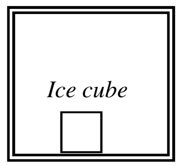
Heat and Thermo 2

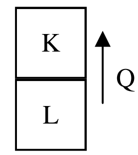
1. Conduction (Cd), Convection (Cv), Radiation (R):

A. ___ *Always moves up.
B. ___ *Can move any direction.
C. ___ Always moves from hot to cold.
D. ___ Between a pot and the stove.
E. ___ Between the pot and the water.
F. __ Moves heat throughout the water.
G. __ How heat enters an egg in the water.
H. __ You lift the pot and put your hand next to (but not touching) the side of the pot. You can feel the heat because of this.

2. An ice cube is in a freezer. Draw an arrow to show the direction of heat transfer between them if they are both at –5°C.



3. Heat moves from L to K.
   A. Which object is at a higher T?
   B. Which object has slower moving atoms?
   C. What kind of heat transfer is this?



4. An ice cube is placed on your skin.

A. Does heat go into or out of your skin?
B. Is Q + or − for your skin?
C. * Is this an endothermal or exothermal process for your skin?
D. Is Q + or − for the ice cube?
E. Is this an endothermal or exothermal process for the ice cube?

Temperature scales:

5. * Convert 20ºC to F.

6. * Convert 50ºF to C, then to Kelvin.

7. A. Fill in the table at the right.
   B. * So ______ºF = ______ºC.
   C. Reduce these numbers to the lowest values.
   D. So ______Fº = ______Cº.

	Boiling point	Melting point	Difference
Fahrenheit			
Celsius			

This where the conversion equations come from: y = mx + b, m = 9/5 and b = 32º.

8. * Using the above information, how many Celsius degrees is 40 Fahrenheit degrees?

Specific Heats (Cp) and Latent Heats (L's) are on the notes.

9. 1000 J of heat is added to three different substances at 40ºC: 1 kg of copper; 1 kg of Aluminum; 1 kg of liquid water.
   A. * Calculate the final temperature of the copper.

   B. Calculate the final temperature of the aluminum.

   C. Calculate the final temperature of the water.

   D. Which material increased its temperature the most?
   E. * Which material is the best insulator?

10. Two unknown substances: Material X has a specific heat of 2488. Material Y has a specific heat of 340.
    A. Which one is the better conductor?
    B. If the same amount of heat is added and both start at the same initial temperature, which substance will end up at a higher final temperature?

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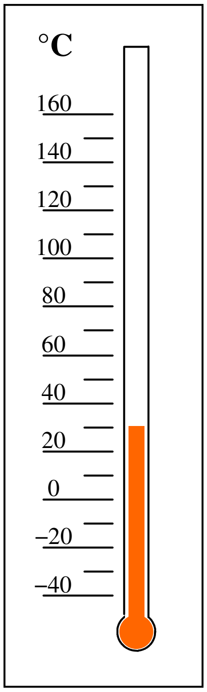
11. The Celsius thermometer below is used to measure the temperature of 5 kg of water. We will assume that the water is at normal atmospheric pressure.



A. Label the boiling point of water. Use an arrow and a label.

A. 100° C

B. Mark and label the freezing point of water.

B. 0°C

C. Label the three most common phases of water on the thermometer. Label them ice, liquid water, and steam (since they are all still water).

C.

D. Label the Cp's for the different phases of water.

D. See HW1 or "Heat" notes

E. Label the present reading as T_1.

E.

F. In what phase would water be at this temperature?

F. Liquid (between 0 and 100°C)

We want to raise the 5 kg of water to 120° C.

G. Mark the desired temperature as T_2.

G.

H. What is the highest temperature this water will stay liquid?

H. 100°C

I. What will be the change of temperature during its liquid phase (ΔT_{liquid})?

I. Tf−Ti = (100−30) =70°C

J. Calculate the heat added from the water to raise it to 0°C.

J. $Q = mc_{p\ water}\Delta T$ = 5(4186)(70) = 1.465E6 J

Now the 3 kg of water is at 100°C. At this point heat must be added to it to vaporize it into steam. This heat is known as "latent heat of vaporization". The equation is $Q = mL_{vaporization}$ and $L_{vapor\ for\ water} = \pm 2.26\times10^6$ J/kg. It is + when boiling and −when condensating (back to liquid).

K. How much heat must be added to vaporize 5kg of water into steam?

K. 5(2.26E6) = 1.13E7 J (+ since boiling)

L. What will be the initial temperature of this water when it has turned to steam?

L. 100°C

M. What will be the change of temperature of this water during its gaseous (steam) phase (ΔT_{steam})?

M. +20°C

N. Calculate the heat added to the steam to raise it to 120°C.

N. $Q = mc_{p\ steam}\Delta T$ = 5(2010)(20) = 2.01E5J

O. Calculate the total heat added to the water to raise it from 30° to 120°C.

O. Add em up: 1.3E7J

1A: convection; 1B: conduction; Q5 : 68ºF Q6: 10ºC (figure out K) Q7B: 180ºF = 100ºC
Q8: 40F(5C/9F) = 22.2 C degrees 9A: 42.6ºC 9E. Water (highest Cp)

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