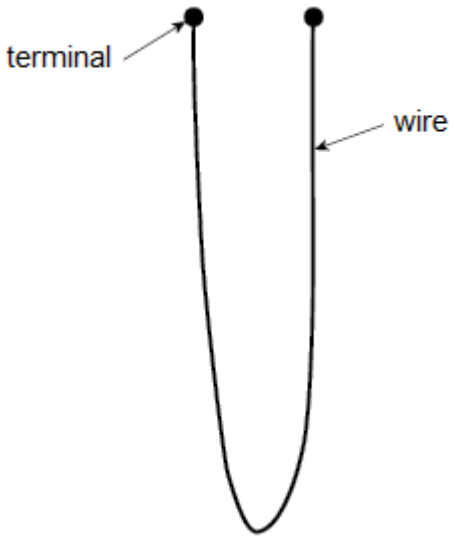
Name of the Student:_____
Max. Marks : 23 Marks **Time :** 23 **Minutes**

Q1.

A wire probe is used to measure the rate of corrosion in a pipe carrying a corrosive liquid. The probe is made from the same metal as the pipe. **Figure 1** shows the probe. The rate of corrosion of the wire in the probe is the same as in the pipe.

Figure 1



(a) The wire in an unused probe has a resistance of 0.070 Ω and a length of 0.50 m.

Calculate the diameter of the wire.

resistivity of metal in the wire = 9.7×10^{-8} Ω m

diameter = _____ m

(3)

(b) In order to measure the resistance of a used working probe, it is connected in the circuit shown in **Figure 2**.

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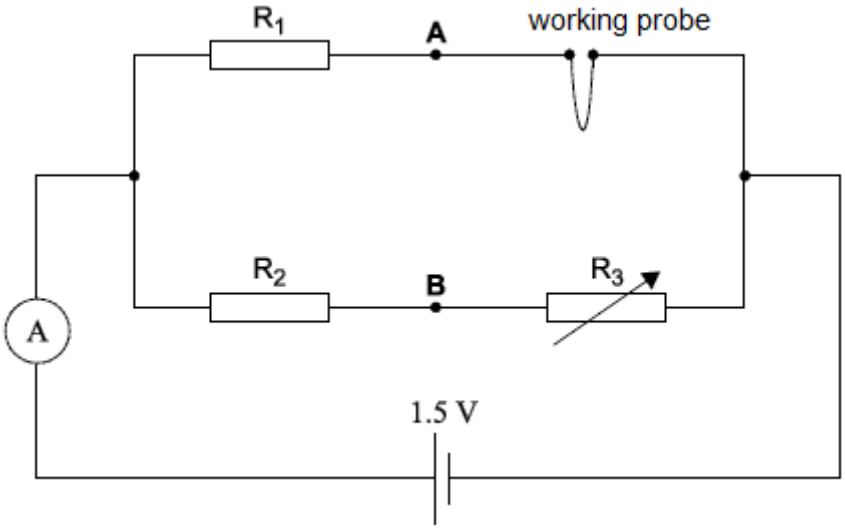
Figure 2



When R_3 is adjusted to a particular value the current in the cell is 0.66 A.

Calculate the total resistance of the circuit.
You may assume that the cell has a negligible internal resistance.

resistance = _____ Ω

(1)

(c) The resistance of R_2 is 22 Ω and the resistance of R_3 is 1.2 Ω.

Calculate the current in R_3.

current = _____ A

(1)

(d) Calculate the resistance of the probe when the resistance of R_1 is 2.4 Ω.

resistance = _____ Ω

(3)

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(e) Calculate the percentage change in the diameter of the probe when its resistance increases by 1.6 %.

percentage change = _____ %

(2)

(f) A voltmeter is connected between points **A** and **B** in the circuit and R_3 stays at 1.2 Ω.

Explain, without calculation, why the reading on the voltmeter does not change when the cell in the circuit is replaced with another cell of the same emf but a significant internal resistance.

_____

_____

_____

_____

_____

(2)

(Total 12 marks)

Q2.

A 'potato cell' is formed by inserting a copper plate and a zinc plate into a potato. The circuit shown in **Figure 1** is used in an investigation to determine the electromotive force and internal resistance of the potato cell.

Figure 1

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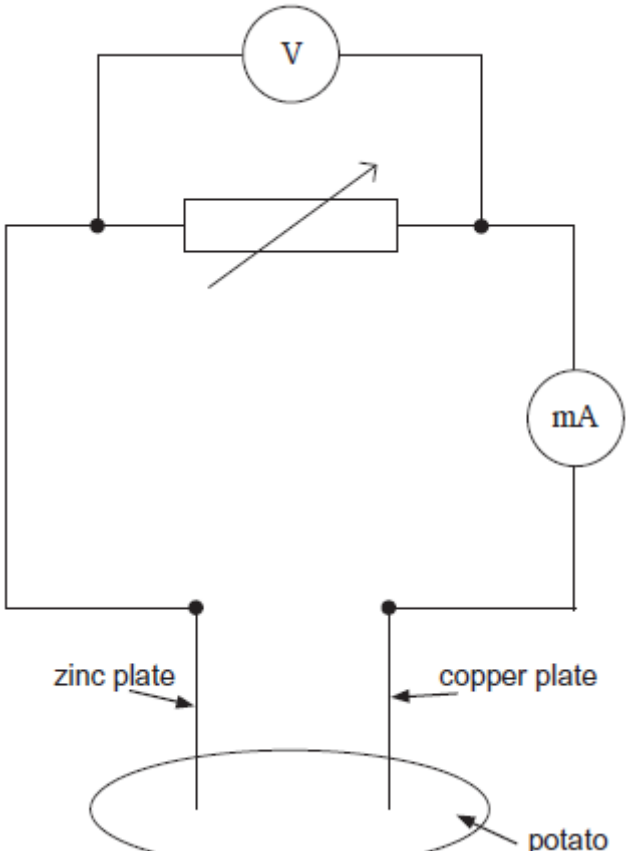

(a) State what is meant by electromotive force.

