

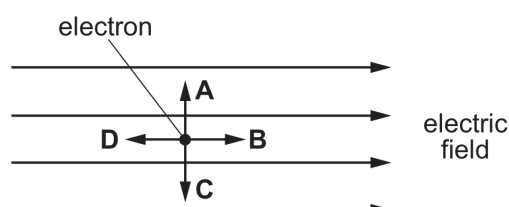
Unit 9: Electricity:

Subunit 9.1: Electric current:

Topical Question No: 1

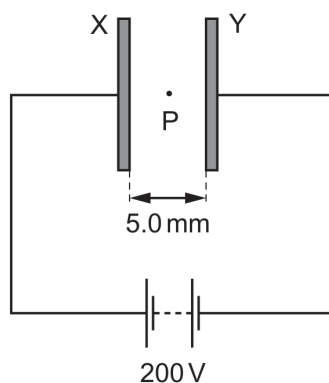
- 27 The diagram shows an electron in a uniform electric field.

In which direction will the field accelerate the electron?



Topical Question No: 2

- 29 Two large parallel plates X and Y are placed a distance of 5.0 mm apart and connected to the terminals of a 200 V d.c. supply, as shown.



A small oil drop at P carries one excess electron.

What is the magnitude of the electrostatic force acting on the oil drop due to the electric field between the plates?

- A $6.4 \times 10^{-15} \text{ N}$
- B $6.4 \times 10^{-18} \text{ N}$
- C $1.6 \times 10^{-19} \text{ N}$
- D $4.0 \times 10^{-24} \text{ N}$

Topical Question No: 3

- 30 An electrical conductor has a resistance of $5.6 \text{ k}\Omega$. 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}

Topical Question No: 4

- 37** The battery of a car has an internal resistance of $0.10\,\Omega$ and an electromotive force of 12 V . When the battery is connected to the starter motor, the potential difference across the battery terminals is 7.0 V .

What is the current supplied to the starter motor?

- A** 50 A **B** 70 A **C** 120 A **D** 190 A

Topical Question No: 5

- 4** A student is investigating an electrical signal using a cathode-ray oscilloscope (c.r.o).

The frequency of the signal is 50 kHz .

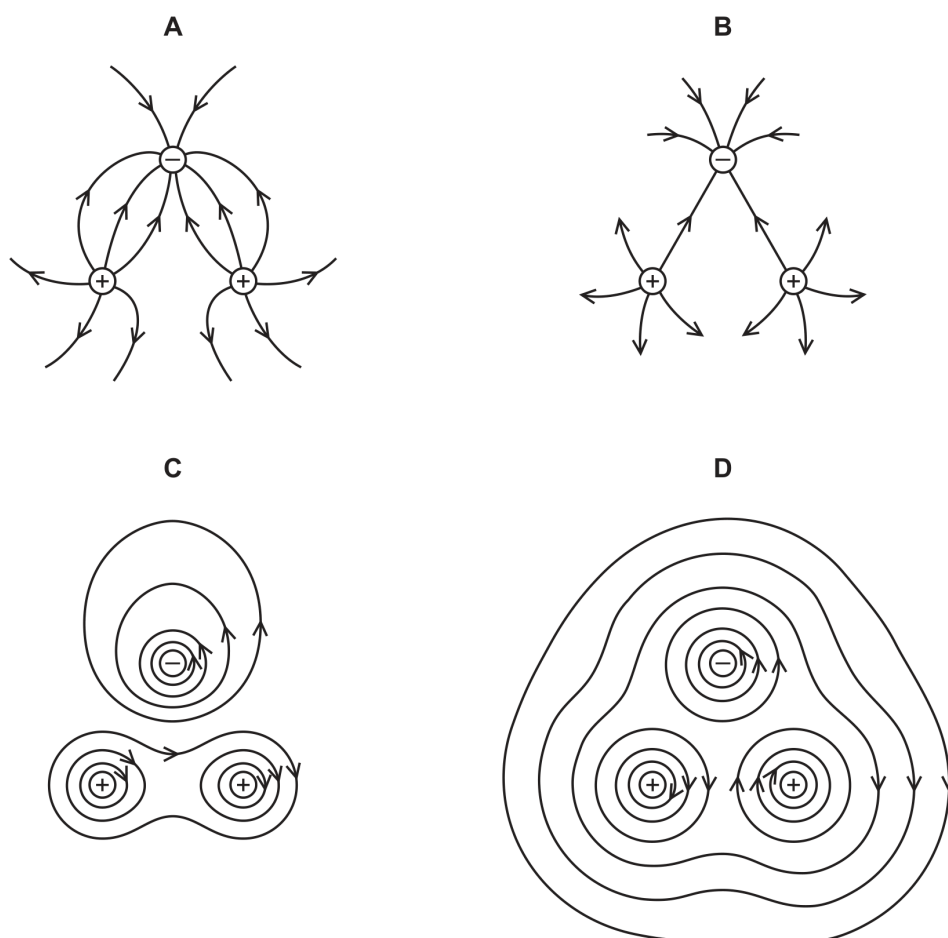
Which time-base setting on the oscilloscope should be used?

