

Thermal Energy Re-Test Study Guide

Essential Vocabulary- Review these NEWs in preparation for the test:

Temperature

Equilibrium

Insulator

Heat

Endothermic

Conduction

Kinetic Energy

Exothermic

Convection

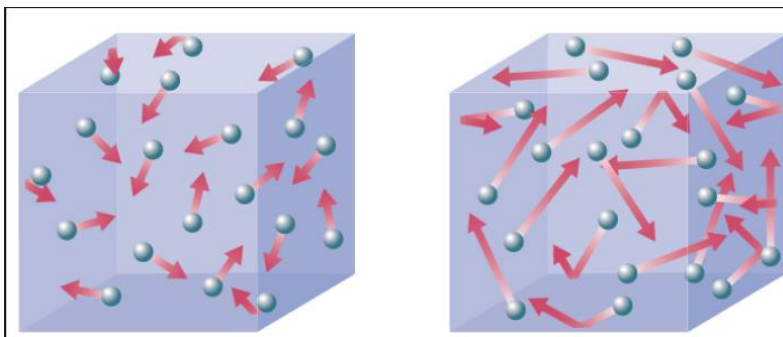
Transfer

Conductor

Radiation

Things To Remember:

The **Temperature** of an object is a measurement of the amount of **kinetic energy** within the system.



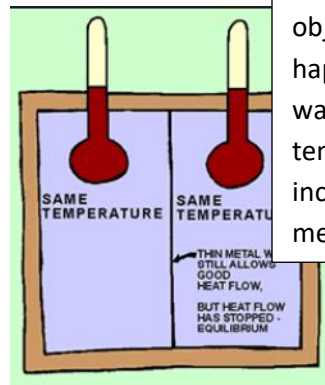
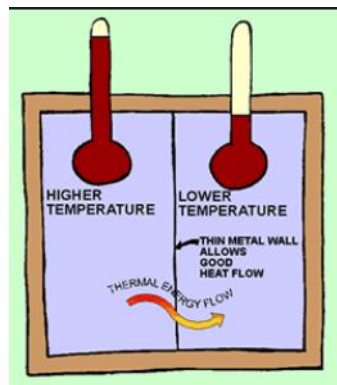
Longer arrows mean higher average speed.

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In the object on the left, the particles are moving slower which means there is less kinetic energy present in the system. Therefore, the object on the left has a lower temperature than the object on the right. The object on the right has more kinetic energy and a higher temperature.

Heat is the *transfer of energy from one system to another*. An object that energy transfers into will have more kinetic energy and, therefore, a higher temperature.

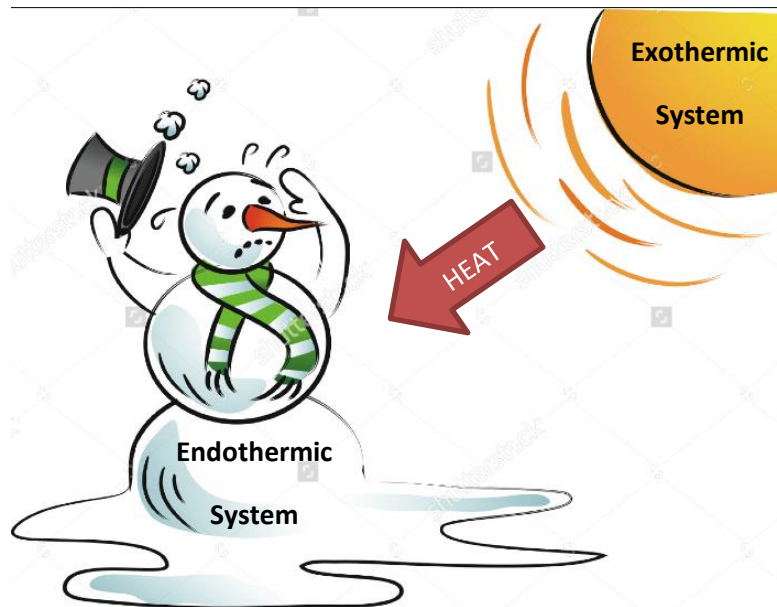
Heat transfers from one system to another until the systems reach *equilibrium* which means the systems have the same temperature. Heat will always move from the warmer object to the cooler object.



Heat transfers from the warmer object to the cooler one. As this happens, the temperature of the warm object decreases and the temperature of the cool object increases until the temperatures meet at the point of equilibrium.

Endothermic vs. Exothermic

When energy transfers from one system to another, the object releasing heat is **EXOTHERMIC** (Heat is **EX**iting the system). The object receiving that heat is **ENDOTHERMIC** (Heat is **EN**tering the system).



The sun is **EXOTHERMIC** because it is releasing thermal energy. The snowman is **ENDOTHERMIC** because it absorbs the heat the sun is releasing.

Exothermic systems always *decrease* in temperature. As heat exits the system, the temperature of the system drops.

Endothermic systems always *increase* in temperature. As thermal energy is absorbed, the temperature goes up.

