Name ______________________________ Hour ___

Honors Chemistry Final Exam Review 2018 - HERBERHOLZ

**Due on the day of the exam! No photocopying or copying other classmate's review. Must be handwritten and show work for calculations.*

Chapter 2:

A. How many significant digits are in the following numbers?

1. 417.0 __________
2. 0.0005 __________
3. 500 000 __________
4. 0.30034 __________
5. 3.970×10^5 __________

B. Convert into Scientific Notation

1. 73 000 000 ________________
2. 547.85 ________________
3. 246.0 ________________
4. 0.000006243 ______________
5. 69 040 ________________

C. Perform the following calculations and Round into correct scientific notation.

1. $(6.40 \times 10^4) \div (3.20 \times 10^2) =$ ________________
2. $(4.42 \times 10^{-3}) \times (4 \times 10^{-2}) =$ ________________
3. $(3.8 \times 10^5) + (7.98 \times 10^3) =$ ________________
4. $(7.8350 \times 10^{-2}) - (2.20 \times 10^{-3}) =$ ________________
5. $(2 \times 10^{-3}) + (8.0 \times 10^{-4}) =$ ________________

D. Perform the following calculations and round to the correct number of significant digits

1. 4.333 + 2.223 + 7.6 = ________
2. 732. 343 – 23 = ___________
3. 5.73060 x 2.1 = _____________
4. 7.85 ÷ 3.77777 = ___________
5. 567.90 x 39 = ____________
6. 3.4680 x 1.5 = _____________

Chapter 3:

1. Compare the arrangement of particles in solids, liquids, and gases.

2. What is the difference between a mixture and a compound?

3. Compare homogeneous and heterogeneous mixtures?

4. Compare chemical and physical changes

Chapter 4:

1. Compare atomic number and mass number

2. What is the difference between an isotope and an ion?

3. Write the following three isotopes in shorthand notation: Carbon-13, Uranium-238, and Bromine-81

4. Compare mass number and average atomic mass

5. Given the following 4 isotopes of lead with their relative abundances, calculate the average atomic mass to 3 decimal places using "a.m.u." as the units.
    a. Lead-204 at 1.4%
    b. Lead-206 at 24.1%
    c. Lead-207 at 22.1%
    d. Lead-208 at 52.4%

Chapter 5:

1. Complete the chart below:

Sublevels	Draw the Number of Orbitals	Maximum Electrons
s		
p		
D		
f		

2. What are the 3 rules that govern electron distributions and electron configurations
   a.
   b.
   c.

3. Show the distribution of electrons and the orbitals for the following elements:
   a. Sodium:
   b. Chlorine
   c. Calcium:
   d. Iron:

4. Write the electron configurations for the following elements
   a. Magnesium:
   b. Titanium:
   c. Zirconium:
   d. S^{2-}:
   e. Ba^{2+}:

5. Explain what is meant by $4p^3$.

Chapter 8-9: *Fill in the chart below*

	NAME	FORMULA	Ionic/Acid/Molecular
1.	Carbon tetrachloride		
2.	Magnesium sulfate		
3.	Iron (II) oxide		
4.	Zinc Chloride		
5.	Copper (I) phosphite		
6.	Aluminum Oxide		
7.	Carbonic Acid		
8.	Phosphorus Tribromide		
9.	Ammonium Hydroxide		
10.	Tin (IV) carbonate		
11.		$Pb_3(PO_4)_2$	
12.		$Hg(CN)_2$	
13.		$AgNO_3$	
14.		$NaClO_3$	
15.		SiO_2	
16.		Co_2S_3	
17.		H_3PO_4	
18.		$Mn(CO_3)_2$	
19.		N_2O_4	
20.		Cu_2SO_3	
21.		$ZnBr_2$	

