

Section 4

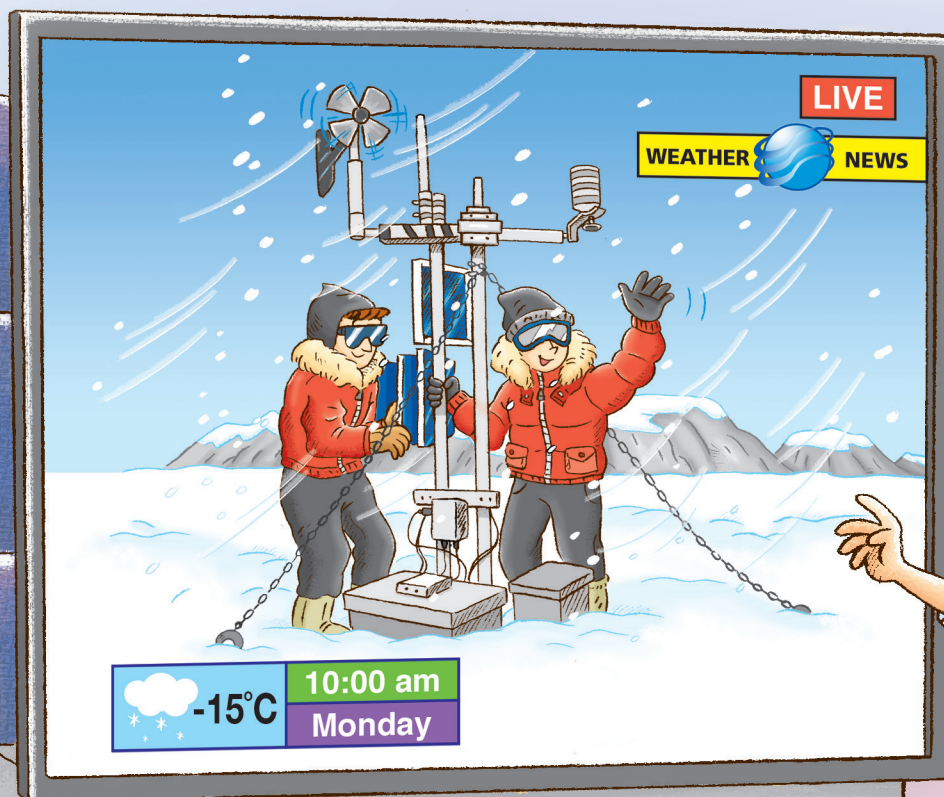
Understanding Earth and Space Systems

EXPLORATION 1

Egg in a Bottle

Study the transfer of heat energy and its effects on air pressure.

You might have heard something like this from meteorologists during a weather forecast: “Expect a cloudy and windy morning with substantial rainfall as a low-pressure system is moving into the area.” or “The high-pressure system will bring in sunny and calm weather tomorrow – perfect for outdoor activities.” Air pressure, as you have learned, is the pressure that air puts on all things. We cannot feel this pressure because our own body presses back against it. But air pressure affects us in many ways, including through the changes in weather. Do you think that air pressure exerts force? Also, does heat energy affect air pressure?



Our crew is reporting on the site with the squalling snow as the low-pressure system is moving in from the north. We'll report back for more weather updates.

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Try this experiment to understand the transfer of heat energy and how it affects air pressure.

Materials:

- a hard-boiled egg
- a glass bottle (with a mouth smaller than the egg)
- cooking oil
- a small strip of paper
- a paper towel

Steps:

1. Make a hard-boiled egg. Peel off the shell and let it cool.
2. Dip a small piece of the paper towel in the cooking oil and coat the inside edge of the bottle's mouth with the oil.
3. Place the smaller end of the egg downward on the bottle. Make sure that it seals the bottle's opening and that does not slide right in. Remove the egg.
4. Ask an adult to light one end of the strip of paper and drop it into the bottle.
5. Immediately place the egg back on the bottle. Observe.

This experiment involves open flames, so conduct this experiment with an adult.



Ask yourself!

- Did the egg get sucked into the bottle? Why or why not?
- Do you think an egg is best suited for this experiment? Could a table tennis ball work as well?

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When the lit piece of paper was dropped in the bottle, the heat energy was transferred to the air inside the bottle and it quickly heated up. This heated air expanded and pushed the egg to escape the bottle. This made the egg vibrate and resulted in less air in the bottle. However, once the flame went out, the air cooled back down and no longer expanded. When the bottle had less air than before, what resulted was less air pressure inside the bottle as compared to the pressure outside the bottle. Since air pressure flows from high to low, the outside higher-pressure air came rushing into the bottle in order to equalize the lower-pressure air in the bottle. However, the egg was blocking the opening for air to enter, so the air outside pushed the egg into the bottle. Therefore, from this experiment, you can see that heat energy can create a difference in air pressure and this difference can exert a force; in this case, the egg was pushed into the bottle.

