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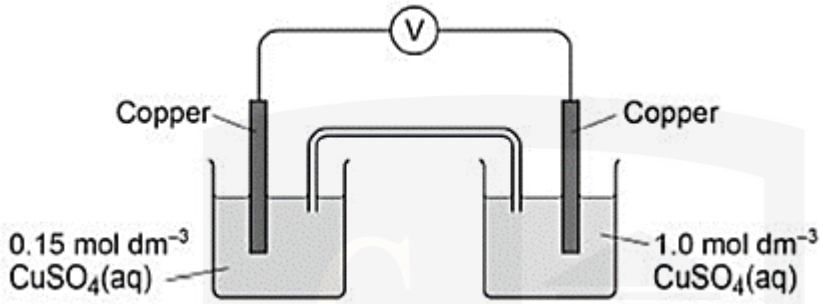
CHEMISTRY

PHYSICAL CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	ELECTRODE POTENTIALS AND CELLS
PAPER TYPE:	QUESTION PAPER - 4
TOTAL QUESTIONS	10
TOTAL MARKS	32

Electrode Potentials and Cells - 4

1. A student set up the cell shown in the diagram.



The student recorded an initial voltage of +0.16 V at 25°C

(a) Explain how the salt bridge provides an electrical connection between the two solutions.

(1)

(b) The standard electrode potential for the Cu^{2+}/Cu electrode is

$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ $\quad E^o = +0.34$ V

Calculate the electrode potential of the left-hand electrode in the diagram.

(1)

(c) Both electrodes contain a strip of copper metal in a solution of aqueous Cu^{2+} ions.

State why the left-hand electrode does not have an electrode potential of +0.34 V

(1)

(d) Give the conventional representation for the cell in the diagram. Include all state symbols.

(1)

(e) When the voltmeter is replaced by a bulb, the EMF of the cell in the diagram decreases over time to 0 V

Suggest how the concentration of copper(II) ions in the left-hand electrode changes when the bulb is alight.

Give one reason why the EMF of the cell decreases to 0 V

(2)

2. Draw the standard hydrogen electrode.

(3)

3. NO_2 reacts with oxygen and water to form nitric acid, HNO_3.

In the atmosphere, this contributes to acid rain.
Construct a balanced equation for this formation of nitric acid and use oxidation numbers to show that this is a redox reaction.

(3)

4. A biocide is a chemical that kills bacteria.

A biocide is added to prevent the growth of bacteria in the water used in vases of flowers.
Household bleach contains aqueous chlorine and can be used as the biocide.
The concentration of chlorine in vase water decreases with time. It was decided to investigate the rate of this decrease.

The following experimental method was used to determine the concentration of chlorine in vase water at different times.

- A sample of vase water was taken.
- An excess of potassium iodide solution was added to the sample.
- The chlorine in the sample oxidised the I^- ions to I_2

- The iodine was titrated with sodium thiosulfate ($Na_2S_2O_3$) solution.
- These steps were repeated using further samples taken from the vase water at hourly intervals.

(a) Suggest two reasons why the concentration of chlorine in the vase water decreases with time.

(2)

(b) Suggest why this sampling technique has no effect on the rate at which the concentration of chlorine in the vase water decreases.

(1)

(c) Why was it important to use an excess of potassium iodide solution?

(1)

5. Why are salt bridges necessary?

(3)

6. The simplified electrode reactions in a rechargeable lithium cell are

Electrode A $Li^+ + MnO^2 + e^- \rightarrow LiMnO_2$ $E = -0.15$ V

Electrode B $Li^+ + e^- \rightarrow Li$

Electrode B is the negative electrode.

(a) The e.m.f. of this cell is 2.90 V.

Use this information to calculate a value for the electrode potential of electrode B.

(1)

(b) Write an equation for the overall reaction that occurs when this lithium cell is being recharged.

(2)

(c) Suggest why the recharging of a lithium cell may lead to release of carbon dioxide into the atmosphere.

I am Sorry !!!!!

(1)

7. Write a half-equation for zinc (s) to zinc (II).

(2)

8. What factors will change E^o values?

(2)

9. The table shows some electrode potential data.

Electrode reaction	E^o / V
$2\ H^+ (aq) + 2e^- \rightarrow H_2(g)$	0.00
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	+0.34
$NO_3^-(aq) + 4H^+ (aq) + 3e^- \rightarrow NO(g) + 2H_2O(l)$	+0.96

Use the data in the table to explain why copper does not react with most acids but does react with nitric acid.
Give an equation for the reaction between copper and nitric acid.

(3)

10. What conditions is the standard hydrogen electrode used in?

(2)

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