Name: _____ Date: _____

Blocking Three Escape Routes for Heat in a Flask

Circle group

A good vacuum flask can keep soup hot all morning. It can keep water cold all afternoon. It does not make heat or cold. It only slows the trip that heat takes from a warm place to a cooler one. Heat is always on the move, and it has three ways to travel. A good flask blocks all three.

The first way is conduction. Heat passes from particle to particle through a solid or a liquid, like a message passed along a line of people. The second is convection. Warm fluid moves and carries heat with it, like warm air rising from a heater. The third is radiation. Heat travels as invisible waves that need no material to cross.

A flask is really two containers, one inside the other. They are joined only at the neck. Almost all the air has been pumped out of the gap between them. This leaves a vacuum. A vacuum has very few particles, so heat has almost nothing to pass itself along. Conduction is stopped. With no air in the gap, no air can move either. Convection is stopped too.

Radiation can still cross empty space. So the inner wall has a shiny, mirror-like coating. A shiny surface reflects heat waves back. The weak spot is the stopper. Heat can creep through the neck and the lid. That is why a flask loses heat slowly, not never.

Questions

1. What are the three ways heat can travel?

_____

_____

2. How is a flask built to have an empty gap?

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_____

3. Why does a vacuum stop conduction?

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_____

4. What stops convection in a flask?

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_____

5. Why is the inner wall shiny?

_____

_____

6. Why does a flask lose heat slowly, not never?

_____

_____

Words to know

conduction: heat passing from one particle to the next
convection: heat carried along by moving air or liquid
radiation: heat that travels in waves through space
vacuum: a space with almost no air or matter in it
stopper: a plug or lid that closes the opening 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: _____

Blocking Three Escape Routes for Heat in a Flask

Triangle group

A good vacuum flask can keep soup hot through a long morning and keep water cold through a hot afternoon, but it does not make heat or cold. It only slows the trip that heat takes from a warm place to a cooler one. Heat is always on the move, and it has three different ways to travel, all of which a well-built flask manages to block.

The first way is conduction, in which heat passes from particle to particle through a solid or a liquid, like a message passed along a line of people. The second is convection, in which warmer fluid itself moves and carries heat with it, as when warm air rises from a heater. The third is radiation, in which heat travels as invisible waves that need no material to cross.

A flask is really two containers, one inside the other, joined only at the neck. Almost all the air has been pumped out of the gap between them, which leaves a vacuum, and because a vacuum has very few particles, heat has almost nothing to hand itself along, so conduction is stopped. With no air in the gap, there is also no moving air, so convection is stopped as well.

Radiation can still cross empty space, so the inner wall has a shiny, mirror-like coating. A shiny surface reflects heat waves back instead of letting them pass. The weak spot of a flask is its stopper, because heat can creep through the neck and the lid. That is why a flask loses heat slowly rather than never.

Questions

1. What are the three ways heat can travel?

_____

_____

2. How is a flask built to include an empty gap?

_____

_____

3. Why does a vacuum stop conduction?

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_____

4. What stops convection in a flask?

_____

_____

5. Why is the inner wall shiny?

_____

_____

6. Why does a flask lose heat slowly rather than never?

_____

_____

Words to know

conduction: heat passing from one particle to the next
convection: heat carried along by moving air or liquid
radiation: heat that travels in waves through space
vacuum: a space with almost no air or matter in it
stopper: a plug or lid that closes the opening 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: _____

Blocking Three Escape Routes for Heat in a Flask

Square group

A well-made vacuum flask can keep soup steaming through a long morning and keep water icy through a sweltering afternoon. It does not manufacture heat or cold. Its only accomplishment is to slow the journey that heat makes from a warm place to a cooler one. Heat is always on the move, and it has three different ways of traveling, all of which a carefully built flask manages to block.

The first way is conduction, in which heat passes from particle to particle through a solid or a liquid, rather like a message handed along a line of people. The second is convection, in which warmer fluid itself moves and carries heat along with it, as when warm air rises from a heater. The third is radiation, in which heat travels as invisible waves that require no material to cross.

A flask is really two containers, one nested inside the other and joined only at the neck. Nearly all of the air has been pumped out of the gap between them, which leaves a vacuum. A vacuum contains very few particles, so heat has almost nothing to hand itself along, and conduction is halted. Without air in the gap, there is also no moving air, so convection is halted as well.

Radiation can still cross empty space, which is why the inner wall carries a shiny, mirror-like coating. A shiny surface reflects heat waves back instead of allowing them to pass through. The weakest point of a flask is its stopper, because heat can creep through the neck and the lid. That is why a flask loses heat slowly, rather than never.

Questions

1. What are the three ways in which heat can travel?

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_____

2. How is a flask constructed to include an empty gap?

_____

_____

3. Why does a vacuum halt conduction?

_____

_____

4. What halts convection in a flask?

_____

_____

5. Why does the inner wall carry a shiny coating?

_____

_____

6. Why does a flask lose heat slowly rather than never?

_____

_____

Words to know

conduction: heat passing from one particle to the next
convection: heat carried along by moving air or liquid
radiation: heat that travels in waves through space
vacuum: a space with almost no air or matter in it
stopper: a plug or lid that closes the opening 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: Blocking Three Escape Routes for Heat in a Flask

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

Circle: Blocking Three Escape Routes for Heat in a Flask

Easier · 234 words · Flesch-Kincaid grade 3.6

1. Conduction, convection, and radiation.
2. It is two containers, one inside the other, with the air pumped out between them.
3. It has very few particles to pass heat along.
4. There is no air in the gap to move and carry heat.
5. A shiny surface reflects heat waves back instead of letting them pass.
6. Heat can still creep through the neck and the stopper.

Triangle: Blocking Three Escape Routes for Heat in a Flask

This passage · 264 words · Flesch-Kincaid grade 8.1

1. Conduction, convection, and radiation.
2. It is two containers, one inside the other, with the air pumped out between them.
3. It has very few particles to pass heat along.
4. There is no air in the gap to move and carry heat.
5. A shiny surface reflects heat waves back instead of letting them pass.
6. Heat can still creep through the neck and the stopper.

Square: Blocking Three Escape Routes for Heat in a Flask

Harder · 274 words · Flesch-Kincaid grade 8.2

1. Conduction, convection, and radiation.
2. It is two containers nested together, with the air pumped out of the space between them.
3. It contains very few particles to hand heat along.
4. There is no air in the gap to move and carry heat.
5. A shiny surface reflects heat waves back instead of allowing them to pass.
6. Heat can still creep through the neck and the stopper.