

Energy, Power and Resistance

Question Paper 8

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Electrons , waves and photons
Sub-Topic	Energy, power and resistance
Booklet	Question Paper 8

Time Allowed: 33 minutes

Score: / 27

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Fig. 1.1 shows the $I-V$ characteristic of a slice of semiconducting material.

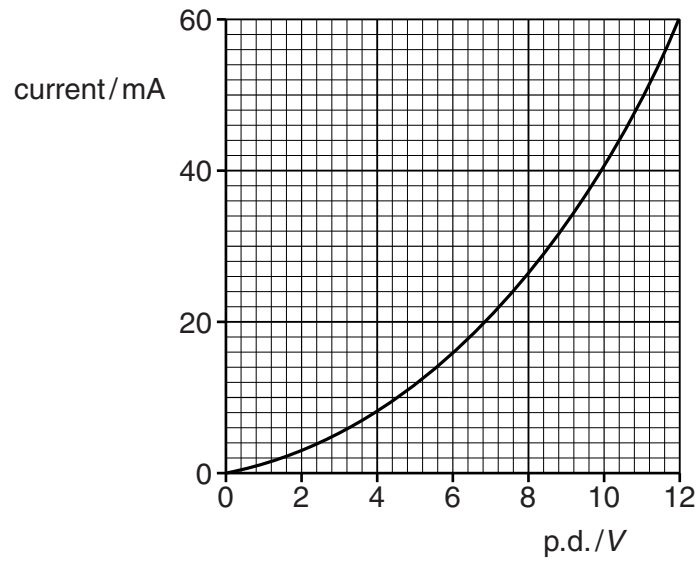


Fig. 1.1

(a) (i) Define *resistance*.

.....
 [1]

(ii) Show that the resistance of the slice is about $250\ \Omega$ when there is a current of 40 mA in it.

[2]

(b) The dimensions of the slice are shown in Fig. 1.2.

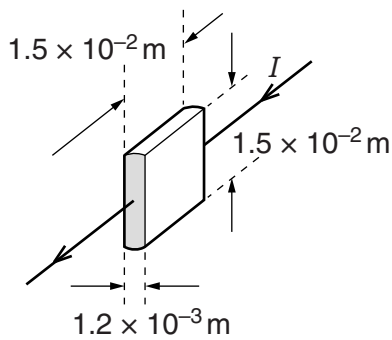


Fig. 1.2

- 2 (a) The battery in an electric car has an e.m.f. of 24V. It can provide a current of 200A to the motor for a period of 4.0 hours.

(i) Define the term *electromotive force* (e.m.f.) for the battery.

.....

 [2]

(ii) Show that the total charge Q that can be delivered by the battery is about $3 \times 10^6\text{C}$.

[2]

(iii) Calculate the total energy E that can be supplied by the battery at a constant e.m.f. of 24V.

$E = \dots\dots\dots\text{J}$ [2]

- (b) The charger for the battery has a 30V output supplying a current I . The total resistance of the circuit is indicated by one resistor R in Fig. 2.1. The positive terminal of the battery is connected to X .

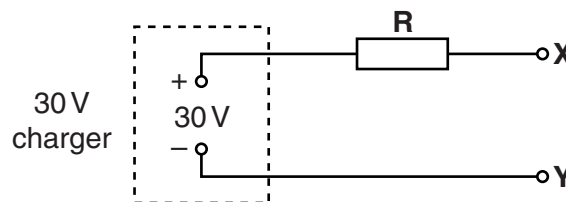


Fig. 2.1

(i) Complete the circuit by drawing the correct symbol for the battery between X and Y on Fig. 2.1. The battery has negligible internal resistance. [1]

(ii) The potential difference across the battery remains at 24V. The current I provided by the battery charger is constant at 120A. Show that the value of the resistance of R is 0.050Ω .

[2]

(iii) Calculate the power lost in **R** as the battery is charging.

power lost =W [2]

(iv) The efficiency of the charging process is given by the equation

$$\text{efficiency} = \frac{\text{input power from charger} - \text{power loss in R}}{\text{input power from charger}}.$$

Calculate its value as a percentage.

efficiency =% [3]

(c) (i) Show that it takes about 7 hours to charge a completely flat battery.

[2]

(ii) Calculate the cost of charging the battery at 26p per kWh.

cost =p [1]

[Total: 17]