- A** 50 ms cm^{-1} **B** 1 ms cm^{-1} **C** $10\,\mu\text{s cm}^{-1}$ **D** $0.5\,\mu\text{s cm}^{-1}$

Topical Question No: 6

- 30** Two positive charges and one negative charge, all of equal magnitude, are set at the corners of an equilateral triangle.

Which diagram best represents the electric field surrounding the charges?



Topical Question No: 7

- 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

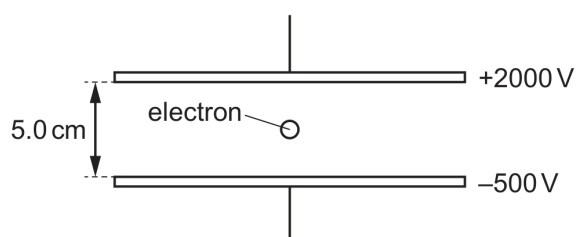
Topical Question No: 8

- 1 Which unit is equivalent to the coulomb?

- A** ampere per second
- B** joule per volt
- C** watt per ampere
- D** watt per volt

Topical Question No: 9

- 30 An electron passes into the space between two parallel plates that are 5.0 cm apart and which are maintained at electric potentials of +2000 V and -500 V, respectively.



What is the electric force on the electron?

- A** $1.6 \times 10^{-15} \text{ N}$
- B** $4.8 \times 10^{-15} \text{ N}$
- C** $6.4 \times 10^{-15} \text{ N}$
- D** $8.0 \times 10^{-15} \text{ N}$

Topical Question No: 10

- 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

Topical Question No: 11

- 30 Two horizontal parallel plate conductors are separated by a distance of 5.0 mm in air. The lower plate is earthed and the potential of the upper plate is +50 V.

What is the electric field strength E at a point midway between the plates?

- A $1.0 \times 10^4 \text{ V m}^{-1}$ downwards
- B $1.0 \times 10^4 \text{ V m}^{-1}$ upwards
- C $2.0 \times 10^4 \text{ V m}^{-1}$ downwards
- D $2.0 \times 10^4 \text{ V m}^{-1}$ upwards

Topical Question No: 12

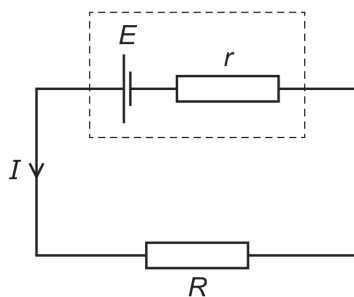
- 32 The electric current in a wire may be calculated using the equation $I = Anvq$.

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.

