

(a)

A battery with internal resistance r is connected to an ideal ammeter, as shown in Fig. 7.1.

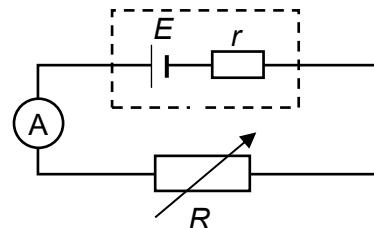
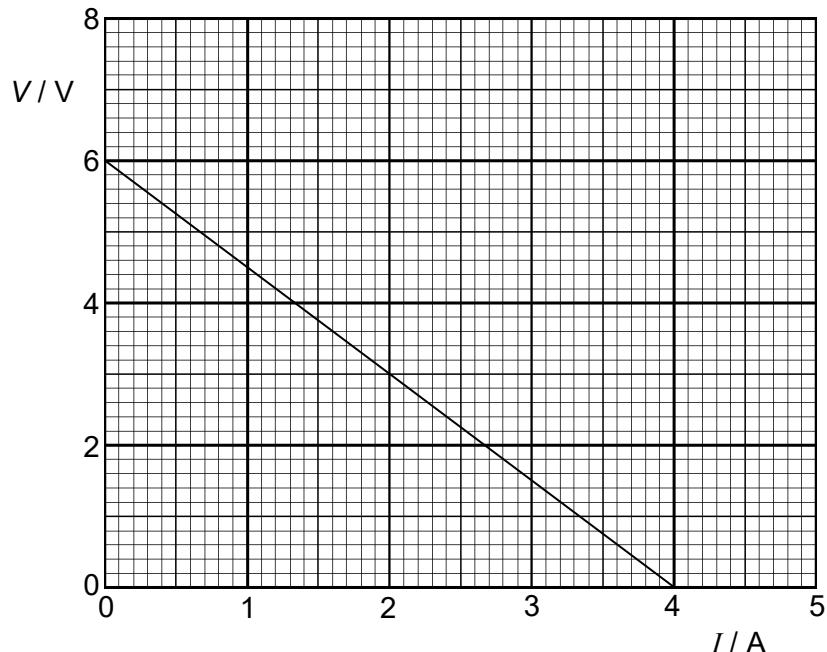
**Fig. 7.1**

Fig. 7.2 shows the variation of current I in the circuit with potential difference V across the variable resistor R .

**Fig. 7.2**

(i)

Define

1. *potential difference*

.....[1]

2. *resistance.*

.....[1]

(ii)

State and explain if the variable resistor is an *ohmic* conductor.

.....
..... [1]

(iii)

1. With reference to Fig. 7.2, express V in terms of I . [1]

2. Hence, state the e.m.f. of the battery E and the internal resistance r .

$$E = \dots \text{ V} [1]$$

$$r = \dots \Omega [1]$$

(iv)

When the current in the variable resistor R is 0.40 A, calculate the

1. resistance of the variable resistor R .

$$R = \dots \Omega [1]$$

2. power dissipated in the variable resistor R .

power = W [1]

(b)

Sketch and explain the *I-V* graph of a filament lamp.

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.....

.....

.....

.....

.....

.[3]

(c)

When a potential difference of 12.0 V is applied across the uniform filament wire of a headlight, 2.0×10^{20} electrons pass through this filament in 6.0 s. The material of the filament has resistivity $7.9 \times 10^{-7} \Omega \text{ m}$ and its radius is $9.0 \times 10^{-5} \text{ m}$.

(i)

Calculate the electric current through the filament wire.

current = A [2]

(ii)

Determine the resistance of this headlight.

resistance = Ω [1]

(iii)

Find the length of the filament in the headlight.

length = m [2]

(d)

A battery of e.m.f. 9.0 V and internal resistance r is connected to four ideal voltmeters, one ideal ammeter and six resistors, four of which have values as shown in Fig. 7.3. The voltmeter V_2 reads 4.0 V.

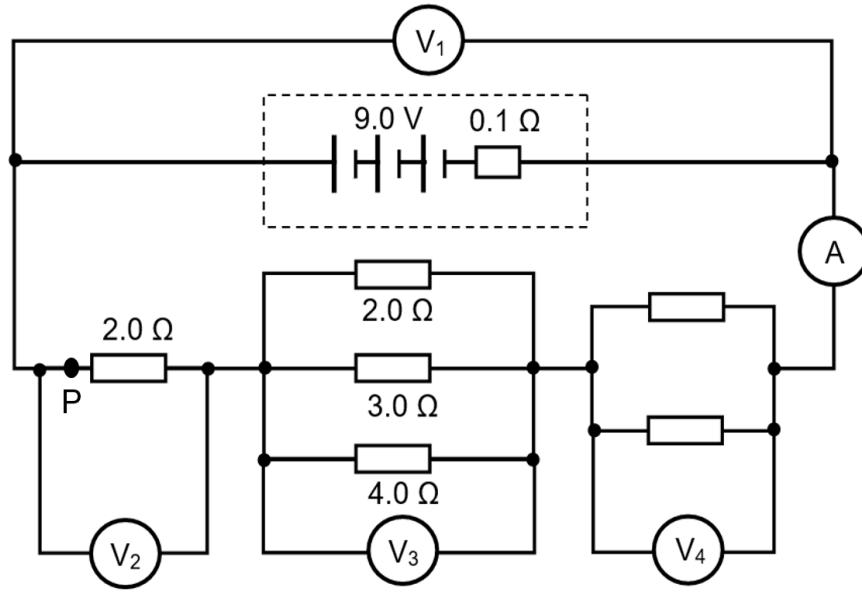


Fig. 7.3

(i)

Calculate the reading of voltmeter, V_3 .

reading of V_3 = V [2]

(ii)

State the reading on voltmeter, V_1 and V_2 when there is a break in wire at point P.

reading of V_1 = V

reading of V_2 = V [2]

[Total: 20]