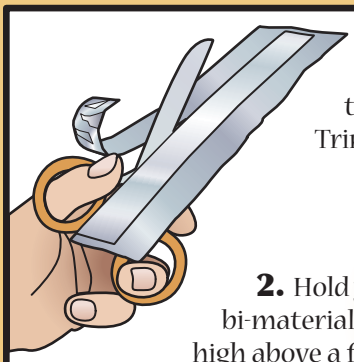
## Another FREE SAMPLE LAB from TOPS LEARNING SYSTEMS!

This **TOPS Idea** is taken from an original series of black-and-white line masters, adapted to stand alone as an independent mini-lesson. Please purchase our original book to get the whole in-depth program.

# bi-material strip

…adapted from **KINETIC MODEL #14** by TOPS Learning Systems



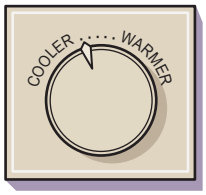
**1.** Stick about 15 cm of clear tape to the dull side of aluminum foil. Trim away all untaped foil.

**2.** Hold your bi-material strip high above a flame. Which way does it bend?

**3.** Aluminum and tape **expand** when heating, and **contract** when cooling.

**a.** Are the changes equal for both materials? Explain.

**b.** How does a bimetal strip work in a thermostat?




*** PROJECT:** Light a flashlight bulb with a candle. Use your bi-material strip, batteries, and other simple things.



### OBJECTIVE

To observe how a bi-material strip bends as its dissimilar sides expand and contract by different amounts. To apply this idea to thermostats.

### LAB NOTES / ANSWERS

Photocopy the activity for each student or team.

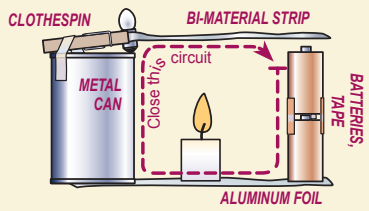
**Step 2.** The strip bends toward its aluminum side as it heats up, and away from its aluminum side as it cools down.

**Step 3a.** No. On heating, the tape expands (lengthens) faster, bending toward the relatively shorter aluminum. On cooling, the tape contracts (shortens) faster, bending away from the relatively longer aluminum side.

**Step 3b.** In a thermostat, a bi-material strip acts as a switch, turning the heat on or off. (We call these *bimetal* strips because the two sides are composed of different metals.) As a strip cools, it bends toward an electrical contact, completes the circuit, and turns on the heat. A warming strip bends in the opposite direction, breaking contact. (An air conditioner thermostat closes the circuit as it gets warmer.)

### PROJECT

*Here is one possible design:*




### EVALUATION

**Q.** To remove a tight metal lid from a jar, it sometimes helps to hold the lid under hot water. Why is this effective?

**A.** Heat expands the metal lid more rapidly than the glass. This increases the space between the two materials, loosening the lid.

### MATERIALS

- Clear tape and aluminum foil.
- A metric ruler and scissors.
- A candle and matches.
- For project: Flashlight bulb, batteries, and various construction materials you have available; drawing above shows one design.

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*Find more at* **www.TOPScience.org**!

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