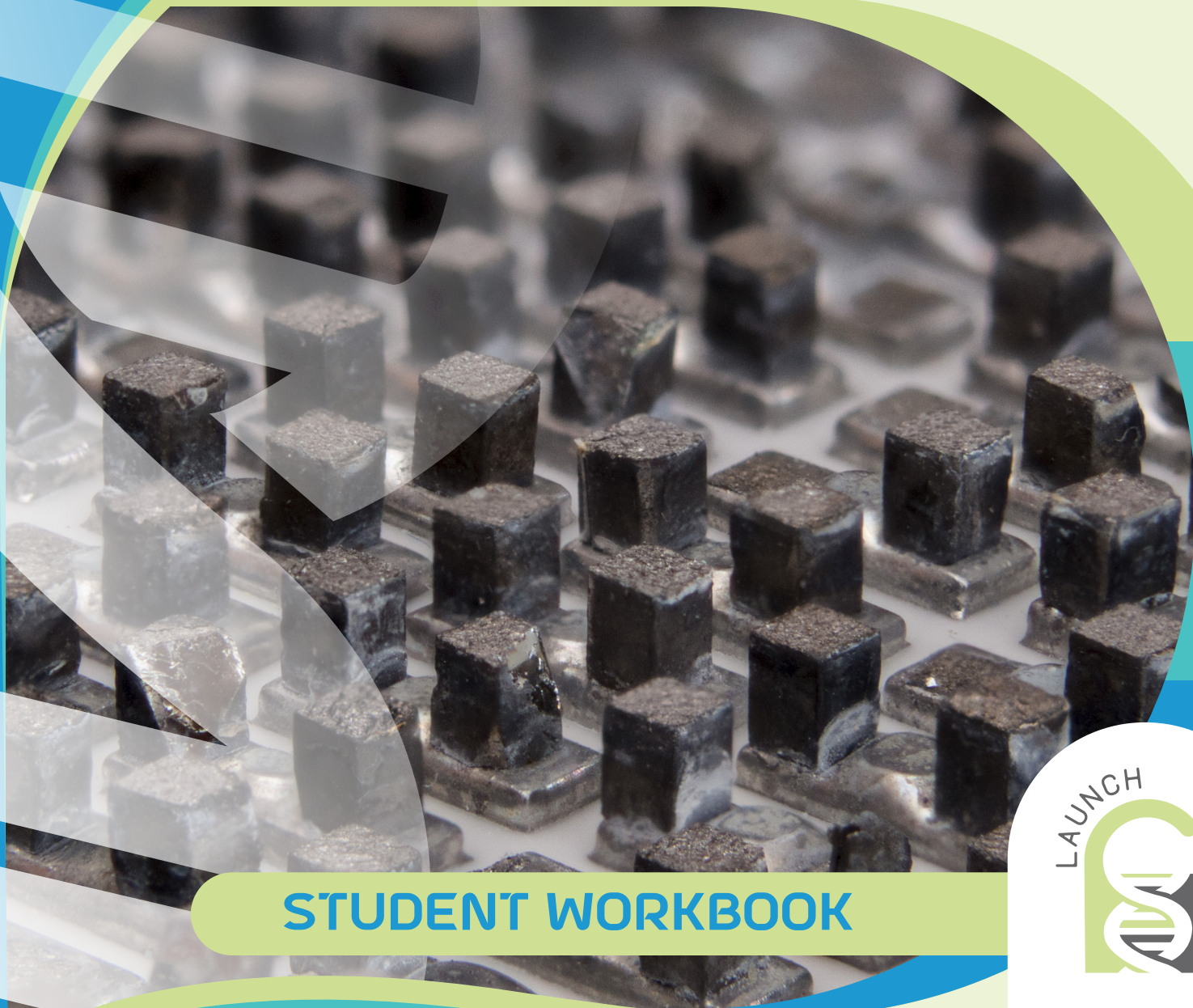


THE MATERIAL WORLD



STUDENT WORKBOOK

LAUNCH



ACTIVITY

1

ENERGY SWITCH

Use a thermoelectric generator to quickly convert between electric and thermal energy. Then, find out how this device is used behind the scenes in everyday life.

LEARNING GOALS:



I can use scientific and technical information to explain why the molecular-level structures of materials are important to their functions.

