A Level · OCR · Physics

13 mins 13 questions

Multiple Choice Questions

Charge & Current

Electric Current & Charge / Electric Current & Electron Flow / Kirchhoff's First Law / Current in a Current Carrying Conductor / Conductors, Semiconductors & Insulators / Circuit Symbols & Diagrams

Easy (3 questions)	/3
Medium (5 questions)	/5
Hard (5 questions)	/5
Total Marks	**/13**

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Easy Questions

1 Which sequence shows the materials arranged in the order of increasing number density of charge carriers?

increasing number density ⟶

A. conductor, insulator, semiconductor

B. conductor, semiconductor, insulator

C. insulator, semiconductor, conductor

D. semiconductor, insulator, conductor

(1 mark)

2 Which law indicates that charge is conserved?

A. Lenz's law

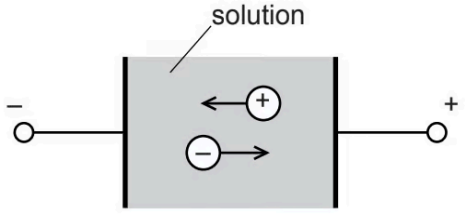
B. Coulomb's law

C. Kirchhoff's first law

D. Faraday's law of electromagnetic induction

(1 mark)

3 The diagram below shows the motion of positive and negative particles in a conducting solution.



Which statement is correct?

A. The current in the solution is zero.

B. The conventional current is to the left.

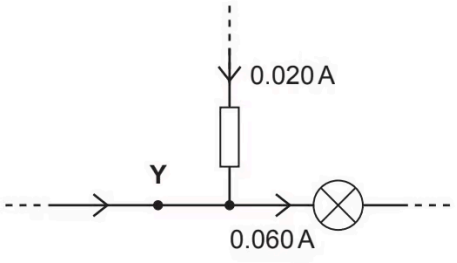
C. The positive particles are always protons.

D. The negative particles are always electrons.

(1 mark)

Medium Questions

1 Part of an electric circuit is shown below.



The direction of all the currents and the magnitude of two currents are shown.

How many electrons pass through the point **Y** in 10 s?

A. 1.25×10^{18}

B. 2.50×10^{18}

C. 3.75×10^{18}

D. 5.00×10^{18}

(1 mark)

2 A battery delivers 1200 C of electric charge to a circuit in 5 minutes. Calculate the average current in the circuit over those 5 minutes.

A. 20 A

B. 240 A

C. 4 A

D. 6000 A

(1 mark)

3 A constant 5 A current source fully charges a metal plate by supplying it with 6.25×10^{20} electrons.

Calculate the time it takes the current source to fully charge the metal plate.

A. 500 s

B. 20 s

C. 150 s

D. 5 s

(1 mark)

4 A circuit consists of a battery attached to a wire with circular cross-section of unknown material placed in series with an ammeter. The results of a previous experiment using the same experimental apparatus indicate that the mean drift velocity of electrons through the wire is $1.04\ \ 10^{-4}$ m s^{-1}. The ammeter measures a reading of 10.0 A and the diameter of the wire is measured to be 3.00 mm.

Which of the materials listed in the table below is the wire likely to be made of?

Material	**Electron number density, n / m^{-3}**
Gold	5.90×10^{28}
Copper	8.51×10^{28}
Iron	1.70×10^{29}
Aluminium	1.81×10^{29}

A. Gold

B. Copper

C. Iron

D. Aluminium

(1 mark)

5 Which of the following statements is/are correct?

1. Conductors have higher electron number densities than semiconductors.
2. Insulators have higher electron number densities than semiconductors.
3. Semiconductors have electron number densities between insulators and conductors.

A. Only 1

B. 1 and 2

C. 1 and 3

D. 1, 2 and 3

(1 mark)

Hard Questions

1 Wires **P** and **Q**, made from the same metal, are connected in **parallel** across a cell of negligible internal resistance.

The table shows some data.

Wire	Length of wire	Diameter of wire	Mean drift velocity of electrons in the wire/mms^{-1}
P	L	d	0.60
Q	$3L$	$2d$	v

What is the mean drift velocity v of the electrons in wire **Q**?