<u>Chapter 10</u>: *Predict the products of each reaction and balance.*

<u>SINGLE REPLACEMENT REACTIONS</u>

1. ___Br_2 + ___CaI_2 →
2. ___Mg + ___HCl →
3. ___Zn + ___H_2SO_4 →

<u>DOUBLE REPLACEMENT REACTIONS</u>

1. ___$Ca(OH)_2$ + ___H_3PO_4 →
2. ___$Cd_3(PO_4)_2$ + ___$(NH_4)_2S$ →
3. ___$AgC_2H_3O_2$ + ___K_2CrO_4 →

<u>DECOMPOSITION REACTIONS</u>

1. ___LiCl →
2. ___Fe_2O_3 →
3. ___ KI →

<u>COMBINATION REACTIONS</u>

1. ___Na + ___O_2 →
2. ___K_2O + ___H_2O →
3. ___Al_2O_3 + ___H_2O →

<u>COMBUSTION RECTIONS</u>

1. ___C_6H_6 + ___O_2 →
2. ___$C_{12}H_{22}O_{11}$ + ___O_2 →
3. ___$C_{25}H_{52}$ + ___O_2 →

Chapter 11:

1. Write the chemical formula, the type of representative particle, and the molar mass for the following:

Chemical Name	Formula	Representative Particle	Molar Mass *(g)*
Sodium sulfate			
Dinitrogen pentoxide			
Lead (IV) phosphate			
Cobalt (II) nitrate			
Hydrogen gas			
Dicarbon hexahydride			
Iron (III) carbonate			

2. Convert 1.41 x 10^2 grams of titanium into atoms

3. Convert 6.32 x 10^4 grams of carbon dioxide into liters @ STP

4. Convert 5.42 x 10^{31} formula units of Calcium carbonate into grams

5. If the molar mass of a gas is 34 grams, what is the density @ STP?

6. Is the unknown gas NO, N_2O, N_2O_5, NO_2, or N_2O_3 if 75.3-g of it occupies a 38.4-L container at STP?

7. You have an unknown gas with a density of 1.25 g/L at STP. Is the gas O_2, N_2, CH_4, CO_2, or NH_3?

8. What is the percent composition of each element in the substance Potassium carbonate?

9. Determine the empirical formula of an unknown substance if it contains 80.0% carbon and 20.0% hydrogen.

10. Using the empirical formula form question 5, determine the molecular formula if the molar mass is 30 grams.

Chapter 12:

1. How many grams of zinc chloride are produced when zinc reacts with 194.5 grams of hydrochloric acid?
    a. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

2. How many grams aluminum are needed to react with 4.95×10^{24} molecules of oxygen gas?
    a. $4Al + 3O_2 \rightarrow 2Al_2O_3$

3. After decomposing 47.7-g $NaHCO_3$, determine the percent yield of sodium hydroxide if 15.0 grams was actually produced during the reaction. $NaHCO_3 \rightarrow NaOH + CO_2$

4. If you start with 14.8 g of C_3H_8 and 3.44 g of oxygen gas, which is the limiting reagent?
    a. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

5. If you start with 14.8 g of C_3H_8 and 3.44 g of oxygen gas, which is the excess reagent and how much excess?
    a. $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

6. If 10.0 g of aluminum sulfite reacts with 10.0 g of sodium hydroxide, what mass of aluminum hydroxide is made?
    a. $Al_2(SO_3)_3 + 6NaOH \rightarrow 3Na_2SO_3 + 2Al(OH)_3$

7. Assuming STP, how many liters of oxygen are needed to produce 24.6 L of Sulfur trioxide?
    a. $2SO_2 + O_2 \rightarrow 2SO_3$

Chapter 13:

1. A sample of 3 gases has a total pressure of 1.24-atm. What is the partial pressure of gas 3 if the partial pressure of gas 1 is 0.21-atm and gas 2 is 0.75-atm?

2. What are the intermolecular forces that hold particles together?

3. Rank the intermolecular forces from strongest to weakest.

4. Calculate the average kinetic energy of a 5.78×10^{-17} gas molecule traveling at a velocity of 2.34×10^{4} m/s.

5. In the lab, you calculated that the density of lead was 12.46 g/mL. The accepted value for the density of lead is 11.35 g/mL. What was your percent error in the lab?

