1 Experiment 6

1.1 Types of chemical reactions

BACKGROUND

In chemistry there are many different types of chemical reactions. Chemists use chemical equations as shorthand representations for reactions. The purpose of this experiment is to observe several important types of chemical reactions and to write equations for these reactions.

EQUIPMENT REQUIRED

Balance
Spatula
Bunsen
Metal tongs
Wax taper
Dropper
Beaker (100ml)
Test tubes (one large fitted with rubber stopper and plastic gas delivery tubing, two small)
Steel wool
Zinc strips (two)
Copper strip (one)
Copper (II) carbonate ($CuCO_3$) (2g)
Calcium carbonate ($CaCO_3$) marble chips (2g)
Magnesium ribbon (two 3cm strips)
Silver nitrate solution ($AgNO_3$) 0.1 mol L^{-1} (30ml)
Sodium bromide solution (NaBr) 0.1 mol L^{-1} (5ml)
Sodium hydroxide solution (NaOH) 0.1 mol L^{-1} (30ml)
Hydrochloric acid (HCl) 2 mol L^{-1} (10ml)
Hydrochloric acid (HCl)).1 mol L^{-1} (30ml)
Limewater ($Ca(OH)_2$) saturated (10ml)
Universal indicator (5 drops)
Lead (II) nitrate solution ($Pb(NO_3)_2$) 0.1 mol L^{-1} (25ml)

PROCEDURE

#1 Prepare a table including space for reactants, observations and products for the following reactions.

Decomposition of a carbonate by heating

#2 Place a spatula of copper (II) carbonate into a large test tube and fit the test tube with a stopper and delivery tube. Heat the test tube with a Bunsen and pass any gas evolved through 5ml of limewater in another test tube.

Decomposition of a carbonate with an acid

#3 Place a spatula of calcium carbonate (marble chips) into a large test tube, add 2 mol L^{-1} hydrochloric acid to a depth of about 2 – 3 cm, and fit the test tube with the stopper and delivery tube as before. Again note the effect of any gas evolved on limewater solution.

Oxidation of a metal

SAFETY NOTE

- **Care must be taken when burning magnesium ribbon.**
- **Do not look directly at the flame produced.**

#4 Place a protective mat on the laboratory bench. Cut a 3cm strip of magnesium ribbon. Hold the ribbon in some tongs and heat in a Bunsen flame above the mat.

Reaction of a reactive metal with a dilute acid

#5 Place another 3cm of magnesium in a small test tube and add 2 mol L^{-1} hydrochloric acid to a depth of about 3cm. note the reaction and collect any gas evolved in inverting another small test tube and holding it directly about the reaction tube. Test the gas evolved by placing a lighted taper in the inverted test tube.

Precipitation reactions

#6 Place 2-3 ml of 0.1 mol L^{-1} $AgNO_3$ solution into a test tube and add the same volume of 0.1 mol L^{-1} NaBr solution.

#7 Place 2 – 3 ml of 0.1 mol L^{-1} $CuSO_4$ solution into a test tube and add about the same volume of 2 mol L^{-1} NaOH solution.

Metal displacement reactions

#8 Place about 25ml of 0.1 mol L^{-1} $CuSO_4$ solution into a 100ml beaker and place into the beaker a freshly cleaned zinc strip.

#9 Place about 25ml of 0.1 mol L^{-1} $Pb(NO_3)_2$ solution into a 100ml beaker and place into the beaker a freshly cleaned zinc strip.

#10 Place about 25ml of 0.1 mol L^{-1} $AgNO_3$ solution into a 100ml beaker and place into the beaker a freshly cleaned copper strip.

Neutralisation reaction – reaction of an acid and a base

#11 Place about 20ml of 0.1 mol L^{-1} HCl into a beaker and add 5 drops of universal indicator. Using a dropper gradually add 0.1 mol L^{-1} NaOH solution until about 25ml of the base has been added. Note any colour changes which take place.

PROCESSING OF RESULTS AND QUESTIONS

1. Write word equations and balanced chemical equations for each of the reactions observed.
2. Write word equations and balanced chemical equations for the following reactions.
    a. Heating magnesium carbonate
    b. Adding dilute sulphuric acid to copper (II) carbonate
    c. Rusting of iron (or the burning of iron in pure oxygen)
    d. Adding dilute sulphuric acid to calcium
    e. Mixing solutions of barium nitrate and sodium sulphate to precipitate barium sulphate
    f. The reaction between lead and copper (II) sulphate to produce lead (II) sulphate and copper metal
    g. The reaction between sulphuric acid and potassium hydroxide solution to form potassium sulphate and water.