Name: _____

EMF

Questions

Date:

Time:

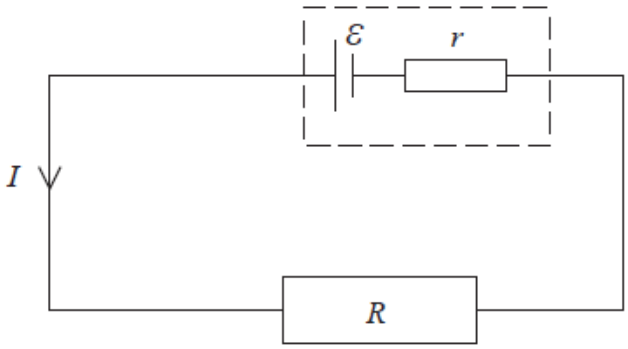
Total marks available:

Total marks achieved: _____

Questions

Q1.

The diagram shows a resistor of resistance R across a cell of e.m.f. ε and internal resistance r.



Which of the following is a correct expression for the current I?

☒ **A** $I = \varepsilon / r$

☒ **B** $I = \varepsilon / R$

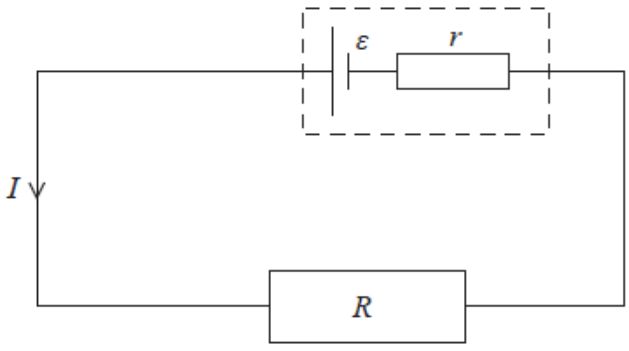
☒ **C** $I = \varepsilon / (R + r)$

☒ **D** $I = \varepsilon / (R - r)$

(Total for question = 1 mark)

Q2.

The diagram represents a resistor of resistance R in a series circuit with a cell of e.m.f. ε and internal resistance r.



Which of the following correctly gives the potential difference V across the internal resistance?

☒ **A** $V = \frac{\varepsilon(R+r)}{r}$

☒ **B** $V = \frac{\varepsilon R}{R+r}$

☒ **C** $V = \frac{\varepsilon(R+r)}{R}$

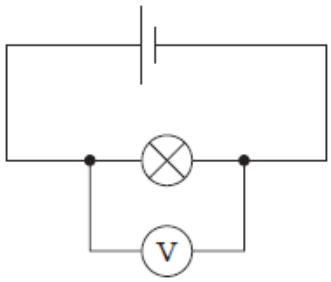
☒ **D** $V = \frac{\varepsilon r}{(R+r)}$

(Total for question = 1 mark)

Q3.

A torch uses a 1.5 V dry cell. Over time, the light intensity produced by the torch decreases as the cell 'goes flat'.

Student A sets up the following circuit in an attempt to measure the e.m.f. of a cell.



Explain why the voltmeter reading will **not** be the e.m.f. of the cell.

(2)

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(Total for question = 2 marks)

Q4. When a cell of e.m.f. 1.5 V is connected across a resistance of 6.6 Ω the current is Ω.21 A.

Calculate the internal resistance of the cell.

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Internal resistance = ...

(Total for Question = 3 marks)

Q5.

A torch uses a 1.5 V dry cell. Over time, the light intensity produced by the torch decreases as the cell 'goes flat'.

Student B correctly determined the e.m.f. of an unused cell as 1.63 V and its internal resistance as 1.15 Ω.

He repeated this after the cell had been used for several weeks. When a voltmeter was connected directly across the used cell, the reading was 1.36 V.
A bulb of resistance 5.92 Ω was then connected across the used cell and the reading fell to 0.84 V.

Student A suggests that the cell goes flat as it is used because the e.m.f. decreases.
Student B suggests it is because the internal resistance increases.

Determine whether either student is correct about the changes in the cell as it goes flat.

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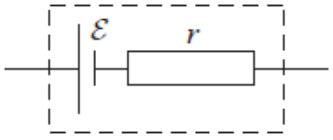
(Total for question = 5 marks)

Q6.

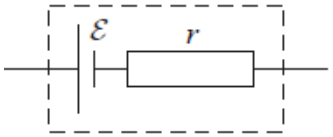
A cell may be represented as an e.m.f. ε in series with an internal resistance r.



A student used the relationship $V = \varepsilon - Ir$ and a graphical method to determine ε and r.
She connected a cell in a circuit and took a series of measurements of the current I in the cell and the potential difference V across the terminals of the cell.