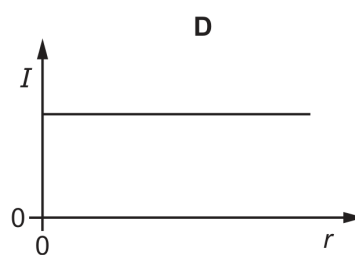
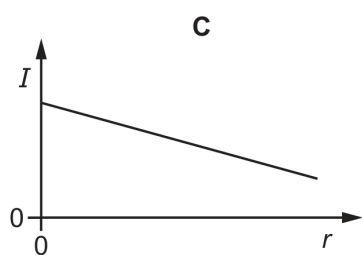
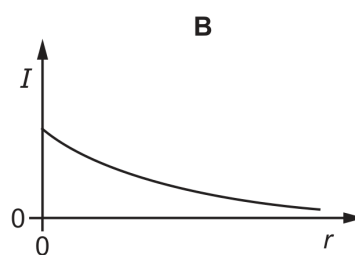
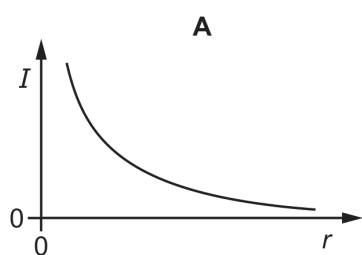
Topical Question No: 13

- 36 A cell of internal resistance r and electromotive force (e.m.f.) E is connected in series with a resistor of resistance R .



The resistance R and the e.m.f. E remain fixed. The internal resistance r of the cell changes over time.

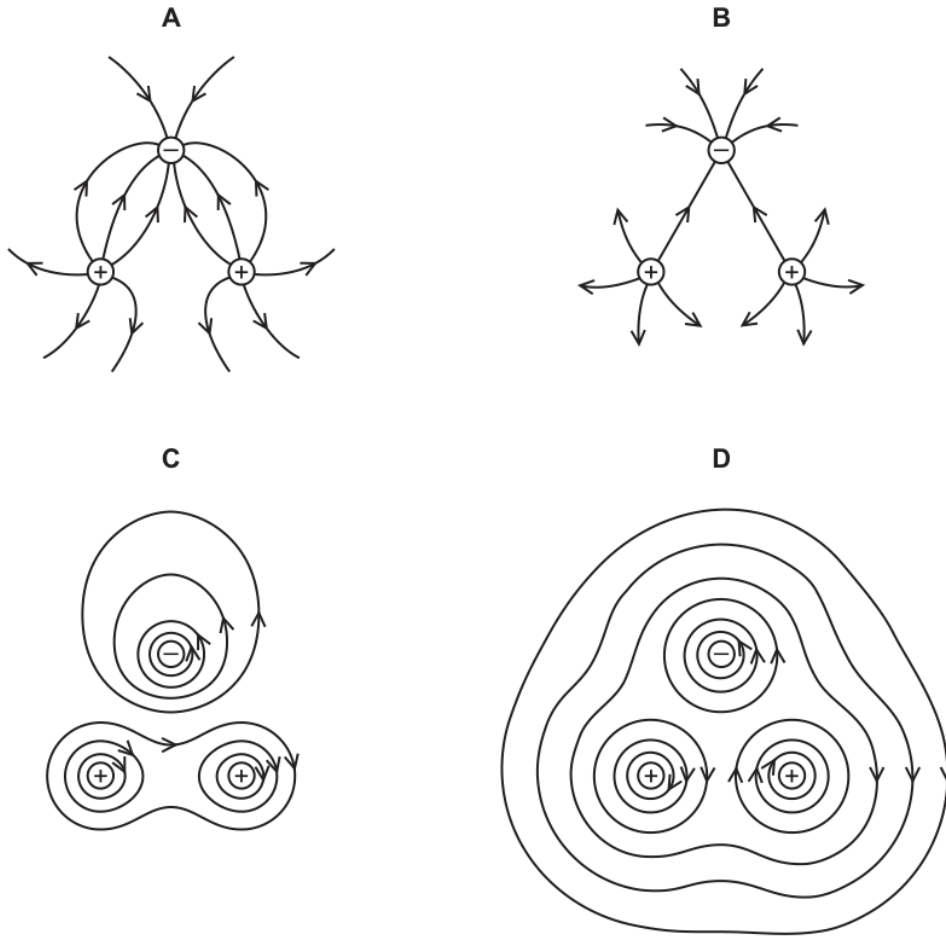
Which graph best shows the variation of the current I in the circuit with the internal resistance r ?



