

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

Chapter 14 Problems

1. A sample of SO₂ 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?

$$T_1 = -35^\circ\text{C} + 273 = 238 \text{ K}$$

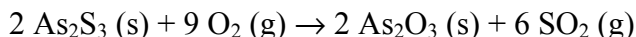
$$\frac{(1.5 \text{ atm})(84 \text{ L})}{238 \text{ K}} = \frac{(2.8 \text{ atm})(95 \text{ L})}{T_2}; T_2 = \frac{(2.8 \text{ atm})(95 \cancel{\text{ L}})(238 \text{ K})}{(1.5 \text{ atm})(84 \cancel{\text{ L}})} = \boxed{502 \text{ K } (229^\circ\text{C})}$$

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 N₂O did she collect?

$$T = 47^\circ\text{C} + 273 = 320 \text{ K}; V = 0.545 \text{ L}; P = 0.95 \text{ atm}; \text{ use } PV = nRT$$

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

3. What volume of SO₂ at STP can be produced by the following reaction of when 89.5 L of O₂ is reacted with excess As₂S₃?



$$? \text{ L SO}_2 = 89.5 \cancel{\text{ L O}_2} \times \frac{6 \text{ L SO}_2}{9 \cancel{\text{ L O}_2}} = \boxed{59.7 \text{ L SO}_2}$$

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?

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

5. What is the molarity of an aqueous solution containing 85.2 g of SrCl₂ in a 750 mL solution?

$$? \text{ mol SrCl}_2 = 85.2 \cancel{\text{ g}} \times \frac{1 \text{ mol}}{158.52 \cancel{\text{ g}}} = 0.537 \text{ mol}; M = \frac{0.537 \text{ mol SrCl}_2}{0.750 \text{ L}} = \boxed{0.717 \text{ M}}$$

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

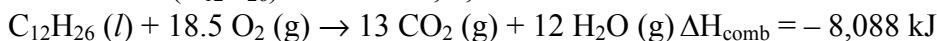
$$V_1 = \frac{(0.30 \text{ M})(400 \text{ mL})}{5.0 \text{ M}} = \boxed{24 \text{ mL}}$$

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.

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

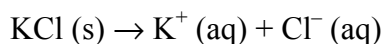
8. When 1 mol dodecane (C₁₂H₂₆) burns in air, 8,088 kJ is released:



How much heat is released when 358.2 g C₁₂H₂₆ is burned?

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

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.



$$\Delta T = 21.6^\circ\text{C} - 31.0^\circ\text{C} = -9.4^\circ\text{C}$$

$$\text{a. } q_{\text{water}} = 75.0 \text{ g} \times 4.18 \text{ J/g} \cdot ^\circ\text{C} \times -9.4^\circ\text{C} = -2950 \text{ J} \quad \text{b. } \text{mol}_{\text{reactant}} = \frac{12.8 \text{ g KCl} \times \frac{1 \text{ mol}}{74.55 \text{ g}}}{1} = 0.172 \text{ mol}$$

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

Reaction is [exothermic, **endothermic**]

10. Predict the sign of ΔS (+, -, or "can't tell") for the following processes:

Reaction or Process

ΔS Sign

a. Br₂ (l) → Br₂ (g) +

b. H₂ (g) + Cl₂ (g) → 2 HCl (g) can't tell

c. Fe (l) → Fe (s) -

11. For the reaction Ca (s) + 2 H₂O (l) → Ca(OH)₂ (s) + H₂ (g), ΔH = -411.6 kJ and ΔS = 31.8 J/K.

Calculate ΔG for the reaction at a temperature of 298 K [watch units!]. Will this reaction be **spontaneous**? *Justify* your answer.

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

Yes, the reaction will be spontaneous since ΔG < 0