Year 11 Chemistry NAME______________________

Chemical Calculations Assignment 3

Practical Applications

1.
   (a) Describe a method for remembering which chemical is the "solute" and which is the "solvent". /2
   (b) State the name of the solvent in aqueous solutions. /1

2. For each of the practical situations below:
   (i) State which quantity (moles, concentration, or volume) remains constant.
   (ii) Combine $C_1 = \frac{n_1}{V_1}$ and $C_2 = \frac{n_2}{V_2}$ to write an equation relating the variables before and after.

   (a) Taking a 10 mL sample from 250 mL of solution /2
   (b) Adding 1 g more of the solute to a solution /2
   (c) Increasing the volume of an aqueous solution from 50 mL to 100 mL by adding water /2
   (d) Adding a compound which reacts with the solute /2

3. Calculate the number of moles in a 20 mL sample taken from a 250 mL solution containing 0.034 moles. /3

4. Calculate the new concentration of solution if 300 mL of 0.10 mol L^{-1} $MgCl_{2\,(aq)}$ is added to 50 mL of water. /3

5. Nitric acid can be used to dissolve copper metal:

   $4HNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

   (a) Calculate the number of moles in 1.0 g of copper metal. /2
   (b) Hence calculate the number of moles of HNO_3 required to dissolve it. /2
   (c) Hence calculate the volume of 2.0 mol L^{-1} HNO_3 required to dissolve it. /2

6. Calculate the concentration of HCl if 20mL of it is neutralised by 0.044 g of magnesium oxide.

   $2HCl + MgO \rightarrow MgCl_2 + H_2O$ /6

7. Biodiesel can be produced from vegetable oil and used as fuel in trucks and buses. The concentration of hydrogen ions in the fuel can be measured using titration with a strong base such as KOH.

   $H^+ + KOH \rightarrow K^+ + H_2O$

   The steps involved are:
   1. Make 250 mL of KOH as the 'standard' (known concentration) solution.
   2. Dilute 20 mL of biodiesel to make 1.0 L of solution.
   3. Titrate 20 mL samples from the 1.0 L with KOH in the burette.

   (a) Draw a diagram to illustrate these steps. /2

   In one particular experiment, a KOH solution with a concentration of 0.010 mol L^{-1} was used.

   (b) Calculate the mass of KOH that was used to make 250 mL of solution. /3

   The average titre value (volume delivered from the burette to exactly react) was found to be 4.2 mL.

   (c) Calculate the number of moles of KOH in the 4.2 mL. /2
   (d) Hence determine the number of moles of H^+ in the 20 mL sample. /2
   (e) Hence calculate the concentration of H^+ in the dilute biodiesel. /2
   (f) Hence calculate the concentration of H^+ in the original biodiesel. /2

TOTAL /42