AS Level Chemistry B

H033/02 Chemistry in depth

Question Set 8

8 Iodine can be extracted from the ash of burnt seaweed. The ash is washed with water. The washed ash is heated with manganese(IV) oxide, MnO_2, and concentrated sulfuric acid, forming iodine.

$$2I^- + MnO_2 + 4H^+ \rightarrow Mn^{2+} + 2H_2O + I_2 \qquad \textbf{Equation 4.1}$$

(a) Complete the table below to show the oxidation states for manganese and iodine in the reaction shown in **equation 4.1**.

Element	Initial oxidation state	Final oxidation state
Mn		
I		

[1]

(b) The half-equation for the conversion of MnO_2 to Mn^{2+} ions is shown below.

$$MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O \qquad \textbf{Equation 4.2}$$

Explain, in terms of electrons, why the manganese is said to be reduced.

..... **[1]**

(c) A student extracts iodine from seaweed ash in the laboratory. The student suspects that the water used to wash the ash contains a mixture of salts, including sodium chloride.

The student tests this water to see if it contains chloride ions by adding silver nitrate solution.

(i) Give the result of the test for chloride ions.

..... **[1]**

(ii) Suggest why the student might not get this result.

..... **[2]**

(d) Iodine and chlorine are both members of the halogen group.

(i) Write the electron configuration for the highest energy sub-shell for an **iodide ion**.

..... **[1]**

(ii) A student carries out a displacement reaction to show that chlorine is more reactive thaniodine.

Describe the experiment the student would do and the expected result. **[2]**

(iii) Write an ionic equation for the reaction in **(ii)**.

[1]

(iv) Describe and explain, in terms of electrons, why chlorine is more reactive than iodine.

..... **[2]**

(e) The student collected 0.92 g of impure iodine, I_2, and decided to determine its purity.

The student dissolved the impure iodine in potassium iodide solution.
This iodine solution was then titrated with sodium thiosulfate solution.
The equation for the reaction is shown below.

$$I_2 + 2S_2O_3^{2-} \rightarrow 2I^- + S_4O_6^{2-}$$ **Equation 4.3**

The titration required 28.40 cm^3 of 0.200 mol dm^{-3} sodium thiosulfate solution.

Calculate the percentage purity of the iodine.

purity of iodine =.....% **[3]**

Total Marks for Question Set 8: 14