A. 0.15 mm s^{-1}

B. 0.20 mm s^{-1}

C. 0.30 mm s^{-1}

D. 0.60 mm s^{-1}

(1 mark)

2 An aluminium wire of length 1.0 m and uniform cross-section is connected to a power source with an e.m.f of 5.0 V and negligible internal resistance.

The electron number density of aluminium is 1.81×10^{29} m^{-3}

The resistivity of aluminium is 2.63×10^{-8} Ω m

What is the mean drift velocity of electrons through the resistor?

A. 6.6×10^{-3} mm s^{-1}

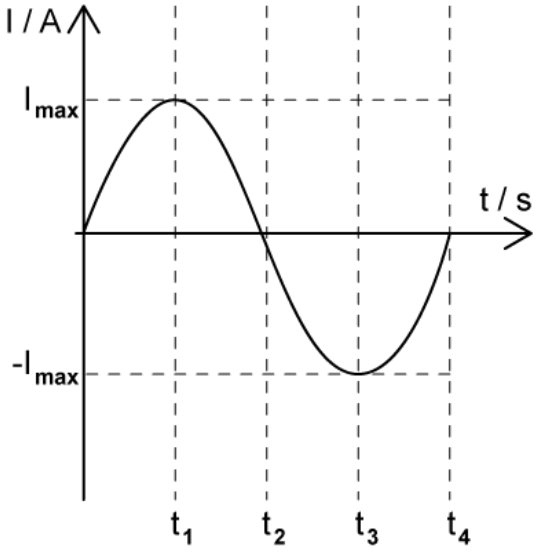
B. 0.6 mm s^{-1}

C. 3.3 mm s^{-1}

D. 6.6 mm s^{-1}

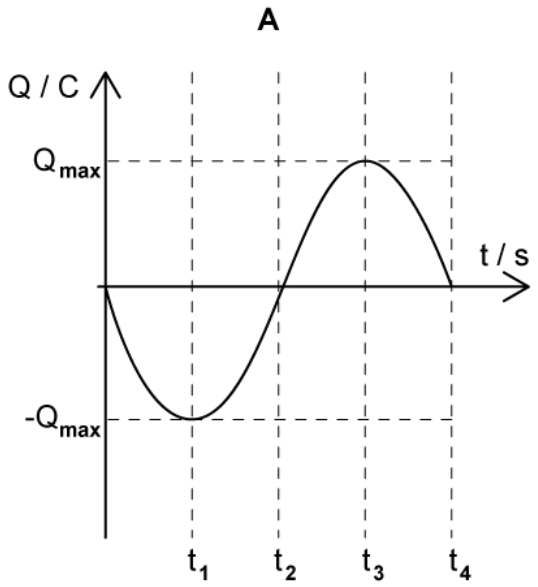
(1 mark)

3 The graph below shows the variation of current *I* against time *t* for a circuit constructed from a variable voltage source in series with a resistor of fixed resistance.

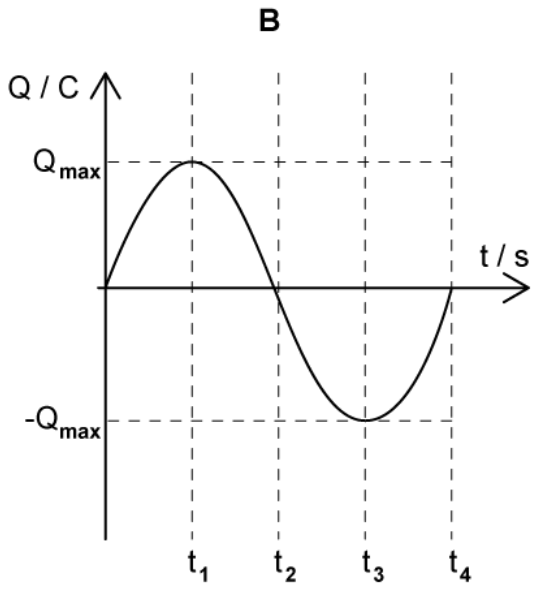


Which of the following graphs represents the variation of charge against time for the circuit?

