For Examiner's Use

8 **(a)** Distinguish between electrical resistance and resistivity.

resistance: .....

.....

resistivity: .....

.....

.....

[4]

(b) An electric cable is made up of 24 thin strands of copper wire, as shown in Fig. 8.1.

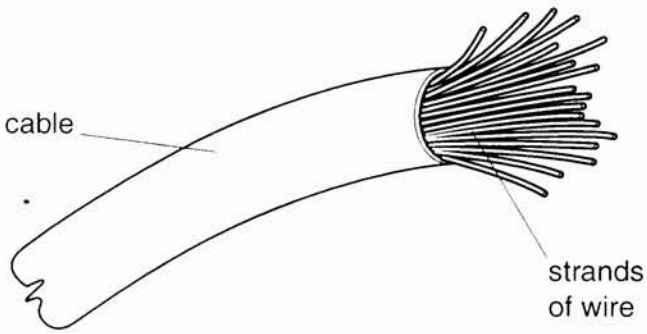

Fig. 8.1

Each strand has diameter 0.26 mm. Copper has resistivity $1.7 \times 10^{-8}\,\Omega\,m$.

Calculate

(i) the resistance of one strand of wire of length 1.0 m,

resistance = ... Ω [2]

(ii) the resistance of the cable of length 5.0 m.

resistance = ... Ω [2]

For Examiner's Use

(c) A battery has an e.m.f. of 12.0 V and negligible internal resistance. A resistor of resistance 3.0 Ω is permanently connected to one of its terminals.

The battery and resistor form a power supply with terminals X and Y, as shown in Fig. 8.2.

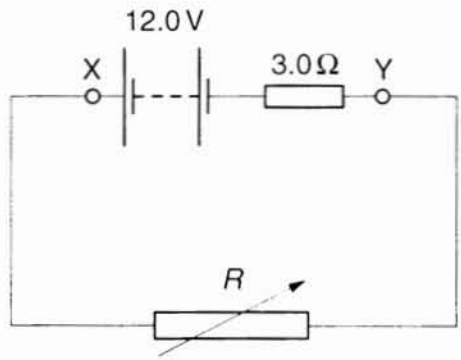

Fig. 8.2

A variable resistor of resistance *R* is connected across terminals X and Y.

(i) Calculate

1. the maximum possible current from the supply,

current = ... A [1]

2. the minimum safe power rating of the 3.0 Ω resistor.

power = ... W [2]

(ii) Suggest the purpose of the 3.0 Ω resistor.

.....

..... [1]

(d) The resistance R in the circuit of Fig. 8.2 is varied. The variation with R of the power P dissipated in the variable resistor is shown in Fig. 8.3.

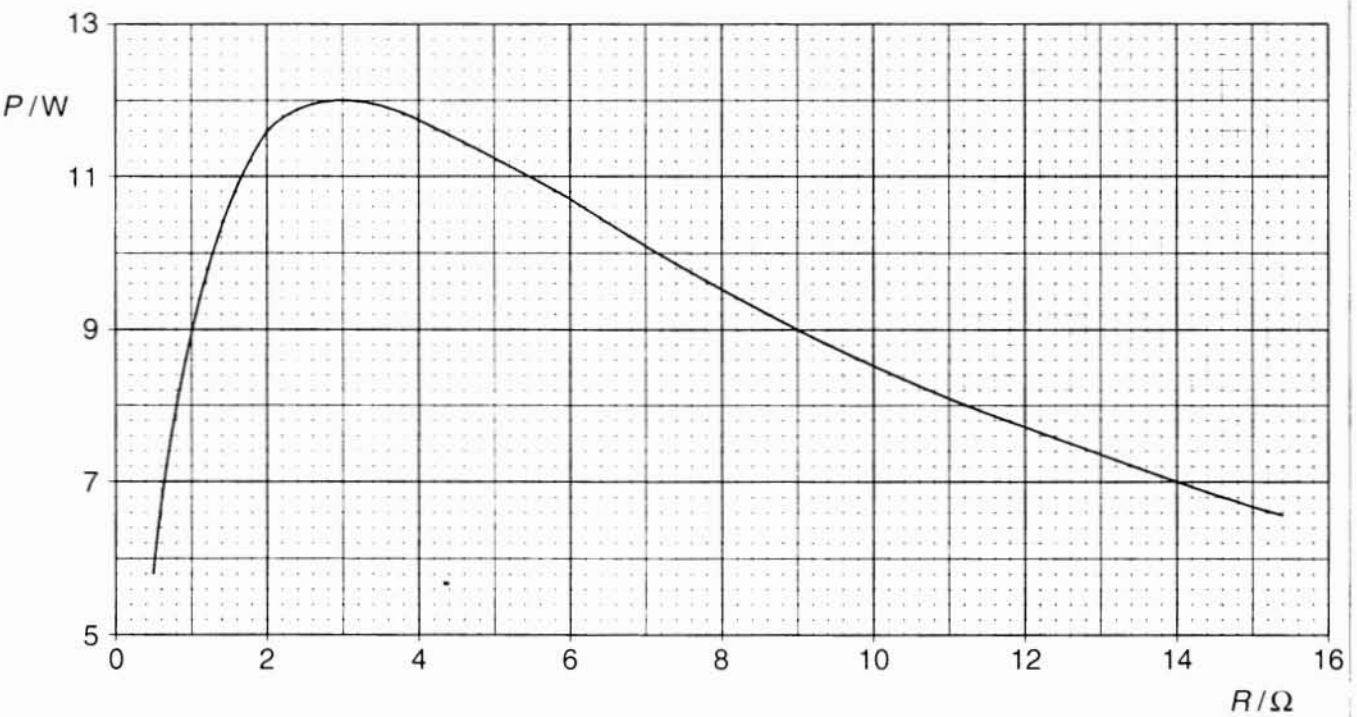

Fig. 8.3

(i) State the two values of R at which the power dissipated in the variable resistor is 9.0W.

R = ... Ω and R = ... Ω [1]

(ii) For each of the two values in **(i)**, calculate the efficiency of transfer of power from the supply to the variable resistor.

$$\text{efficiency} = \left(\frac{\text{power output}}{\text{power supplied}}\right) \times 100\%$$

for resistance of ..... Ω, efficiency = ... %

for resistance of ..... Ω, efficiency = ... %

[5]

(e) A battery is to be designed to provide the power for a component that has a fixed resistance.

The internal resistance r of the battery is to be chosen to provide maximum efficiency of energy transfer to the component.

Use your answers in **(d)** to state and explain the choice of r compared with the component's fixed resistance.

.....

.....

..... [2]