts of a material that have different temperatures.

You can not have heat energy by itself. Heat energy will always be around when another type of energy is in use.

To determine the amount of heat present in matter, you take its temperature. If matter loses heat, its temperature falls. If matter gains heat, its temperature rises.

EXPERIMENT 1: MECHANICAL ENERGY AND HEAT

1. Have the children rub their hands together very quickly. The result is warm hands due to friction. You are taking the mechanical energy of movement, with friction, which generates heat.
2. Distribute a nail and a piece of Emory cloth. In a few seconds, the nail will be warm due to friction.

EXPERIMENT #2: ELECTRICAL, MAGNETIC, AND RADIANT ENERGY AND HEAT

1. The demonstrator turns on the electric light bulb in the reflector. Very shortly, the bulb is hot. The electricity is causing light and heat. If we warm our hands up with the heat from light, we are using RADIANT energy. The electric energy is causing the electricity to flow through the wires.
2. The demonstrator uses a magnet to pick up the nails. This demo shows the use of magnetic energy.
3. Distribute a nail, wire, paper clips, and a battery. If the ends of the wire are not stripped, use the wire stripper to remove the insulation prior to distributing the wire.
4. Have the children wrap the nail with the wire leaving about 8" of ends exposed.
5. After the nail is wrapped, touch the ends of the wire to the battery terminals. In a few seconds the nail/wire will become warm.
6. While the battery is connected, try to pick up the paper clips. The electric energy made in the battery is making the nail magnetic. The magnetic energy is picking up the paper clips. If you feel the wire, the wire is warm due to the electric energy in use.

EXPERIMENT #3: CHEMICAL ENERGY AND HEAT:

1. The demonstrator lights a match. The match is burning and changes into ash, gases, and water. This type of change is called a chemical change. The energy in the match was given off as heat and light since it was given off during a chemical change, it is called chemical energy.
2. Distribute the materials to the children, except the matches. Pre-measure the calcium chloride into a glass bottle (about 10ml). Add 90ml of tap water to each plastic beaker.
3. TELL the students that they will be using chemicals and they are not to touch the chemicals with their hands. If they do touch the chemicals, they need to wash their hands. If they do touch the chemicals, tell them not to touch their faces or put their fingers into their mouths. They need to wash their hands.
4. If necessary, explain what a thermometer is and how it works.
5. Place the thermometers into the beakers. Measure the temperature and record it on the worksheet. Specifically tell the children that the effervescent tablets will go into one beaker and the salt will go into the other beaker. Tell them that after the chemicals are added, they have to watch the thermometers to see what is happening to the temperatures of the water.
6. In one cup, add the pre-measured amount of calcium chloride. In the other cup, add two effervescent tablets. Start measuring the temperature of both cups.
7. The thermometer is determining the amount of heat in the water. When one chemical is added to the water, it is chemically reacting with the water and is releasing heat energy to make it feel warmer. When the other chemical is added to the water, it is chemically reacting with the water and is absorbing heat from the water, making it feel colder. The calcium chloride cup will get hotter. The effervescent cup will get colder.

EXPERIMENT #4 MELTING BLOCKS

1. Pass out the melting blocks to the groups of students.
2. Ask them to hypothesize which ones will melt the fastest.
3. After discussion, put ice on each one.
4. Discussion: The metal will melt faster because the metal conducts the heat.

VOCABULARY WORDS:

ENERGY—The ability to do _____ or to cause _____

Form of Energy:

1. MECHANICAL—Matter which is moving or matter that is not moving because it is being held back
2. MAGNETIC —A form of energy, similar to electrical energy, found in magnets that cause a force to act on certain kinds of objects.
3. ELECTRICAL—A form of energy, similar to magnetic energy, that causes forces to act on objects; also, the energy that causes electricity to flow through electric wires.
4. CHEMICAL —A form of stored energy that is released, often as heat and light, during a chemical change.
5. NUCLEAR—A form of energy given off when one kind of atom splits into two or more parts.
6. RADIANT—The forms of energy (like visible light) that are given off by radiation.

*Radiation is the moving outward of energy from an object in the form of rays, waves, or particles.

7. HEAT —A form of energy that can be used to do work, but which is only given off when another form of energy is also present. Heat is the energy transferred between materials or parts of a material that have different temperatures.

EXPERIMENT #1: MECHANICAL ENERGY

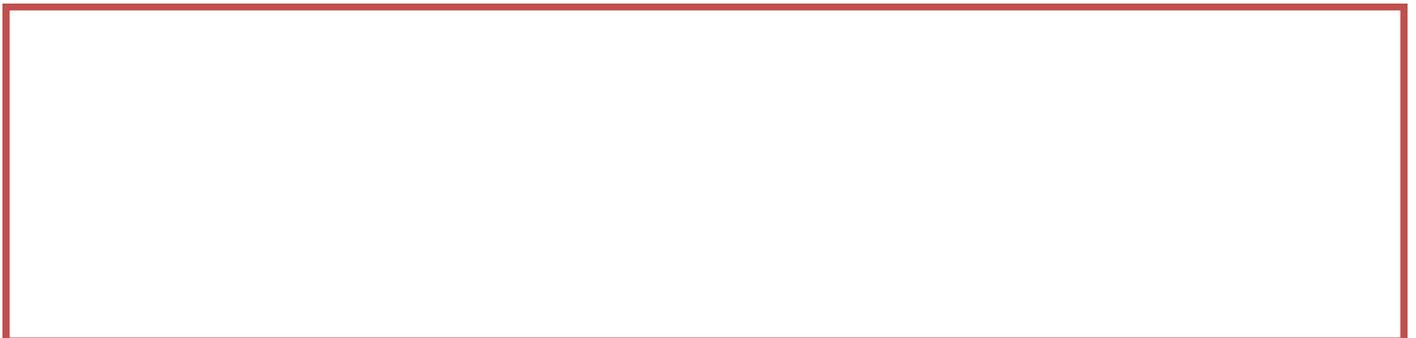
What got hot? _____

EXPERIMENT #2: ELECTRICAL AND MAGNETIC ENERGY

Draw a picture of your electromagnet and label the pieces used to make it.

Word List: *Battery *Wire

*Nail *Paper clips



| | |
|--------------------------------|--|
| NUMBER OF PAPERCLIPS LIFTED | |
| NUMBER OF WINDINGS AROUND WIRE | |

EXPERIMENT #3: CHEMICAL ENERGY

| STARTING temperature | Temperature of water in beaker | DIFFERENCE in the temperature between the before water and: |
|--------------------------------|--|---|
| Beaker #1 _____ | AFTER ADDING THE SALT: _____ | AFTER ADDING THE SALT: _____ |
| Beaker #2 _____ | AFTER ADDING THE ANTACID TABLET: _____ | AFTER ADDING THE ANTACID TABLET: _____ |

EXPERIMENT #4: MELTING BLOCKS

Hypothesize which block will melt the ice the fastest? _____

Why? _____

