**Chemistry HP Final Review Problem** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period: \_\_\_

Methane gas reacts with chlorine gas to produce hydrochloric acid vapor and gaseous carbon tetrachloride.

1. Write a balanced chemical equation for the reaction, including the state of each substance.

\_\_\_\_\_\_\_\_\_\_\_\_ ( ) + \_\_\_\_\_\_\_\_\_\_\_\_ ( ) \_\_\_\_\_\_\_\_\_\_\_\_ ( ) + \_\_\_\_\_\_\_\_\_\_\_\_ ( )

1. The reaction is carried out at 80.0 °C and 8.40 atm with 500.0 mL of methane. Determine the moles of methane contained in this volume.

Moles of methane: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Determine the moles and mass of chlorine required in the reaction.

Moles Chlorine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass Chlorine: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Determine the moles of hydrochloric acid produced. The hydrochloric acid is dissolved in 2.00 L of water. Determine the concentration and pH of the resulting solution.

Moles HCl: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[HCl]: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

pH: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Determine the moles and mass of carbon tetrachloride produced. Calculate the amount of heat required to increase the temperature from 80.0 °C to 95.0 °C (the specific heat capacity of carbon tetrachloride is 0.542 J/g °C)

Moles: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Heat: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate the heat of the reaction from the heats of formation. (The heat of formation of carbon tetrachloride is ‒96.0 kJ/mol) Is the reaction endothermic or exothermic? Write the reaction to include the heat term on the correct side of the equation.

Heat: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Endo or Exo?: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Chlorine-38 undergoes beta decay. Give an equation for this reaction. Chlorine-38 has a half-life of 37.2 minutes. What mass of a 120 g sample would remain after 186 minutes?

Reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Chlorine is a green gas. Describe the effect on the concentration of chlorine and the color for each of the following stresses:
   1. increase the concentration of hydrochloric acid
   2. decrease the temperature
   3. increase the volume.
2. Write a Keq expression for the reaction.

**Final Exam Review Self-Assessment**

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| **Relevant Learning Targets** | **Question** | **Right or Wrong?** | **For any questions you got wrong- simple mistake or need to re-study?** |
| **VI. Chemical Reactions**  (6) Balance chemical equations beginning with either chemical names or formulas.  (8) Predict the products of a reaction given the formulas or names of reactants.  (9) Label the state of a substance in a chemical reaction as **solid (s**), **liquid (l)**, **gas (g)**, or **solution (aq**). | a |  |  |
| **IX. Gases**  (11) Perform calculations using the **Ideal Gas Law**. | b |  |  |
| **VII. Stoichiometry**  (3) Perform stoichiometric calculations involving mass of a reactant or product, giving answers with the appropriate units and significant figures. | c |  |  |
| **VII. Stoichiometry**  (2) Determine **mole ratios** for a reaction from the balanced chemical equation in order to convert between the moles different substances.  **X. Solutions**  (4) Perform calculations involving molarity/solution concentration.  **XI. Acids and Bases**  (3) Calculate pH, pOH, [H+], and [OH‒] for acids and bases. | d |  |  |
| **VII. Stoichiometry**  (3) Perform stoichiometric calculations involving mass of a reactant or product, giving answers with the appropriate units and significant figures.  **XII. Thermochemistry**  (6) Perform calculations involving specific heat capacity for heating and cooling of substances. | e |  |  |
| **XII. Thermochemistry**  (10) Determine if a reaction is exothermic or endothermic from the chemical equation or ∆H value. Given the ∆H value, add the heat term to the appropriate side of a chemical reaction.  (12) Calculate the heat of a reaction from tabulated **heats of formation**. | f |  |  |
| **XII. Nuclear Chemistry**  (1) Write the **nuclide symbol** for a given isotope.  (5) Complete nuclear reactions including those involving alpha, beta, or gamma radiations as well as neutrons and protons.  (7) Perform calculations involving half-life in order to solve for mass, time, original mass, and half-life. | g |  |  |
| **XIII. Equilibrium**  (3) Predict the shift on an equilibrium from changing **concentration**, **temperature**, and **pressure/volume**.  (5) Write a Keq expression for an equilibrium. | h |  |  |

What learning targets were the most difficult on this review problem?

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What are you going to do to master this learning target for the final exam?

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If you did well on all of the learning targets, what did you do to effectively study/prepare?

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