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VCE Chemistry ¾
Primary Cells & Faraday's Laws [1.10]
Test

20 Marks. 1 Minute Reading. 16 Minutes Writing

Results:

Test Questions	_____ / 15
Extension	_____ / 5

Section A: Test Questions (15 Marks)

Question 1 (3 marks)

Tick whether the following statements are **true** or **false**.

		True	False
a.	Whenever a galvanic cell is mentioned, the electrolyte is stored separately for each half-cell.		
b.	Primary cells cannot be reused once they stop producing a voltage.		
c.	Electric charge is defined as how quickly charged particles such as electrons are moving.		
d.	Faraday's first law can be defined as: "The greater the electrical charge passing through the cell, the greater is the amount of chemical change witnessed in the cell".		
e.	Faraday's constant tells us that $96500\ mol$ of e^- are present in $1\ C$ of charge.		
f.	The greater the electrovalency (charge) on a metal ion, the less charge is required to produce the metal itself.		

Space for Personal Notes

Question 2 (4 marks)

The composition of an alkaline battery, a classic example of a primary cell, is shown below:

- Metal top cover
- Insulator
- Seal
- Carbon rod
- Zinc can (electrode)
- Porous separator
- Paste of MnO_2, NH_4Cl, $ZnCl_2$, water
- Metal bottom cover
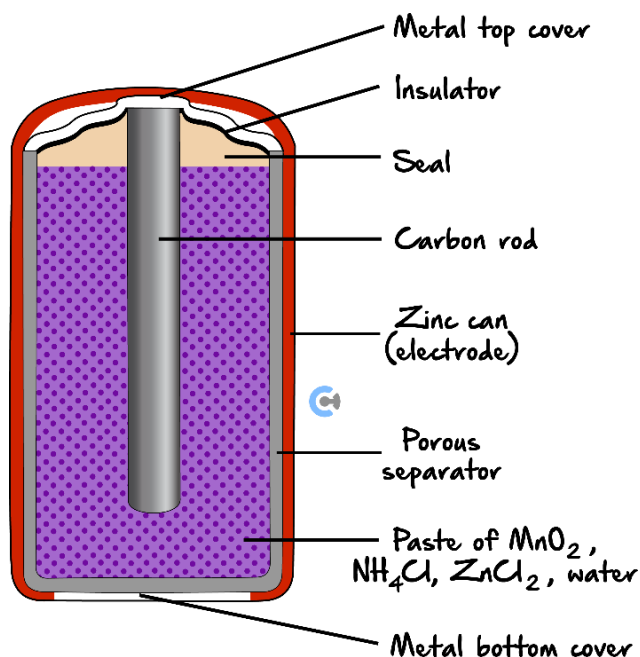
a. Given that zinc metal turns into solid zinc oxide (ZnO), write the relevant balanced half-equation in the table below, and select whether the zinc can function as the anode or cathode. (2 marks)

Half-Equation	Electrode
	[Anode] / [Cathode]

b. If the other half-equation involves a reaction with MnO_2, outline what the purpose of the carbon rod must be. (1 mark)

_____

_____

c. Suggest why the separator is porous. (1 mark)

_____

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Question 3 (3 marks)

Zoe sets up a galvanic cell in her school lab to verify Faraday's findings from decades ago.

a. Given that 2.50 *A* are produced in the galvanic cell she sets up over a single period of class, which lasts 50 minutes, calculate the electric charge passing through the cell. (1 mark)

_____

_____

b. Had this same cell been running over a double period of class (for twice as long) with the same current, explain whether Zoe would have **visibly** noticed anything different about the cell. Justify your explanation with reference to Faraday's laws. (2 marks)

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Question 4 (5 marks)

A simple galvanic cell is shown below.
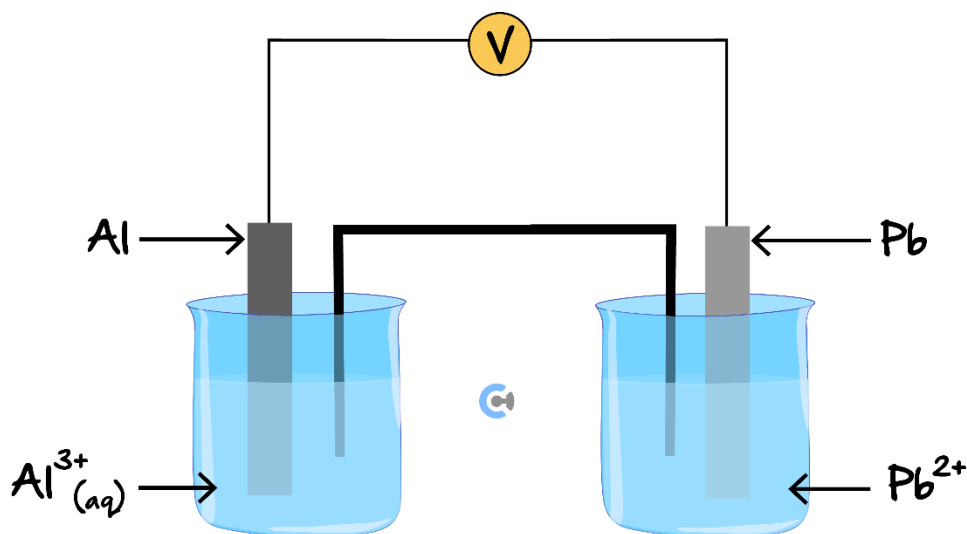
a. Write the half-equation occurring at the cathode. (1 mark)

_____

b. Hence or otherwise, determine how the mass of the cathode would change if this cell is operated for an hour with a constant current of 2.50 A. (4 marks)

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Section B: Extension (5 Marks)

Question 5 (5 marks)

The following electrochemical cell was constructed by Alannah in an attempt to determine the identity of an unknown metal X and its ion, X^{2+}.
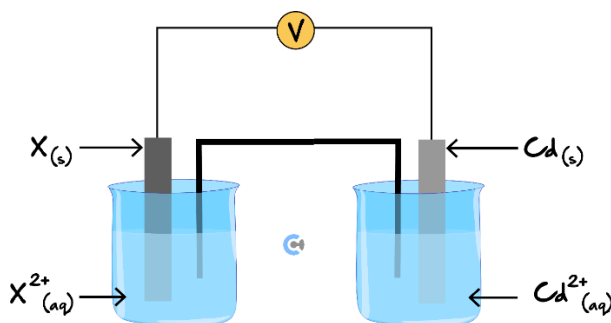
a. If $4.82\ A$ of current were produced fzin order for the cadmium electrode's mass to decrease by $5.264\ g$, calculate the time, in minutes, that this cell was running for. (3 marks)

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b. Using the information from **part a.**, and from the information given below, predict what would be observed in the electrolyte-containing X^{2+}. Justify your reasoning. (2 marks)

$Cd^{2+}\ (aq)\ +\ 2e^-\ \leftrightarrow\ Cd\ (s)$ $E^0 = -0.40\ V$
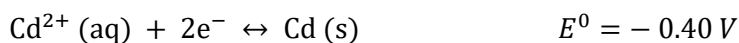
EMF produced when X^{2+}/X and Cd^{2+}/Cd are connected in series: $0.74\ V$

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