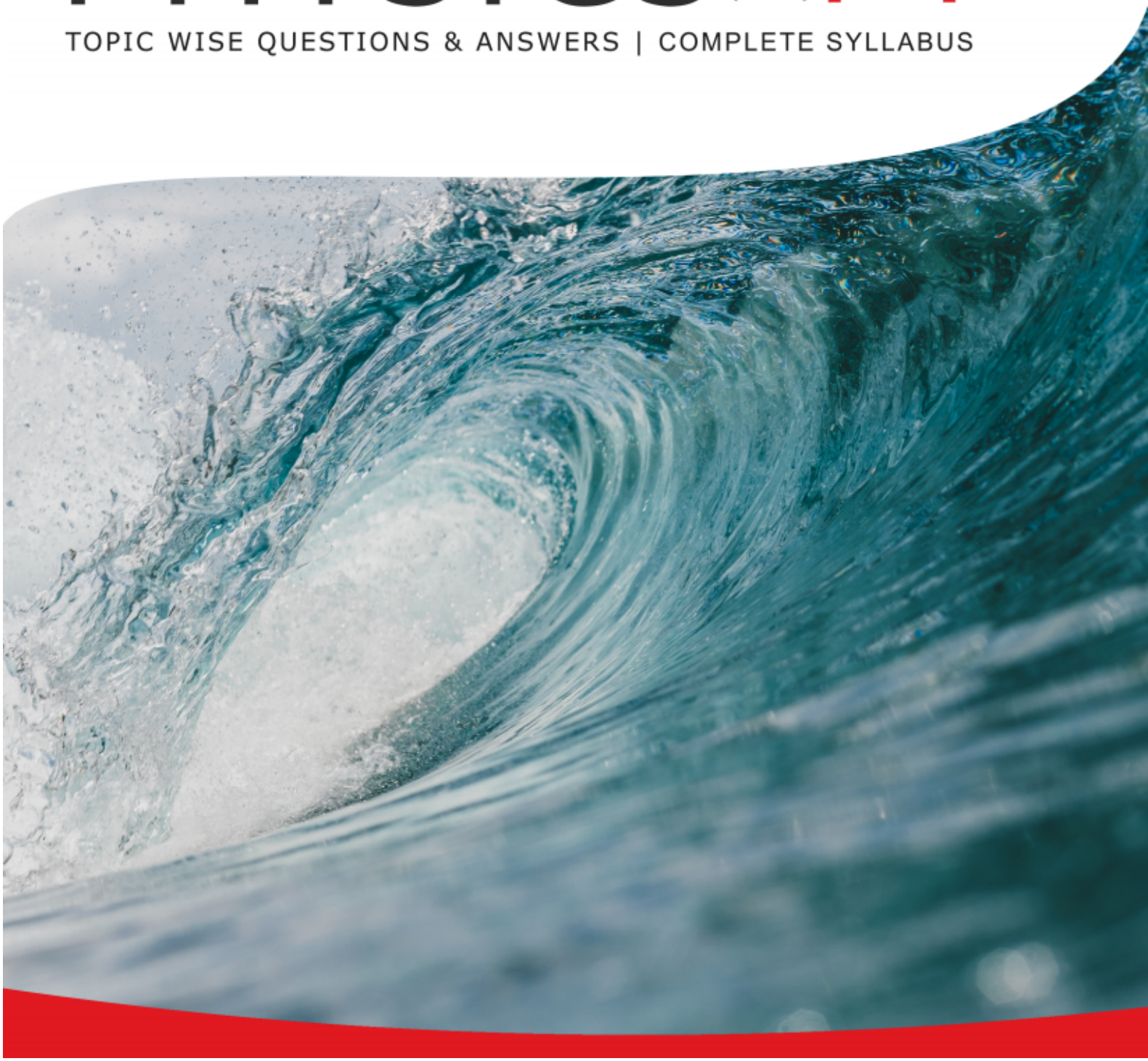
Cambridge International AS & A Level

PHYSICS (9702) P1

TOPIC WISE QUESTIONS & ANSWERS | COMPLETE SYLLABUS



PapaCambridge

Chapter 11

Current of electricity

11.1 Electric current

1080. 9702_m20_qp_12 Q: 32

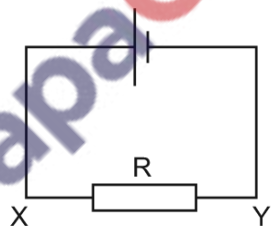
Electrons move in a vacuum from one metal plate to another metal plate. As a result of this, there is an electric current of 48 μA between the two plates.

How many electrons are emitted by the first plate in a time of 5.0 minutes?

A 1.4×10^{4} **B** 1.5×10^{15} **C** 1.8×10^{16} **D** 9.0×10^{16}

1081. 9702_s20_qp_11 Q: 33

The current in the circuit shown is 3.2 mA.



What are the direction of flow and the rate of flow of electrons through the resistor R?

	direction of flow	rate of flow / s^{-1}
A	X to Y	2.0×10^{16}
B	X to Y	5.1×10^{-22}
C	Y to X	2.0×10^{16}
D	Y to X	5.1×10^{-22}

1082. 9702_s20_qp_12 Q: 33

The number density of free electrons in copper is $8.0 \times 10^{28}\,\text{m}^{-3}$.

A copper wire has diameter 0.42 mm.

What is the average drift speed of the free electrons in the wire when the current in the wire is 0.57 A?

A $8.0 \times 10^{-11}\,\text{m s}^{-1}$

B $3.2 \times 10^{-10}\,\text{m s}^{-1}$

C $8.0 \times 10^{-5}\,\text{m s}^{-1}$

D $3.2 \times 10^{-4}\,\text{m s}^{-1}$

1083. 9702_s20_qp_13 Q: 33

The unit of electric charge is the coulomb.

What is meant by 1 coulomb?

A the charge passing a point in 1 second when a current produces 1 joule of work

B the charge passing a point in 1 second when a current produces 1 watt of power

C the charge passing a point in 1 second when there is a current of 1 ampere

D the charge passing a point in 1 second when there is 1 ohm of resistance

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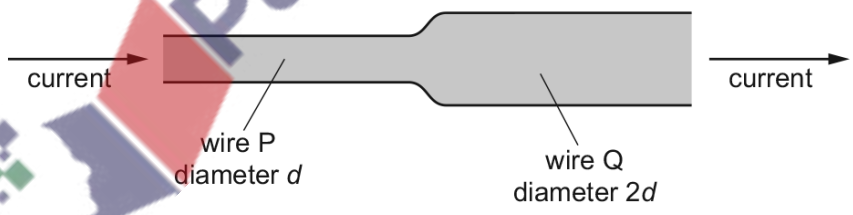
1084. 9702_s20_qp_13 Q: 34

Two copper wires are joined together and carry a current, as shown.



Wire P has diameter d and wire Q has diameter $2d$.

What is the ratio $\dfrac{\text{average drift speed of the free electrons in wire P}}{\text{average drift speed of the free electrons in wire Q}}$?

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

1085. 9702_m19_qp_12 Q: 32

The electric current in a wire may be calculated using the equation $I = Anvq$.

Which statement is **not** correct?

A n is the number of charge carriers per unit volume of the wire.

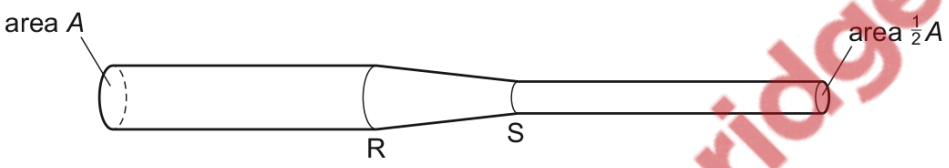
B nA is the number of charge carriers per unit length of the wire.

C q is the charge of each charge carrier.

D v is the velocity of each charge carrier.

1086. 9702_s19_qp_12 Q: 33

A length of wire is connected into a circuit.



The area of the cross-section of the wire changes from A at R to $\frac{1}{2}A$ at S.

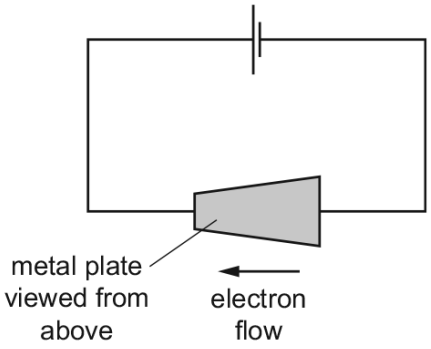
There is a constant current in the wire. Charge Q passes R in time t.

What is the charge passing point S in the same time t?

