Final Exam Review

**DIRECTIONS**: Complete the following review study guide. All topics from the course are covered.

Day 1

1. CO\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Al2(SO4)3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. ZnI2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Pb(NO3)2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Mg(C2H3O2)2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. Na3PO4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. NH4NO3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Copper (I) sulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Calcium chlorite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. Hydrofluoric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
11. Acetic Acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
12. Barium Sulfite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Acetic Acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
14. Triphosphorus octaiodide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Day 2

1. For the following reactions (a-e) predict the products of the nuclear reaction **AND** write the equation in short hand notation in the space provided to the right.
2. $\begin{matrix}245\\95\end{matrix}$Am + $\begin{matrix}1\\0\end{matrix}$n 🡪$\begin{matrix}0\\-1\end{matrix}$β + \_\_\_\_\_\_\_\_\_\_
3. $\begin{matrix}1\\1\end{matrix}$H + $\begin{matrix}1\\1\end{matrix}$H 🡪 \_\_\_\_\_\_\_\_ + $\begin{matrix}0\\1\end{matrix}$e
4. $\begin{matrix}35\\17\end{matrix}$Cl + $\begin{matrix}1\\0\end{matrix}$n 🡪$\begin{matrix}35\\16\end{matrix}$S + \_\_\_\_\_\_\_\_\_
5. 54Fe + 1n 🡪1H + \_\_\_\_\_\_\_\_\_\_
6. 238U + 12C 🡪246Cm + \_\_\_\_\_\_\_\_\_
7. If gallium-68 has a half-life of 68.3 minutes, how much of a 10.0 mg sample is left after one half life? Two Half-lives? Three half-lives?
8. Another element - Z - has three isotopes: Z-78 with a weight of 77.989, Z-81 with a weight of 81.000, and Z-82 with a weight of 82.003. The percent abudance of the three isotopes is: Z-78 34.050%, Z-81 50.720%, and Z-82 15.230%. What is the average atomic weight of element Z ?
9. Complete the following table.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Element | Nuclear Symbol | Mass Number | Atomic Number | protons | neutrons | electrons |
| Fluorine -- 19 | $\begin{matrix}19\\9\end{matrix}$F |  | 9 |  |  |  |
|  |  | 197 |  | 77 |  | 80 |

Day 3

1. For each of these elements (Ni, S, Br) indicate the following: (1) Electron and noble gas configurations, (2) Aufbau diagram, and (3) Bohr diagram.
2. For the following periodic table label the following items: Alkali Metals, Alkaline Earth Metals, Metalloids, Lanthanides, Actinides, Halogens, Noble Gases, s-block, p-block, d-block, f-block, metalloids, transition metals, and non-metals. **ALSO** label the following trends: ionization energy, electronegativity, and atomic radius.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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Day 4

1. Complete the following table using VSEPR Theory by predicting the products of the reaction in the first row of the column. BALANCE this equation. Afterwards, complete each row with the specified item for the molecule in the column above.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Reaction | CH4 | + | O2 | 🡪 |  | + |  |
| Lewis Dot Structure |  |  |  |  |  |  |  |
| Electron Group Geometry |  |  |  |  |  |  |  |
| Molecular Shape |  |  |  |  |  |  |  |
| Bond Angle |  |  |  |  |  |  |  |
| Bond Polarity |  |  |  |  |  |  |  |
| Overall (Molecular) Polarity |  |  |  |  |  |  |  |
| IMFs |  |  |  |  |  |  |  |

Day 5

For the following reactions, predict the products of the reaction, balance the reaction and indicate what type of reaction it is.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Cu(s) + AgNO3(aq)🡪
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Br2(g) + NaF🡪
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ H2SO4(aq) + KOH(aq)🡪
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ni + MgCl2🡪
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CoO🡪
6. Label the following diagram with these items: energy of the reactants, energy of the products, activation energy, the activated complex, the energy of the activated complex, the enthalpy of the reaction (ΔH).

