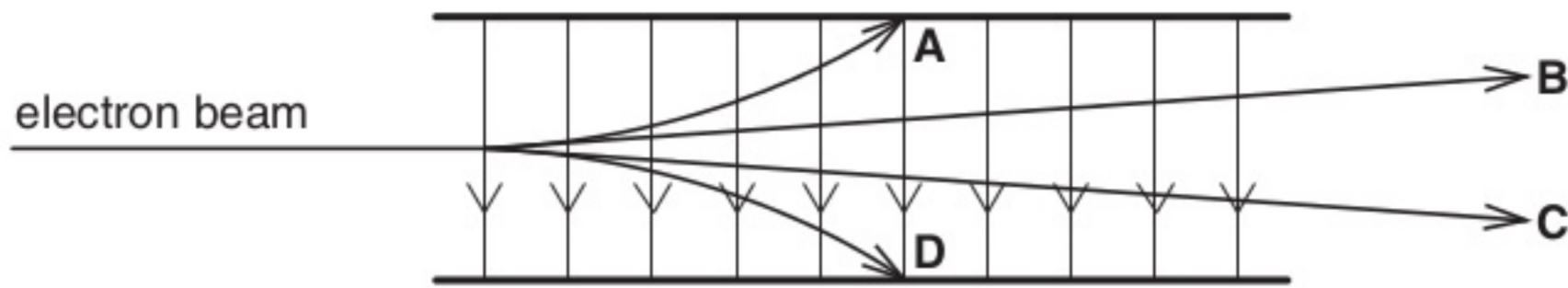


36 Which path shows a possible movement of an electron in the electric field shown?

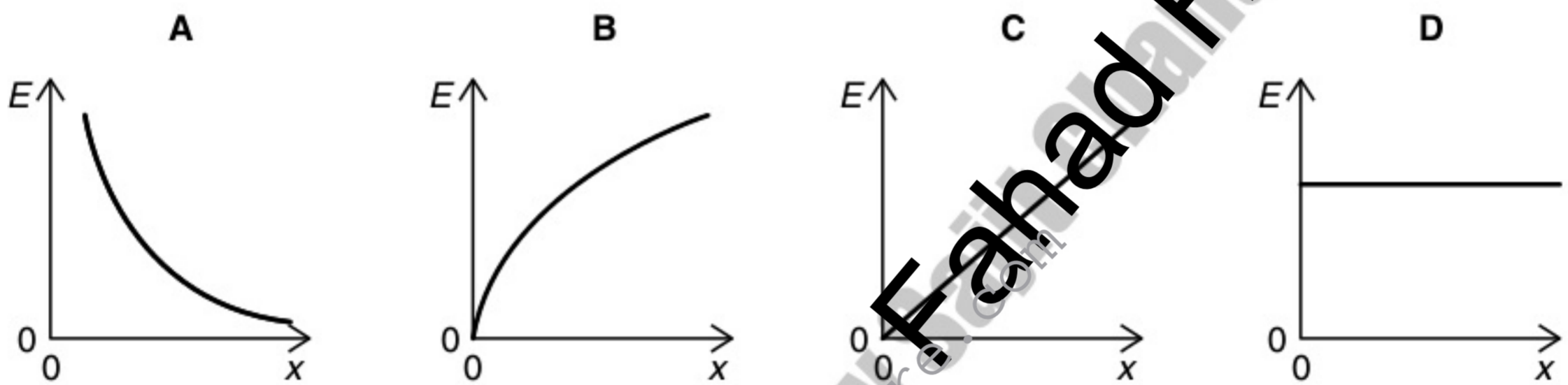
9702/1/M/J/02



37 Two parallel conducting plates are connected to a battery, one plate to the positive terminal and the other plate to the negative. The plate separation is gradually increased, the plates remaining connected to the battery.

