Thermal Equalibrium

Engage

Think about the last time you had a cold soda in a can or bottle. If you left it out for an hour what happened to the soda inside the can or bottle?

Think about the last time you had a hot cup of coffee or soup. If you left it out for an hour what happened to the cup of coffee or soup?

Share your experiences with your partners.

Explore

Materials: hot plate, coffee carafe or large coffee maker, ice water, 3 Styrofoam cups, graduated cylinder, thermometer, funnel

What To Do:
When equal amount of warm water and cold water are mixed together it stands to reason that the resulting temperature will be somewhere in the middle of the two starting temperatures.
The equation for this prediction would be:

$$\frac{\text{Cold starting temp.} + \text{Hot starting temp.}}{\mathbf{2}} = \text{Ending temp.}$$

Cold temp = 4ºC **Hot temp = 56ºC**
What would be the ending temp? _____

Cold temp = 3ºC **Hot temp = 67ºC**
What would be the ending temp? _____

1. Get half a cup of each temperature of water.
2. Measure the starting temperature of each cup of water.
3. Record both temperatures in the data table below.
4. Do the math shown above and predict the temperature of the mixed water. Record your prediction below.

5. Use the funnel and measure out 40 mL of hot water into the graduated cylinder and then pour it into the empty cup.
6. Use the funnel and measure out 40 mL of cold water into the graduated cylinder and then pour it into the empty cup to mix them.
7. Measure the temperature of the 3rd cup of water.

Amount of water mL	Temp. of warm water	Temp. of cold water	Predicted mixed temp.	Temp. of mixed water
40 warm 40 ice				

How close was your prediction to the real temperature?

_____

Explain

EQUILIBRIUM

THERMAL EQUILIBRIUM

DIRECTION OF TRANSFER

Elaborate

1.Watch the video "Thermal Equilibrium-Science with Bexy at https://www.youtube.com/watch?v=gxwuXwRe0K4

2. As you watch fill in the blanks below.

3. A Word Bank is provided for you.

WORD BANK

no more temperature heat different same

1. Thermal equilibrium is the condition under which two physical systems interact with each other and exchange no _____ energy.

2. When two objects are in contact with each other and are the same _____, they are in thermal equilibrium.

3. Whey two objects of _____ temperatures are brought in contact with each other; heat will be transferred from one object to the other until they both reach the _____ temperature.

4. Once thermal equilibrium has been reached _____ heat flow will take place.

Your teacher may stop the video at this point. If you continue to watch it try to figure out why they called this law the zeroth law. Write what you think below.

Elaborate page 2

Direction of Heat Transfer

Watch the video "Hot or Not" by Steve Spangler Science at https://www.youtube.com/watch?v=GB916OHfFiU

1. Describe what you observe the liquid doing.

2. In which direction did the heat move?

3. Identify the direction of heat transfer by telling where the heat would go.

System	Surroundings	Where would the heat go?
Classroom 78ºF	Outside Air 94ºF	
Ice cream cone 30ºF	Cafeteria 78ºF	
Can of soda 65ºF	Outside Air 94ºF	
Attic of House 120ºF	Outside Air 94ºF	
Cup of coffee 120ºF	Classroom 78ºF	
Living Room 73ºF	Attic of House 120ºF	

Evaluate

Name _____ period _____

EXIT TICKET

Thermal Equilibrium

1. The direction heat transfer occurs is -

A. from warm temperature to warm temperature
B. from cold temperature to cold temperature
C. from warm temperature to cold temperature
D. from cold temperature to warm temperature

2. Thermal equilibrium only occurs when –

A. objects reach the same temperature
B. objects are surrounded by heat
C. objects are surrounded by cold
D. objects are far away from each other

3. When thermal equilibrium has been reached –

A. heat moves in the direction of the Sun
B. heat moves in the direction of gravity
C. heat does not flow
D. heat moves in the direction of the nearest person

4. If a soda that is at the temperature of 26ºC and ice cubes that are at a temperature of 0ºC are mixed together, what temperature would you predict the soda to become?

A.52ºC
B. 1ºC
C. 22ºC
D. 13ºC