Name: _____ Date: _____

How a Thermos Keeps Drinks Hot

Circle group

A good thermos can keep soup steaming for hours on a cold trail. It can keep lemonade icy on a hot day. To see how, you need to know a fact. Heat always moves from warmer things toward cooler things. It travels in three ways.

Conduction is heat passing through things that touch. A spoon handle warms up in hot soup. Convection is heat carried by moving liquids or gases. Warm air rises above a radiator. Radiation is heat that travels as invisible waves. Sunshine warms your face across empty space. A thermos blocks all three.

The bottle has two walls with a gap between them. Most of the air is pumped out of the gap. That makes a vacuum. With almost nothing in the gap, little heat can move by conduction or convection. The inner wall has a shiny coating. It reflects radiation like a mirror bounces back light. A tight stopper keeps warm air from escaping at the top.

A Scottish scientist, James Dewar, invented it in 1892. A thermos does not make anything hot or cold. It slows heat down. Your drink stays near its first temperature much longer.

Questions

1. What are the three ways heat travels?

_____

_____

2. What is in the gap between the two walls?

_____

_____

3. What does the shiny coating do?

_____

_____

4. Why does a thermos keep lemonade cold on a hot day?

_____

_____

5. Why does a vacuum stop heat from crossing the gap?

_____

_____

Words to know

conduction: heat moving through materials that touch
convection: heat carried by moving liquids or gases
radiation: heat that travels as invisible waves
vacuum: a space with almost no air or matter in it
reflects: bounces back instead of passing through
stopper: a plug that closes the top of a bottle

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: _____

How a Thermos Keeps Drinks Hot

Triangle group

A good thermos can keep soup steaming for hours on a cold hiking trail, and it can keep lemonade icy on a hot afternoon. To see how it works, it helps to know that heat always moves from warmer things toward cooler things, and that it travels in three ways.

Conduction is heat passing through touching materials, such as the handle of a spoon warming up in hot soup. Convection is heat carried by moving liquids or gases, like warm air rising above a radiator. Radiation is heat that travels as invisible waves, the way sunshine warms your face across empty space. A thermos is built to block all three.

The bottle has two walls with a gap between them. Most of the air has been pumped out of that gap, which makes a vacuum. With almost nothing in the gap, there is little to carry heat by conduction or convection. The inner wall is also coated with a shiny layer that reflects radiation, much as a mirror bounces back light. Finally, a tight stopper keeps warm air from escaping at the top.

The design was invented by a Scottish scientist, James Dewar, in 1892. A thermos does not make anything hot or cold. It simply slows heat down so that your drink stays near its original temperature far longer.

Questions

1. What are the three ways that heat travels?

_____

_____

2. What is in the gap between the two walls of a thermos?

_____

_____

3. What does the shiny coating on the inner wall do?

_____

_____

4. Why does a thermos help keep lemonade cold on a hot day?

_____

_____

5. Why is a vacuum good at stopping heat from passing through the gap?

_____

_____

Words to know

conduction: heat moving through materials that touch
convection: heat carried by moving liquids or gases
radiation: heat that travels as invisible waves
vacuum: a space with almost no air or matter in it
reflects: bounces back instead of passing through
stopper: a plug that closes the top of a bottle

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: _____

How a Thermos Keeps Drinks Hot

Square group

A well-made thermos can keep soup steaming for hours on a frigid hiking trail, and it can keep lemonade icy throughout a sweltering afternoon. To understand how it accomplishes this, it helps to know that heat always moves from warmer objects toward cooler ones, and that it travels in three distinct ways.

Conduction is heat passing through materials that touch one another, such as the handle of a spoon gradually warming up in hot soup. Convection is heat carried by moving liquids or gases, like warm air rising above a radiator. Radiation is heat that travels as invisible waves, in the same way that sunshine warms your face across the emptiness of space. A thermos is engineered to block all three.

The bottle consists of two walls separated by a narrow gap. Nearly all of the air has been pumped out of that gap, which creates a vacuum. With almost nothing inside the gap, there is very little to carry heat by conduction or convection. The inner wall is also coated with a shiny layer that reflects radiation, much as a mirror bounces back light. Finally, a tight stopper prevents warm air from escaping at the top.

The design was invented by a Scottish scientist named James Dewar in 1892. A thermos does not actually make anything hot or cold. It merely slows the movement of heat so that your drink remains close to its original temperature for far longer.

Questions

1. What are the three distinct ways that heat travels?

_____

_____

2. What exists in the narrow gap between the two walls of a thermos?

_____

_____

3. What is the purpose of the shiny coating on the inner wall?

_____

_____

4. Why does a thermos also help keep lemonade cold throughout a sweltering afternoon?

_____

_____

5. Why is a vacuum effective at preventing heat from crossing the gap?

_____

_____

Words to know

conduction: heat moving through materials that touch
convection: heat carried by moving liquids or gases
radiation: heat that travels as invisible waves
vacuum: a space with almost no air or matter in it
reflects: bounces back instead of passing through
stopper: a plug that closes the top of a bottle

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: How a Thermos Keeps Drinks Hot

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

Circle: How a Thermos Keeps Drinks Hot

Easier · 191 words · Flesch-Kincaid grade 3.7

1. Conduction, convection, and radiation.
2. A vacuum, because most of the air is pumped out.
3. It reflects radiation.
4. It slows heat from the warm outside so it cannot easily reach the drink.
5. With almost nothing in the gap, little heat can move by conduction or convection.

Triangle: How a Thermos Keeps Drinks Hot

This passage · 219 words · Flesch-Kincaid grade 6.9

1. Conduction, convection, and radiation.
2. A vacuum, because most of the air has been pumped out.
3. It reflects radiation.
4. It slows heat from the warm outside so it cannot reach the drink easily.
5. With almost nothing in the gap, there is little to carry heat by conduction or convection.

Square: How a Thermos Keeps Drinks Hot

Harder · 240 words · Flesch-Kincaid grade 8.8

1. Conduction, convection, and radiation.
2. A vacuum, because nearly all of the air has been pumped out.
3. It reflects radiation.
4. It slows the movement of heat from the warm outside, so it cannot easily reach the drink.
5. With almost nothing inside the gap, there is very little to carry heat by conduction or convection.