**Name of the Student**:_____
**Max. Marks : 15 Marks** **Time : 15 Minutes**

Q1.

(a) When a solution containing iron(II) ions is treated with a slight excess of a solution containing ethanedioate ions a bright yellow precipitate of hydrated iron(II) ethanedioate, $FeC_2O_4.2H_2O$, is formed. The precipitate is filtered off, washed with propanone and then allowed to dry. A typical yield of the solid is 95%.

(i) Propanone boils at 56 °C and is miscible with water in all proportions. Suggest **two** reasons why washing with propanone is an effective method for producing a pure, dry precipitate.

Reason 1 _____

_____

Reason 2 _____

_____

**(2)**

(ii) By suggesting a simple test tube reaction, state how the filtrate could be tested to show that all of the iron(II) ions have been removed from the solution. State what you would observe.

Test _____

Observation _____

**(2)**

(iii) Suggest **one** reason why the typical yield of iron(II) ethanedioate is less than 100%.

_____

_____

**(1)**

(iv) Calculate the mass of hydrated iron(II) ethanedioate, $FeC_2O_4.2H_2O$ that can be formed from 50.0 $cm^3$ of a 0.50 mol $dm^{-3}$ solution of iron(II) sulfate when the yield of the reaction is 95%. Show your working.

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**(3)**

(v) The identity of the precipitate can be confirmed by dissolving it in sulfuric acid and titrating the mixture with potassium manganate(VII).

Deduce the number of moles of iron(II) ethanedioate that would react with one mole of potassium manganate(VII) in acidic solution.

_____

_____

**(1)**

(b) Ethanedioate ions can be used to remove calcium ions from blood plasma.
A precipitate of calcium ethanedioate is formed. Write an ionic equation for the reaction of ethanedioate ions with calcium ions.

_____

_____

**(1)**

(c) Ethanedioic acid is used to clean marble, a form of calcium carbonate. Suggest **one** reason why the reaction between ethanedioic acid and marble stops after a short time.

_____

_____

**(1)**

(d) Tea leaves contain ethanedioic acid. Suggest **one** reason why tea drinkers do **not** suffer from ethanedioic acid poisoning.

_____

**(1)**

(e) Ethanedioic acid is produced by the oxidation of carbon monoxide in a multi-step process. The equation which summarises the reactions taking place is shown below.

$$4CO + 4NaOH + O_2 + 4HCl \rightarrow 2H_2C_2O_4 + 4NaCl + 2H_2O$$

Calculate the percentage atom economy for the formation of ethanedioic acid in this reaction.
Show your working.

_____

_____

_____

**(2)**

**(Total 14 marks)**

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Q2.

Refer to the following reaction

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H^{\ominus} = -11 \text{ kJ mol}^{-1}, \qquad \Delta S^{\ominus} = +20 \text{ J K}^{-1} \text{ mol}^{-1}$$

Which one of the following statements is correct?

**A** This is a redox reaction.

**B** The reaction is **not** feasible below 298 K

**C** At equilibrium, the yield of hydrogen iodide is changed by increasing the pressure.

**D** At equilibrium, the yield of hydrogen iodide increases as the temperature is increased.

**(Total 1 mark)**

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