Topical Question No: 14

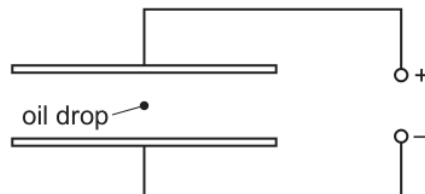
- 30 Two positive charges and one negative charge, all of equal magnitude, are set at the corners of an equilateral triangle.

Which diagram represents the electric field surrounding the charges?



Topical Question No: 15

- 31 A negatively charged oil drop is held stationary, equidistant between two plates connected to a high voltage supply, as shown.



Which change would **not** increase the upward electrical force on the drop?

- A decreasing the distance between the plates whilst keeping the drop equidistant from them
- B increasing the amount of negative charge on the drop
- C increasing the supply voltage
- D moving the drop closer to the positive plate

Topical Question No: 16

- 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 $48\text{ }\mu\text{A}$ between the two plates.

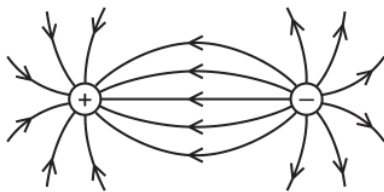
How many electrons are emitted by the first plate in a time of 5.0 minutes?

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

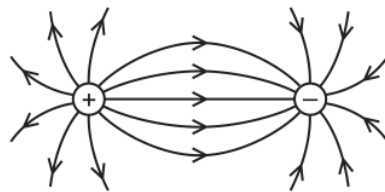
Topical Question No: 17

- 30 Which diagram best represents the field lines in the electric field produced by a combination of one point positive charge and one point negative charge?

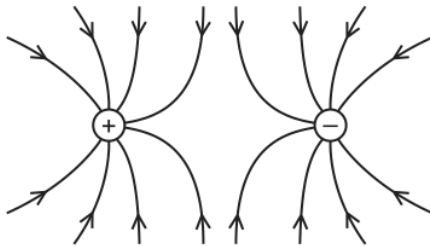
A



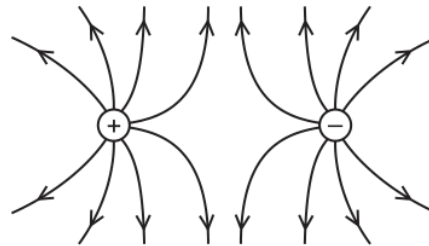
B



C

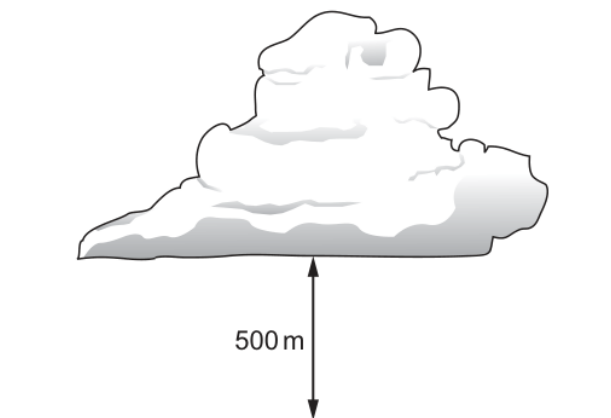


D



Topical Question No: 18

- 31 The diagram shows a thundercloud whose base is 500 m above the ground.