A $\frac{1}{2}Q$ **B** Q **C** $Q\sqrt{2}$ **D** $2Q$

1087. 9702_w19_qp_11 Q: 30

A metal plate of uniform thickness is connected to a cell as shown.



Electrons move clockwise around the circuit.

Which statement about the metal plate is correct?

A The average drift speed of the conduction electrons decreases as they move from right to left through the plate.

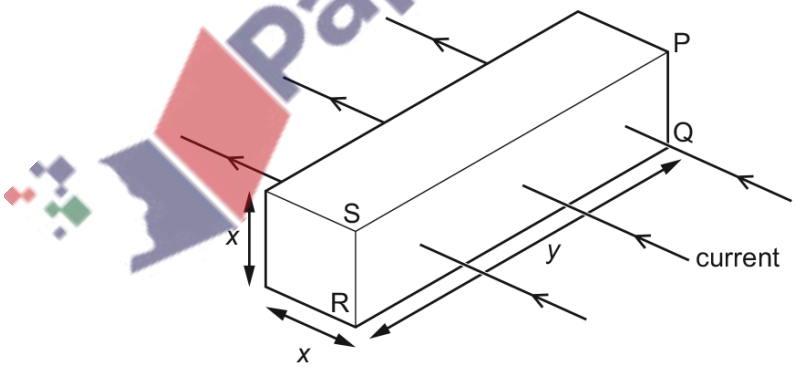
B The average drift speed of the conduction electrons increases as they move from right to left through the plate.

C The number density of the conduction electrons decreases from right to left through the plate.

D The number density of the conduction electrons increases from right to left through the plate.

1088. 9702_w19_qp_11 Q: 31

The diagram shows the direction of the current in a metal block. The charge carriers enter the block through the face PQRS and leave the block through the opposite face.



The number density of charge carriers is n. Each charge carrier has charge e. The average drift speed of the charge carriers is v.

Which expression gives the current in the block?

A $envx^2$ **B** $envxy$ **C** $envx^3y^2$ **D** $envx^4y$

1089. 9702_w19_qp_12 Q: 31

When the current in a wire is 5.0 A, the average drift speed of the conduction electrons in the wire is $7.4 \times 10^{-4}\,\text{m s}^{-1}$.

Which row gives a possible cross-sectional area and number of conduction electrons per unit volume for this wire?

	cross-sectional area / m^2	number of conduction electrons per unit volume / m^{-3}
A	7.2×10^{-7}	1.2×10^{28}
B	7.2×10^{-7}	5.9×10^{28}
C	2.3×10^{-6}	7.3×10^{26}
D	2.3×10^{-6}	3.7×10^{27}

1090. 9702_w19_qp_13 Q: 33

A metal electrical conductor has a resistance of 5.6 kΩ. A potential difference (p.d.) of 9.0 V is applied across its ends.

How many electrons pass a point in the conductor in one minute?

A 6.0×10^{20} **B** 1.0×10^{19} **C** 6.0×10^{17} **D** 1.0×10^{16}

1091. 9702_m18_qp_12 Q: 35

Charge carriers, each of charge q, move along a wire of fixed length. The number density of the charge carriers in the wire is n.

What is also required, for this wire, to determine the average drift velocity of the charge carriers in terms of n and q?

A current per unit of cross-sectional area

B potential difference per unit of length

C resistance and cross-sectional area

D resistivity and length

1092. 9702_s18_qp_11 Q: 30

The current I in a metal wire is given by the expression shown.

$$I = Anvq$$

What does the symbol n represent?

A the number of atoms per unit volume of the metal

B the number of free electrons per atom in the metal

C the number of free electrons per unit volume of the metal

D the total number of electrons per unit volume of the metal

1093. 9702_s18_qp_13 Q: 29

What is a possible charge on a particle?

A $6.40 \times 10^{-20}\,\text{C}$

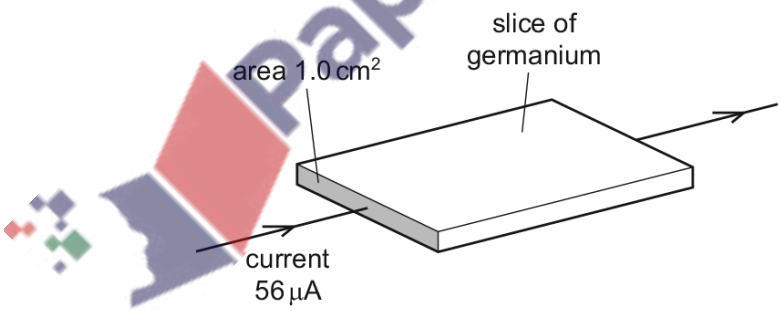
B $4.00 \times 10^{-19}\,\text{C}$

C $1.12 \times 10^{-18}\,\text{C}$

D $9.11 \times 10^{-18}\,\text{C}$

1094. 9702_s18_qp_13 Q: 30

A slice of germanium of cross-sectional area $1.0\,\text{cm}^2$ carries a current of $56\,\mu\text{A}$. The number density of charge carriers in the germanium is $2.0 \times 10^{13}\,\text{cm}^{-3}$. Each charge carrier has a charge equal to the charge on an electron.



What is the average drift velocity of the charge carriers in the germanium?

A $0.18\,\text{m s}^{-1}$ **B** $18\,\text{m s}^{-1}$ **C** $180\,\text{m s}^{-1}$ **D** $1800\,\text{m s}^{-1}$

1095. 9702_w18_qp_11 Q: 33

When there is a current of 5.0 A in a copper wire, the average drift velocity of the free electrons is $8.0 \times 10^{-4}\,m\,s^{-1}$.

What is the average drift velocity in a different copper wire that has twice the diameter and a current of 10.0 A?

A $4.0 \times 10^{-4}\,m\,s^{-1}$

B $8.0 \times 10^{-4}\,m\,s^{-1}$

C $1.6 \times 10^{-3}\,m\,s^{-1}$

D $3.2 \times 10^{-3}\,m\,s^{-1}$

1096. 9702_w18_qp_12 Q: 33

Which two units are used to define the coulomb?

A ampere and second

B ampere and volt

C volt and ohm

D volt and second

1097. 9702_w18_qp_13 Q: 32

The current I in a copper wire can be calculated using the equation shown.

$$I = Anvq$$

What does the symbol v represent?

A the average drift velocity of the charge carriers

B the instantaneous velocity of the charge carriers

C the voltage applied across the wire

D the volume of the wire

1098. 9702_m17_qp_12 Q: 32

An electric current I is given in the list of formulae on page 3 as $I = Anvq$.

What do each of the symbols represent for an electric current in a metal wire?

	A	n	v	q
A	area of cross-section	number of free electrons	voltage	charge of each molecule
B	area of cross-section	number of free electrons per unit volume	average drift speed of electrons	charge of each electron
C	current	number of free electrons	average drift speed of electrons	charge of each molecule
D	current	number of free electrons per unit volume	voltage	charge of each electron

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1099. 9702_s17_qp_11 Q: 32

The diagram shows the symbol for a wire carrying a current I.

What does this current represent?

A the charge flowing past a point in the wire per unit time

B the number of electrons flowing past a point in the wire per unit time

C the number of positive ions flowing past a point in the wire per unit time

D the number of protons flowing past a point in the wire per unit time

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1100. 9702_s17_qp_12 Q: 32

The current in a circuit component is 2.00 μA.

How many electrons pass through the component each second?

A 1.25×10^{13} **B** 1.25×10^{16} **C** 1.25×10^{19} **D** 1.25×10^{25}

1101. 9702_s17_qp_13 Q: 31

Two metal plates are a distance of 30 cm apart in a vacuum.

A current exists between the two plates consisting of electrons moving at a constant speed of $1.5 \times 10^6\,\text{m s}^{-1}$.

At any instant, there is always just one electron travelling between the plates.

What is the current between the plates?

A $3.2 \times 10^{-26}\,\text{A}$

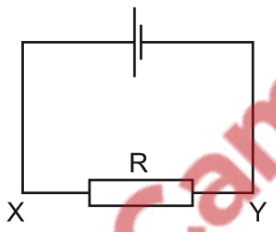
B $8.0 \times 10^{-13}\,\text{A}$

C $1.6 \times 10^{-12}\,\text{A}$

D $2.0 \times 10^{-7}\,\text{A}$

1102. 9702_w17_qp_11 Q: 33

The current in the circuit shown is 3.2 mA.

