Name _____   **AP Chem**   ___/___/___

Practice Exam 1
Part 1 - 20 Multiple Choice Question – 20 minutes

1. _____ When potassium dichromate($K_2Cr_2O_7$) is dissolved in water, it is best represented by:
     a. $K_2^+ + Cr_2O_7^{2-}$ **b. $2K^+ + Cr_2O_7^{2-}$**   c. $2K^+ + Cr_2O_7^-$
           d. $K_2^{2+} + Cr_2O_7^{2-}$ e. $2K^+ + 2Cr^{4+} + 7O^{2-}$

2. _____ Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
     a. $KMnO_4$ and KOH b. HI and HIO_3 c. O_2 and O_3
           d. SO_3 and SO_2   e. both C & D

3. _____ Which of the following elements forms a polyatomic anion where it has an oxidation number of +5?
     a. Ca   b. S   c. Fe   **d. N**   e. Cs

4. _____ How many electrons does a sulfide ion have?
     a. 18   b. 20   c. 14   d. 16   e. 32

5. _____ When the following half reaction is balanced with the smallest whole number coefficients, it will contain: $CN^- \rightarrow CNO^-$
     a. $2e^-$ on the right side   b. $1e^-$ on the right side   c. H_2O on the right side
           d. $2H^+$ on the left side   e. a coefficient of 2 for CNO^-

6. _____ The compound that contains 28.6% oxygen is:
     a. NaOH   **b. CaO**   c. Al_2O_3 d. BaO   e. $Ca(OH)_2$

7. _____ Which of the following cannot be a reducing agent?
     a. Au   b. S^{2-} **c. Mn^{7+}**   d. Cu^+ e. O^{2-}

8. _____ How many grams of $Ca(OH)_2$ (molar mass = 74.0 g/mol) are contained in 5.00×10^2 mL of a 0.80 M calcium hydroxide solution?
     a. 40 g   b. 60. g   **c. 30. g**   d. 18 g.   e. none of these

9. _____ $CH_3OH(g) + \_\_O_2(g) \rightarrow \_\_CO_2(g) + \_\_H_2O(g)$
The reaction above represents the oxidation of methanol. How many moles of O_2 are needed to oxidize 1 mole of CH_3OH?
     a. 3/2 moles   b. 5/2 moles   c. 2 moles   d. 1/2 moles   e. 1 mole

10. _____ A 450. mL sample of a 0.375 M solution is left on a hot plate overnight; the following morning the solution is 1.50 M. What volume of solvent has evaporated from the 0.375 M solution?
     a. 338 mL   b. 56.3 mL   c. 112 mL   d. 230. mL   e. 288 mL

11. _____ What is the mass ratio of iron to oxygen in iron(II) oxide?
     a. 3.5 to 1   b. 2.3 to 1   c. 1 to 3.5   d. 1 to 2.3   e. 1 to 1.75

12. _____ When 100 grams of butane gas (C_4H_{10}, MW = 58.14) is burned in excess oxygen gas, the theoretical yield of H_2O (in grams) is:

     a. $\dfrac{(58.14)(18.02)}{(100)(5)}$ b. $\dfrac{(58.14)(5)}{(100)(18.02)}$ c. $\dfrac{(4)(18.02)}{(58.14)(5)}$ d. $\dfrac{(5)(58.14)(18.02)}{(100)}$ e. $\dfrac{(100)(5)(18.02)}{(58.14)}$

13. _____ Excess S_8(s) is heated with a metallic element until the metal reacts completely. All excess sulfur is combusted to a gaseous compound and escapes from the crucible. Given the information that follows, determine the most probable formula for the residue.