The potential difference between the base of the cloud and the ground is 200 MV. A raindrop with a charge of $4.0 \times 10^{-12} \text{ C}$ is in the region between the cloud and the ground.

What is the electrical force on the raindrop?

- A** $1.6 \times 10^{-6} \text{ N}$ **B** $8.0 \times 10^{-4} \text{ N}$ **C** $1.6 \times 10^{-3} \text{ N}$ **D** 0.40 N

Topical Question No: 19

- 32 The current I in a metal wire is given by the equation

$$I = Anvq.$$

What does the symbol n represent?

- A** the number of charge carriers in the wire
B the number of charge carriers per unit cross-sectional area of the wire
C the number of charge carriers per unit length of the wire
D the number of charge carriers per unit volume of the wire

Topical Question No: 20

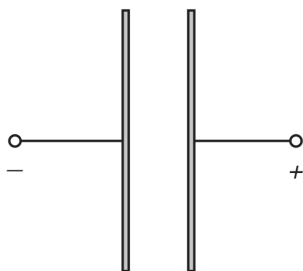
- 37 The charge carriers in a metal wire are free electrons.

Which statement about the charge of each free electron is correct?

- A** The magnitude of the charge increases with the potential difference across the wire.
B The magnitude of the charge is zero unless there is a potential difference across the wire.
C The sign and magnitude of the charge do **not** depend on the potential difference across the wire.
D The sign of the charge depends on the potential difference across the wire.

Topical Question No: 21

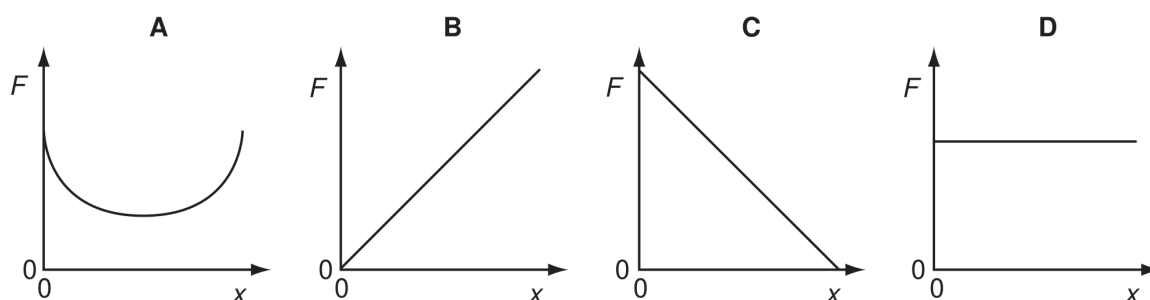
- 26 Two oppositely-charged parallel plates are arranged as shown.



An electron is released from rest from the surface of the negatively-charged plate.

The electron travels from the negatively-charged plate towards the positively-charged plate.

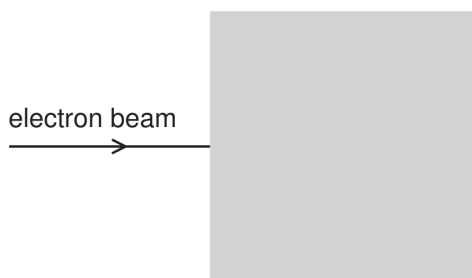
Which graph shows how the force F on the electron varies with its distance x from the negative plate?



Space for working

Topical Question No: 22

- 27 In the diagram, the shaded area represents a uniform electric field directed away from the observer (at right-angles into the plane of the paper).



A horizontal beam of electrons enters the field, travelling from left to right.

In which direction is this beam deflected by the field?