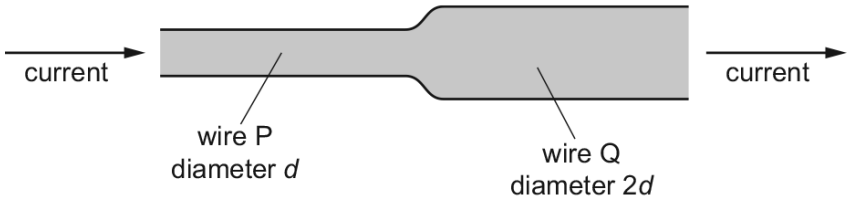


What are the direction of flow and the rate of flow of electrons through the resistor R?

	direction of flow	rate of flow / s^{-1}
A	X to Y	2.0×10^{16}
B	X to Y	5.1×10^{-22}
C	Y to X	2.0×10^{16}
D	Y to X	5.1×10^{-22}

1103. 9702_w17_qp_12 Q: 33

Two copper wires are joined together and carry a current, as shown.



Wire P has diameter d and wire Q has diameter $2d$.

What is the ratio $\frac{\text{average drift speed of the free electrons in wire P}}{\text{average drift speed of the free electrons in wire Q}}$?

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

1104. 9702_w17_qp_13 Q: 33

The number density of conduction electrons in copper is $8.0 \times 10^{28}\,\text{m}^{-3}$.

What is the average drift speed of electrons in a copper wire of diameter 0.42 mm when the current in the wire is 0.57 A?

A $8.0 \times 10^{-11}\,\text{m s}^{-1}$

B $3.2 \times 10^{-10}\,\text{m s}^{-1}$

C $8.0 \times 10^{-5}\,\text{m s}^{-1}$

D $3.2 \times 10^{-4}\,\text{m s}^{-1}$

1105. 9702_m16_qp_12 Q: 30

An electrical conductor has a resistance of 5.6 kΩ. A potential difference (p.d.) of 9.0 V is applied across its ends.

How many electrons pass a point in the conductor in one minute?

A 6.0×10^{20} **B** 1.0×10^{19} **C** 6.0×10^{17} **D** 1.0×10^{16}

1106. 9702_s16_qp_13 Q: 31

In an electrolyte, the electric current is carried by charged particles (ions) in solution.

What is **not** a possible value for the charge on an ion in solution?

A -4.8×10^{-19} C

B $+1.6 \times 10^{-19}$ C

C $+3.2 \times 10^{-19}$ C

D $+4.0 \times 10^{-19}$ C

1107. 9702_w16_qp_12 Q: 33

A wire carries a current of 2.0 A for 1.0 hour.

How many electrons pass a point in the wire in this time?

A 1.2×10^{-15} **B** 7.2×10^{3} **C** 1.3×10^{19} **D** 4.5×10^{22}

11.2 Potential difference and power

1108. 9702_s20_qp_12 Q: 34

An electric kettle is rated at 2.0 kW, which describes the power supplied to the heating coil in the kettle.

The coil has a resistance of 5.0 kΩ.

What is the current in the coil?

A 0.40 A **B** 0.63 A **C** 1.6 A **D** 2.5 A

1109. 9702_m19_qp_12 Q: 16

A crane is being used to lift containers off a ship. One container has a mass of 14 000 kg and is being lifted vertically with a speed of 3.2 m s^{-1}.

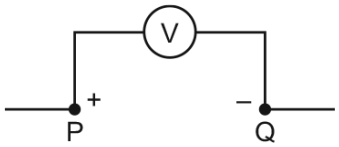
The electric motor being used to supply the power to lift the container is using a current of 240 A at a potential difference of 2200 V.

What is the efficiency of the system?

A 8.1% **B** 8.5% **C** 48% **D** 83%

1110. 9702_s19_qp_11 Q: 33

A voltmeter connected between two points P and Q in an electrical circuit shows a reading of 1 V.



Which statement is correct?

A The energy needed to move +1 C of charge from P to Q is 1 J.

B The energy needed to move +1 C of charge from Q to P is 1 J.

C The energy needed to move one electron from P to Q is 1 J.

D The energy needed to move one electron from Q to P is 1 J.

1111. 9702_s19_qp_13 Q: 32

Which two units are used to define the volt?

A ampere and ohm

B coulomb and joule

C coulomb and ohm

D coulomb and second

1112. 9702_s19_qp_13 Q: 35

A wire supplying a shower heater with a current of 35 A has a resistance of 25 mΩ.

What is the power dissipated in the wire?

A 31 W **B** 49 W **C** 31 kW **D** 49 kW

1113. 9702_w19_qp_11 Q: 32

What could **not** be used as a unit of potential difference?

A $A\Omega$ **B** $Nm^{-1}C^{-1}$ **C** WA^{-1} **D** $(\Omega W)^{\frac{1}{2}}$

1114. 9702_w19_qp_12 Q: 32

A fixed resistor of resistance 12 Ω is connected to a battery. There is a current of 0.20 A in the resistor. The current is now doubled.

What is the new power dissipated in the resistor?

A 0.48 W **B** 0.96 W **C** 1.9 W **D** 4.8 W

1115. 9702_w19_qp_12 Q: 33

There is a current in a resistor for an unknown time.

Which two quantities can be used to calculate the energy dissipated by the resistor?

A the current in the resistor and the potential difference across the resistor

B the resistance of the resistor and the current in the resistor

C the total charge passing through the resistor and the potential difference across the resistor

D the total charge passing through the resistor and the resistance of the resistor

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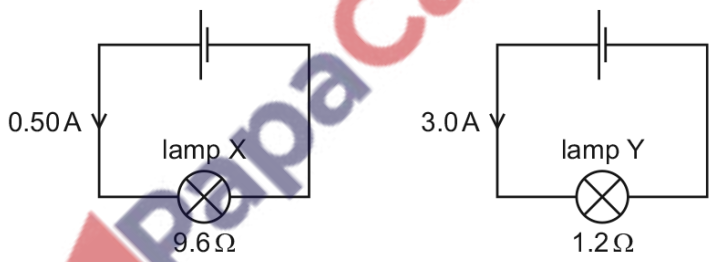
1116. 9702_s18_qp_11 Q: 31

The circuit diagrams show two lamps X and Y each connected to a cell. The current in lamp X is 0.50 A and its resistance is 9.6 Ω. The current in lamp Y is 3.0 A and its resistance is 1.2 Ω.



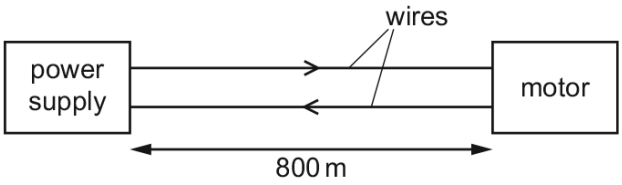
What is the ratio $\frac{\text{power in lamp X}}{\text{power in lamp Y}}$?

A 0.22 **B** 0.75 **C** 1.3 **D** 4.5

1117. 9702_s18_qp_11 Q: 37

A motor is required to operate at a distance of 800 m from its power supply. The motor requires a potential difference (p.d.) of 16.0 V and a current of 0.60 A to operate.

Two wires are used to supply power to the motor as shown.



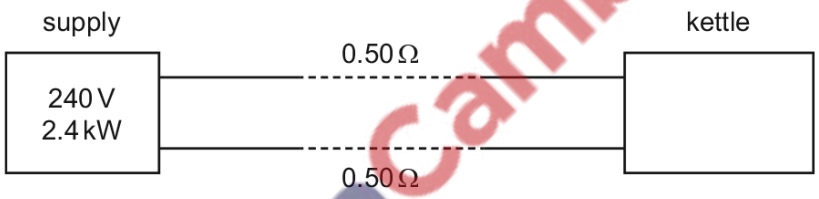
The resistance of each of these wires is 0.0050 Ω per metre.

What is the minimum output p.d. of the power supply?

A 11.2 V **B** 16.0 V **C** 18.4 V **D** 20.8 V

1118. 9702_s18_qp_12 Q: 32

The power output of an electrical supply is 2.4 kW at a potential difference (p.d.) of 240 V. The two wires between the supply and a kettle each have a resistance of 0.50 Ω, as shown.



What is the power supplied to the kettle and what is the p.d. across the kettle?

	power / kW	p.d. / V
A	2.3	230
B	2.3	235
C	2.4	230
D	2.4	235

1119. 9702_w18_qp_11 Q: 34

What is equivalent to one volt?

A one coulomb per second

B one joule per coulomb

C one joule per second

D one joule second per coulomb squared

1120. 9702_m17_qp_12 Q: 33

The potential difference across a resistor is 12 V. The current in the resistor is 2.0 A.

A charge of 4.0 C passes through the resistor.

