Name _____ Date _____

Transfer of Thermal Energy Lab

Background

Thermal energy refers to the amount of energy a substance contains based on the motion of its particles. More motion means more thermal energy. Temperature is a measurement of the average amount of motion of a substance's particles. Heat is the flow of thermal energy and can occur in three different ways: radiation, conduction, and convection.

Radiation

During radiation, thermal energy is transferred through electromagnetic waves. Radiation occurs without any contact between atoms.

When electromagnetic waves, in the form of light, strike an object, they can be transmitted, reflected, or absorbed. When electromagnetic waves are absorbed, the light waves are changed into infrared or heat waves and the temperature of the object will increase.

The color of a substance determines which light waves will be absorbed and which will be reflected. White objects reflect most of the electromagnetic light waves. Black objects absorb most of the electromagnetic light waves. Colored objects absorb some light waves but reflect the color of light that the object appears.

In this lab, you measure the temperature change of three jars that are exposed to light waves: one clear, transparent jar, one black jar, and one white jar.

1. Make a hypothesis on which jar you think will experience the greatest temperature change: _____
   _____
   _____
2. Record the temperature of three different thermometers.
3. Place a thermometer in each jar and seal the jars.
4. Place each jar on the counter, an equal distance from the lights and turn the lights on.
5. Near the end of class, turn off the lights, open the jars, and record the temperatures on each thermometer.

Data

Clear Jar

Beginning Temperature ___^{o}C Ending Temperature ___^{o}C Temperature change: _____^{o}C

White Jar

Beginning Temperature ___^{o}C Ending Temperature ___^{o}C Temperature change: _____^{o}C

Black Jar

Beginning Temperature ___^{o}C Ending Temperature ___^{o}C Temperature change: _____^{o}C

Conclusion (explain):

_____
_____
_____
_____

Convection

Convection is the transfer of thermal energy within a substance that can flow. During convection, the particles within a warm substance increase in motion, spread out, become less dense, and rise. As the particles move away from the heat source, the particles begin to cool as the particles slow down in motion, condense, increase in density, and sink. The rising and sinking of the fluid creates convection currents.

In this lab, you will observe two different situations:

First situation
A bottle of warm water to which yellow food coloring has been added being placed over a bottle of cold water to which blue food coloring has been added.
Second situation
A bottle of cold water to which blue food coloring has been added being placed over a bottle of warm water to which yellow food coloring has been added.

1. Make a hypothesis about what you think will happen during each situation:
    a. Warm bottle on top of cold bottle: _____
    _____
    _____
    b. Cold bottle on top of warm bottle: _____
    _____
    _____
2. Observe and record what happens:
    a. Warm Bottle on top of cold bottle: _____
    _____
    b. Cold Bottle on top of warm bottle: _____
    _____

Conclusion (Explain what happened); _____
_____

Conduction

Conduction of thermal energy occurs when faster moving particles (more thermal energy) collide with slower moving particles (less thermal energy) and transfer some of their thermal energy to slower moving particles.

During this lab, you will observe thermal energy transferred from one end of a metal skewer that has one end placed on a hot plate. In order to determine if thermal energy is being conducted through the skewer, a piece of chocolate will be placed on the metal skewer.

1. Make a hypothesis about what you think will happen to piece of chocolate: _____
_____
2. Place one end of the metal skewer on a hot plate and then slowly push it through the piece of chocolate. You may need to heat the skewer a few times. Try your best not to deform the chocolate.
3. Place one end of the metal skewer back on the hot plate and the other end on another hot plate.
4. Turn on one of the hot plates and observe what happens.
5. Draw a conclusion (explain): _____
_____
_____
_____