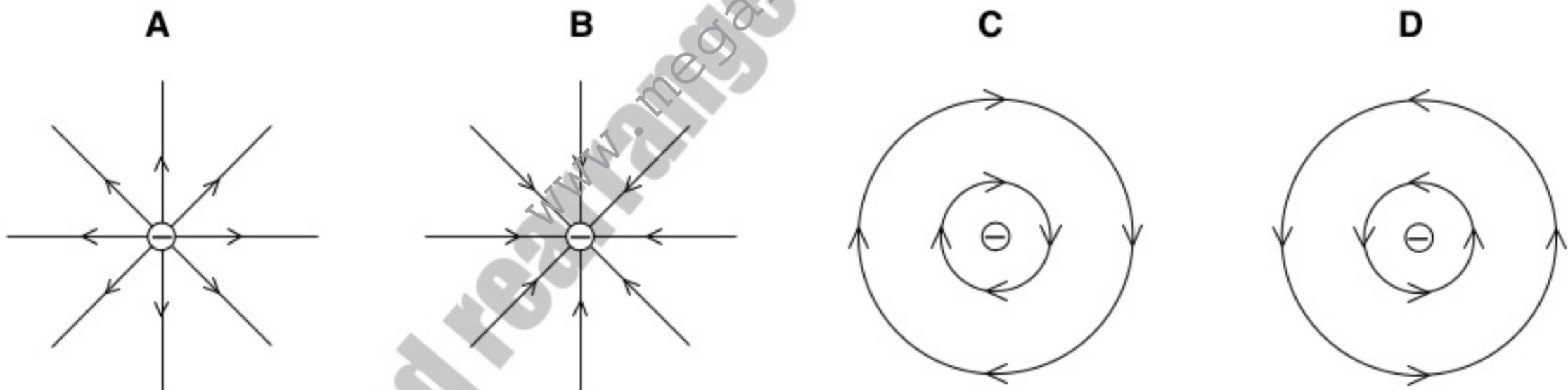
9702/1/M/J/02

Which graph shows how the electric field E between the plates depends on the plate separation x ?