6. What state(s) of matter can flow?

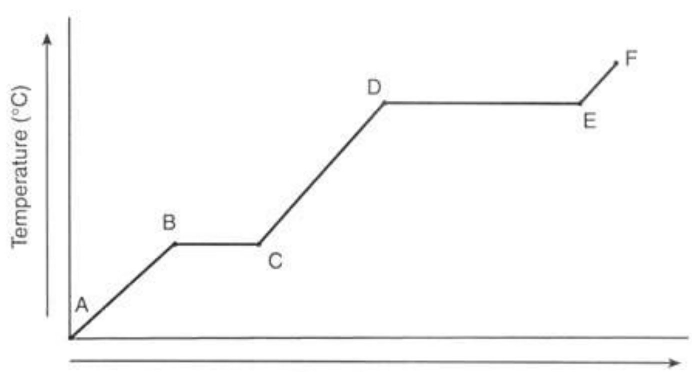
7. Which state(s) of matter have a definitely volume?

8. Which state(s) of matter have the most fixed particles?

9. What is absolute zero?

10. What temperature is absolute zero in Celsius and in kelvin?

11. Is energy gained or lost during the following processes?
    a. Identify the parts of the heating curve and what is happening at each letter and each phase.



Chapter 14:

1. What pressure will be exerted by 22-g of CO_2 at a temperature of 22 °C and volume of 222-mL?

2. At conditions of 1.03 atm and 15.0 °C, a gas occupies a volume of 45.5-mL. What will the volume of the same gas be at 0.98 atm and 30.0 °C?

3. A sample of air contains O_2, N_2, and CO_2. The partial pressure of O_2 is 31.3-kPa, the partial pressure of N_2 is 57.8-kPa, and the partial pressure of CO_2 is 3.9-kPa. What will the partial pressures of the gases be if the total pressure of the air sample is increased to 356.0-kPa? Give answers in atm.

4. A sample of CO_2 gas has a pressure of 4.3-atm and a temperature of 340 K. What is the density?

5. An unknown gas at STP has a density of 0.179 g/L. Determine the unknown gas by calculating the molar mass.

6. If 4.0 moles of a gas at a pressure of 5.4 atmospheres has a volume of 120.0 -L, what is the temperature?

7. A given mass of gas has a pressure of 0.829-atm and a temperature of 35 ^{0}C. When the gas is heated an additional 230 degrees, what will the new pressure be in a rigid container?

8. A balloon is 1.5-L with a pressure of 1.12-atm at a temperature of 15°C. If the volume changes to 2.5-L and temperature of 30°C, what will the new pressure in the balloon be?

9. Oxygen gas is a temperature of 40 °C when it occupies a volume of 2.3 L. To what temperature should it be raised to occupy a volume of 6.5 L?

10. Compare effusion rates of Nitrogen gas, oxygen gas, and helium? Explain what effusion is.

<u>Chapter 15</u>:

1. Calculate the final concentration if 5.0-L of 2.50-M NaCl, 6.5-L of 3.75-M NaCl and 7.00-L of water are mixed.

2. Compare solutions, suspensions, & colloids? Which can be filtered?

3. You are using a 16.0-M stock solution of HCl to make 4.0-L of 3.0-M HCl? After determining the amount of stock solution needed, how much water was <u>added</u> to make the diluted solution?

4. What is a colligative property?

5. What are the 3 colligative properties?

6. What are electrolytes?

7. Describe how vapor pressure changes in a solution can change the boiling point.

8. If 310.0-grams of H_2SO_4 are dissolved to make 500.0-mLof sulfuric acid, what is the molarity?

9. At 25º, you can dissolve 12.0 g/L of oxygen gas at 288.0-kPa. If temperature remains constant, what is the solubility of oxygen gas (in g/L) if the pressure is raised to 466.0-kPa?

10. What mass of NaCl *(in grams)* is required to make 700.0-mL of 6.0-*M* salt water solution?

11. What is the difference between saturated, supersaturated, and unsaturated solutions?

12. A stock solution of 12.0-M NaOH is used to make 950.0-mL of 3.25-M solution. After determining the volume of stock solution needed, how much water (in mL) is added to it?