- A upwards (in the plane of the paper)
- B downwards (in the plane of the paper)
- C away from the observer
- D towards the observer

Space for working

Topical Question No: 23

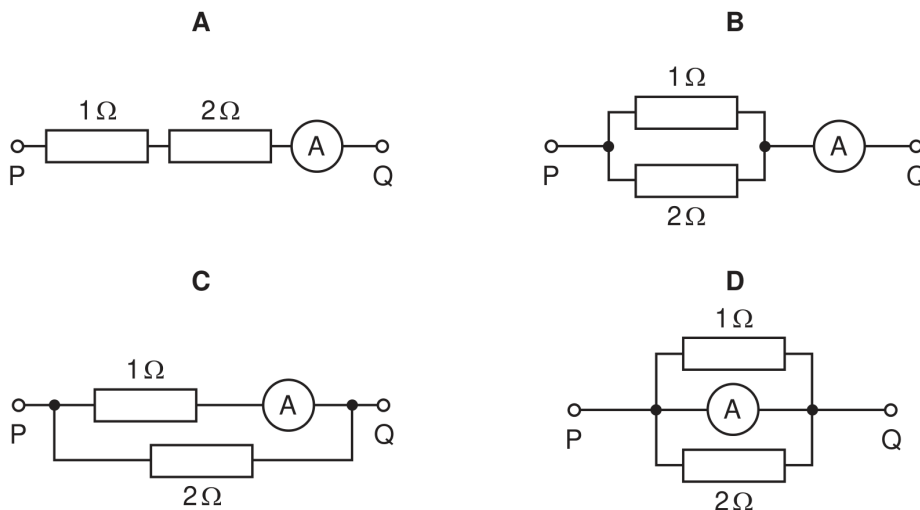
- 29 Which row describes the circumstances under which forces act on a charged particle in a uniform electric field?

	charged particle	direction of force
A	moving charges only	parallel to the field
B	stationary charges only	perpendicular to the field
C	stationary and moving charges	parallel to the field
D	stationary and moving charges	perpendicular to the field

Topical Question No: 24

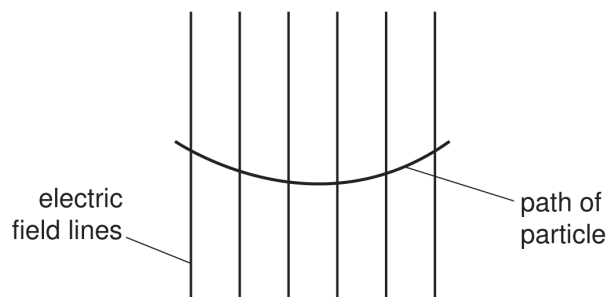
- 32 In each arrangement of resistors, the ammeter has a resistance of 2Ω .

Which arrangement gives the largest reading on the ammeter when the same potential difference is applied between points P and Q?



Topical Question No: 25

- 30 The diagram shows the path of a charged particle through a uniform electric field, having vertical field lines.



What could give a path of this shape?

- A** a positive charge travelling left to right in a field directed downwards
- B** a positive charge travelling right to left in a field directed downwards
- C** a negative charge travelling right to left in a field directed upwards
- D** a negative charge travelling left to right in a field directed downwards

Topical Question No: 26

- 30 Before a thunderstorm, the hairs on your head sometimes stand on end.

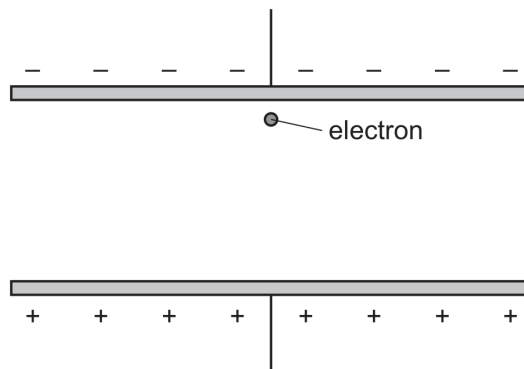
A hair with mass 0.50 mg and charge 1.0 pC is supported by a force due to an electric field. Ignore any forces other than the weight of the hair and the electric force.

What is the electric field strength?