37 Which diagram shows the electric field pattern of an isolated negative point charge?

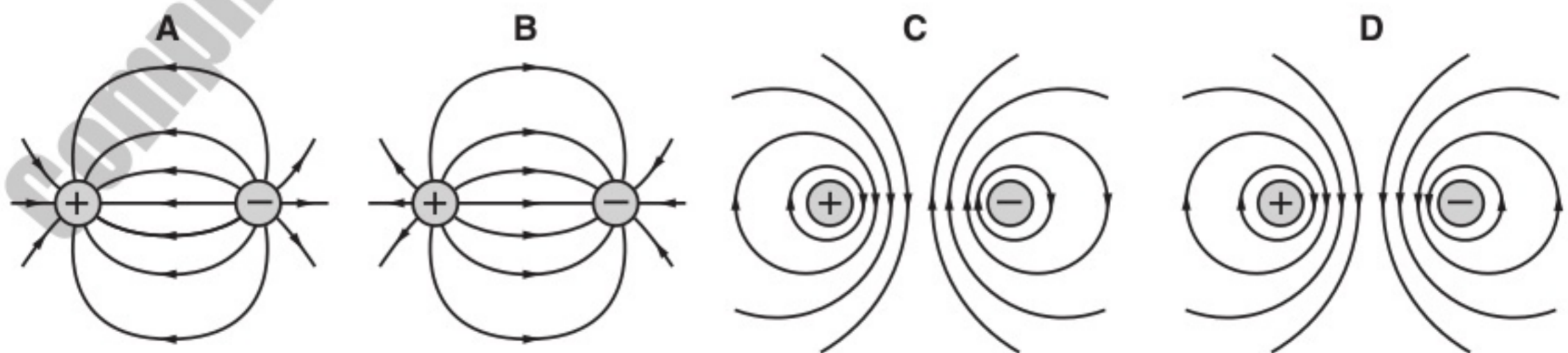
9702/1/O/N/02



37 A positive charge and a negative charge of equal magnitude are placed a short distance apart.

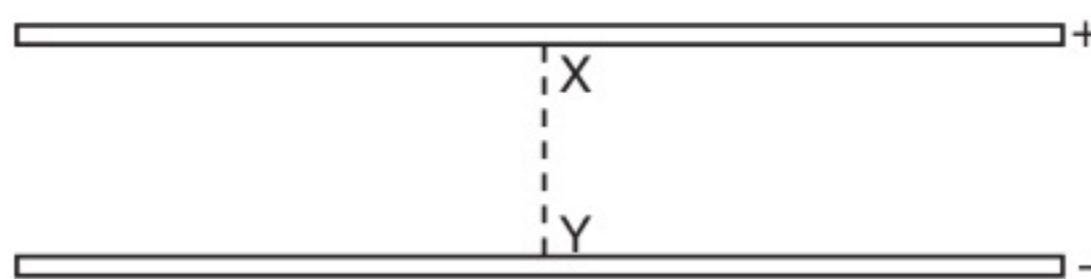
9702/01/M/J/03

Which diagram best represents the associated electric field?

