A-Day Due Mon., Mar 21
B-Day: Due Tues., Mar 22

2011 PreAP Thermo 4

I am NOT going to repeat myself. You need to rework the previous homeworks and notes.

Let me explain the difference between Celsius degrees and degrees Celsius: From 15ºC to 20ºC is 5 Celsius degrees, same for 40ºC to 45ºC is 5 Celsius degrees. But 5ºC = 41ºF, meaning exact points on the thermometer. Between Celsius and Kelvin is easy because 5 Kelvin degrees = 5 Celsius degrees.

1. Using the melting and boiling points of water, ____ Celsius degrees = ____ Fahrenheit degrees.
2. A change of 15 Celsius degrees equals how many Fahrenheit degrees?

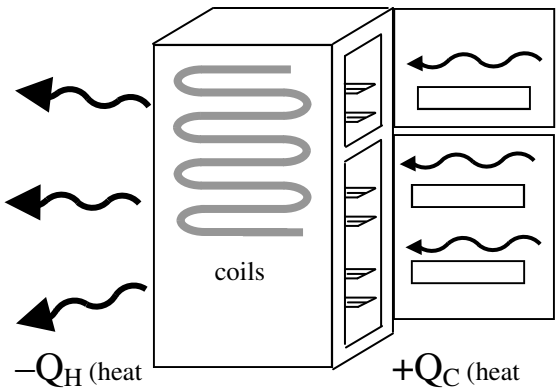
3. 15 degrees Celsius equals what temperature Fahrenheit?

4. Heat is added to a gas.
   A. Q for the gas is:
   B. Give one way that the gas could not change its temperature.
   C. * True or false and why: "A gas's temperature must decreases when it releases heat."

5. * The melting point of Aluminum is 660ºC. How much heat is added or removed to solidify 65 grams of aluminum that is originally at 780ºC? (Just use 899 for the c_p of liquid Aluminum and 3.97×10^5 for Lf.)

6. 3 kg of water is frozen. How much energy was removed or added?

7. 5 kg of an unknown substance requires 60kJ to vaporize completely. What is the latent heat of vaporization for this substance?



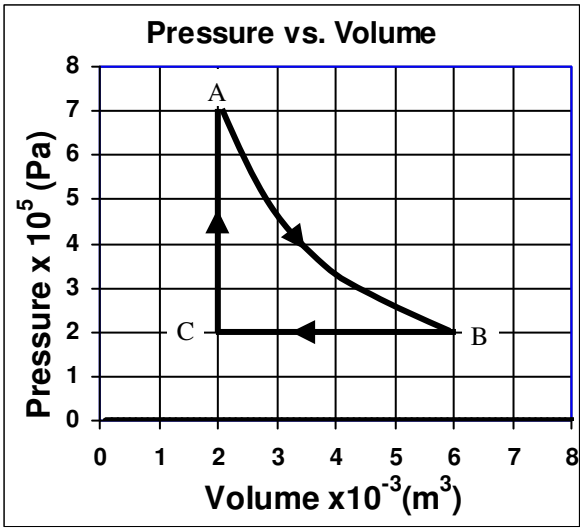
More notes: *A hot object is placed inside a refrigerator. As the object cools it heats the air inside the refrigerator. This heat them moves to the walls of the refrigerator and is eventually absorbed by the actual refrigerant inside metal coils (conducting coils) that are inside the walls. So, each of these is equivalent: heat is removed from the food inside the refrigerator = heat is absorbed by the coils in the walls of the refrigerator = heat is absorbed by the refrigerant inside the refrigerator (or coils) = Q_C. Why does the refrigerant absorb heat? Because it is cold and heat travels from hot to cold. Then this refrigerant travels to the compressor, which does work, raising the temperature of the refrigerant. Behind the refrigerator more metal coils (again conductors) release heat (Q_H) to the room. Why is heat released? Because the gas is hot.*

And why would an open refrigerator increase the temperature of the room? Because Q_H is bigger than Q_C (due to W of the compressor). So you are adding more Q to the room than you are moving.

8. 350g of water at 15° is placed inside a refrigerator. The water is cooled to 4°C in 12 minutes. 25 kJ of heat is dissipates into the room from the coils behind the refrigerator.
   A. Calculate the heat removed from the water.

   B. Remembering that 1 kJ = 1000 J, how much work was done by the compressor?

   C. * What is the power used by the compressor during the 12 minutes?



The graph at the left is known as a PV diagram, or a Pressure/ Volume diagram. Let's learn how to read it. Be sure to notice that the numbers on each axis are multiplied by a factor.

9. * What is the pressure at point A?
10. * What is the volume at point B?
11. As the gas moves from point B to point C the volume changes at constant pressure.
    A. Did the gas expand or contract?
    B. Is this + or − work done by the gas?
    B. Calculate the work done by the gas from B to C.

Actually point C is at a lower temperature than B. Since PV = nRT, if P stays the same and V decreases, T must also decrease.

12. Since the gas compresses from B to C and the temperature decreased,
    A. ____ ΔU = +, −, or 0?
    B. ____ Q = +, −, or 0?
    C. ____ $W_{\text{by the gas}}$ = +, −, or 0?
    D. * Which is greater: the magnitude of Q or W?

13. * How much work is done from C to A?

B and A are on a curved line known as an <u>isotherm</u>.

14. If B is at 350K, what is the temperature of A?
15. From A to B is an isothermal process.
    A. ____ ΔU = +, −, or 0?
    B. ____ Q = +, −, or 0?
    C. ____ $W_{\text{by the gas}}$ = +, −, or 0?
    D. Which is greater: the magnitude of Q or W?

Q4C: False. If you compressed the gas you could raise its temperature. If W > Q then T goes up.

Q5: make sure to use kilograms. You should be able to do this one on your own.

Q8C: P = W/t or joules/sec = 8884/(12(60)) =12.3 W

Q9: 7×10^{5} PA

Q10: 6×10^{-3} m^3

Q12D use