Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Electrode Potentials And Electrochemical Cells

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Name of the Student:_____
Max. Marks : 21 Marks **Time : 21 Minutes**

Q1.

Hydrogen–oxygen fuel cells are used to provide electrical energy for electric motors in vehicles.

(a) In a hydrogen–oxygen fuel cell, a current is generated that can be used to drive an electric motor.

(i) Deduce half-equations for the electrode reactions in a hydrogen–oxygen fuel cell.

Half-equation 1 _____

Half-equation 2 _____

(2)

(ii) Use these half-equations to explain how an electric current can be generated.

_____

_____

_____

_____

(2)

(b) Explain why a fuel cell does **not** need to be recharged.

_____

_____

_____

(1)

(c) To provide energy for a vehicle, hydrogen can be used either in a fuel cell or in an internal combustion engine.

Suggest the main advantage of using hydrogen in a fuel cell rather than in an internal combustion engine.

_____

_____

_____

(1)

(d) Identify **one** major hazard associated with the use of a hydrogen–oxygen fuel cell in a vehicle.

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_____

_____

(1)

(Total 7 marks)

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Q2.

The table below shows some standard electrode potential data.

	$E^{\ominus}$ / V
$ZnO(s) + H_2O(l) + 2e^- \longrightarrow Zn(s) + 2OH^-(aq)$	–1.25
$Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$	–0.44
$O_2(g) + 2H_2O(l) + 4e^- \longrightarrow 4OH^-(aq)$	+0.40
$2HOCl(aq) + 2H^+(aq) + 2e^- \longrightarrow Cl_2(g) + 2H_2O(l)$	+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.

_____

_____

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(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

_____

_____

_____

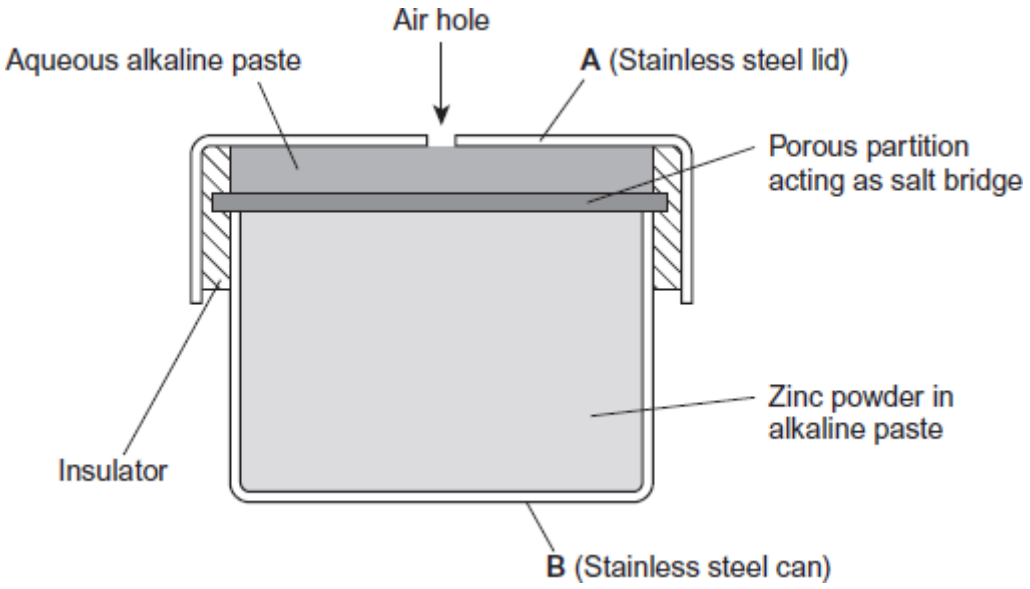
(2)

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

	$E^{\ominus}$ / V
$ZnO(s) + H_2O(l) + 2e^- \longrightarrow Zn(s) + 2OH^-(aq)$	–1.25
$Fe^{2+}(aq) + 2e^- \longrightarrow Fe(s)$	–0.44
$O_2(g) + 2H_2O(l) + 4e^- \longrightarrow 4OH^-(aq)$	+0.40
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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.

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_____

_____

_____

(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)

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