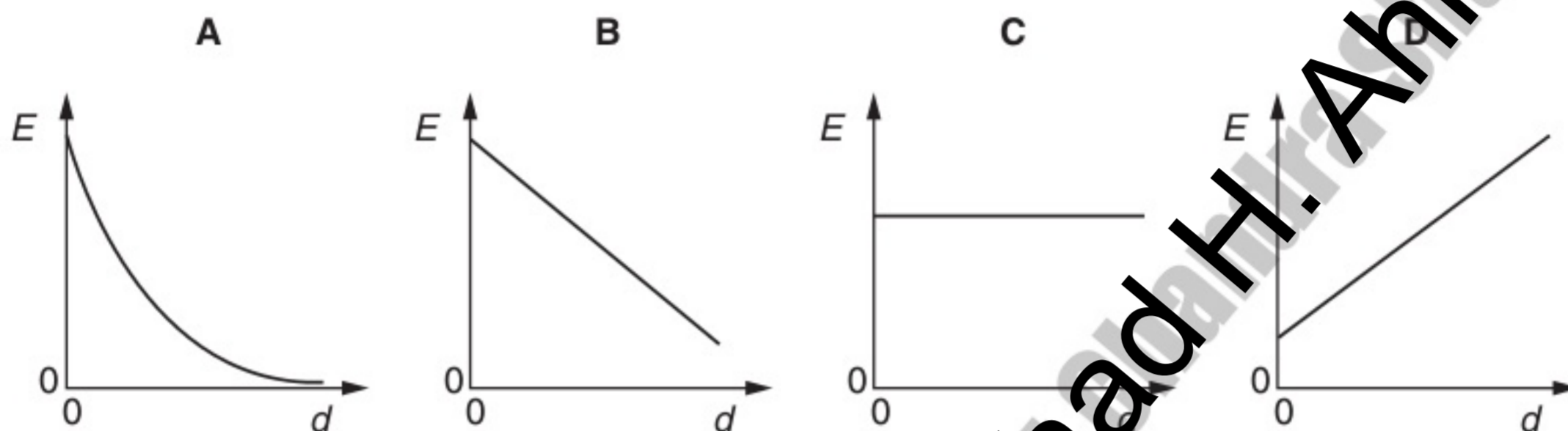


35 An electric field exists in the space between two charged metal plates.

9702/01/M/J/03

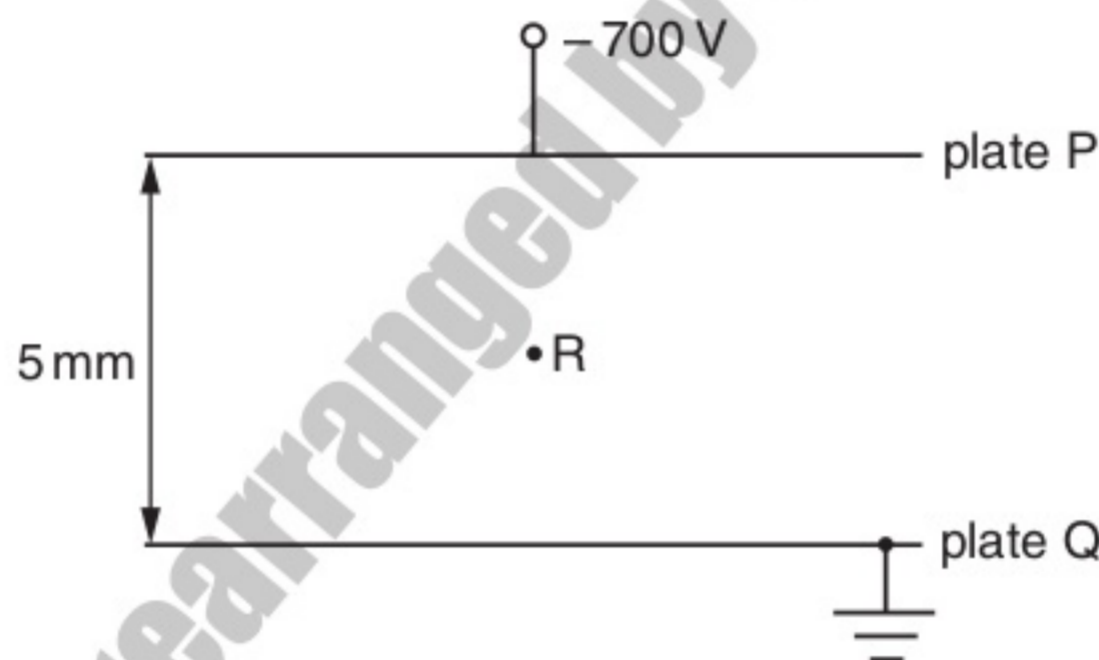


Which of the following graphs shows the variation of electric field strength E with distance d from X along the line XY?



36 The diagram shows two metal plates P and Q between which there is a potential difference of 700 V. Plate Q is earthed.

9702/01/M/J/03



What is the magnitude and direction of the electric field at point R?

- A $1.4 \times 10^2 \text{ N C}^{-1}$ from P towards Q
- B $1.4 \times 10^2 \text{ N C}^{-1}$ from Q towards P
- C $1.4 \times 10^5 \text{ N C}^{-1}$ from P towards Q
- D $1.4 \times 10^5 \text{ N C}^{-1}$ from Q towards P

30 The electric field strength between a pair of parallel plates is E . The separation of the plates is doubled and the potential difference between the plates is increased by a factor of four.