Chapter 16:

1. Use the equation below to determine the amount of energy required to produce 3 moles of water.
   $2NaHCO_3 + 129\ kJ \rightarrow Na_2CO_3 + H_2O + CO_2$

2. What is the amount of heat needed to raise the temperature of a 350.0 g piece of iron by 25 °C?
   a. (C_{iron} = 0.45 J/g x °C)

3. Calculate ΔH for the following reaction: $2CO + O_2 \rightarrow 2CO_2$
   a. (ΔH^0_f for CO_2 = -394 kJ/mol; ΔH^0_f for CO = -111 kJ/mol)

4. Use the following two equations to determine ΔH for $N_2(g) + 2H_2(g) \rightarrow N_2H_4(l)$

   $N_2H_4(l) + O_2(g) \rightarrow N_2(g) + 2H_2O(l)$ ΔH=-622.2 kJ
   $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$ ΔH=-285.8 kJ

5. A 40.0 g piece of iron was inserted into 100-mL of water at 10 °C. The final temperature of the water and iron was 12°C. What was the original temperature of the iron? (C_{iron} = 0.45 J/g x °C)

6. What is the specific heat of a 230 gram sample of an unknown substance if it absorbed 5.2 kJ raising its temperature from 10 °C to 32 °C?

7. Explain the difference between an ideal spontaneous and ideal nonspontaneous reaction.

8. What is entropy? What phases have high entropy?

9. Calculate the free energy change of a system at 275 K with an enthalpy change of 104 kJ and an entropy change of 270 J/K.

10. A 42.0 gram sample of steam at 108°C changes into ice at -14°C. Calculate the enthalpy change (in kJ) that takes place during this process.

11. When looking at a chemical equation, how do you know if entropy is increasing or decreasing?

Chapter 17:

1. What must happen in order for a reaction to occur according to the collision theory?

2. What happens to a reaction when temperature is increased, and how does it actually affect the reaction?

3. What increases the rate of a reaction? Give an example.

4. What happens to a catalyst during a reaction?

5. Use the graph below to answer questions:

   a. What is the activation energy of the un-catalyzed reaction?

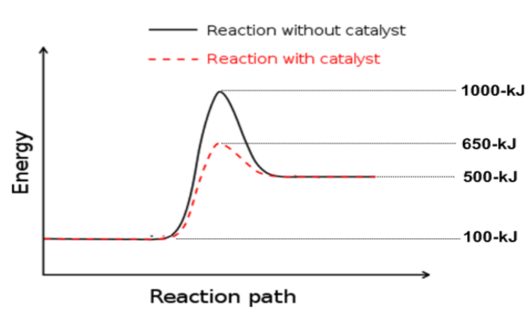
   b. What is the activation energy of the catalyzed reaction?

   c. How much energy is stored in the reactants?

   d. How much energy is stored in the products?

   e. What is the enthalpy change in the reaction?

   f. How much energy does the activated complex have during this reaction?



Chapter 18:

1. What does it mean when a reaction reaches a chemical equilibrium?

2. What happens to the equilibrium when products are removed or added?

3. What happens to the equilibrium position when temperature is increased or decreased in an endothermic or exothermic reaction?

4. Write the expression for the equilibrium constant for this reaction. $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$

5. Calculate the equilibrium constant for the reaction at equilibrium if the concentrations are $[CO_2] = 0.552\text{-}M$, $[H_2] = 0.552\text{-}M$, $[CO] = 0.448\text{-}M$, $[H_2O] = 0.448\text{-}M$. $CO_{2(g)} + H_{2(g)} \Leftrightarrow CO_{(g)} + H_2O_{(g)}$

6. The equilibrium constant for the following reaction is 5.6. If a one liter container of N_2O_4 is 0.66- M, what is the equilibrium concentration of NO_2? $2NO_2(g) \Leftrightarrow N_2O_4(g)$

6. Write the expression for the equilibrium constant for this reaction: $2N_2O_{5\,(g)} \Leftrightarrow 4NO_{2\,(g)} + O_{2\,(g)}$

   - Calculate the equilibrium constant for the reaction if the concentrations are $[N_2O_5] =$ 0.50 mol/L, $[NO_2] =$ 0.80 mol/L, $[O_2] =$ 0.20 mol/L

   - How would the equilibrium shift if oxygen was added to this reaction?

   - How would the equilibrium shift if pressure was decreased in this reaction?

