

Name of the Student: _____

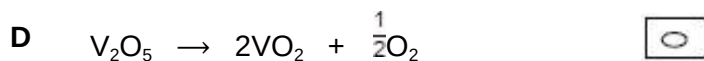
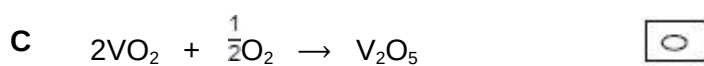
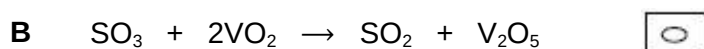
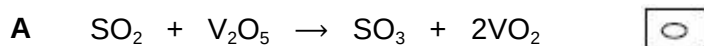
Max. Marks :19 Marks

Time : 19 Minutes

Q1.

V_2O_5 can be used as a catalyst in the Contact Process.

Which is a step in the Contact Process in which the vanadium is oxidised?

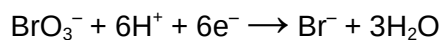
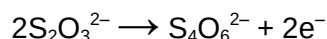


(Total 1 mark)

Q2.

Sodium bromate(V) is a primary standard. This means that its solution can be used to check the concentration of other solutions.

- (a) The half-equations for the reaction between bromate(V) ions and thiosulfate ions in the presence of acid are



Use these half-equations to deduce an overall equation for this reaction.

(1)

- (b) A laboratory technician decided to use a $5.00 \times 10^{-3} \text{ mol dm}^{-3}$ solution of sodium bromate(V) to check the concentration of a sodium thiosulfate solution that was labelled as $1.00 \times 10^{-3} \text{ mol dm}^{-3}$. The sodium bromate(V) solution was placed in the burette and 25.0 cm^3 of the sodium thiosulfate solution was pipetted into a conical flask.

Use the concentration of the sodium thiosulfate solution to calculate the expected titre value in this experiment.

Show your working.

(2)

- (c) Consider the titre value that you have calculated in part (b).

Suggest one change to the experimental procedure in part (b) that would enable you to calculate a more accurate value for the concentration of the sodium thiosulfate solution.

(1)

(Total 4 marks)

Q3.

The table below shows some standard electrode potential data.

	$E^\ominus / \text{V}$
$\text{ZnO(s)} + \text{H}_2\text{O(l)} + 2\text{e}^- \longrightarrow \text{Zn(s)} + 2\text{OH}^-(\text{aq})$	-1.25
$\text{Fe}^{2+}(\text{aq}) + 2\text{e}^- \longrightarrow \text{Fe(s)}$	-0.44
$\text{O}_2(\text{g}) + 2\text{H}_2\text{O(l)} + 4\text{e}^- \longrightarrow 4\text{OH}^-(\text{aq})$	+0.40
$2\text{HOCl(aq)} + 2\text{H}^+(\text{aq}) + 2\text{e}^- \longrightarrow \text{Cl}_2(\text{g}) + 2\text{H}_2\text{O(l)}$	+1.64

- (a) Give the conventional representation of the cell that is used to measure the standard electrode potential of iron as shown in the table.

(2)

- (b) With reference to electrons, give the meaning of the term **reducing agent**.

(1)

- (c) Identify the weakest reducing agent from the species in the table.

Explain how you deduced your answer.

Species _____

Explanation _____

(2)

- (d) When HOCl acts as an oxidising agent, one of the atoms in the molecule is reduced.

- (i) Place a tick (✓) next to the atom that is reduced.

Atom that is reduced	Tick (✓)
H	
O	
Cl	

(1)

- (ii) Explain your answer to part (i) in terms of the change in the oxidation state of this atom.

(1)

- (e) Using the information given in the table, deduce an equation for the redox reaction that would occur when hydroxide ions are added to HOCl

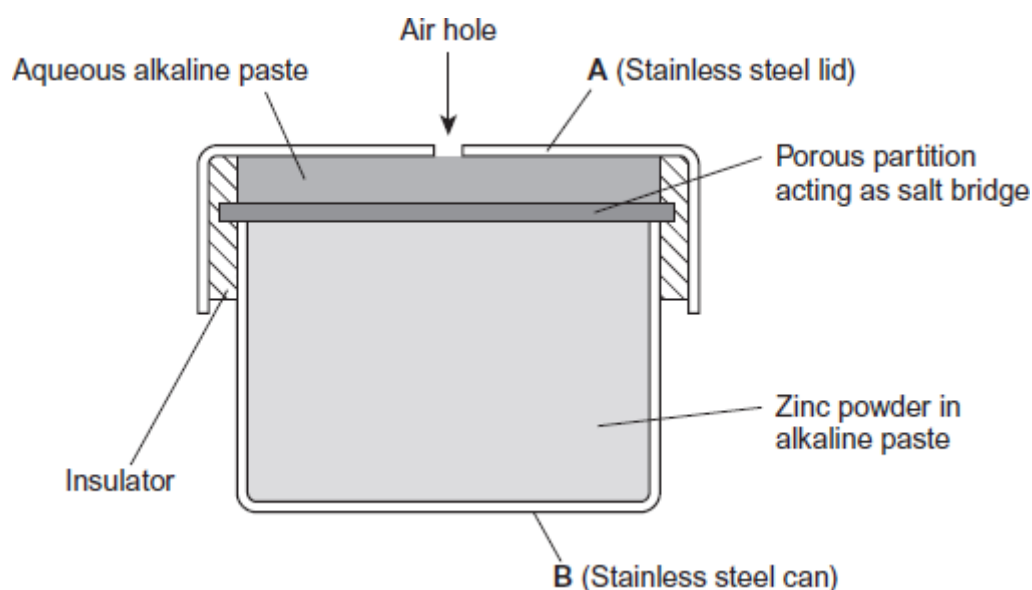
(2)

- (f) The table is repeated to help you answer this question.

	$E^\ominus / \text{V}$
$\text{ZnO(s)} + \text{H}_2\text{O(l)} + 2\text{e}^- \longrightarrow \text{Zn(s)} + 2\text{OH}^-(\text{aq})$	-1.25
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The half-equations from the table that involve zinc and oxygen are simplified versions of those that occur in hearing aid cells.

A simplified diagram of a hearing aid cell is shown in the following figure.



- (i) Use data from the table to calculate the e.m.f. of this cell.

Answer = _____

(1)

- (ii) Use half-equations from the table to construct an overall equation for the cell reaction.

(1)

- (iii) Identify which of **A** or **B**, in the figure, is the positive electrode. Give a reason for your answer.

Positive electrode _____

Reason _____

(2)

- (iv) Suggest **one** reason, other than cost, why this type of cell is **not** recharged.

(1)

(Total 14 marks)