Name: _____ Date: _____

Two Metals That Bend When They Warm Up

Circle group

Almost every material gets a little bigger when it is heated. It gets a little smaller when it cools. The change is small, but different materials change by different amounts. Brass grows more than steel for the same rise in heat. Inventors found a way to use this difference. They made a bimetallic strip.

To make one, a maker bonds a thin strip of brass to a thin strip of steel. They are stuck so tightly that they act as one piece. At room temperature the strip is straight. When it is warmed, the brass tries to grow longer than the steel. The two layers are stuck together, so the only way both can fit is to curve. The brass is on the outside of the bend. When the strip cools, it gets straight again. If it gets colder than where it began, it bends the other way.

An old wall thermostat used this trick. The strip was often a coil, because a coil turns a small bend into a bigger movement. As the room warmed, the coil slowly turned. At the set temperature, the motion tipped a small switch or pulled a contact apart, and the furnace shut off. When the room cooled, the coil turned back. The switch closed, and the heat came on.

The strip is used in other things too. Some kitchen thermometers, toasters and irons use one to cut power when they get too hot. It is simple. The metal itself feels the heat and moves. No computer is needed.

Questions

1. Which metal grows more for the same rise in heat, brass or steel?

_____

_____

2. How is a bimetallic strip made?

_____

_____

3. Why was the strip in a thermostat often a coil?

_____

_____

4. What happened when the room reached the set temperature?

_____

_____

5. Why does the strip curve and not just grow longer?

_____

_____

6. Why is the strip called simple?

_____

_____

Words to know

bimetallic: made of two different metals

thermostat: a device that keeps a room or machine at a set temperature

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Two Metals That Bend When They Warm Up

Triangle group

Almost every material grows slightly when it is heated and shrinks slightly when it cools, and although the change is small, different materials change by different amounts. Brass, for example, expands more than steel for the same rise in temperature. Inventors learned to turn that difference into a useful tool called a bimetallic strip.

To make one, a manufacturer bonds a thin strip of brass to a thin strip of steel so tightly that they behave as a single piece. At room temperature the strip is straight. When it is warmed, the brass tries to grow longer than the steel. The two layers are stuck together, so the only way both can fit is for the strip to curve, with the brass on the outside of the bend. When the strip cools, it straightens again. If it becomes colder than its starting temperature, it bends the other way.

A traditional thermostat on a wall once relied on this trick. The strip was often shaped into a coil, because a coil magnifies a small bend into a larger movement. As the room warmed, the coil slowly turned. When the temperature reached the setting, the motion tipped a small switch or pulled a contact apart, and the furnace shut off. As the room cooled, the coil turned back, the switch closed, and the heat came on again.

The same strip appears in many other devices, such as some kitchen thermometers, toasters, and irons that cut off power when they become too hot. Its great advantage is simplicity, since the metal itself senses the temperature and moves, with no computer required.

Questions

1. Which metal expands more for the same rise in temperature, brass or steel?

_____

_____

2. How is a bimetallic strip made?

_____

_____

3. Why was the strip in a thermostat often shaped into a coil?

_____

_____

4. What happened when the room reached the temperature setting?

_____

_____

5. Why does the strip curve instead of just growing longer?

_____

_____

6. Why is the strip described as simple?

_____

_____

Words to know

expand: to grow bigger or take up more space
bimetallic: made of two different metals
thermostat: a device that keeps a room or machine at a set temperature
magnifies: makes something seem or act bigger

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Two Metals That Bend When They Warm Up

Square group

Almost every material grows slightly when it is heated and shrinks slightly when it cools, and although the change is small, different materials respond by different amounts. Brass, for example, expands considerably more than steel for the same rise in temperature. Inventors eventually learned to turn that difference into a remarkably useful device called a bimetallic strip.

To make one, a manufacturer bonds a thin strip of brass to a thin strip of steel so securely that they behave as a single piece. At room temperature the strip is perfectly straight. When it is warmed, the brass tries to grow longer than the steel. The two layers are firmly attached to each other, so the only way both can fit is for the strip to curve, with the brass on the outside of the bend. When the strip cools, it straightens again. If it becomes colder than its starting temperature, it bends in the opposite direction.

A traditional thermostat on a wall once relied on this principle. The strip was often shaped into a coil, because a coil magnifies a small bend into a much larger movement. As the room warmed, the coil slowly turned. When the temperature reached the chosen setting, the motion tipped a small switch or pulled a contact apart, and the furnace shut off. As the room cooled, the coil turned back, the switch closed, and the heat came on once more.

The same strip appears in many other devices, such as some kitchen thermometers, toasters, and irons that cut off their power when they become too hot. Its greatest advantage is simplicity, since the metal itself senses the temperature and moves, with no computer required.

Questions

1. Which metal expands more for the same rise in temperature, brass or steel?

_____

_____

2. How does a manufacturer make a bimetallic strip?

_____

_____

3. Why was the strip in a thermostat often shaped into a coil?

_____

_____

4. What happened when the room reached the chosen setting?

_____

_____

5. Why does the strip curve instead of simply growing longer?

_____

_____

6. Why is the strip described as having the advantage of simplicity?

_____

_____

Words to know

expand: to grow bigger or take up more space
bimetallic: made of two different metals
thermostat: a device that keeps a room or machine at a set temperature
magnifies: makes something seem or act bigger

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: Two Metals That Bend When They Warm Up

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: Two Metals That Bend When They Warm Up

Easier · 255 words · Flesch-Kincaid grade 3.5

1. Brass.
2. A thin strip of brass is bonded to a thin strip of steel.
3. A coil turns a small bend into a bigger movement.
4. The motion tipped a switch or pulled a contact apart, and the furnace shut off.
5. The layers grow by different amounts but are stuck together, so the strip must bend.
6. The metal itself feels the heat and moves, so no computer is needed.

Triangle: Two Metals That Bend When They Warm Up

This passage · 268 words · Flesch-Kincaid grade 7.6

1. Brass.
2. A thin strip of brass is bonded tightly to a thin strip of steel.
3. A coil magnifies a small bend into a larger movement.
4. The motion tipped a switch or pulled a contact apart, and the furnace shut off.
5. The two layers grow by different amounts but are stuck together, so the strip must bend.
6. The metal itself senses the temperature and moves, so no computer is needed.

Square: Two Metals That Bend When They Warm Up

Harder · 280 words · Flesch-Kincaid grade 8.8

1. Brass expands considerably more than steel.
2. By bonding a thin strip of brass to a thin strip of steel.
3. A coil magnifies a small bend into a much larger movement.
4. The motion tipped a small switch or pulled a contact apart, and the furnace shut off.
5. The two layers expand by different amounts but are firmly attached, so the strip must bend.
6. The metal itself senses the temperature and moves, so no computer is required.