Chem 1104 - 2018 Summer Problem Set #9

1. Which of the following substances would you expect to have the lower boiling point, CS_2 or CCl_4? Why?

2. Arrange the following substances in the expected order of increasing melting point: Cl_2, CsCl, CCl_4, $MgCl_2$. Give reasons for your ranking. Hint: Compare molar masses and if the compounds are ionic, polar, or nonpolar.

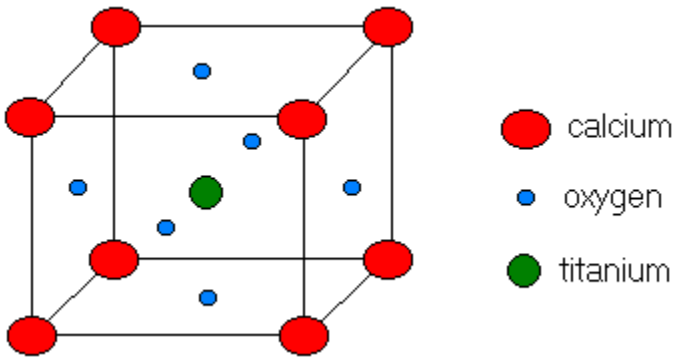
3. Using a phase diagram for water, see your text book, determine the state of water for the following conditions: a) 1 atm, 200 °C; b) 100 atm, 200 °C; c) 3 Torr, 25 °C; d) 218 atm, 375 °C.

4. How many kilojoules of heat are required to vaporize 1.00 kg of $CS_2(l)$? ΔH_{vap} = 27.4 kJ/mole

5. Use the following data to draw a rough phase diagram for hydrogen: normal melting point, 14.01 K; normal boiling point, 20.38 K; triple point, 13.95 K, 0.07 atm; critical point, 33.3 K; critical pressure 12.8 atm; vapor pressure of solid at 10 K, 0.001 atm.
Critical temperature: Temperature above which it is impossible to liquefy a gas at any pressure.
Critical pressure: Minimum pressure needed to liquefy a gas at its critical temperature.

6. Ethylene glycol, $HOCH_2CH_2OH$, is an active ingredient in antifreeze. Would you expect the viscosity of ethylene glycol to be greater or less than the viscosity of ethanol, CH_3CH_2OH. Explain.

7. One unit cell of the mineral perovskite is illustrated. The compound is composed of calcium, oxygen, and titanium. The basic unit cell is similar to a face centred cubic cell with a titanium ion at the centre. Based on the unit cell, what is the formula of perovskite.



8. Rhodium has a density of 12.41 g/cm^3 and an edge length of 302.1 pm. Determine if it has a simple-body, face-centred, or body-centred cubic unit cell.

Answer Set for Chem 1104-2018 Summer Problem Set #9

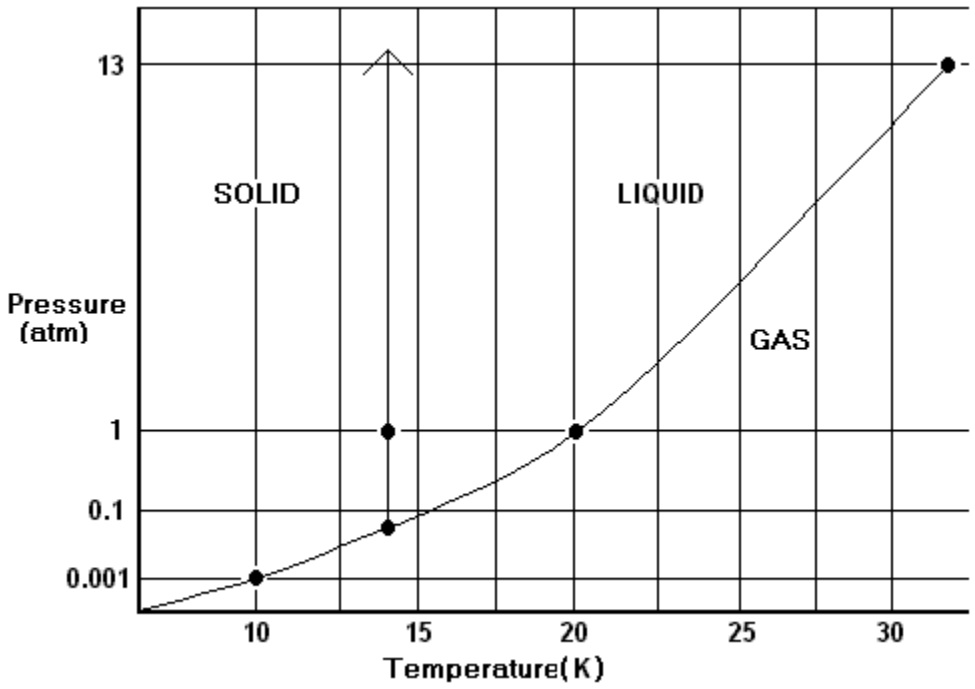
1. Carbon disulfide, CS_2, has the lower boiling point. Both substances are nonpolar, but CCl_4 has a higher molecular wieght and thus has higher dispersion forces and a higher boiling point.

2. (lowest melting point)$Cl_2 < CCl_4 < CsCl < MgCl_2$(highest melting point). Cl_2 and CCl_4 are nonpolar molecular substances. CsCl and $MgCl_2$ are ionic and have higher melting points than molecular compounds. The smaller size and higher charge of Mg^{2+} compared to Cs^+ gives $MgCl_2$ the highest melting points.

3.a) vapor, b) liquid, c) vapor, d) vapor

4. 3.60×10^2 kJ

5.



6. Ethylene glycol has a greater viscosity than ethanol because ethylene glycol is capable of forming more hydrogen bonds and thus the attractive forces between ethylene glycol molecules are stronger than those between ethanol molecules.

7. perovskite: $CaTiO_3$

8. body-centred