Dr. Casagrande's Chemistry 1 Final Exam Review Sheet 2

Chapter 14 Problems

1. A sample of SO_2 gas has a volume of 84 L at a pressure of 1.5 atm and a temperature of –35°C. At what temperature will the fluorine occupy 95 L at 2.8 atm?

$T_1 = -35°C + 273 = 238\ K$

$$\frac{(1.5\ atm)(84\ L)}{238\ K} = \frac{(2.8\ atm)(95\ L)}{T_2};\ T_2 = \frac{(2.8\ \cancel{atm})(95\ \cancel{L})(238\ K)}{(1.5\ \cancel{atm})(84\ \cancel{L})} = \boxed{502\ K\ (229\ °C)}$$

2. A student collects 545 mL of nitrous oxide gas at a temperature of 47°C and a pressure of 722 mm Hg. How many moles of N_2O did she collect?

$T = 47°C + 273 = 320\ K$; $V = 0.545\ L$; $P = 0.95\ atm$; use $PV = nRT$

$$(0.95\ atm)(0.545\ L) = n\left(0.0821\frac{L \cdot atm}{mol \cdot K}\right)(320\ K);\ n = \frac{(0.95\ \cancel{atm})(0.545\ \cancel{L})}{\left(0.0821\frac{\cancel{L} \cdot \cancel{atm}}{mol \cdot \cancel{K}}\right)(320\ \cancel{K})} = \boxed{0.0197\ mol}$$

3. What volume of SO_2 at STP can be produced by the following reaction of when 89.5 L of O_2 is reacted with excess As_2S_3?

$$2\ As_2S_3\ (s) + 9\ O_2\ (g) \rightarrow 2\ As_2O_3\ (s) + 6\ SO_2\ (g)$$

$$?\ L\ SO_2 = 89.5\ \cancel{L\ O_2} \times \frac{6\ L\ SO_2}{9\ \cancel{L\ O_2}} = \boxed{59.7\ L\ SO_2}$$

Chapter 15 Problems

4. At what pressure will the solubility of a gas be 0.895 g/L if its solubility at 0.785 atm is 0.186 g/L?

$$\frac{s_1}{P_1} = \frac{s_2}{P_2} \Rightarrow \frac{0.186\ g/L}{0.785\ atm} = \frac{0.895\ g/L}{P_2} \Rightarrow P_2 = \frac{(0.785\ atm)(0.895\ g/L)}{0.186\ g/L} = \boxed{3.78\ atm}$$

5. What is the molarity of an aqueous solution containing 85.2 g of $SrCl_2$ in a 750 mL solution?

$$?\ mol\ SrCl_2 = 85.2\ \cancel{g} \times \frac{1\ mol}{158.52\ \cancel{g}} = 0.537\ mol;\ M = \frac{0.537\ mol\ SrCl_2}{0.750\ L} = \boxed{0.717\ M}$$

6. What volume of 5.0 M stock solution of HCl would you need to prepare 400 mL of 0.30 M solution?

$$V_1 = \frac{(0.30\ \cancel{M})(400\ mL)}{5.0\ \cancel{M}} = \boxed{24\ mL}$$

Chapter 16 Problems

7. 35.0 g of silver is heated from 21.5°C to 195.3°C, and absorbs 1417 joules of heat in the process. Calculate the specific heat capacity of silver.

$$1417\ J = (35.0\ g)(C)(195.3°C - 21.5°C);\ C = \frac{1417\ J}{(35.0\ g)(173.8°C)} = \boxed{0.233\ J/g \cdot °C}$$

8. When 1 mol dodecane ($C_{12}H_{26}$) burns in air, 8,088 kJ is released:

$$C_{12}H_{26}\ (l) + 18.5\ O_2\ (g) \rightarrow 13\ CO_2\ (g) + 12\ H_2O\ (g)\ \Delta H_{comb} = -8{,}088\ kJ$$

How much heat is released when 358.2 g $C_{12}H_{26}$ is burned?

$$?\ kJ = \frac{358.2\ g\ C_{12}H_{26}}{1} \times \frac{1\ mol\ C_{12}H_{26}}{170.3\ g\ C_{12}H_{26}} \times \frac{-8{,}088\ kJ}{1\ mol\ C_{12}H_{26}} = \boxed{-1.70 \times 10^4\ kJ}$$ (– indicates heat released)

9. When a 12.8-g sample of KCl dissolves in 75.0 g of water in a calorimeter, the temperature drops from 31.0°C to 21.6°C. Calculate ΔH (per mole) for the process.

$KCl\ (s) \rightarrow K^+\ (aq) + Cl^-\ (aq)$ $\Delta T = 21.6°C - 31.0°C = -9.4°C$

a. $q_{water} = 75.0\ g \times 4.18\ J/g \cdot °C \times -9.4°C = -2950\ J$

b. $mol_{reactant} = 12.8\ g\ KCl \times \frac{1\ mol}{74.55\ g} = 0.172\ mol$

c. $\Delta H_{rxn} = \frac{-(-2950\ J)}{0.172\ mol} \times \frac{1\ kJ}{1000\ J} = \boxed{+17.1\ kJ/mol}$ (+ since endothermic)

Reaction is [**exothermic, endothermic**]

10. Predict the sign of Δ*S* (+, –, or "can't tell") for the following processes:

Reaction or Process	Δ*S* Sign
a. $Br_2\ (l) \rightarrow Br_2\ (g)$	+
b. $H_2\ (g) + Cl_2\ (g) \rightarrow 2\ HCl\ (g)$	can't tell
c. $Fe\ (l) \rightarrow Fe\ (s)$	–

11. For the reaction $Ca\ (s) + 2\ H_2O\ (l) \rightarrow Ca(OH)_2\ (s) + H_2\ (g)$, ΔH = –411.6 kJ and ΔS = 31.8 J/K. **Calculate** Δ*G* for the reaction at a temperature of 298 K [watch units!]. Will this reaction be **spontaneous**? *Justify* your answer.

$\Delta G = -411.6\ kJ - (298\ K)(31.8\ J/K)(1\ kJ/1000\ J) = \boxed{-421.1\ kJ}$

Yes, the reaction will be spontaneous since $\Delta G < 0$