I

HEAT IN A HURRY

WHAT YOU NEED:

FROM THE KIT:

- Battery
- Battery cap
- Thermoelectric generator

FROM THE KIT

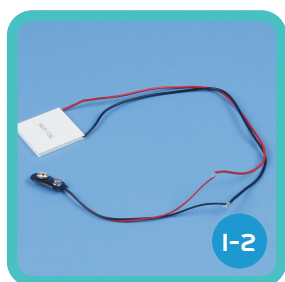
- Scissors or wire strippers



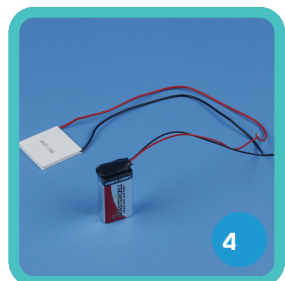
SAFETY!

WARNING! Batteries can be dangerous. Store away from metal objects. Only use with an adult's supervision.

WARNING! An adult should help cut thicker materials like cardboard and plastic. Always cut away from your body.



1-2



4

WHAT TO DO:

1. Twist the exposed end of the black wire of the thermoelectric generator around the exposed end of the black wire of the battery cap. Use the scissors or wire strippers to cut more rubber off the ends of the battery cap wires if needed.
2. Repeat Step 1 with the red wires.
3. Predict what will happen when you connect the battery cap to the battery. What changes do you think you will observe in the thermoelectric generator? Write your predictions in the Heat in a Hurry Table.
4. Connect the battery cap and observe for 5–10 seconds. Write your results in the table.



Note: Don't hold the generator in your hand, don't touch it for more than a few seconds at a time, and don't let it stay connected for more than 10 seconds.



THINK ABOUT IT!

? At this point, you have limited information about how the thermoelectric generator works. Based on what you know so far, develop an initial model of the flow of energy within the device and draw its internal structure.



MARVELOUS MATERIALS: AEROGEL



Discovery/invention: Steven Kistler in 1931, United States

Chemical structure: Varies, with common types including air in silica, air in carbon, or air in a metal oxide

Physical properties: Extremely strong and light, often fireproof, translucent, dry

How it's made: The liquid is removed from a gel through freeze-drying or drying under high pressure.

Uses: Insulation, catalysts, chemical spills, cosmic dust catcher, supercapacitors, fabrics, medicine delivery, laser targets



BIOLOGICAL POLYMERS

There are many polymers that allow organisms to function.

The major categories of biological polymers are:



Carbohydrates, such as starch and glycogen. These provide energy for cells, give rigidity to cells, and act as tiny messengers.



Proteins, such as collagen, keratin, and lactase. Most enzymes are proteins, and they also perform other functions such as providing structure and sending messages between cells.



Lipids, such as cholesterol, oil, and phospholipids. They make up membranes, store energy, and are active in cell signaling.



Nucleic acids, including deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Nucleic acids store and transmit the genetic information of all organisms.

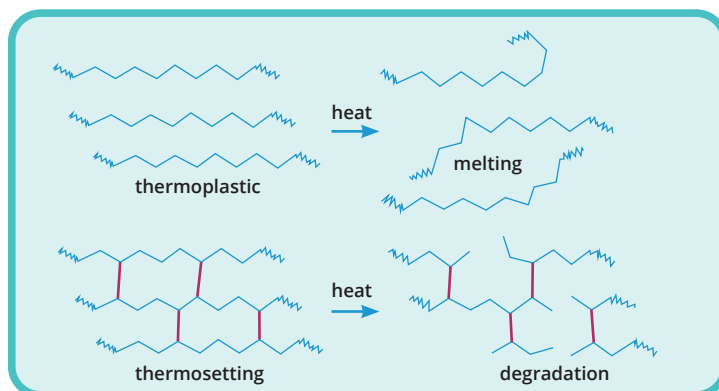
5

PLASTICS ARE POLYMERS

You may have recognized several of the example polymers as being plastics. **Plastics** are polymers that are made mostly of carbon and hydrogen that can be molded into shapes.

There are many types of plastics. They can be categorized or sorted in several ways. One of these ways is by labeling them as either thermoplastics or thermosets.

Thermoplastics keep their chemical structure when heated, so they can be molded and shaped repeatedly. **Thermosets** go through an irreversible decomposition reaction when heated, so they can only be shaped when they are first made.



Other ways of categorizing plastics are molecular structure (crystalline plastics have a highly ordered internal structure while amorphous plastics do not), hardness, biodegradability (tendency to break down over time), and density. In the earlier examples, many properties that included these categorizations were listed.



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Kit	SU-MATWOR
Instructions	IN-MATWORS
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