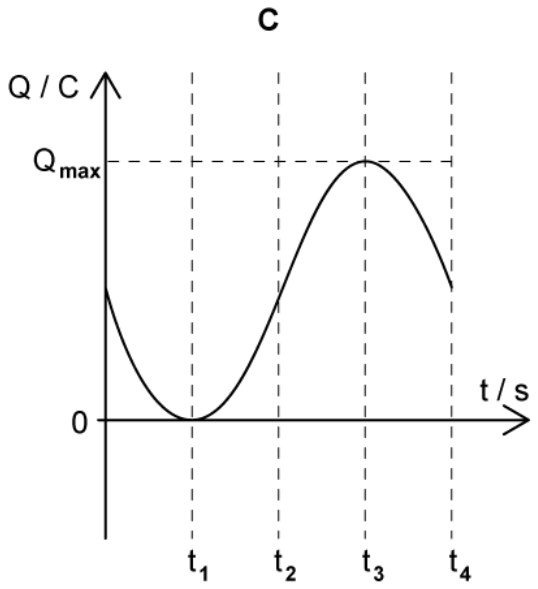
A.



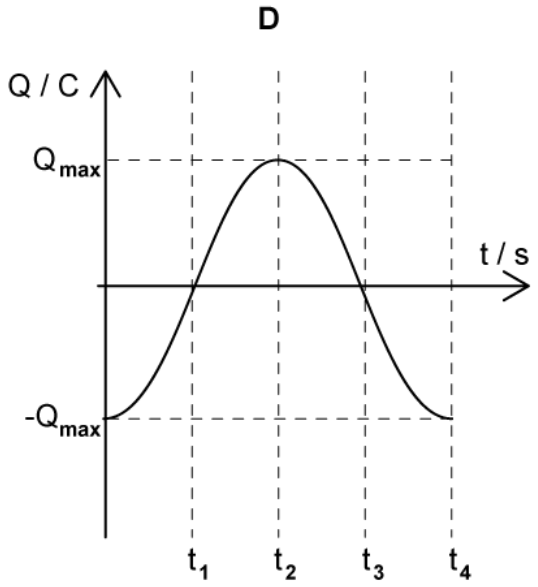
B.



C.



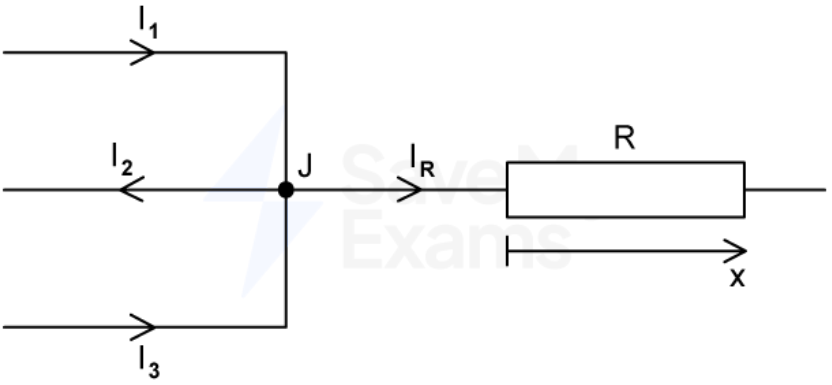
D.



(1 mark)

4 The diagram below shows a section of a circuit in which three wires meet at J with a

fourth wire which is connected to a resistor of resistivity ρ and diameter d labelled R.



What is the correct expression for the power dissipated by the resistor per length x when $I_1 = 2I_2 = 3I_3$?

A. $\frac{I_1^2\rho}{9\pi d^2}$

B. $\frac{25I_1^2\rho}{36\pi d^2}$

C. $\frac{25I_1^2\rho}{9\pi d^2}$

D. $\frac{25I_1^2\rho x}{36\pi d^2}$

(1 mark)

5 An electron is initially at rest before accelerating uniformly from a negatively charged plate to a positively charged plate separated by a distance *d*. The voltage applied across the plates is equal to *V*.

Which statements are correct?

1. The time it takes for an electron to travel a distance *d* depends on the square root of its mass-to-charge ratio

2. Doubling the voltage causes the time it takes for the electron to travel a distance *d* to halve

3. The number of electrons incident on the positively charged plate each second is inversely proportional to the distance *d*

A. 1, 2 and 3

B. Only 1 and 2

C. Only 2 and 3

D. Only 1 and 3

(1 mark)