Mass of crucible, lid and metal = 55.00 grams
Mass of crucible and lid = 41.00 grams
Mass of crucible , lid and residue = 62.00 grams

      a. CuS   b. Cu_2S c. FeS   d. Fe_2S_3 e. not enough information

14. _____ What ions would you find in solution if potassium perchlorate was dissolved in water?
      a. KCl, O_2 b. K^+, ClO^-, O^{2-} c. KCl, O^{2-} **d. K^+, ClO_4^-**   e. K^+, Cl^-, O^{2-}

15. _____ Arrange the following species in order of increasing oxidation number of the sulfur atom
              SCl_2 S_8 SO_2 H_2S S_2Cl_2 SO_3

      a. H_2S, S_8, S_2Cl_2, SCl_2, SO_2, SO_3
      b. SO_3, SO_2, SCl_2, S_2Cl_2, S_8, H_2S
      c. H_2S, S_8, SCl_2, S_2Cl_2, SO_3, SO_2
      d. SO_2, SO_3, S_2Cl_2, H_2S, SCl_2, S_8
      e. S_8, H_2S, SO_3, SCl_2, SO_2, S_2Cl_2

16. _____ How much 2.0 M H_2SO_4 would be required to make 500 mL of 0.50 M H_2SO_4?
      a. 100 mL   **b. 125 mL**   c. 250 mL   d. 500 mL   e. 400 mL

17. _____ Balance the following equation using the lowest possible whole-number coefficients.
      $NH_3 + CuO \rightarrow Cu + N_2 + H_2O$
The sum of the coefficients is:
      a. 9   b. 10   c. 11   **d. 12**   e. 13

18. _____ If a 10. cm^3 sample of unknown contains 1 cm^3 of 0.1 M $AlCl_3$, then the concentration of Al^{3+} in the unknown is about:
      a. 0.001 M   **b. 0.01 M**   c. 0.1 M   d. 1 M   e. 10 M

19. _____ Which one of the following is correct?
      a. $KClO_3$, potassium perchlorate   b. CuO copper oxide
      c. $Al_3(SO_3)_2$ aluminum sulfate   d. $MgPO_4$ magnesium phosphate
            E. $Na_2Cr_2O_7$ sodium dichromate

20._____ A student was given 31.5 mg of $Ba(OH)_2 * 8H_2O$ (MW = 315 g/mol). She wanted to make a solution where the $[OH^-]$ is 0.10 M. How much water should she add to make the solution?
      a. 1.0 mL   **b. 2.0 mL**   c. 4.0 mL   d. 8.0 mL   e. 99 mL
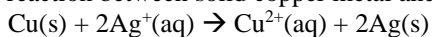
Practice Exam 1
Part 2 - 2 Free Response Question – 20 minutes

Answer the following questions that relate to the analysis of chemical compounds.
(a) A compound containing the elements C, H, N and O is analyzed. When a 2.1106 g sample is burned in excess oxygen, 3.2017 g of $CO_2(g)$ is formed.The combustion analysis also showed that the sample contained 0.1710 g of hydrogen.

  (i) Determine the mass, in grams, of C in the 2.1106 g sample of the compound. **0.8737 g**
  (ii) When the compound is analyzed for N content only, the mass percent of N is found to be 32.16%. Determine the mass, in grams of N in the original 2.1106 g sample of the compound. **0.6788 g**
  (iii) Determine the mass, in grams, of oxygen in the original 2.1106 g sample of the compound. **0.3871 g**
  (iv) Determine the empirical formula of the compound. **$C_3N_2H_7O$**
  (v) The molecular mass of the compound is 174.2 g/mol. Determine the molecular formula of the compound. **$C_6N_4H_{14}O_2$**

#2. The reaction between solid copper metal and silver nitrate can be represented by the following reaction:
  $Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$
(a) A 1.87 g sample of copper wire was placed in 225 mL of 0.250 M $AgNO_3$ at 25°C.
  (i) Identify the limiting reactant. **Ag**
  (ii) What is the maximum mass of solid silver that can be produced? **6.07 g Ag**
  (iii) Determine the value of $[Cu^{2+}]$ after the reaction is complete. Assume the volume change is negligible. **0.125 M**
  (iv) When all of the limiting reactant has been consumed, how many moles of the other reactant remain? **0.00133 moles**
(b) Answer the following questions about the reaction above.
  (i) Which substance acts as the oxidizing agent? **Ag^+**
  (ii) How many electrons are transferred in the reaction? **$2e^-$**