- A $4.9 \times 10^3 \text{ NC}^{-1}$
- B $4.9 \times 10^5 \text{ NC}^{-1}$
- C $4.9 \times 10^6 \text{ NC}^{-1}$
- D $4.9 \times 10^9 \text{ NC}^{-1}$

Topical Question No: 27

- 32 An electron is situated in a vacuum between two charged plates, as shown.

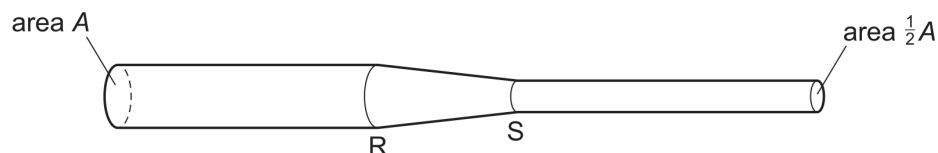


Which statement describes the motion of the electron due to the uniform electric field?

- A It moves downwards with a constant acceleration.
- B It moves downwards with zero acceleration.
- C It moves upwards with a constant acceleration.
- D It moves upwards with a decreasing acceleration.

Topical Question No: 28

- 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 .

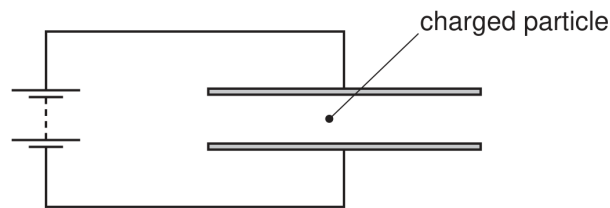
There is a constant current in the wire. Charge Q passes R in time t .

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

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

Topical Question No: 29

- 31 A charged particle is in the electric field between two horizontal metal plates connected to a source of constant potential difference, as shown.



There is a force F on the particle due to the electric field.

The separation of the plates is doubled.

What will be the new force on the particle?

- A $\frac{F}{4}$ B $\frac{F}{2}$ C F D $2F$

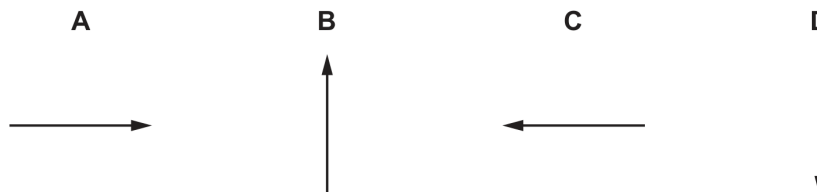
Topical Question No: 30

- 29 P is a point near to charge X as shown.



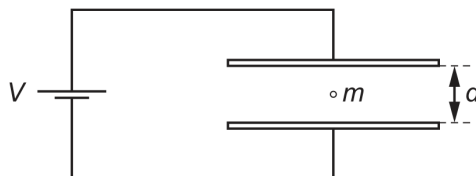
When a negatively charged test charge is placed at point P, it is found to experience a force of repulsion from X that is radially away from X.

Which arrow correctly shows the direction of the electric field at point P due to the charge X?



Topical Question No: 31

- 30 A charged oil drop of mass m , with n excess electrons, is held stationary in the uniform electric field between two horizontal plates separated by a distance d .



The voltage between the plates is V , the elementary charge is e and the acceleration of free fall is g .

What is the value of n ?

- A $\frac{eV}{mgd}$ B $\frac{mgd}{eV}$ C $\frac{meV}{gd}$ D $\frac{gd}{meV}$

Topical Question No: 32

- 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}

Answer Key

1. N/A
2. N/A
3. N/A
4. N/A
5. N/A
6. N/A
7. N/A
8. N/A
9. N/A
10. N/A
11. N/A
12. N/A
13. N/A
14. A
15. D
16. D
17. B
18. A
19. D
20. C
21. N/A
22. N/A
23. N/A
24. N/A
25. N/A
26. N/A
27. N/A