What is the energy transferred in the resistor and the time taken for the charge to pass through the resistor?

	energy / J	time / s
A	3.0	2.0
B	3.0	8.0
C	48	2.0
D	48	8.0

1121. 9702_s17_qp_11 Q: 33

Which values of current and resistance will produce a rate of energy transfer of 16 J s^{-1}?

	current / A	resistance / Ω
A	1	4
B	2	8
C	4	1
D	16	1

1122. 9702_s17_qp_12 Q: 33

The filament of a 240 V, 100 W electric lamp heats up from room temperature to its operating temperature. As it heats up, its resistance increases by a factor of 16.

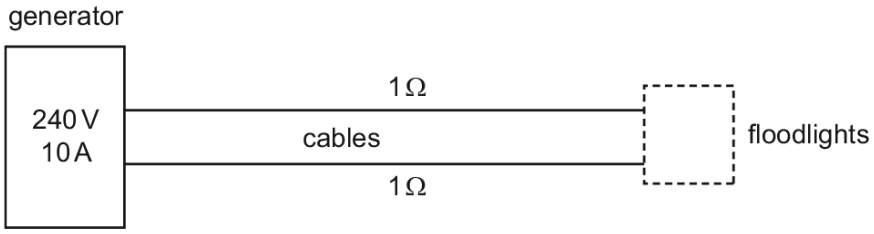
What is the resistance of the filament at room temperature?

A 36 Ω **B** 580 Ω **C** 1.5 kΩ **D** 9.2 kΩ

1123. 9702_s17_qp_13 Q: 32

The diagram shows a portable generator connected by cables to floodlights. The generator produces a current of 10 A at a constant potential difference (p.d.) of 240 V.

The total resistance of the cables is 2 Ω.



What is the p.d. V across, and the power P delivered to, the floodlights?

	V/V	P/W
A	220	2000
B	220	2200
C	230	2000
D	230	2300

1124. 9702_w17_qp_11 Q: 34

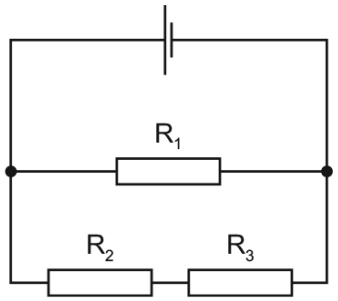
A filament lamp has a resistance of 180 Ω when the current in it is 500 mA.

What is the power dissipated in the lamp?

A 45 W **B** 90 W **C** 290 W **D** 360 W

1125. 9702_w17_qp_12 Q: 34

A cell of negligible internal resistance is connected to resistors R_1, R_2 and R_3, as shown. The cell provides power to the circuit and power is dissipated in the resistors.



Which word equation **must** be correct?

A power loss in R_1 = power loss in R_2 + power loss in R_3

B power loss in R_2 = power loss in R_3

C power output of cell = power loss in R_1 + power loss in R_2 + power loss in R_3

D power output of cell = power loss in R_1

1126. 9702_m16_qp_12 Q: 31

A fixed resistor of resistance 12 Ω is connected to a battery. There is a current of 0.20 A in the resistor. The current is now doubled.

What is the new power dissipated in the resistor?

A 0.48 W **B** 0.96 W **C** 1.92 W **D** 4.8 W

1127. 9702_m16_qp_12 Q: 33

A 12 V battery is charged for 20 minutes by connecting it to a source of electromotive force (e.m.f.). The battery is supplied with 7.2×10^4 J of energy in this time.

How much charge flows through the battery?

A 5.0 C **B** 60 C **C** 100 C **D** 6000 C

1128. 9702_s16_qp_11 Q: 30

There is a current in a resistor for an unknown time.

Which two quantities can be used to calculate the energy dissipated by the resistor?

A the current in the resistor and the potential difference across the resistor

B the resistance of the resistor and the current in the resistor

C the total charge passing through the resistor and the potential difference across the resistor

D the total charge passing through the resistor and the resistance of the resistor

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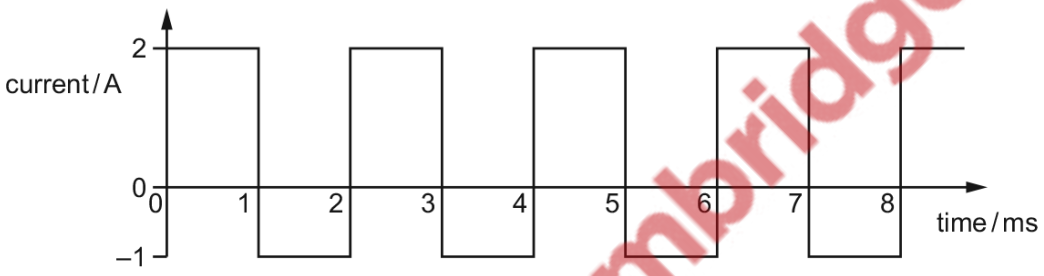
1129. 9702_s16_qp_11 Q: 32

A 100 Ω resistor conducts a current with changing direction and magnitude, as shown.



What is the mean power dissipated in the resistor?

A 100 W **B** 150 W **C** 250 W **D** 400 W

1130. 9702_s16_qp_12 Q: 33

Two lamps are connected in series to a 250 V power supply. One lamp is rated 240 V, 60 W and the other is rated 10 V, 2.5 W.

Which statement most accurately describes what happens?

A Both lamps light at less than their normal brightness.

B Both lamps light at their normal brightness.

C Only the 240 V lamp lights.

D The 10 V lamp blows.

1131. 9702_s16_qp_13 Q: 33

What describes the electric potential difference between two points in a wire that carries a current?

A the force required to move a unit positive charge between the points

B the ratio of the energy dissipated between the points to the current

C the ratio of the power dissipated between the points to the current

D the ratio of the power dissipated between the points to the charge moved

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1132. 9702_w16_qp_11 Q: 33

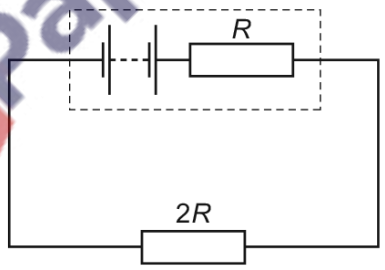
An electric kettle is marked 3.10 kW. It is used with an electrical supply of 240 V.

What is the electric current in the kettle and what is the kettle's electrical resistance when working?

	current / A	resistance / Ω
A	0.0129	18 600
B	0.0770	3100
C	12.9	18.6
D	12.9	3100

1133. 9702_w16_qp_12 Q: 34

The diagram shows an electric circuit in which the resistance of the external resistor is $2R$ and the internal resistance of the source is R.



What is the ratio $\frac{\text{power in internal resistance}}{\text{power in external resistor}}$?

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

1134. 9702_w16_qp_13 Q: 33

An electric kettle is marked 3.10 kW. It is used with an electrical supply of 240 V.

What is the electric current in the kettle and what is the kettle's electrical resistance when working?

	current / A	resistance / Ω
A	0.0129	18 600
B	0.0770	3100
C	12.9	18.6
D	12.9	3100

1135. 9702_s15_qp_11 Q: 35

The charge that an electric battery can deliver is specified in ampere-hours.

For example, a battery of capacity 40 ampere-hours could supply, when fully charged, 0.2 A for 200 hours.

What is the maximum energy that a fully charged 12 V, 40 ampere-hour battery could supply?

A 1.7 kJ **B** 29 kJ **C** 1.7 MJ **D** 29 MJ

1136. 9702_s15_qp_12 Q: 31

Which unit is **not** used in either the definition of the coulomb or the definition of the volt?

A ampere

B joule

C ohm

D second

1137. 9702_s15_qp_13 Q: 32

A pedal bicycle is fitted with an electric motor. The rider switches on the motor for a time of 3.0 minutes. A constant current of 3.5 A in the electric motor is provided from a battery with a terminal voltage of 24 V.

What is the energy supplied by the battery?

A 84 J **B** 250 J **C** 630 J **D** 15 000 J

11.3 Resistance and resistivity

1138. 9702_m20_qp_12 Q: 34

A manufacturer recommends that the longer the extension cord you use with an electric drill, the bigger the cross-sectional area of the cord should be.

What is a reason for this recommendation?

A Resistance is inversely proportional to both the length and the cross-sectional area.

B Resistance is inversely proportional to the length and directly proportional to the cross-sectional area.

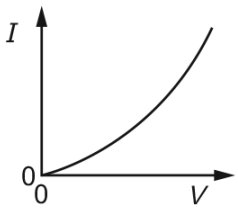
C Resistance is proportional to both the length and the cross-sectional area.

D Resistance is proportional to the length and inversely proportional to the cross-sectional area.

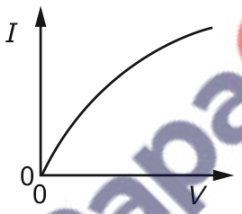
1139. 9702_s20_qp_11 Q: 34

Which graph best represents the way the current I through a filament lamp varies with the potential difference V across it?

