CH302 Spring 2009 Practice Quiz 1

1. Rank the following in order of decreasing vapor pressure:
Ar, NH_2, TiO_2, C_6H_6, CH_3OH, LiBr, CH_2Cl_2, C_2H_6.
   1. TiO_2 > LiBr > NH_2 > CH_3OH > CH_2Cl_2 > C_6H_6 > C_2H_6 > Ar.
   2. Ar > C_6H_6 > CH_2Cl_2 > C_2H_6 > CH_3OH > LiBr > NH_2 > TiO_2.
   3. Ar > C_2H_6 > C_6H_6 > CH_2Cl_2 > CH_3OH > NH_2 > LiBr > TiO_2.
   4. Ar > C_2H_6 > C_6H_6 > CH_2Cl_2 > NH_2 > CH_3OH > LiBr > TiO_2

2. An unknown liquid is 2000 Pa at 25 ^oC and 7500 Pa at 50 ^oC. Based on the Clausius-Clapeyron equation which expression below could be used to solve for the enthalpy of vaporization (ΔH_{vap}) of the unknown liquid?
   1. $[(8.314 \text{ J/mol*K})\ln(7500 \text{ Pa} /2000 \text{ Pa})] / [(1/50) - (1/25)] = \Delta H_{vap}$
   2. $-[(8.314 \text{ J/mol*K})\ln(7500 \text{ Pa} /2000 \text{ Pa})] / [(1/323) - (1/298)] = \Delta H_{vap}$
   3. $[(8.314 \text{ J/mol*K})\ln(7500 \text{ Pa} /2000 \text{ Pa})] / [(1/323) - (1/298)] = \Delta H_{vap}$
   4. $-[(8.314 \text{ J/mol*K})\ln(7500 \text{ Pa} /2000 \text{ Pa})] / [(1/50) - (1/25)] = \Delta H_{vap}$
   5. $-[(8.314 \text{ J/mol*K})\ln(7500 \text{ Pa} /2000 \text{ Pa})] / [(1/323) + (1/298)] = \Delta H_{vap}$

3. For the process of ice sublimating to water vapor the sign of ΔH is (positive\negative) and the sign of ΔS is (positive\negative).
   1. positive, positive
   2. positive, negative
   3. negative, positive
   4. negative, negative

4. Consider the phase diagram below. A sample of water starts out at 298 K and 1 atm. It is compressed to 500 atm at constant temperature, and then heated to 750 K at constant pressure. Next, it is decompressed at 750 K back to 1 atm and finally cooled to 400 K at constant pressure.

What is the initial phase of the water (solid, liquid, gas, supercritical fluid), and does the water undergo any phase transition during the four steps described above (yes, no)?
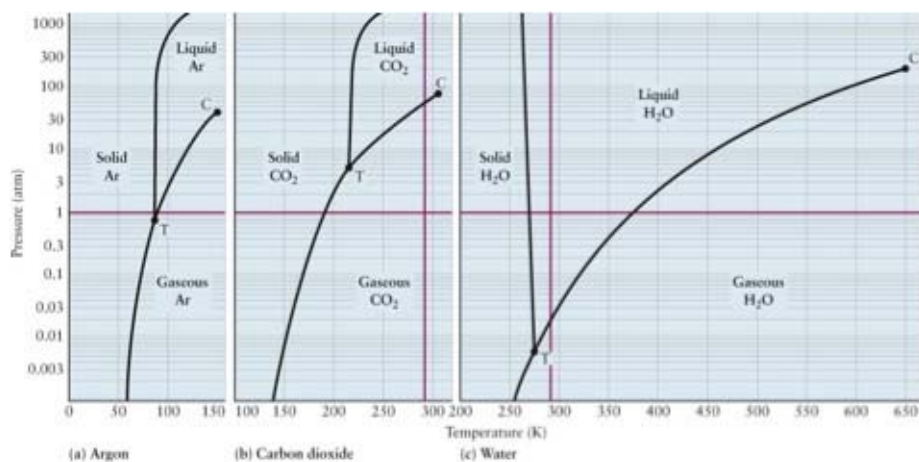
   1. liquid, yes
   2. solid, yes
   3. gas, yes

   4. liquid, no

   5. solid, no

   6. gas, no

5. 10g of steam at 200°C is cooled to ice at -100°C. Assuming the following constants:

$c_{ice} = A$ J/g °C

$c_{water} = B$ J/g °C

$c_{steam} = C$ J/g°C

$\Delta H_{fusion} = D$ J/g

$\Delta H_{vaporization} = E$ J/g

express ΔH_{total} in terms of A, B, C, D and E.

   1. $1000(A+B+C+D+E)$ J
   2. $10(A+B+C+D+E)$ J
   3. $1000(A+B+C) + 10(D+E)$ J
   4. $10(A+B+C) + 1000(D+E)$ J
   5. $1000(A+B) + 10(C+D+E)$ J

6. Which of the following statements regarding the dissolution of salt is true?
   1. The greater the charge density of the ions in the salt, the more favorable dissolution is.
   2. The stronger the intermolecular forces of the salt, the less favorable dissolution is.
   3. The solubility of salts generally decreases as temperature increases.
   4. The salt's lattice energy is irrelevant to its solubility.
   5. None of these are true.

7. Dissolving gases in water is always an (endothermic\exothermic) process because the gas molecules must (lose\gain) kinetic energy in the form of heat in order to enter the aqueous phase.
   1. endothermic, lose
   2. endothermic, gain
   3. exothermic, lose
   4. exothermic, gain

8. Rank the following liquids in terms of increasing miscibility in water: H_2O_2 (hydrogen peroxide), CH_3OH (methanol), C_8H_{18} (octane), C_2H_7Cl (chloroethane).
   1. $CH_3Cl < CH_3OH < H_2O_2 < C_8H_{18}$
   2. $C_8H_{18} < CH_3Cl < CH_3OH < H_2O_2$
   3. $H_2O_2 < C_8H_{18} < CH_3Cl < CH_3OH$
   4. $CH_3OH < H_2O_2 < C_8H_{18} < CH_3Cl$