32 What is a possible charge on a particle?

A 6.40×10^{-20} C

B 4.00×10^{-19} C

C 1.12×10^{-18} C

D 9.11×10^{-18} C

35 A wire carries a current of 5.6 A.

What is the number of conduction electrons that pass a point on the wire in a time of 20 s?

A 1.8×10^{18} **B** 2.2×10^{19} **C** 3.5×10^{19} **D** 7.0×10^{20}

34 A resistor of resistance 200 Ω is connected to a supply that has a p.d. of 4.00 V.

How many electrons enter the resistor in 4.00 s?

A 3.13×10^{16} **B** 1.25×10^{17} **C** 5.00×10^{17} **D** 1.25×10^{21}

4 A sample of material has cross-sectional area A and length L. The temperatures at the two sides of the sample are T_1 and T_2. Thermal energy Q is transferred through the sample in time t.

These quantities are related by

$$\frac{Q}{t} = \frac{k \times A \times (T_1 - T_2)}{L}$$

where k is a constant.

What are the SI base units of k?

A $\text{kg m s}^{-3}\,^{\circ}\text{C}^{-1}$ **B** $\text{kg m s}^{-3}\text{K}^{-1}$ **C** $\text{kg m s}^{-1}\,^{\circ}\text{C}^{-1}$ **D** $\text{kg m s}^{-1}\text{K}^{-1}$

32 The current I in a metallic conductor of cross-sectional area A is given by

$$I = Anve$$

where e is the elementary charge and v is the mean drift velocity of the conduction electrons.

What is represented by the letter n in the equation?

A density of conduction electrons

B number of conduction electrons per unit time

C number of conduction electrons per unit volume

D volume of conduction electrons

29 The resistance of a lamp is 10 Ω and the potential difference across it is 6.0 V.

How many electrons pass through the lamp in a time of 24 hours?

A 5.2×10^{4} **B** 9.0×10^{19} **C** 5.4×10^{21} **D** 3.2×10^{23}

30 Two cylindrical conductors, X and Y, are made from the same material. The conductors have equal lengths, but Y has a smaller diameter than X.

X and Y are connected in series to a cell.

Which row compares the number of charge carriers per unit time passing through X and through Y and compares the average drift speed of the charge carriers in X and in Y?

	number of charge carriers per unit time	average drift speed of charge carriers
A	Y greater than X	Y greater than X
B	Y same as X	Y same as X
C	Y greater than X	Y same as X
D	Y same as X	Y greater than X

6 A cylindrical copper wire P of length 0.24 m is shown in Fig. 6.1.

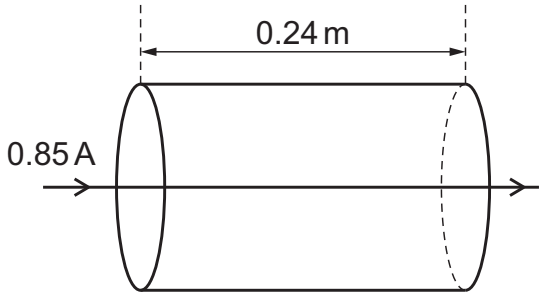

Fig. 6.1 (not to scale)

The current in the wire is 0.85 A.
The resistance of the wire is 3.3 mΩ.
The **total** number of charge carriers N in the wire is 2.6×10^{22}.
The resistivity of copper is $1.8 \times 10^{-8}\,\Omega\,m$.

(a) Calculate the potential difference between the two ends of the wire.

potential difference = ... V [2]

(b) (i) Show that the cross-sectional area of the wire is $1.3 \times 10^{-6}\,m^2$.

[2]

(ii) Show that the number density of charge carriers in the wire is $8.3 \times 10^{28}\,m^{-3}$.

[1]

(iii) Calculate the average drift speed of the charge carriers (electrons) in the wire.

average drift speed = ... $m\,s^{-1}$ [2]

(c) A different copper wire Q has the same volume as wire P, but non-uniform radius, as shown in Fig. 6.2.

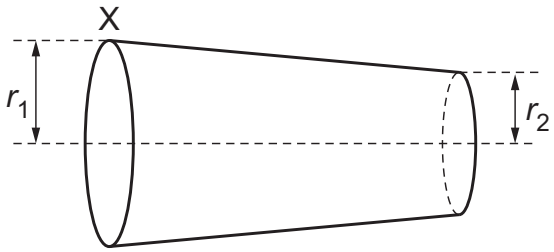

Fig. 6.2 (not to scale)

The radius r_1 at end X of wire Q is the same as the radius of wire P. Radius r_2 is less than r_1.

(i) State and explain how the resistance of wire Q compares with the resistance of wire P.

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..... [4]

(ii) On Fig. 6.3, sketch a graph of the variation of the average drift speed of the charge carriers with distance from end X of wire Q.

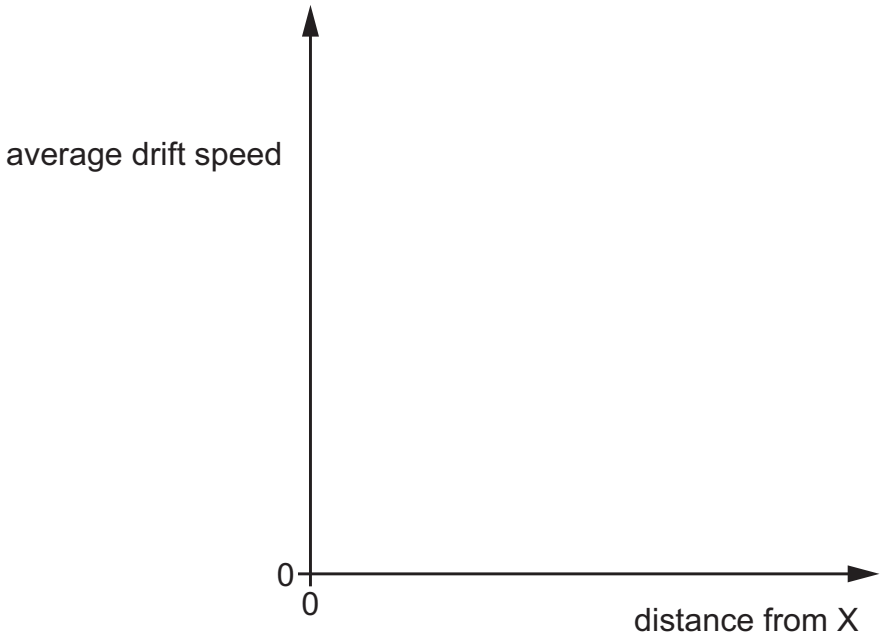

Fig. 6.3

[2]

[Total: 13]