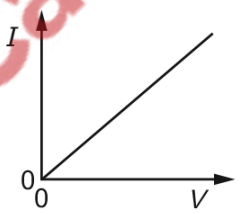
A



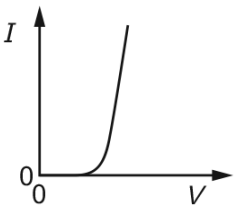
B



C



D



1140. 9702_s20_qp_11 Q: 35

A cylindrical metal wire X has resistance R. The same volume of the same metal is made into a cylindrical wire Y of double the length.

What is the resistance of wire Y?

A R **B** $2R$ **C** $4R$ **D** $8R$

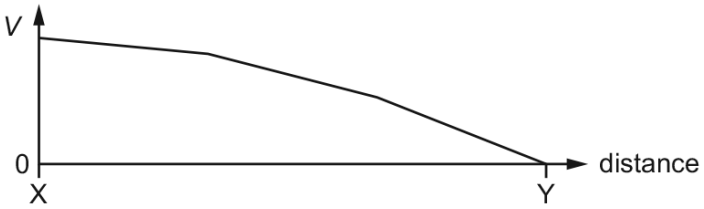
1141. 9702_s20_qp_12 Q: 35

A conductor consists of three wires connected in series. The wires are all made of the same metal but have different cross-sectional areas. There is a current I in the conductor.

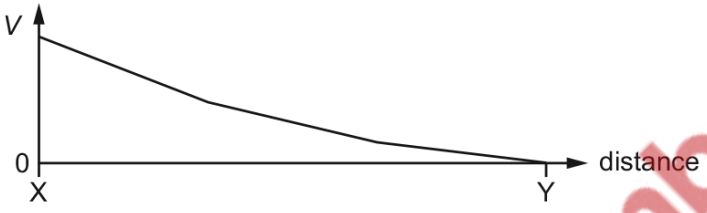
Point Y on the conductor is at zero potential.

Which graph best shows the variation of potential V with distance along the conductor?

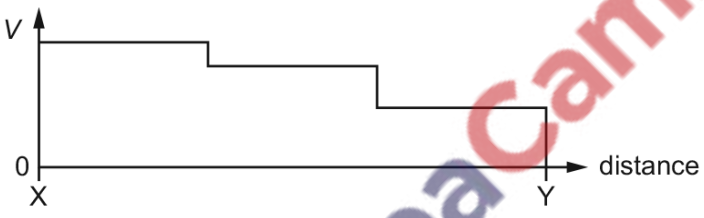
A



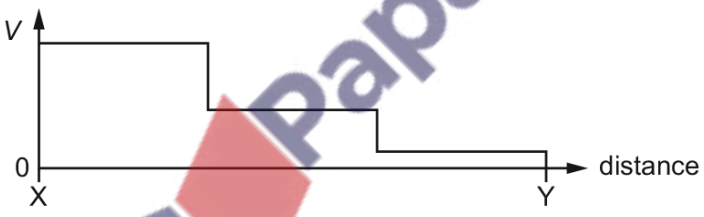
B



C



D



1142. 9702_s20_qp_13 Q: 36

The wire of a heating element has resistance R. The wire breaks and is replaced by a different wire.

Data for the original wire and for the replacement wire are shown in the table.

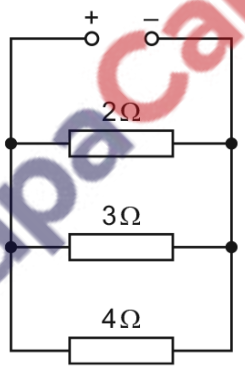
	length	diameter	resistivity of metal
original wire	l	d	ρ
replacement wire	l	$2d$	2ρ

What is the resistance of the replacement wire?

A $\frac{R}{4}$ **B** $\frac{R}{2}$ **C** R **D** $2R$

1143. 9702_m19_qp_12 Q: 33

Three resistors are connected in parallel across a power supply, as shown.



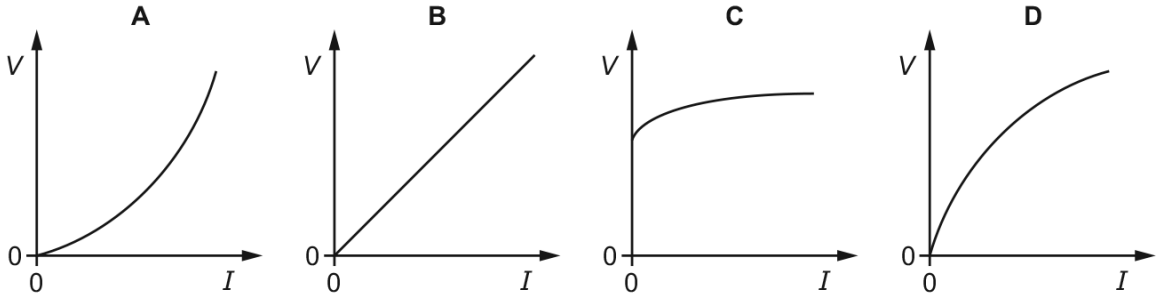
The power dissipated in each of the resistors of resistance 2Ω, 3Ω and 4Ω is P_2, P_3 and P_4 respectively.

What is the ratio $P_2 : P_3 : P_4$?

A 2:3:4 **B** 4:3:2 **C** 6:4:3 **D** 36:16:9

1144. 9702_m19_qp_12 Q: 34

Which graph shows the variation with current I of the potential difference V of a filament lamp?



1145. 9702_m19_qp_12 Q: 35

A wire of cross-sectional area $5.0 \times 10^{-6}\,m^2$ is made of a metal of resistivity $50 \times 10^{-8}\,\Omega m$.

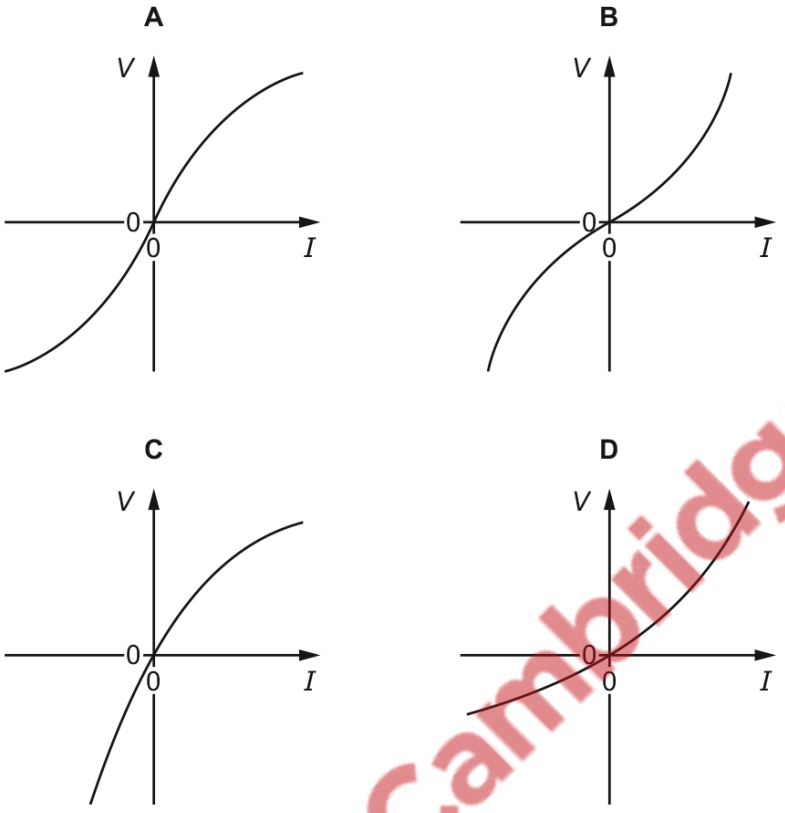
The potential difference across the wire is 6.0 V and the current is 3.0 A.

What is the length of the wire?

A 0.050 m **B** 0.20 m **C** 5.0 m **D** 20 m

1146. 9702_s19_qp_11 Q: 34

Which graph best represents the variation with current I of potential difference V for a filament lamp?



1147. 9702_s19_qp_12 Q: 34

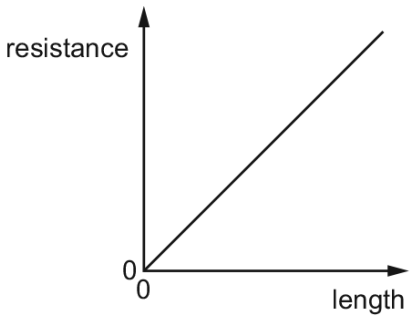
Four wires are made of the same metal. The cross-sectional areas, lengths and thermodynamic temperatures of the wires are shown.