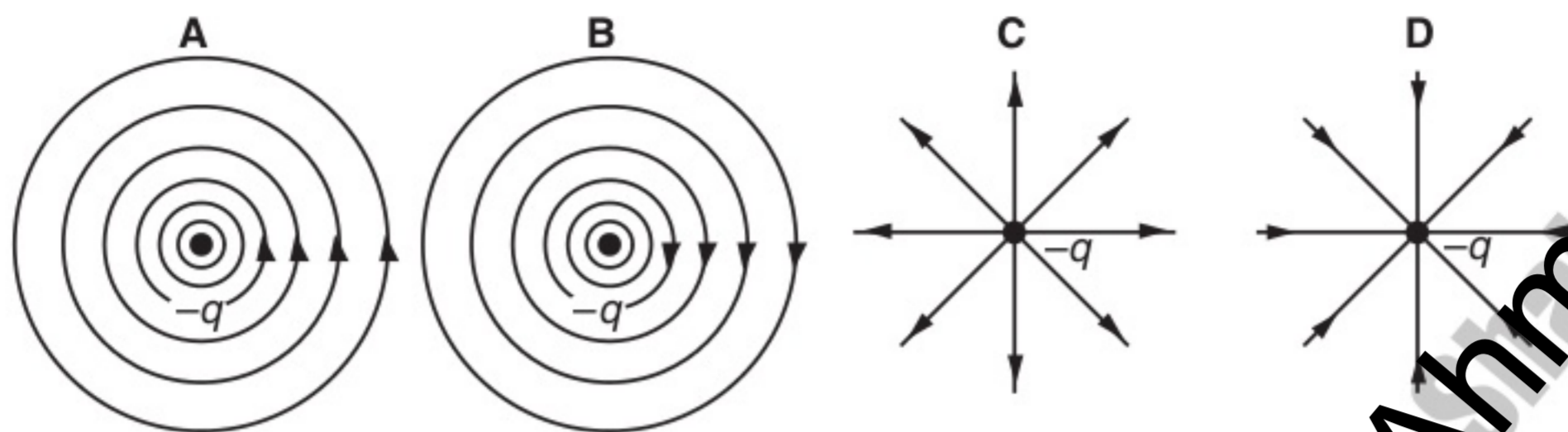
9702/01/M/J/07

What is the new electric field strength?

- A E
- B $2E$
- C $4E$
- D $8E$

35 Which diagram represents the electric field of a negative point charge $-q$?

9702/01/O/N/03



36 A potential difference V is applied between two parallel plates a small distance d apart, and produces an electric field of strength E between the plates.

9702/01/O/N/03

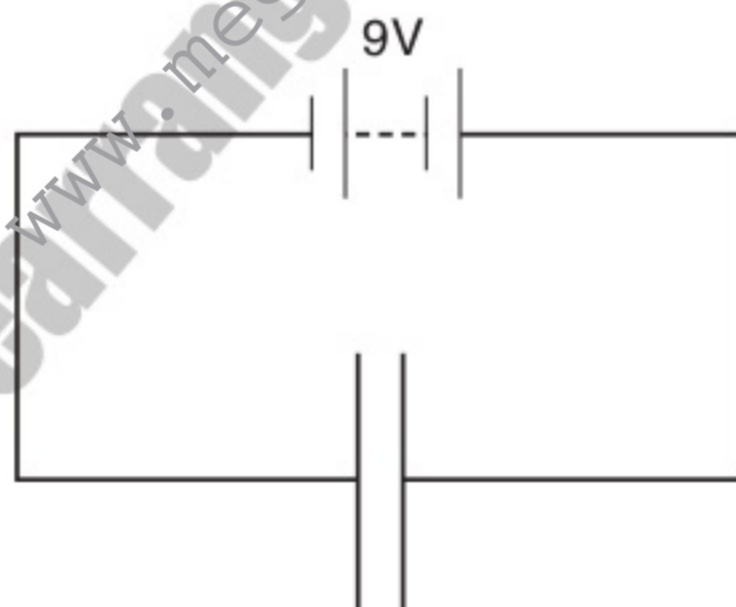


What is the electric field strength between the plates when both V and d are doubled?

- A $E/4$ B E C $2E$ D $4E$

37 In the circuit below, the distance between the two parallel plates is $2.0 \times 10^{-3} \text{m}$. An electron is situated between the plates.

9702/01/O/N/03



What is the force on the electron?

- A $3.2 \times 10^{-22} \text{N}$
 B $2.9 \times 10^{-21} \text{N}$
 C $8.9 \times 10^{-18} \text{N}$
 D $7.2 \times 10^{-16} \text{N}$

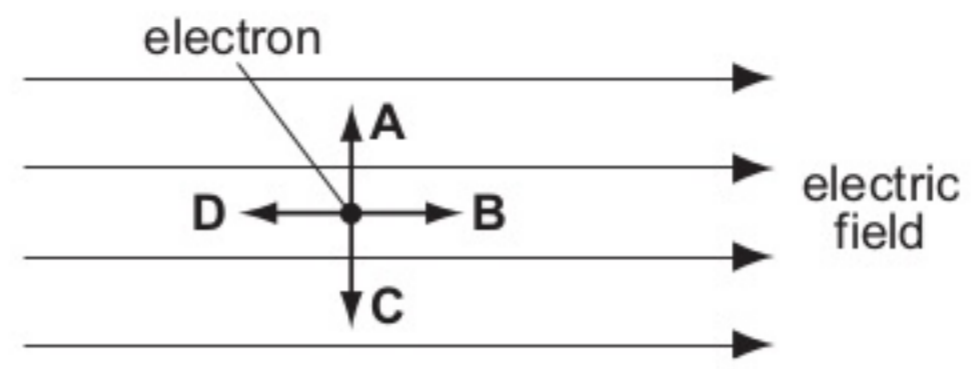
32 What is an equivalent unit to 1 volt?

