QUESTION 10

The concentration of hydrogen peroxide in a commercial hydrogen peroxide solution can be determined by titration with potassium permanganate solution.

(a) Balance the half-equation for the reaction of the permanganate ion below.

$$MnO_4^- \longrightarrow Mn^{2+}$$

(2 marks)

(b) The half-equation for the reaction of H_2O_2 in this titration is:

$$H_2O_2 \longrightarrow O_2 + 2H^+ + 2e^-$$

Using the two balanced half-equations, show why the reacting mole ratio $\frac{n(MnO_4^-)}{n(H_2O_2)} = \frac{2}{5}$.

(2 marks)

Credit will be given for the correct use of significant figures in part (c).

(c) The following procedure is used to determine the concentration of hydrogen peroxide:

Step 1 Dilute 25.00 mL of the commercial hydrogen peroxide solution to 250.0 mL with water.

Step 2 Pipette 20.00 mL of this dilute hydrogen peroxide solution into a conical flask and acidify.

Step 3 Titrate with potassium permanganate solution that has a concentration of 0.02123 mol L^{-1}.

In one titration, a titre of 27.63 mL was required to completely react with the dilute hydrogen peroxide solution.

(i) Calculate the number of moles of MnO_4^- that reacted in the titration.

(3 marks)

(ii) Using the reacting mole ratio from part (b), calculate the number of moles of hydrogen peroxide in the dilute solution.

(2 marks)

(iii) Calculate the concentration, in mol L^{-1}, of hydrogen peroxide in the commercial hydrogen peroxide solution.

(4 marks)

(iv) Calculate the concentration, in %w/v, of the commercial hydrogen peroxide solution.

(3 marks)

TOTAL: 16 marks