

5 (a) Define the *ohm*.

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

(b) A wire is made of metal of resistivity  $\rho$ . The length  $L$  of the wire is gradually increased. Assume that the volume  $V$  of the wire remains constant as its length is increased.

Show that the resistance  $R$  of the extending wire is proportional to  $L^2$ .

[2]

(c) A battery of electromotive force (e.m.f.)  $E$  and internal resistance  $r$  is connected to a variable resistor of resistance  $R$ , as shown in Fig. 5.1.

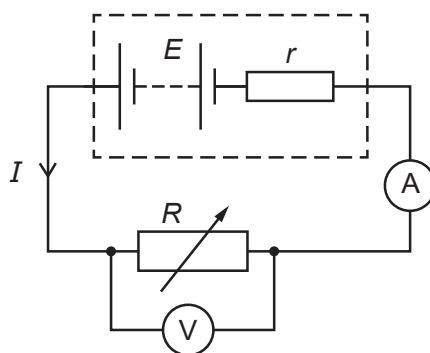
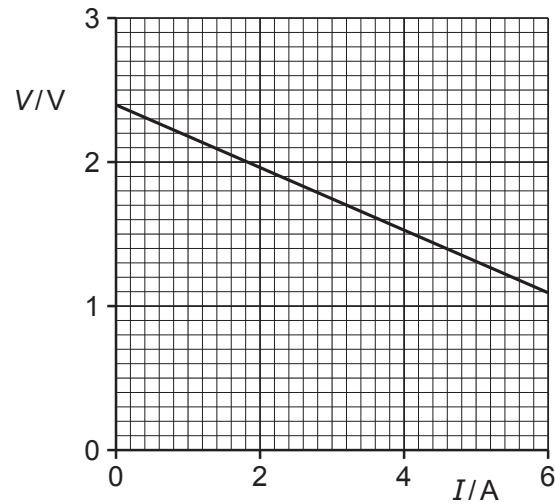


Fig. 5.1

An ammeter measures the current  $I$  in the circuit. A voltmeter measures the potential difference  $V$  across the variable resistor.

The resistance  $R$  is now varied to change the values of  $I$  and  $V$ .

The variation with  $I$  of  $V$  is shown in Fig. 5.2.



**Fig. 5.2**

- (i) Use Fig. 5.2 to state the e.m.f.  $E$  of the battery.

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

- (ii) Use Fig. 5.2 to determine the power dissipated in the variable resistor when there is a current of 5.0A.

$$\text{power} = \dots\dots\dots \text{ W [3]}$$

- (iii) State what is represented by the value of the gradient of the graph.

$$\dots\dots\dots [1]$$