_____

_____

_____

_____

(2)

(b) The plotted points on **Figure 2** show the data for current and voltage that were obtained in the investigation.

Figure 2

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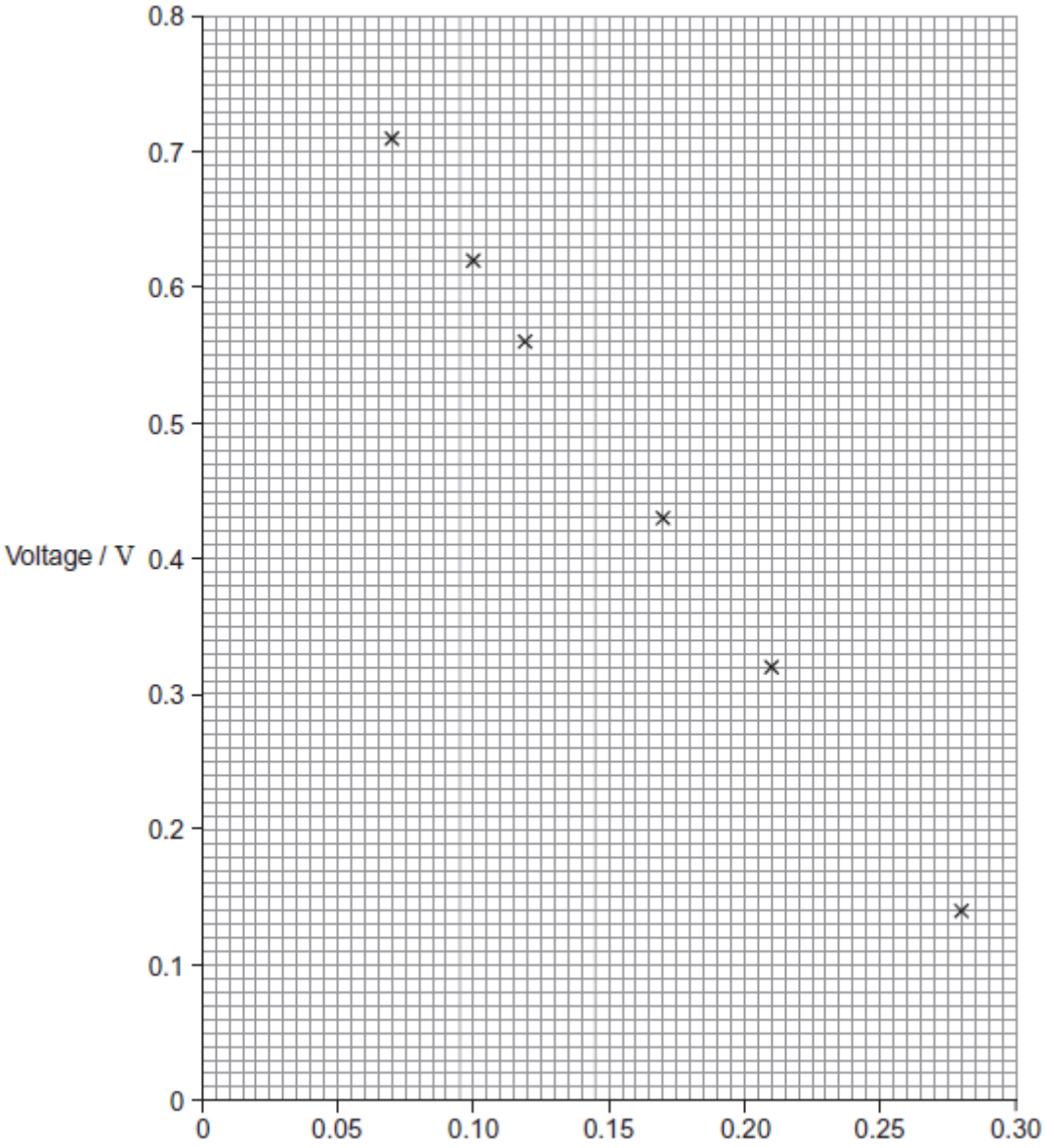

(i) Suggest what was done to obtain the data for the plotted points.

_____

_____

_____

_____

(1)

(ii) The electromotive force (emf) of the potato cell is 0.89 V. Explain why the voltages plotted on **Figure 2** are always less than this and why the difference between the emf and the plotted voltage becomes larger with increasing current.

_____

_____

_____

_____

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_____

_____

_____

(3)

(iii) Use **Figure 2** to determine the internal resistance of the potato cell.

internal resistance = _____ Ω

(3)

(c) A student decides to use two potato cells in series as a power supply for a light emitting diode (LED). In order for the LED to work as required, it needs a voltage of at least 1.6 V and a current of 20 mA.

Explain whether the LED will work as required.

_____

_____

_____

_____

_____

_____

(2)

(Total 11 marks)

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