Insulators and Conductors

Some objects are better than others at allowing thermal energy to enter and exit them. An object that allows thermal energy to easily transfer through it is known as a **Thermal Conductor**. An object that impedes (slows down) or prohibits (stops) thermal energy from transferring through it is a **Thermal Insulator**.



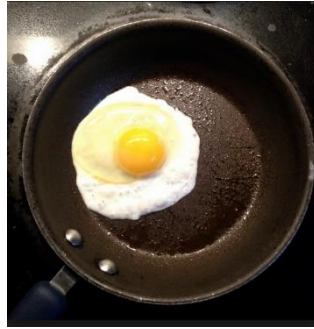
Metal pans are great conductors and so are you. This is why heat can easily transfer from the pan to you when you touch it. Oven Mitts are great insulators. When you use them, they stop the heat from transferring to your hand so you can hold a hot dish!

Methods of Thermal Energy Transfer

You already know that heat can transfer between systems. Is it important to note that heat moves in three very different ways:

1. Conduction:

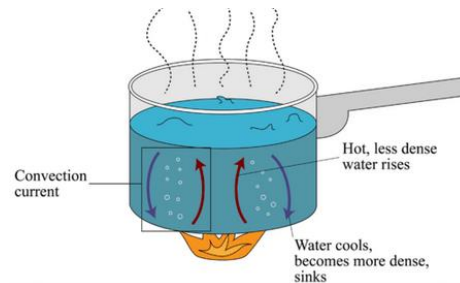
Conduction requires direct contact between system in order to transfer thermal energy. As kinetic energy increases in particles in adjacent regions, the temperature of the entire system gradually increases as well. Conduction usually involves at least one system in a solid state of matter.



Conduction: This egg cooks because it is in direct contact with a hot pan. As energy from the pan transfers to the egg, the egg gradually gets warmer and warmer until it is fully cooked.

2. Convection:

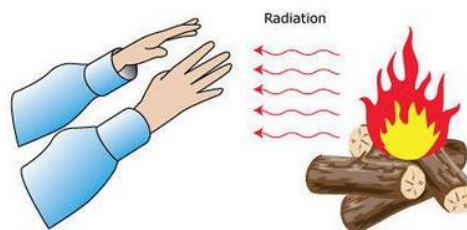
Convection is a form of thermal energy transfer that can only occur in fluids (liquids and gases). As kinetic energy increases, particles become less dense. In a fluid, these less dense particles rise above the rest. As they cool down, they become more dense again and sink to the bottom of the fluid. This continuous rising and sinking creates a **convection current** within the fluid that continues until equilibrium is reached.

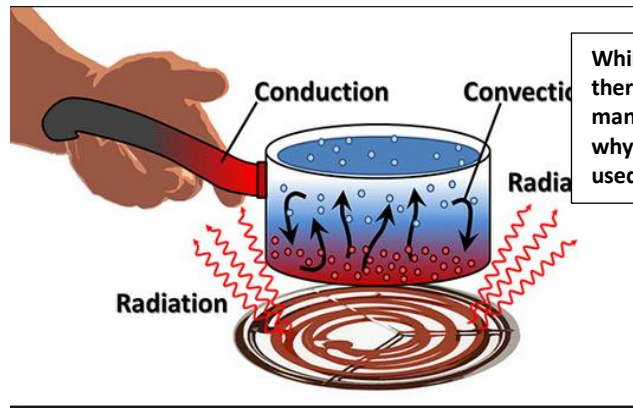


Convection currents are responsible for boiling water. As water at the bottom heats, it rises to the top of the pot where it becomes exothermic, cools and sinks to the bottom before warming up and rising again.

3. Radiation:

Radiation is a form of thermal energy transfer that requires absolutely no contact between the heat source (exothermic object) and the system being warmed (endothermic object). In radiation, the heat travels in waves from the warmer object to the cooler. The heat literally radiates from one object to another. Radiation can happen to objects in any state of matter.





While each is unique, all three types of thermal energy transfer are present in many everyday situations. Can you identify why each type of thermal energy transfer is used in the image to the left?

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PRACTICE QUESTIONS:

In each scenario below, tell which system is endothermic and which is exothermic.

1. Butter melting on a warm piece of toast

Endothermic: _____

Exothermic: _____

2. Water freezing into ice cubes in the freezer

Endothermic: _____

Exothermic: _____

3. Baking brownies in an oven

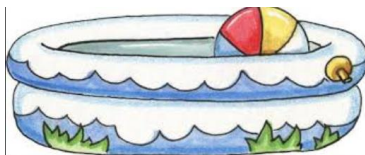
Endothermic: _____

Exothermic: _____

Write the correct type of thermal energy transfer for each image below. There may be more than one method of transfer present—choose the one that is most efficient.



4. The Outside of a bowl of pasta gets hot after placing the warm noodles inside.
What type of Thermal Energy Transfer is this?: _____



5. The water at the top of a swimming pool feels warmer than the water at the bottom.
What type of Thermal Energy Transfer is this?: _____



6. A cat stays warm by sitting in the windowsill on a sunny day.
What type of Thermal Energy Transfer is this?: _____