Which wire has the largest resistance?

	cross-sectional area	length	temperature
A	A	$2L$	$2T$
B	A	L	T
C	$2A$	$2L$	$2T$
D	$2A$	L	T

1148. 9702_s19_qp_13 Q: 33

The graph shows the variation with length of the resistance of a uniform metal wire.



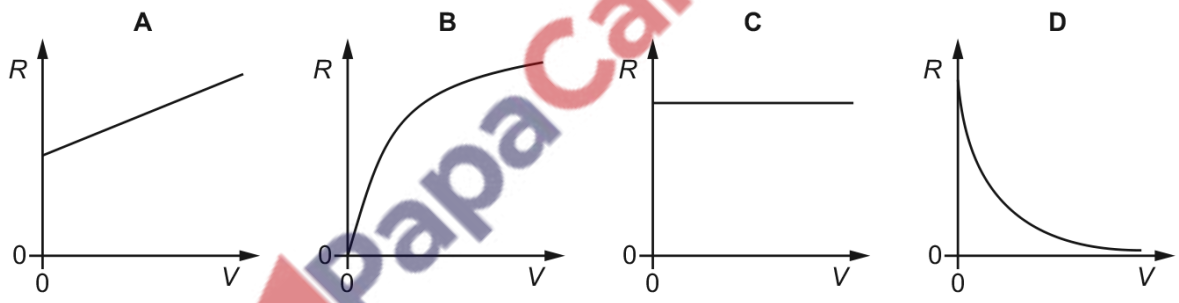
The gradient of the graph is G.
The wire has cross-sectional area A.

Which expression could be used to calculate the resistivity of the metal of the wire?

A $G \times A$ **B** $\frac{G}{A}$ **C** $\frac{A}{G}$ **D** $G \times A^2$

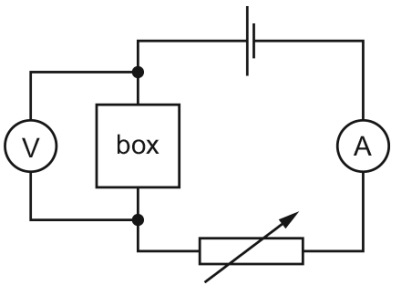
1149. 9702_w19_qp_11 Q: 33

Which graph could show how the resistance R of a filament lamp varies with the applied potential difference (p.d.) V, as V is increased to the normal operating p.d.?

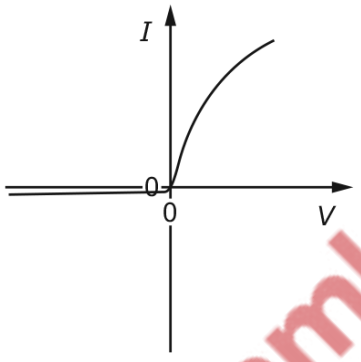


1150. 9702_w19_qp_13 Q: 35

A box containing two electrical components is connected into a circuit.



The variable resistor is adjusted and measurements are taken to determine the I–V characteristic for the box, as shown.



Which arrangement of two electrical components in the box would create the best fit to the measured I–V characteristic?

A a filament lamp and a fixed resistor in parallel

B a filament lamp and a fixed resistor in series

C a semiconductor diode and a filament lamp in parallel

D a semiconductor diode and a filament lamp in series

1151. 9702_m18_qp_12 Q: 33

A resistor has resistance R. When the potential difference across the resistor is V, the current in the resistor is I. The power dissipated in the resistor is P. Work W is done when charge Q flows through the resistor.

What is **not** a valid relationship between these variables?

A $I = \frac{P}{V}$ **B** $Q = \frac{W}{V}$ **C** $R = \frac{P}{I^2}$ **D** $R = \frac{V}{P}$

1152. 9702_m18_qp_12 Q: 34

A wire of resistance 9.55 Ω has a diameter of 0.280 mm.

It is made of metal of resistivity $4.90 \times 10^{-7}\,\Omega\,\text{m}$.

What is the length of the wire?

A 1.20 m **B** 4.80 m **C** 19.0 m **D** 76.8 m

1153. 9702_s18_qp_11 Q: 32

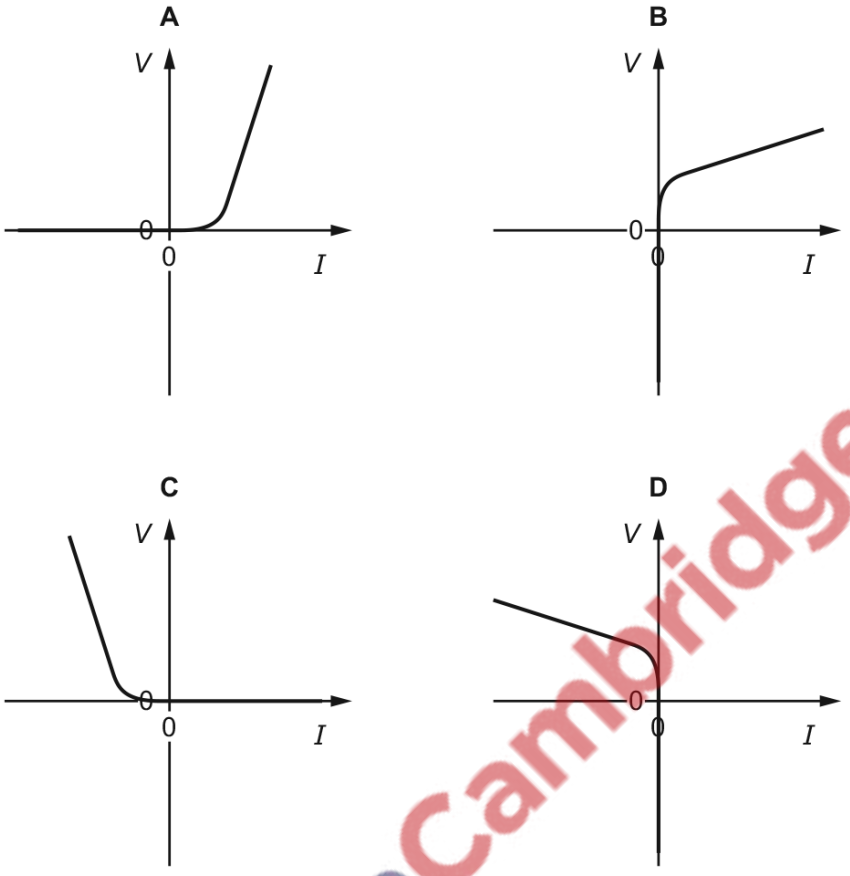
A cylindrical piece of a soft, electrically-conducting material has resistance R. It is rolled out so that its length is doubled but its volume stays constant.

What is its new resistance?

A $\frac{R}{2}$ **B** R **C** $2R$ **D** $4R$

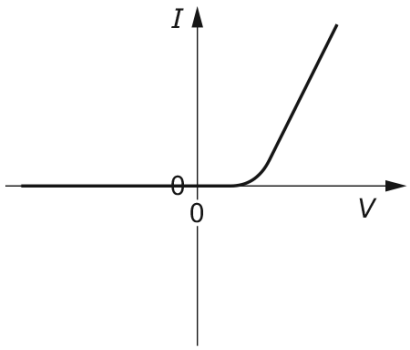
1154. 9702_s18_qp_12 Q: 33

Which graph shows the variation of voltage V with current I for a semiconductor diode?



1155. 9702_s18_qp_13 Q: 32

The graph shows the I-V characteristic of an electrical component.



What is the component?

A a filament lamp

B a metallic conductor at constant temperature

C a resistor

D a semiconductor diode

1156. 9702_s18_qp_13 Q: 33

A metal wire of length 1.4 m has a uniform cross-sectional area of $7.8 \times 10^{-7}\,\text{m}^2$.

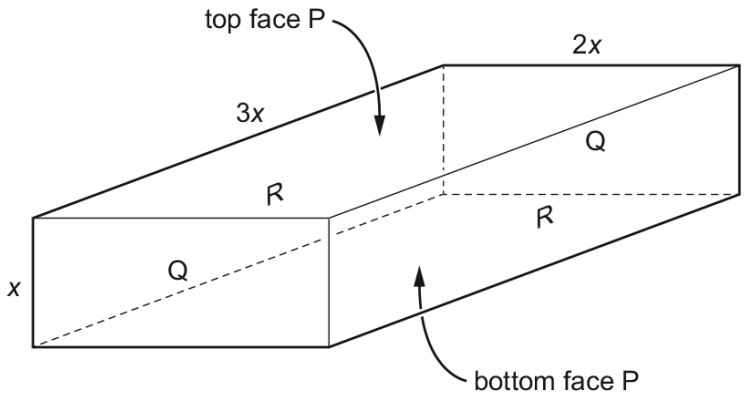
The resistivity of the metal is $1.7 \times 10^{-8}\,\Omega\text{m}$.

