

## Potential Dividers, EMF and Internal Resistance - Questions by Topic

Q1.

A car battery is constructed using six cells connected in series, with a combined electromotive force (e.m.f.) of 12.00 V.

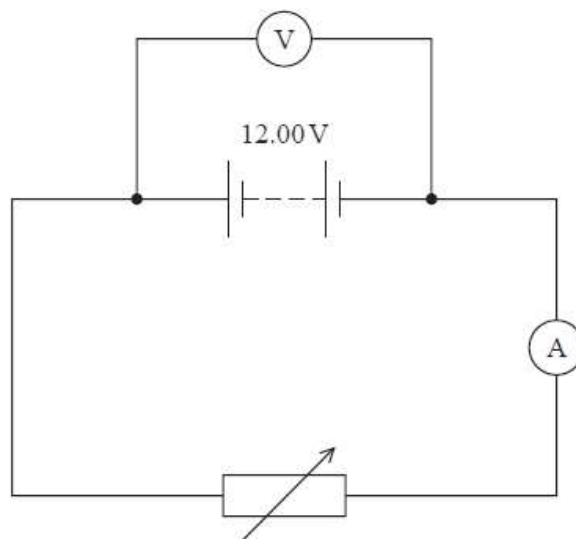
(a) State what is meant by e.m.f.

(1)

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(b) A student set up the circuit shown, using the car battery.



The student adjusted the variable resistor until the reading on the voltmeter was 11.81 V. The reading on the ammeter was 9.83 A.

(i) Calculate the internal resistance of the car battery.

(2)

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Internal resistance = .....

(ii) The student adjusted the variable resistor several times and recorded corresponding values from the ammeter and voltmeter.

Describe how the values can be used to determine the internal resistance of the battery using a graphical method.

(3)

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(c) With use, the internal resistance of a battery will increase. Eventually the power available from a battery will become too small to be useful.

The student calculated the power available from a battery of e.m.f 9.0 V and internal resistance  $0.10 \Omega$  when connected across a  $5.0 \Omega$  resistor.

He concluded that when the internal resistance had risen to  $0.50 \Omega$ , the power dissipated in the  $5.0 \Omega$  resistor would reduce to 70% of its original value.

Determine whether the student's conclusion is correct.

(4)

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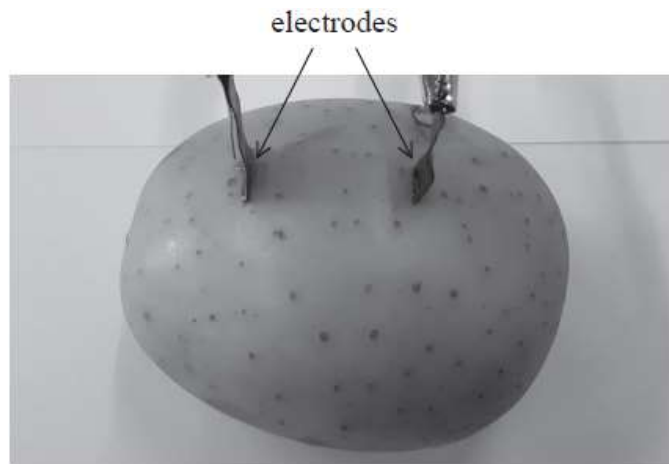
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**(Total for question = 10 marks)**

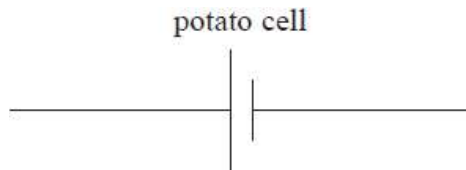
Q2.

A student carried out an experiment to determine the e.m.f.  $\epsilon$  and internal resistance  $r$  of a potato cell. The potato used in the experiment was connected to the rest of the circuit using electrodes of two different metals as shown.

