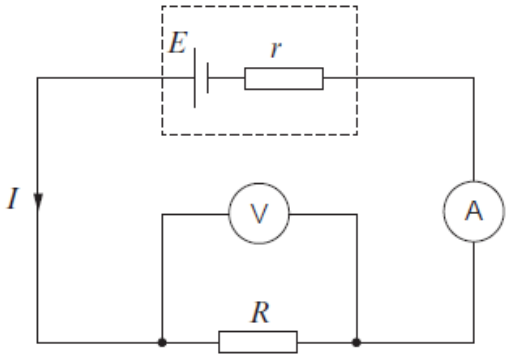
GCE PHYSICS

S21-A420QS

Assessment Resource number 13

Electricity and the Universe Resource D

1. The following circuit shows a cell of emf, E, and internal resistance, r, connected to a resistor of resistance, R.



(a) An equation which can be applied to the above circuit is:

$$V = E - Ir$$

Explain this equation in terms of energy. [4]

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(b) Two students, Kiera and Tom, set up a circuit using two identical cells in series, each with an emf of 1.5 V, to power a small heating coil. The heating coil dissipates power at the rate of 1050 mW and the pd across the coil is 2.5 V.

Calculate:

(i) the internal resistance of each cell; [3]

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(ii) the energy dissipated in each cell in **one minute**. [2]

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(c) The students note that the cells get hot when the heater is switched on for long periods. Tom believes that adding an identical heating coil in parallel with the original would halve the energy dissipated in each cell. Kiera disagrees. She believes that the energy dissipated would increase by a factor of 3 if a coil is added in parallel. Investigate whether Kiera or Tom or neither of them is correct. [4]

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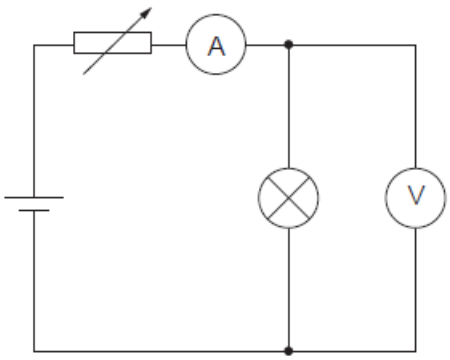
2. Jasmine uses the following circuit to investigate how the resistance, R, of a filament lamp varies with the potential difference, V, across it.



(a) Jasmine obtains a range of values for V and I. Describe **briefly** how she does this. [1]

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(b) The relationship between R and V can be expressed as:

$$R = kV^n$$

where k and n are unknown constants. By taking logs of both sides of the equation, show how it can be written in the form $y = mx + c$. [2]

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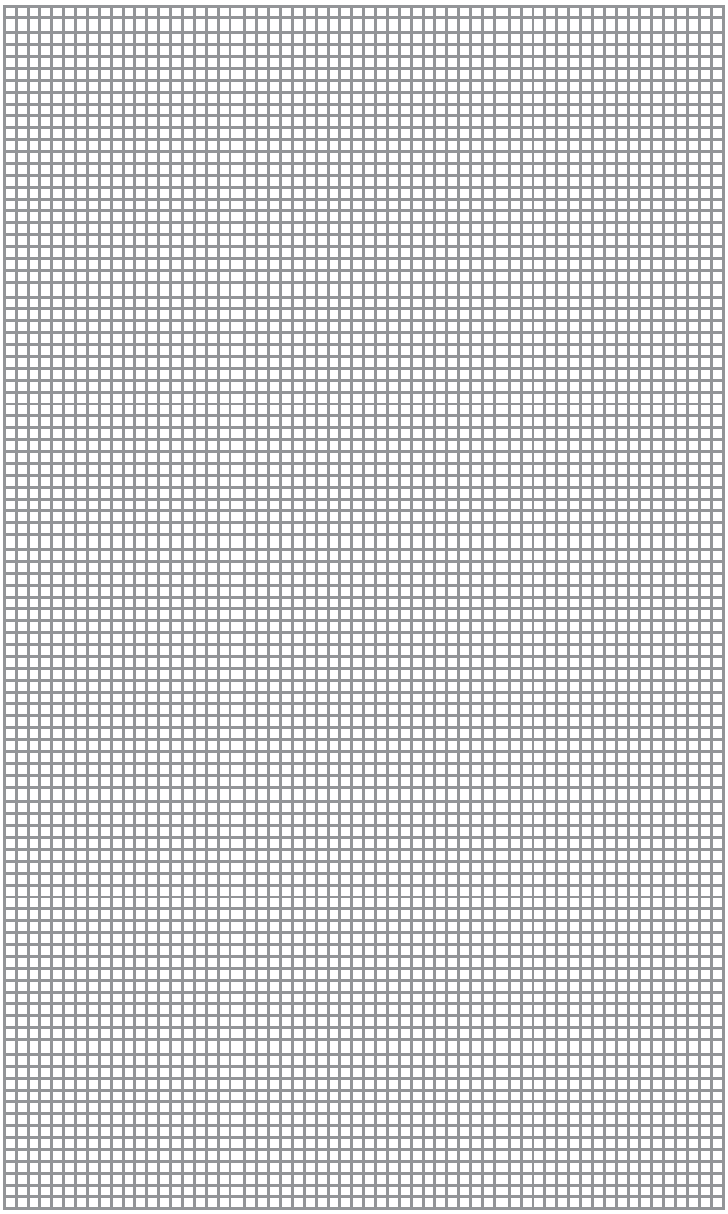
(c) Jasmine records the following data. Complete the table using an appropriate number of significant figures. [3]

V / V	I / A	R / Ω	log(V / V)	log(R / Ω)
1.00	0.52			
2.00	0.72			
4.00	0.98			
6.00	1.20			
8.00	1.40			
10.00	1.54			

(d) Draw a graph of log R (vertical axis) against log V (horizontal axis) and draw a line of best fit. Error bars are not required. [5]



(e) (i) Use your graph to determine suitable values for k and n. [4]

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(ii) Hence, write down an equation showing the relationship between R and V for this filament lamp. [1]

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(f) Comment on the quality of Jasmine's results. [1]

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