Day 1  *Weekly Question*

**How does a thermos work?**

In 1892, a scientist named James Dewar needed a way to store extremely cold liquid oxygen without the heat from his laboratory warming up his samples. So Dewar designed a container that was able to hold liquid oxygen at −300°F. This container, which became known as the Dewar flask, is the ancestor of the modern thermos bottle. The thermos is an amazing container that can not only keep cold things cold but can keep hot things hot. It maintains temperature by slowing the transfer of heat due to conduction, convection, and radiation.

A. Fill in the blanks to explain the direction in which heat is flowing between the hand and the container in each picture.

![Dewar flask](image1)

**picture 1**

1. In picture 1, heat is flowing from the _________ to the _________.

![Modern thermos](image2)

**picture 2**

2. In picture 2, heat is flowing from the _________ to the _________.

B. Cross out the incorrect word in each sentence and write the correct word above it to make the statement true.

1. Heat flows from objects at room temperature to objects that are warmer.

2. James Dewar invented a special flask to keep liquid oxygen warm.

3. A thermos maintains temperature by slowing condensation, convection, and radiation.
**Weekly Question**

How does a thermos work?

One way to slow down the transfer of heat between objects is to keep them separated. This stops heat transfer by conduction, which requires that objects physically touch each other for heat to flow from one to the other. A second way to slow conduction is by the use of insulators. Materials such as plastic, wood, and fabric are poor conductors of heat and therefore make good insulators. Air can work as an insulator as well. For example, Styrofoam® cups have tiny air pockets in the foam that keep heat from moving out or in.

A thermos is basically a bottle inside a bottle that limits heat conduction in both ways—through the use of insulators and physical separation. The inner bottle, which is where you put your hot or cold drink, has little contact with the outside. The only places where heat can travel are through the thermos cap and at points where the inner and outer walls of the bottles meet. And to further reduce heat conduction, these parts of the thermos are made from insulators.

A. List the two ways a thermos bottle slows heat transfer by conduction.

1. 

2. 

B. If you were designing a pot to cook spaghetti in, which parts would you make from good conductors of heat? Which parts would you make from insulators? Explain your answer.
**Weekly Question**

How does a thermos work?

While air is a good insulator, a vacuum is even better. That is because in a vacuum, heat cannot be transferred by convection. Remember that convection is the transfer of heat by movement of a gas or a liquid. Since there is no air in the space between the walls of a thermos bottle, convection of heat does not occur. In fact, another name for a thermos is vacuum bottle.

Many devices utilize a vacuum. For example, foods that are vacuum-packed are sealed within a vacuum in order to keep air from touching the food and spoiling it. On the other hand, despite its name, a vacuum cleaner doesn’t actually contain a vacuum. But it does create one by pulling air through it when it is turned on.

**Vocabulary**

vacuum
VAK-yoom
a space empty of air or other material

A. Write true or false.

1. Convection cannot take place in a vacuum.  
2. A vacuum cleaner creates conduction when it is turned on.  
3. The space between the thermos walls contains a vacuum.  
4. A vacuum is a good conductor.

B. Use words from the passage to complete the sentences.

1. Some foods are packed within a ____________________ to keep air out.
2. ____________________ requires the movement of a gas or a liquid.
**Weekly Question**

How does a thermos work?

The inside surface of the inner bottle of a thermos is shiny, like a mirror. This reflective surface is not just for looks. Shiny surfaces block the loss of heat energy through radiation, which is the movement of energy through matter and space. The shiny surface inside a thermos prevents heat from a hot drink from radiating out of the vessel. Some thermoses even have shiny outer surfaces. These surfaces reflect heat from outside the bottle and keep it from warming up cold drinks.

A thermos bottle is designed to slow the transfer of thermal energy by radiation, convection, and conduction, and it relies on reflective surfaces, a vacuum, and the use of insulators to do this. However, no container can completely stop all types of heat transfer. Even a thermos can only slow the flow of heat. Eventually, a hot or cold liquid in a thermos will reach room temperature.

A. Explain in your own words how the shiny surfaces of a thermos help keep hot drinks hot and cold drinks cold.


B. The word thermos contains the Greek root therm, meaning “heat.” List three other words that contain therm and write their definitions.

1.

2.

3.