

TEACHERS GUIDE



COMPOUND BAR
ITEM # 3230-00

CHEMISTRY - PROPERTIES OF MATTER

- What commonplace devices rely on the fact that different metals expand at different temperatures?
- How does a home thermostat work?

Demonstrate the usable force created by unequal expansion of heated metals. One laminated metal strip on each side of a bar with a wooden. When one metal expands more quickly than the other, it pushes the other metal backwards, according to the differing coefficients of linear expansion.



Materials

- 4-5 Compound Bars
- 4-5 blow dryers or other heat sources
- dominoes
- marbles with track and/or plastic cars with track

Goals & Objectives

Students will:

- describe the forces that affect objects
- relate uses for the behavior of metals

ASSESSMENT

Participation of lab and discussion, working model with object reaching desired spot, explanation of use of heat to trigger furnace.

ACTIVITIES

- 1 Organize the students in groups of 3-4.
- 2 Discuss with students how technology allows us to accomplish tasks in our absence, or with less of our effort. Ask how machinery is built to automatically cause this to happen. Guide students to realize that the trick is often to get an element to do what it does naturally, just in an area that will trigger a desired effect. One such example is to use metals and their response to heat to create work.
- 3 Have one student per group to hold the compound bar, and another to turn the blow dryer on high, aimed down the metal strips. The other student(s) should observe the response as one side expands sooner and exerts energy on the other, causing the bar to bend.
- 4 Once an obvious change has occurred, stop the experiment. Discuss the result, and the reason one side would push the other side over. (Two different metals that respond to heat at different speeds. As one expands, it exerts force against the other.)
- 5 Now it's time to use this reaction to our benefit. Give each group a set of dominoes, or marbles with a track, or plastic car with a track. Students are to work together to

create an apparatus which can use the compound bar's reaction to push into the domino/marble/car until it is moved to a designated point. Groups should be able to modify their initial plan twice to achieve the goal.

Note

It is always best to **DO** an experiment ahead of time to be able to best present it to the class.



- 6 Students will look online at HowStuffWorks.com for how this concept is used in a home thermostat. Then they will explain what force triggers the furnace and the steps that occur. (Heat is the triggering element. As the inner metal coil cools, it winds tightly, tipping the mercury switch so as to close an electrical circuit, causing the furnace to begin heating. As it heats, the metal coil heats, tipping the mercury in the opposite direction to shut the furnace off.)