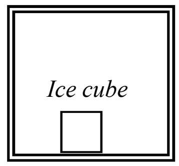
A-Day Due Wed., Mar 2
B-Day: Due Thurs., Mar 3

2011 Heat 1

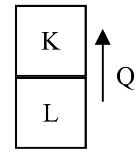
1. Conduction (Cd), Convection (Cv), Radiation (R):

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 ______ºF = ______ºC.

	Boiling point	Melting point	Difference
Fahrenheit			
Celsius			

This where the conversion equations come from, plus or minus 32º, which is the y-intercept.

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

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?

You should now know that you use $Q = mc_p\Delta T$ when an object changes temperature and $Q = mL$ for phase changes. Cp's and L's are on your notes.

11. * 5 kg of water is at −12ºC. How much heat is necessary to raise the water to 55ºC. (Visualize the thermometer diagram, if need be.)

12. 15 kg of water is at 140ºC. How much heat must be removed to lower the water to 75ºC.

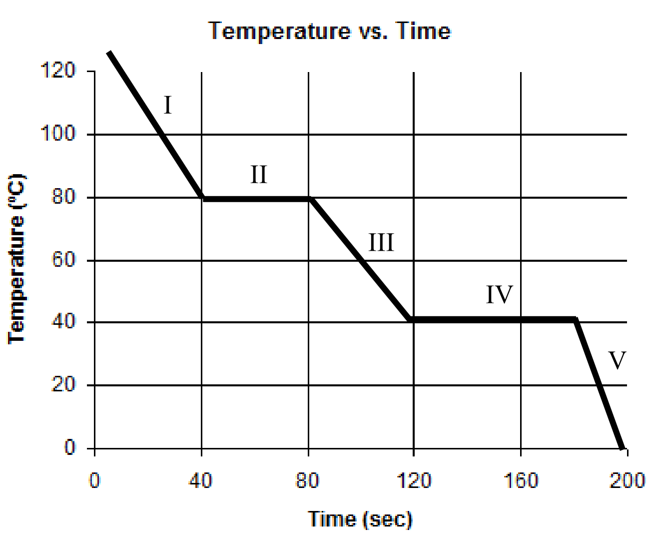
Now let's try this with something different than water.

13. * 6 kg of liquid Aluminum is at 660ºC, the melting point for Aluminum. How much heat must be removed to solidify the Aluminum and lower its temperature to 625ºC?

14. The melting point of gold is 1064ºC. If 0.4 kg of gold is at 1000ºC, how much heat is necessary to completely melt the gold? The specific heat of solid gold is 129. The Latent heat of Fusion for gold is 6.37×10^4.

15. * 1.5 kg of solid copper is in a cup of water at 50ºC. The water is then frozen at 0ºC. How much heat is removed from the copper?

16. * 0.6 kg of an unknown substance absorbs 8.7kJ of heat when its temperature rises from 10ºC to 38ºC. Calculate the specific heat of the substance.



17. The graph shows the heat being removed at a rate of 500 J/sec. The object has a mass of 2 kg.
    A. *Which segment shows freezing?
    B. Which segment shows condensation?
    C. Which segment shows the liquid phase?
    D. Is the substance's molecules gaining or losing heat?
    E. Is the substance's molecules gaining or losing internal kinetic energy?
    F. What is the melting point (temp) for this substance?
    G. What is the boiling point for this substance?
    H. * How much time is the object in the liquid phase?
    I. * How much heat is lost by the object in the liquid phase?
    J. Calculate the specific heat of the substance in its liquid phase.

And do the TAKS homework.

Helps and hint:

Q5 : 68ºF Q6: 10ºC (figure out K)

Q9: 42.6ºC

11. * 5 kg of water is at −12°C. How much heat is necessary to raise the water to 55°C.
diagram, if need be.)

$Q_{ice} = 5(2090)(0-(-12)) = 1.25 \times 10^5$ J

$Q_{melt} = 5(3.33E5) = 1.67 \times 10^6$ J

$Q_{liq} = 5(4186) = 1.15 \times 10^6$ J

total = 2.94×10^6 J

13. * 6 kg of liquid Aluminum is at 660°C, the melting point for gold. How much heat must be removed to solidify the gold and lower its temperature to 625°C?

$Q_{freeze} = 6(3.97 \times 10^5) = -2.38 \times 10^6$ J

$Q_{solid} = 6(899)(625-660) = -1.89 \times 10^5$

$Q_{total} = -2.57 \times 10^6$ J

Q15: isn't the change of temperature the same for the copper as for the water?

Q16: 518 J/kgºC

Q17: A: IV; H: 40 sec I: 20kJ