What is the resistance of the wire?

A $0.016\,\Omega$ **B** $0.031\,\Omega$ **C** $33\,\Omega$ **D** $64\,\Omega$

1157. 9702_w18_qp_11 Q: 35

The diagram shows a rectangular block with dimensions x, $2x$ and $3x$.



Electrical contact can be made to the block between opposite pairs of faces (for example, between the faces labelled R).

Which statement describing the electrical resistance of the block is correct?

A It is maximum between the faces labelled P.

B It is maximum between the faces labelled Q.

C It is maximum between the faces labelled R.

D It is the same, whichever pair of faces is used.

1158. 9702_w18_qp_12 Q: 35

A wire of length L has resistance R. The cross-section of the wire is circular with radius r.

A second wire, also of circular cross-section, and of the same material, has resistance $\frac{1}{2}R$.

What could be the radius and the length of the second wire?

	radius	length
A	$\frac{r}{2}$	$\frac{L}{2}$
B	$\frac{r}{\sqrt{2}}$	$\frac{L}{2}$
C	$r\sqrt{2}$	$2L$
D	$2r$	$2L$

1159. 9702_w18_qp_13 Q: 34

Gold is sometimes used to make very small connecting wires in electronic circuits.

A particular gold wire has length 2.50×10^{-3} m and cross-sectional area 6.25×10^{-8} m^2. Gold has resistivity $2.30 \times 10^{-8}\,\Omega$m.

What is the resistance of the wire?

A $3.6 \times 10^{-18}\,\Omega$

B $5.8 \times 10^{-13}\,\Omega$

C $9.2 \times 10^{-4}\,\Omega$

D $6.8 \times 10^{-3}\,\Omega$

1160. 9702_m17_qp_12 Q: 34

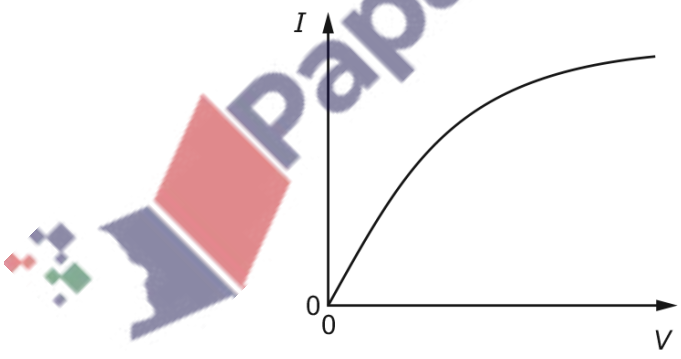
A coil contains N turns of insulated copper wire wound on to a cylindrical iron core of diameter D. The copper wire has a diameter d. The resistivity of copper is ρ. Diameter D is much greater than diameter d.

What is the total resistance between the two ends of the coil?

A $\frac{4N\rho D}{d^2}$ **B** $\frac{4N\rho d}{D^2}$ **C** $\frac{8N\rho D}{d^2}$ **D** $\frac{8N\rho d}{D^2}$

1161. 9702_s17_qp_11 Q: 34

Which component has the I-V graph shown?



A filament lamp

B metallic conductor at constant temperature

C resistor of fixed resistance

D semiconductor diode

1162. 9702_s17_qp_12 Q: 34

Two wires have the same length and the same resistance. Wire X is made of a metal of resistivity $1.7 \times 10^{-8}\,\Omega\,\text{m}$ and wire Y is made of a metal of resistivity $5.6 \times 10^{-8}\,\Omega\,\text{m}$.

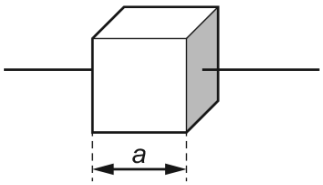
The diameter of wire X is 0.315 mm.

What is the diameter of wire Y?

A 0.17 mm **B** 0.33 mm **C** 0.57 mm **D** 1.0 mm

1163. 9702_s17_qp_13 Q: 33

A metal cube with sides of length a has electrical resistance R between opposite faces.

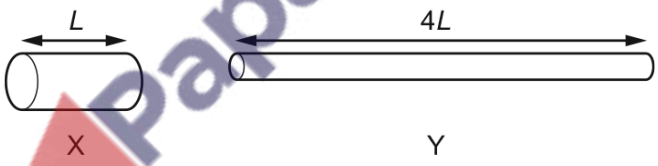


What is the resistance between the opposite faces of a cube of the same metal with sides of length $3a$?

A $9R$ **B** $3R$ **C** $\frac{R}{3}$ **D** $\frac{R}{9}$

1164. 9702_w17_qp_11 Q: 35

Two copper wires X and Y have the same volume. Wire Y is four times as long as wire X.

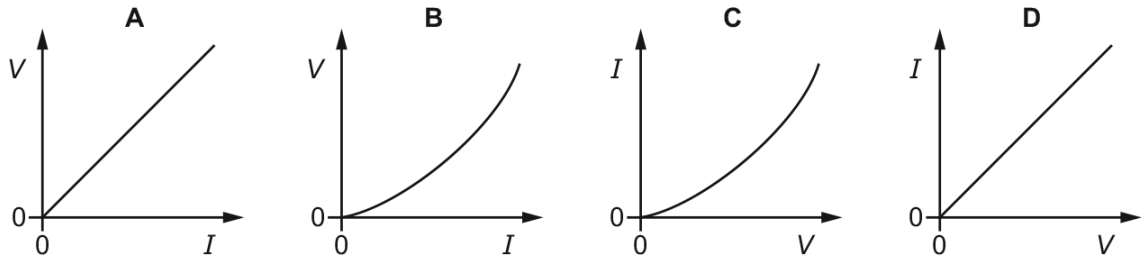


What is the ratio $\frac{\text{resistance of wire Y}}{\text{resistance of wire X}}$?

A 1 **B** 4 **C** 8 **D** 16

1165. 9702_w17_qp_12 Q: 35

Which graph represents a metallic conductor, where the resistance of the conductor is given by the gradient of the graph?



1166. 9702_m16_qp_12 Q: 32

Which **measurements** are taken in order to calculate the resistivity of the metal of a piece of wire?

A p.d., current, area, length

B p.d., current, diameter, length

C resistance, area, length

D resistance, length, radius

1167. 9702_s16_qp_11 Q: 31

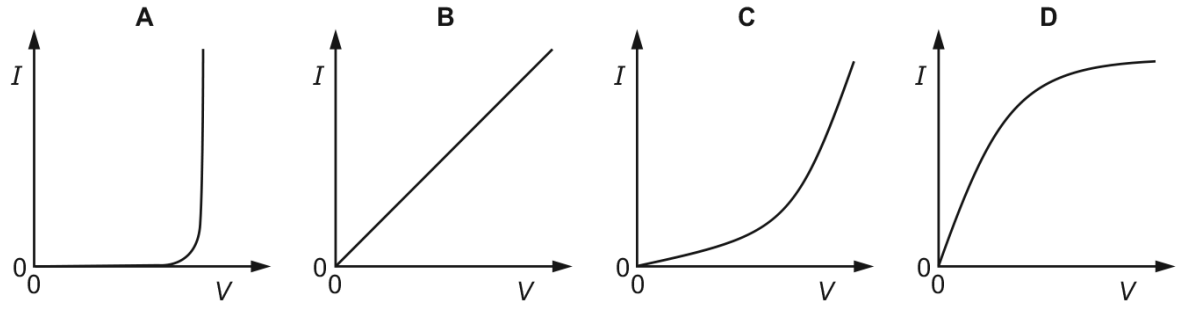
Two copper wires of equal length are connected in parallel. A potential difference is applied across the ends of this parallel arrangement. Wire S has a diameter of 3.0 mm. Wire T has a diameter of 1.5 mm.

What is the value of the ratio $\frac{\text{current in S}}{\text{current in T}}$?

