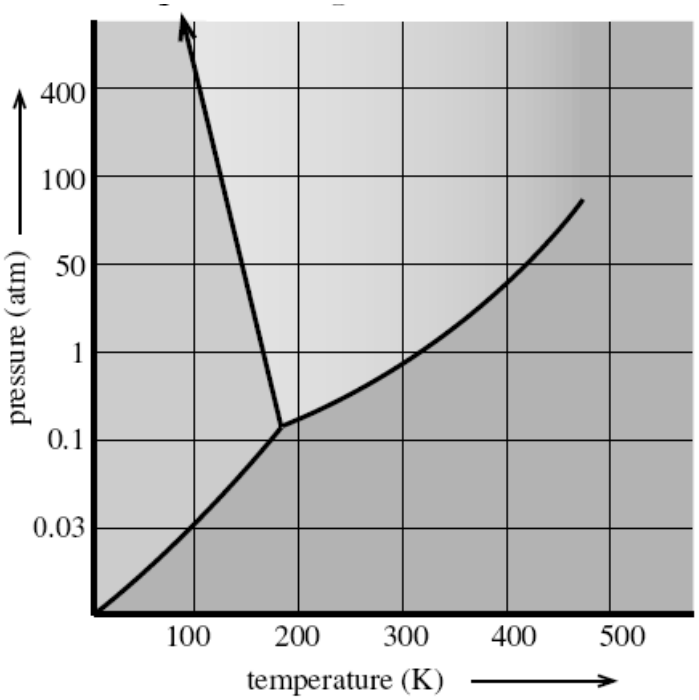
Spring 2008 CH 302 Worksheet 2

1. 100 g of ice at -25°C is heated to steam at 125°C. For water, the specific heats are c_{ice} = 2.093 J/g°C, c_{water} = 4.186 J/g°C, and c_{steam} = 2.009 J/g°C. The enthalpy changes are ΔH_{fusion} = -335.5 J/g and $\Delta H_{vaporization}$ = 2.26 kJ/g. What is ΔH_{sys} for this process?

2. 1 MJ of heat is dumped into 2 kg of ice at -25°C. What is the final temperature and state (solid, liquid, or gas) of the water?



3. The phase diagram for water (shamelessly borrowed from last year's quiz 2) is shown above. What phase change(s) occur when going from 1 atm, 100 K to 1 atm, 400K? From 0.1 atm, 100 K to 0.1 atm, 400K?

4. For any temperature less than ~475 K, if you keep increasing the pressure on the system, what will be the eventual state of the system? Is this the same or different from most other substances?

5. Describe the physical state of the system at the point where the three lines meet, and at temperatures above ~475K.

6. Give a basic explanation for the well-known rule "like dissolves like."

7. Describe the structure formed by soap molecules around a grease molecule.

8. Which of the following will be most miscible in water: methanol (CH_3OH), ethanol (CH_3CH_2OH), propanol ($CH_3CH_2CH_2OH$), butanol ($CH_3CH_2CH_2CH_2OH$).

9. Which of the above alcohols will be most miscible in hexane (C_6H_{12})?

10. At 0°C, the vapor pressure of acetone is 0.095 atm, and at 20°C, the vapor pressure is 0.243 atm. What is the enthalpy of vaporization of acetone?

11. Using the information from the above problem, what is the boiling point of acetone?

12. Rank the following in terms of increasing ability to increase the boiling point of water: NaCl, sugar, $CaCl_2$, BaS.

13. Rank the osmotic pressure in increasing order when 1 mol of each of the compounds in #12 is dissolved in water.

14. At room temperatures, he vapor pressures of ethylene glycol ($HOCH_2CH_2OH$) and water (H_2O) are 0.06 torr and 17.54 torr, respectively. What is the vapor pressure of a mixture of 500 mL of ethylene glycol and 500 mL of water? Assume the densities of the two liquid are the same (1 g/mL).

15. A 1 L mixture of ethylene glycol and water has a vapor pressure of 10 torr. What is the volume of ethylene glycol in the mixture?

16. Give a simple explanation for the depression of the vapor pressure of water by the addition of a solute.

17. 5 g of table salt (NaCl) are dissolved in 100 mL of water. What is the vapor pressure of the solution, given P° = 17.54 torr?

18. What is the freezing point of the solution, given K_f = 1.86 °C/molal?

19. What is the change in osmotic pressure of the solution at 298K? Assume the salt contributes negligibly to the volume.

20. What would be the change in osmotic pressure if the same number of moles of sugar instead of salt were dissolved in the water?