DEBRE MARKOS UNIVERSITY
NATURAL AND COMPUTATIONAL SCIENCE COLLEGE
CHEMISTRY DEPARTMENT

University chemistry (Chem1012) assignment (chapter four only) for first year students. Semester II max mark (25%)

I. Do the following questions accordingly

1. On the basis of the general solubility rules given in Table 4.2 in general chemistry module, write and balance chemical equations in molecular, total ionic and net ionic equations for the reaction of the following pairs of solutions are mixed. **(0.5 pt each)**

   a. $AgNO_3(aq) + Na_2SO_4(aq)$

   b. $BaCl_2(aq) + ZnSO_4(aq)$

   c. $(NH_4)_2CO_3(aq) + CaCl_2(aq)$

   d. $KNO_3(aq) + BaCl_2(aq)$

   e. $Na_2SO_4(aq) + Pb(NO_3)_2(aq)$

2. Differentiate the following reactions as acid-base reactions or oxidation-reduction reactions

(0.5 pt each)

   a. $HCl(aq) + NaHCO_3(s) \rightarrow NaCl(aq) + H_2O(l) + CO_2(g)$

   b. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

   c. $NH_3(aq) + H_2O(l) \leftrightarrow NH_4^+(aq) + OH^-(aq)$

   d. $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

   e. $HF(aq) + KOH(aq) \rightarrow KF(aq) + H_2O(l)$

3. Write balanced net-ionic equations for the following oxidation–reduction reactions. Supply H+ and/or H_2O as needed, to obtain a balance **(0.5 pt each)**

   a. $NO_3^- + Cu(s) \rightarrow NO_2(g) + Cu2+$

   b. $V(OH)_4^+ + U^{4+} \rightarrow VO^{2+} + UO_2^{2+}$

   c. $MnO_4^- + H_2SO_3 \rightarrow Mn2+ + SO_4 2-$

   d. $MnO_4^- + C_2O_4^{2-} \rightarrow Mn^{2+} + CO_2(g)$

4. Assign oxidation numbers to all the elements in the following compounds and ion: **(0.5 pt each)**

a. Li_2O, b. HNO_3, c. $Cr_2O_7\ 2^-$ d. MnO_4^- e. $ClNO_2$

5. On the basis of the general solubility rules given in Table 4.2 in general chemistry module predict which of the following substances are likely to be soluble in water. **(0.5 pt each)**
   a. aluminum nitrate
   b. magnesium chloride
   c. rubidium sulfate
   e. magnesium hydroxide
6. Silver (Ag) is used in jewelry and table ware but no longer in U.S. coins. How many grams of Ag are in 0.0342 mol of Ag? **(1 pts)**
7. A silicon chip used in an integrated circuit of a microcomputer has a mass of 5.68 mg. How many silicon (Si) atoms are present in the chip? **(1 pts)**
8. When 1.827 g of a hydrocarbon, C*x*H*y*, was burned in a combustion analysis apparatus, 6.373 g of CO_2 and 0.7829 g of H_2O were produced. In a separate experiment, the molar mass of the compound was found to be 252.31 g/mol. Determine the empirical formula and molecular formula of the hydrocarbon. **(2 pts)**
9. When iron (II) hydroxide is mixed with phosphoric acid, iron (II) phosphate precipitate results. **(0.5 pt in each)**
   a. Balance the following equation: $Fe(OH)_2\ (aq) + H_3PO_4\ (aq) \rightarrow Fe_3(PO_4)_2\ (s) + H_2O\ (l)$
   b. If 3.20 g of $Fe(OH)_2$ is treated with 2.50 g of phosphoric acid, what is the limiting reagent and what is the reactant in excess?
   c. How many grams of $Fe_3(PO_4)_2$ precipitate can be formed?
   d. If 3.99 g of $Fe_3(PO_4)_2$ is actually obtained, what is the percent yield?
10. Suppose 25.0 grams of nitrogen and 5.00 grams of hydrogen are mixed and reacted to form ammonia. How do we calculate the mass of ammonia produced when this reaction is run to completion (until one of the reactants is completely consumed)? The balanced chemical reaction is $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$. **(2 pts)**
11. Calculate the molarity and normality of a solution made by adding 100 mL of water to 55 mL of a 2.00 *M* NaOH solution. **(1 pts)**

12. Calculate the mole and mass of Ba $(OH)_2$ required to prepare 2.50L of a 0.06M solution of $Ba(OH)_2$. **(1 pts)**
13. Describe the basic steps involved in an acid-base titration. Why is this technique of great practical value? How does an acid-base indicator work in this titration? **(1.5 pts)**
14. Exactly 50.00 ml of HCl solution required 29.00 ml of 0.01M $Ba(OH)_2$ to reach the end point with bromocresol green indicator. Calculate the molarity of the HCl. **(1 pts)**
15. What are the advantages of using Gravimetric Titrimetry? What of using volumetric? **(1 pts)**

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