Please read all the questions VERY carefully before answering. If you do not understand any question, please ask. Use the reverse side of the question paper as scratch. Use the periodic table and constant chart in the last page. No outside paper is allowed. Total points = 48+(22x3=)66=114

SHORT ANSWER. Please write the set-up equation first, then insert the raw data with units in the equation before doing your calculations. Points will be deducted if your answer is not clear.

1) Calculate the number of atoms in 39.7 g of naturally occuring bromine (Note the formula of Bromine). (6 pts.)
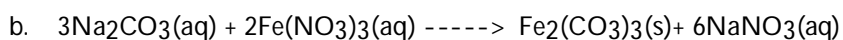
1) _____

2) Calculate the amount (in grams) of phosphorous in a 15.5 gram sample of phosphorous pentachloride. (10 pts.)

2) _____

3) Write the net-ionic equation for the following reactions: Include phase labels for both reactants and products. Also classify each reaction, giving its type. (4 pts/each; 8 pts. tot)

3) _____

    a. $2Na(s) + 2H_2O(l) -----> 2NaOH(aq) + H_2(g)$
       Net Ionic Equation: Reaction Type:
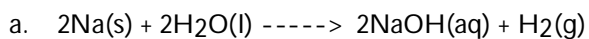
    b. $3Na_2CO_3(aq) + 2Fe(NO_3)_3(aq) -----> Fe_2(CO_3)_3(s) + 6NaNO_3(aq)$
       Net Ionic Equation: Reaction Type:

4) An acid has 40% C, 6.7% H, 53.3% O and its molar mass is 60.05 g/mol. Show your   4) _____
   calculation to find the molecular formula of the acid? (10 pts.)

5) (a) Calculate how many grams of anhydrous magnesium sulfate is in 63.6 grams of its   5) _____
   hydrate salt . The hydrate salt contains 51.1% water by weight. (3 pts.)

   (b) Calculate how many grams of water is in the 63.6 grams of the magnesium sulfate
   hydrate salt (3 pts.)

6) Iron, Fe(s) reacts with oxygen gas, O_2(g) to produce Fe_2O_3 (s). Calculate how many grams   6) _____
   of (a) Fe and (b) O are necessary to make 23.7 g of Fe_2O_3 (4 pts. each, total 8 pts)

MULTIPLE CHOICE. On scantron, answer the questions starting from number 8. Choose the one alternative that best completes the statement or answers the question. (3 poins each)

7) A fictional element has two isotopes, each making up 50% of the population. Isotope 1 has a mass   7) _____
   of 80.0 amu, Isotope 2 has a mass of 85.0 amu. Calculate the atomic mass of the fictional element.
   A) 40 amu
   B) 82.5 amu
   C) 42.5 amu
   D) 165 amu
   E) none of the above

8) What is the mass percent of hydrogen in water?   8) _____
   A) 88.8
   B) 11.2
   C) 33.3
   D) 5.60
   E) none of the above

9) What is the formula mass for diboron tetrachloride?   9) _____
   A) 198.89 amu
   B) 163.43 amu
   C) 127.98 amu
   D) 234.34 amu
   E) none of the above

10) You have 10.0 g each of Na, C, Pb, Cu and Ne. Which contains the smallest number of moles?   10) _____
   A) Ne   B) Na   C) Pb   D) C   E) Cu

11) How many moles of carbon are in 3.5 moles of calcium carbonate?   11) _____
   A) 7
   B) 3.5
   C) 100.09
   D) 10.5
   E) none of the above

12) What is the value of n when the empirical formula is C_3H_5 and the molecular mass is 205.4 g/mol?   12) _____
   A) 140
   B) 5
   C) 10
   D) 0.02
   E) none of the above

13) When the equation __Ca_3N_2 + __H_2O →__$Ca(OH)_2$ + __NH_3 is balanced, the coefficient of H_2O is: 13) _____
   A) 12
   B) 2
   C) 3
   D) 6
   E) none of the above

3

14) If you had an aqueous mixture that contained Ag^+, K^+, and Pb^{+2} cations, how many different solids could precipitate if a chloride solution was added?

   A) 4
   B) 2
   C) no solids will precipitate
   D) 3
   E) 1

15) A precipitate is expected to be formed when an aqueous solution of sodium sulfate is added to an aqueous solution of

   A) iron(III) chloride.
   B) potassium chloride.
   C) barium chloride.
   D) magnesium chloride.
   E) none of the above

16) What is the molecular equation for the reaction of hydrochloric acid with potassium hydroxide?

   A) $HCl + KOH \rightarrow H_2O + KCl$
   B) $2HCl + K(OH)_2 \rightarrow 2H_2O + KCl_2$
   C) $H_2Cl + 2KOH \rightarrow H_2O + 2KCl$
   D) $H^+ + OH^- \rightarrow H_2O$
   E) none of the above

17) What type of a reaction occurs when a hydrochloric acid solution is mixed with a sodium bicarbonate solution?

   A) precipitation
   B) gas evolution
   C) acid-base neutralization
   D) oxidation-reduction
   E) no reaction

18) Identify the double displacement reactions among the following:

      1. $KCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + KNO_3(aq)$
      2. $Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$
      3. $H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$
   A) 1 and 3 only
   B) 2 and 3 only
   C) 1 and 2 only
   D) All of 1, 2, and 3
   E) None of 1, 2, and 3

19) Which of the following is TRUE?

   A) Stoichiometry allows prediction of how much of the reactants are necessary to form a given amount of product.
   B) Stoichiometry allows prediction of the amounts of products that form in a chemical reaction based on the amounts of reactants.
   C) Stoichiometry shows the numerical relationship between chemical quantities in a balanced chemical equation.
   D) All of the above are true.
   E) None of the above are true.

20) How many grams of water are made from the reaction of 4.0 grams of hydrogen gas? 20) _____
Given the reaction: $2H_2 + O_2 \rightarrow 2H_2O$
  A) 36
  B) 72
  C) 18
  D) 4.5
  E) not enough information

21) A chemist wishes to perform the following reaction: $N_2 + 3 H_2 \rightarrow 2 NH_3$ 21) _____
If only 14.0 g of N_2 is available, what is the minimum amount, in grams, of H_2 needed to completely react with this quantity of N_2?
  A) 3.03 g
  B) 6.06 g
  C) 1.51 g
  D) 1.01 g
  E) none of the above

22) What is the theoretical yield of waffles if you have 5 cups of flour, 9 eggs and 3 tbs of oil? 22) _____
Given: 2 cups flour + 3 eggs + 1 tbs oil $\rightarrow$ 4 waffles
  A) 4
  B) 10
  C) 6
  D) 12
  E) not enough information

TRUE/FALSE. On scantron, choose "A" for a true answer and "B" for wrong answer. (3 points each)

23) The mole has a value of 6.023×10^{22}. 23) _____

24) The mass of 2.0 moles of H_2O is greater than the mass of 1.0 mole of CO_2. 24) _____

25) Combustion reactions are a subcategory of oxidation-reduction reactions. 25) _____

26) A precipitation reaction occurs when water is formed as a product. 26) _____

27) Given the chemical equation: $2 Ca + O_2 \rightarrow 2 CaO$, 27) _____
if 2 moles of CaO are formed in this reaction, then 2 moles of O_2 must have reacted.

28) The limiting reactant determines what the actual yield is. 28) _____