A $\frac{1}{4}$ **B** $\frac{1}{2}$ **C** 2 **D** 4

1168. 9702_s16_qp_11 Q: 33

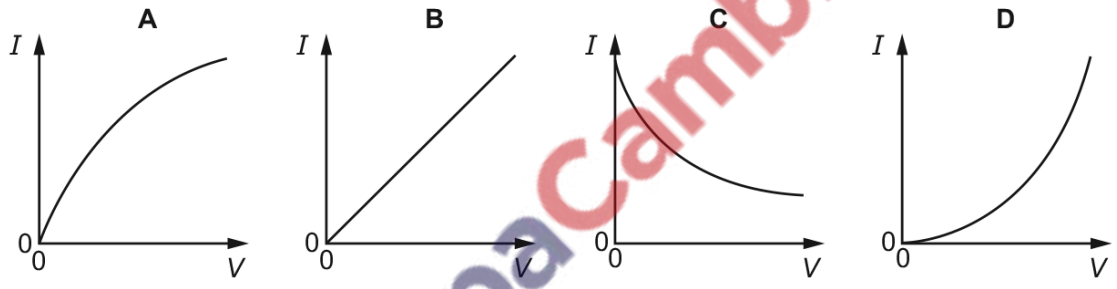
Which graph shows the I–V characteristic of a filament lamp?



1169. 9702_s16_qp_12 Q: 32

The potential difference V across a filament lamp is slowly raised from zero to its normal operating value.

Which graph represents the variation with V of the current I in the lamp?



1170. 9702_s16_qp_12 Q: 34

Which equation is used to define resistance?

A energy = (current)^2 × resistance × time

B potential difference = current × resistance

C power = (current)^2 × resistance

D resistivity = resistance × area ÷ length

1171. 9702_s16_qp_12 Q: 35

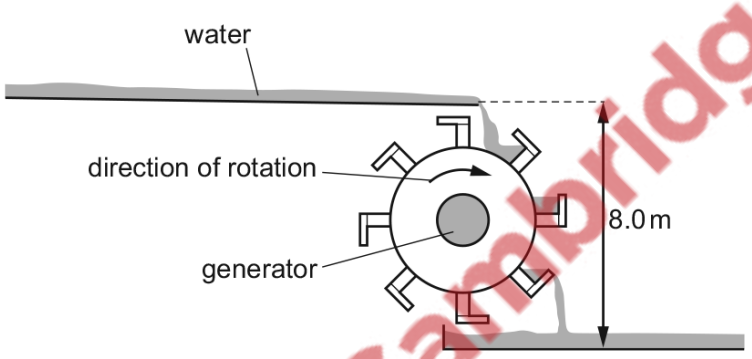
The charge that a fully charged 12 V car battery can supply is 100 kC. The starter motor of the car requires a current of 200 A for an average period of 2.0 s. The battery does not recharge because of a fault.

What is the maximum number of times the starter motor of the car can be used?

A 21 **B** 25 **C** 42 **D** 250

1172. 9702_s16_qp_13 Q: 19

The diagram shows the design of a water wheel which drives a generator to produce electrical power. The flow rate of the water is 200 kg s^{-1}. The generator supplies a current of 32 A at a voltage of 230 V.

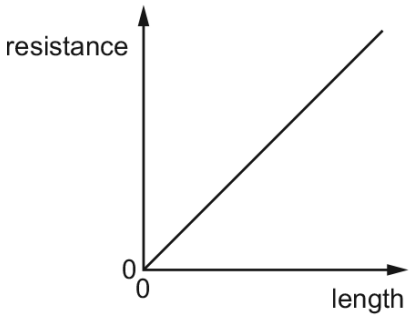


Ignoring any changes in kinetic energy of the water, what is the efficiency of the system?

A 14% **B** 16% **C** 22% **D** 47%

1173. 9702_s16_qp_13 Q: 32

The graph shows the variation with length of the resistance of a uniform metal wire.



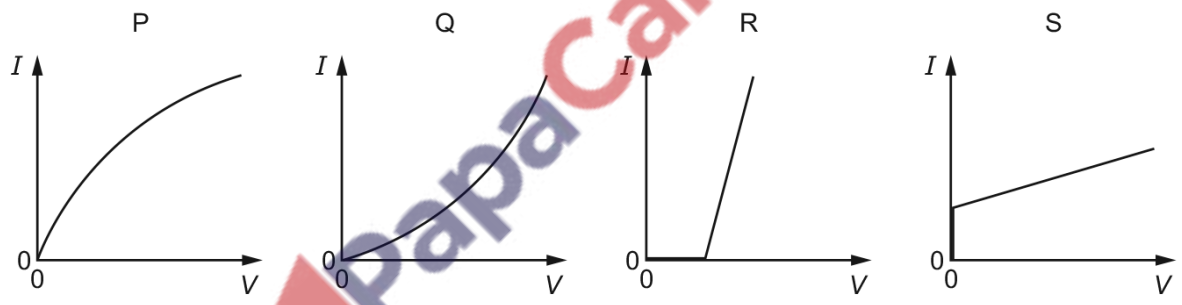
The gradient of the graph is G.
The wire has cross-sectional area A.

Which expression could be used to calculate the resistivity of the metal of the wire?

A $G \times A$ **B** $\frac{G}{A}$ **C** $\frac{A}{G}$ **D** $G \times A^2$

1174. 9702_s16_qp_13 Q: 34

The graphs show possible current-voltage (I-V) characteristics for a filament lamp and for a semiconductor diode.

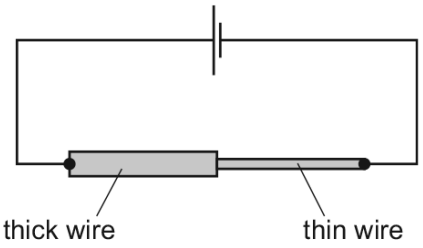


Which row in the table best specifies the correct I-V graphs for the lamp and for the diode?

	filament lamp	semiconductor diode
A	P	R
B	P	S
C	Q	R
D	Q	S

1175. 9702_w16_qp_11 Q: 34

A thick copper wire is connected to a thin copper wire in series with a cell, as shown.



What is significantly **less** in the thick wire than in the thin wire?

A the charge passing a point per unit time

B the drift speed of the electrons

C the number density of the free electrons

D the number of free electrons passing a point per unit time

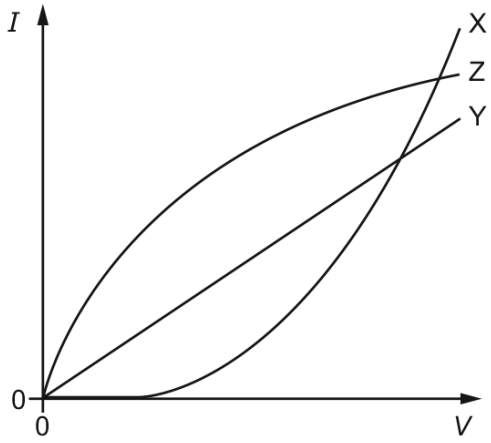
1176. 9702_w16_qp_11 Q: 35

What is a typical value for the order of magnitude of the resistivity of copper?

A $10^{-13}\,\Omega\text{m}$ **B** $10^{-8}\,\Omega\text{m}$ **C** $10^{-3}\,\Omega\text{m}$ **D** $10^{2}\,\Omega\text{m}$

1177. 9702_w16_qp_12 Q: 35

The graph shows the variation with potential difference V of the current I in components X, Y and Z.

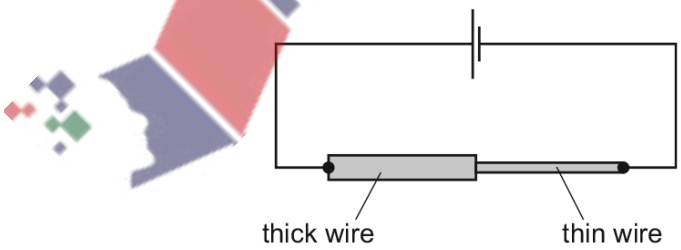


Which row correctly identifies the components?

	metallic conductor at constant temperature	semiconductor diode	filament lamp
A	X	Z	Y
B	Y	X	Z
C	Y	Z	X
D	Z	Y	X

1178. 9702_w16_qp_13 Q: 34

A thick copper wire is connected to a thin copper wire in series with a cell, as shown.



What is significantly **less** in the thick wire than in the thin wire?

A the charge passing a point per unit time

B the drift speed of the electrons

C the number density of the free electrons

D the number of free electrons passing a point per unit time

1179. 9702_w16_qp_13 Q: 35

What is a typical value for the order of magnitude of the resistivity of copper?

A $10^{-13}\,\Omega\text{m}$ **B** $10^{-8}\,\Omega\text{m}$ **C** $10^{-3}\,\Omega\text{m}$ **D** $10^{2}\,\Omega\text{m}$

1180. 9702_s15_qp_12 Q: 32

When a thin metal wire is stretched, it becomes longer and thinner. This causes a change in the resistance of the wire. The volume of the wire remains constant.

Which graph could represent the variation with extension x of the resistance R of the wire?