7. What effect would an increase in pressure have on the equilibrium position of each reaction?
   - $4NO_{(g)} + 2O_{2(g)} \Leftrightarrow 2N_2O_{4\,(g)}$
   - $2NO_{(g)} + Br_{2(g)} \Leftrightarrow 2NOBr_{(g)}$
   - $CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH_{(g)}$
   - $SO_{2(g)} + NO_{2(g)} \Leftrightarrow SO_{3(g)} + NO_{(g)}$

8. Circle the K_{eq} value that is most favorable to product formation:

   - $K_{eq} = 1 \times 10^{12}$ b. $K_{eq} = 1.5$ c. $K_{eq} = 5.6 \times 10^{-4}$ d. $K_{eq} = -21.2$

Chapter 19:

1. What is the difference between red and blue litmus paper?

2. What is phenolphthalein used for? What color is it in an acid and a base?

3. What is the difference between "→" and "⇋" in an acid or base reaction?

4. What is the name of HBr?

5. What is the name of HNO_3?

6. What is the name of H_2SO_3?

7. Compare the ionization of weak and strong acids.

8. Compare the ionization of weak and strong bases

9. List some properties of acids.

10. List some properties of bases.

11. What volume of 2.13-*M* $Ba(OH)_2$ *(in mL)* is needed to neutralize 305-mL of 1.9-*M* H_2SO_4? You must first write a balanced equation.

12. If 163-mL of 1.95-*M* $Ca(OH)_2$ is neutralized by 207-mL of HCl, what is Molarity of the HCl? You must first write a balanced equation.

13. If the pH = 4.5, what is the hydroxide ion concentration of the solution?

14. If the pOH = 6.7, what is the hydrogen ion concentration of the solution?

15. A solution has a hydrogen ion concentration of 4.5×10^{-4} *M*, what is the pH and pOH?

Chapter 20:

1. What are transferred in oxidation-reduction reactions?

2. Why are redox reactions energy producing reactions?

3. What is the oxidation number of sulfur in H_2SO_4?

4. Write the following redox reaction into two balanced half-reactions and identify oxidation or reduction.
    a. $Al + O_2 \rightarrow Al_2O_3$

5. In the following unbalanced redox reaction, what is oxidizing and what is reducing?
    a. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

6. What is the oxidation change for the oxidized and reduced atoms in the following unbalanced redox reaction?
    a. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

7. How many total electrons are lost and gained in the following redox reaction?
    a. $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$

8. What are the oxidation numbers for each atom in $Al_2(SO_4)_3$?

Chapter 25

1. Complete the following nuclear reactions.

$a.\ ^{31}_{15}P\ +\ ^{2}_{1}H \rightarrow\ ^{32}_{15}P\ +$ ________

$b.\ ^{37}_{17}Cl\ +$ ______ $\rightarrow\ ^{35}_{16}S\ +\ ^{4}_{2}He$

$c.\ ^{30}_{15}P\ +$ __________ $\rightarrow\ ^{30}_{14}Si\ +\ ^{1}_{1}H$

$d.\ ^{31}_{15}P\ +\ ^{1}_{1}H \rightarrow\ ^{28}_{14}Si\ +$ ________

$e.\ ^{2}_{1}H\ +$ ________ $\rightarrow\ ^{1}_{1}p\ +\ ^{1}_{0}n$

f. ________ $\rightarrow\ ^{237}_{93}Np\ +\ ^{4}_{2}He$

$g.\ ^{14}_{6}C \rightarrow\ ^{14}_{7}N\ +$ ________

$h.\ ^{63}_{29}Cu\ +\ ^{2}_{1}H \rightarrow 2\ ^{1}_{0}n\ +$ ________

2. Write a nuclear equation for the following radioactive processes.

a. Alpha decay of Francium – 208

b. Beta (electron) capture of Thorium – 232

c. Alpha, Beta, Gamma emission of Plutonium – 246

3. Polonium -214 has a relatively short half life of 164 s. How many seconds would it take for 50.0 g of this isotope to decay to 3.125 g ? Show work.

4. If we start with 20 grams of Thorium 234, what amount (g) would remain after 75 days pass if the half life is 25 days ? Show work.

5. Explain fission and fusion.