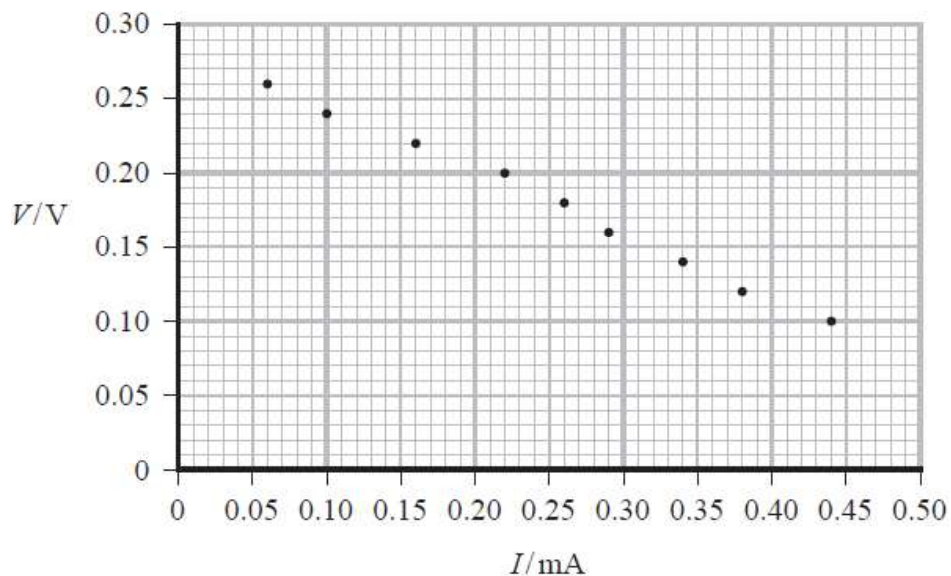


(a) Complete the diagram below to show a circuit that could be used in order to determine  $\epsilon$  and  $r$  for the potato cell.

(2)



(b) The student completed the experiment and plotted a graph showing the relationship between potential difference  $V$  and current  $I$  as shown.



Use the graph to determine values for  $\epsilon$  and  $r$ .

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$\epsilon =$  .....

$r =$  .....

(c) In a separate experiment two resistors, with equal resistance  $R$ , are connected to a battery (with internal resistance  $r$ ) with the two resistors firstly in a series arrangement (diagram A) and then in a parallel arrangement (diagram B).

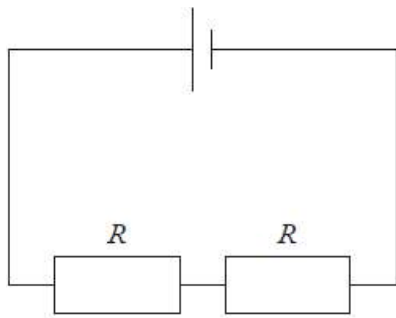


Diagram A

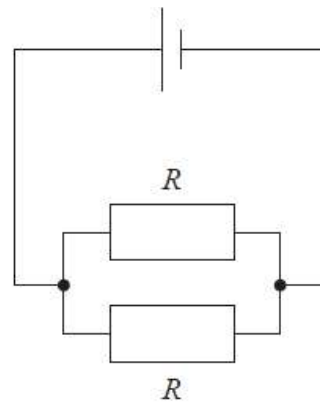


Diagram B

Explain which, if either, of the two arrangements would lead to a greater value for the terminal potential difference.

(4)

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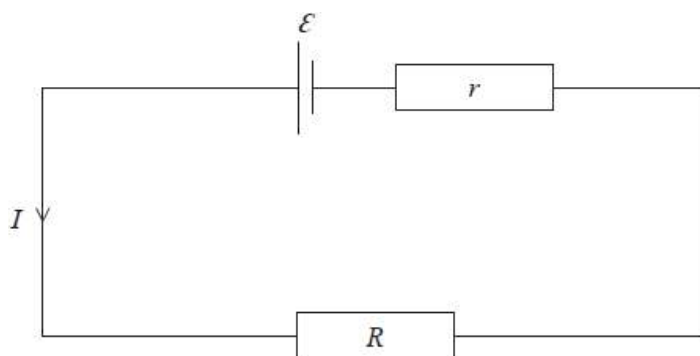
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**(Total for question = 10 marks)**

Q3.

The circuit shows a resistor of resistance  $R$  connected to a cell of e.m.f.  $\mathcal{E}$  and internal resistance  $r$ . When the current in the circuit is  $I$  the terminal potential difference is  $V$ .



Which of the following is an expression for the power  $P$  dissipated in the internal resistance of the cell?

**(1)**

- A**  $P = I(\mathcal{E} - V)$
- B**  $P = I^2R$
- C**  $P = I\mathcal{E}$
- D**  $P = V^2 / r$

**(Total for question = 1 mark)**

Q4.

**Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box  and then mark your new answer with a cross .**

Which of the following is an SI unit for electromotive force (e.m.f)?

- A** coulomb
- B** joule
- C** newton
- D** volt

**(Total for question = 1 mark)**