**2nd Law of Thermodynamics and Entropy**

1. What is the 2nd Law of Thermodynamics?

**Read pages 413-414**

Pierre works in a small office on the South side of the building with a wall of windows; however, for safety purposes, the windows do not open. His office gets very warm!

1. Will it help to close his blinds? Why or why not?
2. What if he brings in a small window air conditioner and sets it up in his office so that it blows cold air over his desk. Is this a good idea, will he be more comfortable?

Entropy

S = Q/T

1. Calculate the entropy change when melting a 300 g piece of ice.
2. What would the total entropy change be if 8.00 J of heat were transferred from a large cool object (ice for example) 273K to a large hot object 373 K (boiling water for example). Calculate S for the cool object, then S for the hot object. (remember that heat lost is -)

Entropy is a convenient mathematical definition of the second law. “The entropy of the Universe increases in all natural process.”

1. With the above definition in mind, is 3. above possible? Why or why not? (Check with your instructor before proceeding)
2. What would the total entropy change be if the 8.00 J in 3. above went from the hot object to the cool object?
3. Is order or disorder more probably in nature? What do you think?
4. You have 100 marbles in a bag, 50 red and 50 green.
5. What are all the different possible ways you can pick 2 green and 1 red?
6. What are all the different possible ways you can pick 2 a red and 1 green?
7. What are the different possible ways you can pick all Red?
8. What are the different possible ways you can pick all green?
9. Is all red marbles or 2 red and 1 green more ordered? Which is more probable?
10. Does it seem likely that a grove of trees would be arranged as in A or B below?

The 2nd law of Thermodynamics is really a statement of probability. Nature tends towards disorder.

If you put an ice cube in hot water, it is possible for a cold molecule to hit a hot one just right so that energy from the cold molecule transfers to the hot one. But there are many more possible ways for them to collide and transfer energy to the cold molecule.  *Odds are overwhelmingly in favor of hot to cold.*

The most ordered state for an ice cube at water would be for exactly ½ the molecules to have one KE and half to have the higher KE. NOT very likely!

Entropy also defines the direction of time:

If you watch a video of an ice cube melting in reverse ( you know it’s in reverse) .

1. Which forms of energy would you rate as most ordered and least ordered? (*which is most likely the initial state versus final state)* Mechanical, Chemical, Thermal
2. Have you heard of the heat death of the universe? What do you think it is?

(*check with your instructor after you answer)*