Day 6

For questions 28-31 consider the combustion of butane gas (C4H10) according to the following balanced eqn:

2 C4H10 (g) + 13 O2 (g)🡪 8 CO2 (g) + 10 H2O(liq)

1. According to the balanced equation, if a student burns **8.80 molesof butane gas** in an excess of oxygen, how many **moles** of **carbon dioxide** gas should be expected to produce?
2. If you start with **20.0 gramsof oxygen gas** and an excess of butane, how many **molesof carbon dioxide** should be produced theoretically?
3. If you start with **24.0 gramsof oxygen gas** and an excess of butane, how many **gramsof water** should be produced theoretically?
4. If a chemist notices that 35.6 liters of carbon dioxide was produced in the reaction, how many liters of oxygen were consumed in the reaction?

Day 7

1. In the space provided below, sketch a **PHASE DIAGRAM**. Be sure to include the following items: solid, liquid, and gas phases, the triple point, the critical point. Also include these processes: freezing/melting, evaporation/condensation, and sublimation/deposition.
2. Observe the phase change diagram provided to the upper right. Compare the boiling and melting points of both Substance A and Substance B. What could you say about both of these points for both substances?
3. Methanol has a heat of fusion of 109 J/g. If 900. J of energy is added to solid methanol, how many grams will melt completely?
4. 8653 J of heat are added to 350. g of ice. How much will this increase the temperature (in 0C)?

1. What amount of heat (in joules) is needed to freeze 50.00 g of water?

Day 8

1. Determine the volume of a gas at STP if originally occupying 10 L at 2000 mm of Hg at 35° C.
2. What mass of water vapor will occupy 5 L at 2.5 atm and 75 °C?
3. Determine the pressure of O2 if in a mixture at standard pressure with N2 at .78 atm and H2O vapor at .11 atm.
4. 250 g of carbon dioxide are place in a 15 L container at – 33 °C. What is the pressure in the container?
5. A sample of air in a syringe exerts a pressure of 1.02 atm at a temperature of 22.0°C. The syringe is placed in a boiling water bath at 100°C. The pressure of the air is increased to 1.23 atm by pushing the plunger in reducing the volume to 0.224 mL. What was the original volume of the air?

Day 9



Use the solubility curve to the right to answer questions 42-45. Put your answer in the space provided. 46-48 are calculation problems independent of the graph.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ At 60°C, what is the solubility of potassium chloride? Be sure to include units.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ How would the solubility of 20 grams of sodium nitrate at 90°C be classified?
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ What temperature would classify 140 grams of potassium iodide as a saturated solution?
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A solution of Ce2(SO4)3 at 90 deg C is given 30 grams more solute and allowed to cool. How would this solution be classified?
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_What would be the concentration of a solution made by diluting 45.0 mL of 4.2 M KOH to 250 mL?
6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ A 135 gram sugar cube (sucrose C12H22O11, Mw= 342 g/mol) is dissolved in a 350 ml teacup filled with hot water. What is the molarity of the solution?
7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ How many grams of copper (II) sulfate are needed to make 750 ml of a 3.5 M solution?

Day 10

1. What is the pH of a 0.0059 M NaOH solution?
2. What is the [H3O+] of a solution whose pH is 5.4?
3. What is the [OH-] of a solution that has a pH of 10.7?

Identify the following as **Acid, Base,** or **Neutral** in terms of the pH:

 **pH** **A, B, N?**

1. [H3O+] = 1 X 10-7 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. [H3O+] = 6.6 X 10-10 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. [H3O+] = [OH-] \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. [OH-] = 2.3 X 10-8 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. [OH-] = 7.9 X 10-4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
6. pOH = 3.7 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. pH = 13.4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Day 11

59. Methanol (methyl alcohol) can be manufactured using the following equilibrium reaction:

CO(g) + 2H2(g) → CH3OH(g) + energy

Write equilibrium expressions for this system and predict the effect of the following changes on the equilibrium concentration of CH3OH(g).

a. a decrease in temperature

b. an increase in pressure

c. addition of H2(g)

d. addition of a catalyst

60. In the equilibrium reaction:

4HCl(g) + O2(g) → 2H2O(g) + 2Cl2(g) + 114.4 kJ

Write equilibrium expressions for this system and predict the direction of equilibrium shift if the following changes occur.

a. the pressure in increased

b. energy is added

c. oxygen is added

d. HCl is removed

e. a catalyst is added