7 **(a)** Define the *ohm*.

.....

..... [1]

(b) A uniform wire has resistance 3.2 Ω. The wire has length 2.5 m and is made from metal of resistivity 460 nΩ m.

Calculate the cross-sectional area of the wire.

cross-sectional area = ... m^2 [3]

(c) A cell of electromotive force (e.m.f.) *E* and internal resistance *r* is connected to a variable resistor of resistance *R*, as shown in Fig. 7.1.

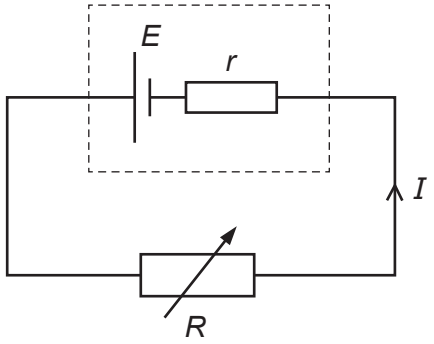

Fig. 7.1

The current in the circuit is I.

(i) State, in terms of energy, why the potential difference across the variable resistor is less than the e.m.f. of the cell.

.....

..... [1]

(ii) State an expression for E in terms of I, R and r.

E = ... [1]

(iii) The resistance R of the variable resistor is changed so that it is equal to r.

Determine an expression, in terms of only E and r, for the power P dissipated in the variable resistor.

P = ... [2]

[Total: 8]

8 **(a)** State a similarity and a difference between a down quark and a down antiquark.

similarity: .....

difference: .....
[2]

(b) a nucleus of aluminium-25 ($^{25}_{13}Al$):

(i) state the number of protons and the number of neutrons

number of protons = ...

number of neutrons = ...

[1]

(ii) show that the charge is 2.1×10^{-18} C.

[1]

(c) The nucleus in **(b)** is moved along a straight line from point A to point B in a uniform horizontal electric field in a vacuum, as shown in Fig. 8.1.

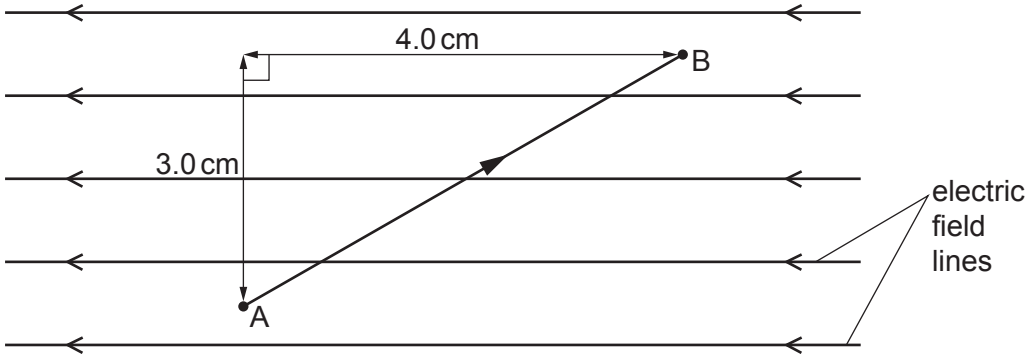

Fig. 8.1

The electric field strength is 11 kV m^{-1}.

Calculate the work done to move the charge from A to B.