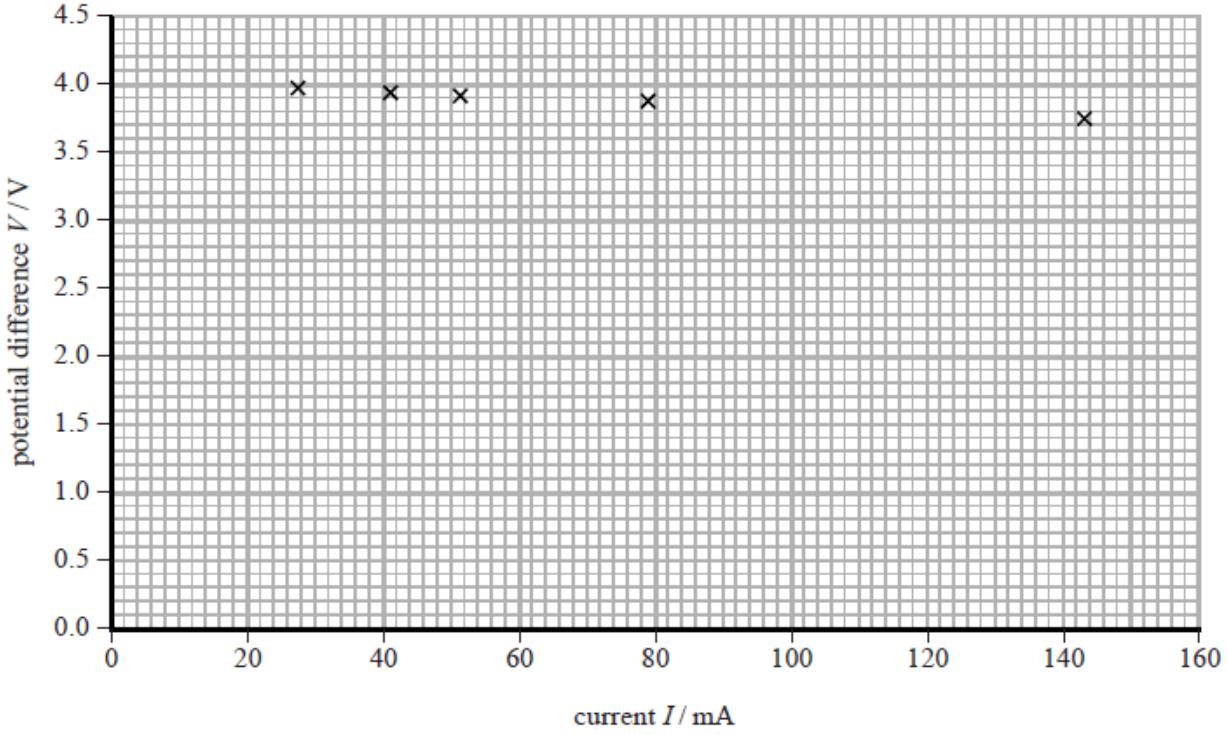
(a) Complete a circuit diagram of a circuit she could have used.

(2)



(b) The student's measurements are shown in the table and plotted on the graph.

I / mA	V / V
27.5	3.97
41.0	3.94
51.6	3.90
78.6	3.88
143.0	3.75



Determine values for ε and r from the graph and show how you obtained your answers.

(4)

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ε = ...

r = ...

(c) Explain how the graph could be constructed to obtain better values for ε and r.

(2)

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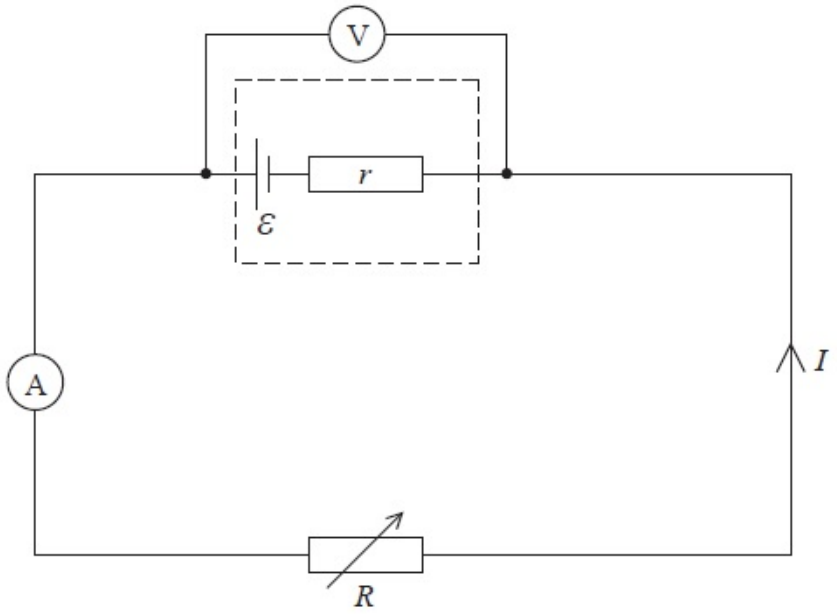
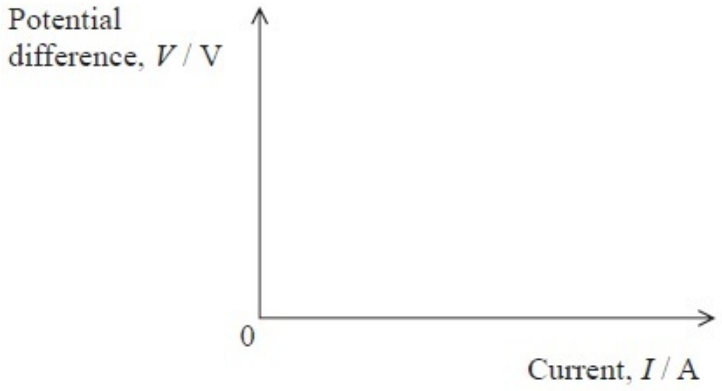
Q7. The diagram shows a circuit which may be used to find the emf ε and internal resistance r of a cell.



(a) As the resistance R of the variable resistor is varied, values of the current I in the circuit and the terminal potential difference V across the cell are recorded.

Sketch the graph of V against I and explain how it may be used to determine ε and r.

(5)



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*(b) We usually assume that ammeters have negligible resistance and voltmeters have infinite resistance.

The determination of ε and r is not affected by using an ammeter with non-negligible resistance but is affected by using a voltmeter with a low resistance.

Explain why.

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(Total for Question = 9 marks)