

A Level Physics A

H556/02 Exploring physics

Question Set 5

1 (a) Fig. 18.1 shows a circuit.

Both positive so e.m.f.s cancel

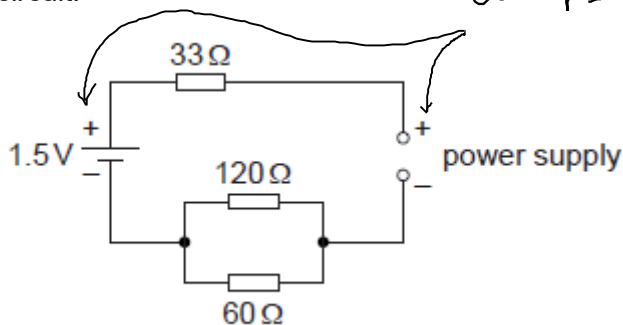


Fig. 18.1

The cell has e.m.f. 1.5 V. The cell and the variable power supply both have negligible internal resistance.

- (i) The e.m.f. of the power supply is set at 4.2V.
Calculate the current I in the 33Ω resistor.

$$R \text{ of resistors in parallel } \rightarrow R_p = \left(\frac{1}{60} + \frac{1}{120} \right)^{-1} = 40 \Omega$$

$$\text{Total } R = 40 + 33 = 77 \Omega$$

$$I = \frac{V}{R} = \frac{4.2 - 1.5}{77} = 0.037 \text{ A}$$

$$I = \dots\dots\dots 0.037 \text{ A [3]}$$

- (ii) The e.m.f. of the variable supply is now slowly decreased from 4.2V to 0V.
Describe the effect on the current I in the 33Ω resistor. [2]

I decreases up to 1.5V, where it is 0. It then reverses direction and increases below 1.5V.

- (b)* A group of students are investigating the power dissipated in a variable resistor connected across the terminals of a cell. The cell has e.m.f. 1.5V.
The students determine the power P dissipated in the variable resistor of resistance R .

Fig. 18.2 shows the data points plotted by the students on a graph of P (y-axis) against R (x-axis).

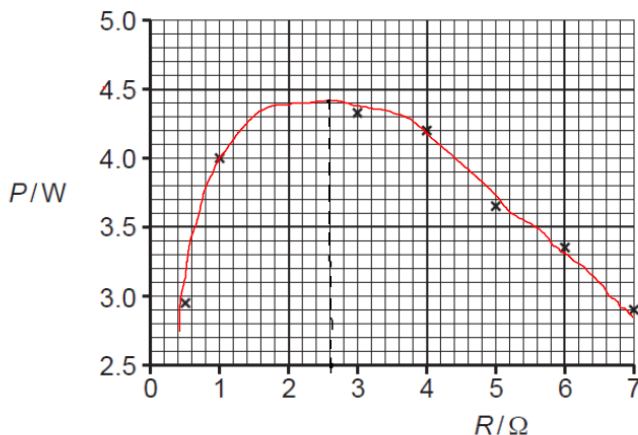
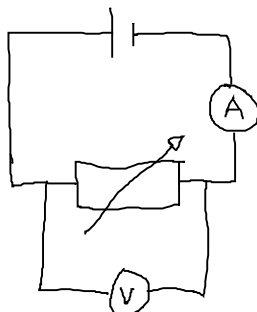


Fig. 18.2

The group of students know that **maximum power** is dissipated in the variable resistor when R is equal to the internal resistance r of the cell.

Describe, with the help of a suitable circuit diagram, how the students may have determined P and R . Use Fig. 18.2 to estimate the internal resistance r of the cell and discuss any limitations of the data plotted by the group.



- Vary R to get changing values of P
- Measure R by $R = V/I$ from voltmeter and ammeter readings
- Measure P by $P = VI$
- Peak P is at $R = 2.6 \Omega$ so $r = 2.6 \Omega$
- Limitations: need more data, especially in the region of the peak between 1Ω and 3Ω . Also, error bars would be useful to aid drawing a line of best fit.

[6]

Total Marks for Question Set 5: 11

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