

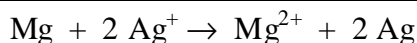
2007 Exam Instructions for Question 4

(Note: in 2007, only three reactions will appear. These are the eight from 2006 re-written.)

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. Coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized.

Example: A strip of magnesium is added to a solution of silver nitrate.

(i)

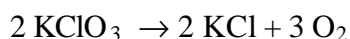


(ii) Which substance is oxidized in the reaction?

Magnesium metal (Mg)

a) Solid potassium chlorate is strongly heated resulting in a change in the oxidation numbers of both chlorine and oxygen.

(i)

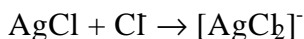


(ii) What is the oxidation number of chlorine before and after the reaction?

Chlorine has an oxidation number of +5 in KClO_3 and -1 in KCl

b) Solid silver chloride is added to a solution of concentrated hydrochloric acid forming a complex ion.

(i)

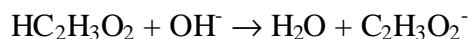


(ii) Which species acts as a Lewis base in the reaction? Explain.

The chloride acts as a Lewis base in the reaction; it donates an electron pair in the reaction.

c) A solution of ethanoic (acetic) acid is added to a solution of barium hydroxide.

(i)

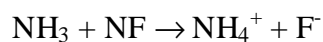


(ii) Explain why a mixture of equal volumes of equimolar solutions of ethanoic acid and barium hydroxide is basic.

In the mixture there are initially twice as many moles of hydroxide ions as molecules of acid; since they react in a 1:1 ratio, there is an excess of hydroxide ions, leading to the basic solution.

d) Ammonia gas is bubbled into a solution of hydrofluoric acid

(i)

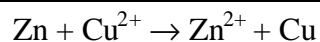


(ii) Identify a conjugate acid-base pair in the reaction.

NH_3 (base) and NH_4^+ (acid) or HF (acid) and F^- (base)

e) Zinc metal is placed in a solution of copper(II) sulfate.

(i)

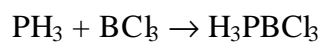


(ii) Describe the change in color of the solution that occurs as the reaction proceeds.

The blue color of the solution due to the presence of the hydrated copper(II) ion fades as the copper(II) ion reacts and the colorless hydrated zinc(II) ion forms.

f) Hydrogen phosphide (phosphine) as is added to boron trichloride gas.

(i)



(ii) Which species acts as a Lewis acid in the reaction? Explain.

BCl_3 ; it accepts the non-bonded pair of electrons of the phosphorous atom in PH_3

g) A solution of nickel(II) bromide is added to a solution of potassium hydroxide.

(i)

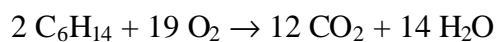


(ii) Identify the spectator ions in the reaction mixture.

Spectator ions are the bromide ion (Br^-) and the potassium ion (K^+)

h) Hexane is combusted in air.

(i)



(ii) When one molecule of hexane is completely combusted, how many molecules of products are formed.

1 molecule of hexane produces 13 molecules of products