Name of the Student:_____
Max. Marks : 14 Marks **Time : 14 Minutes**

Q1.

A 0.263 g sample of impure iron, containing an unreactive impurity, was reacted with an excess of hydrochloric acid. All of the iron in the sample reacted, evolving hydrogen gas and forming a solution of iron(II) chloride. The volume of hydrogen evolved was 102 cm^3, measured at 298 K and 110 kPa.

The percentage, by mass, of iron in the sample can be determined using either the volume of hydrogen produced or by titrating the solution of iron(II) chloride formed against a standard solution of potassium dichromate(VI).

(a) (i) Write an equation for the reaction between iron and hydrochloric acid.

_____

(ii) Calculate the number of moles of hydrogen produced in the reaction.

_____

_____

_____

_____

(iii) Use your answers to parts (a)(i) and (ii) to determine the number of moles of iron and the mass of iron in the original sample. (If you have been unable to complete part (a)(ii) you should assume the answer to be 4.25×10^{-3} mol. This is not the correct answer.)

Moles of iron _____

Mass of iron _____

(iv) Calculate the percentage of iron in the original sample.

_____

_____

(7)

(b) (i) Write half-equations for the oxidation of Fe^{2+} and for the reduction of $Cr_2O_7^{2-}$ in acidic solution, and use these to construct an overall equation for the reaction between these two ions.

Half-equation for the oxidation of Fe^{2+}

_____

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Half-equation for the reduction of Cr_2O_{2-}

_____

Overall equation

_____

(ii) The number of moles of iron in the sample was determined in part (a)(iii). Use this answer to calculate the volume of a 0.0200 mol dm^{-3} solution of potassium dichromate(VI) which would react exactly with the solution of iron(II) chloride formed in the reaction.

(If you have been unable to complete part (a)(iii) you should assume the answer to be 3.63×10^{-3} mol. This is not the correct answer.)

_____

_____

_____

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_____

(iii) Explain why an incorrect value for the number of moles of iron(II) chloride formed would have been obtained if the original solution had been titrated with potassium manganate(VII).

_____

_____

(7)

(Total 14 marks)

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