9702/01/M/J/04

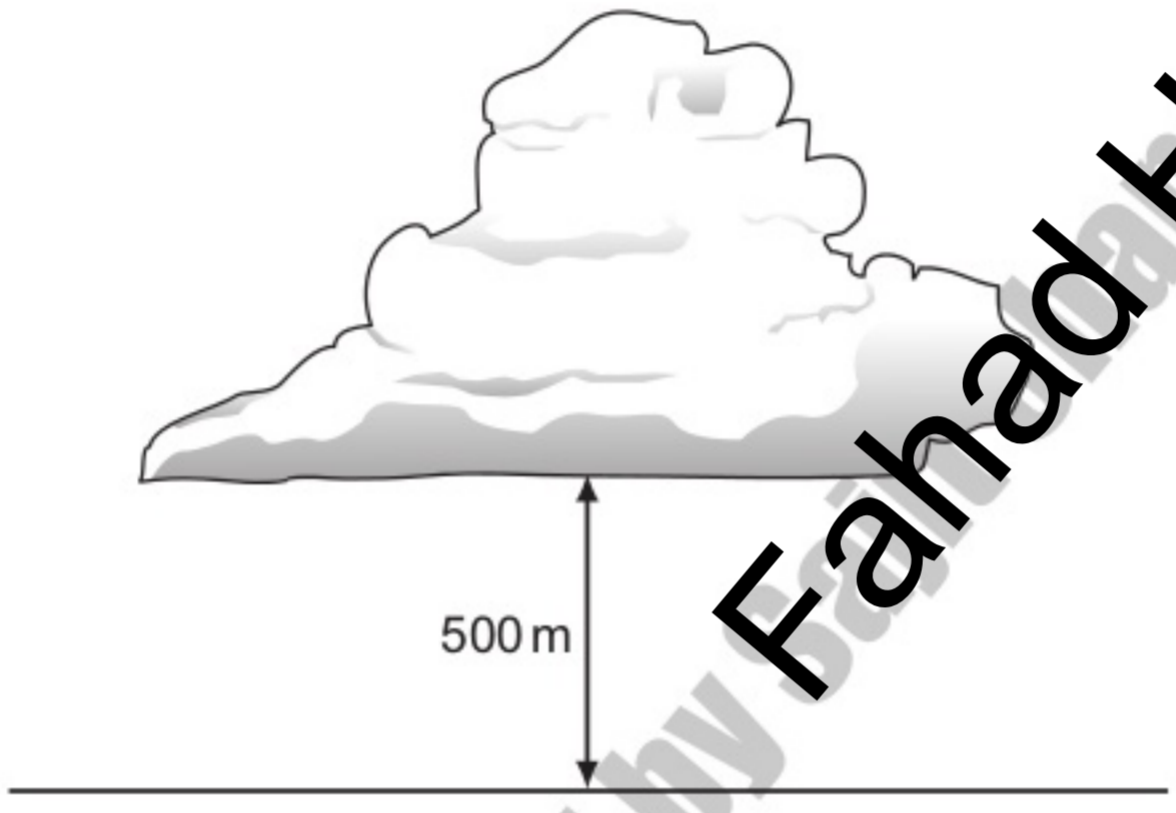
- A 1JA^{-1} B 1JC^{-1} C 1WC^{-1} D 1Ws^{-1}

29 The diagram shows an electron in a uniform electric field.

In which direction will the field accelerate the electron?



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



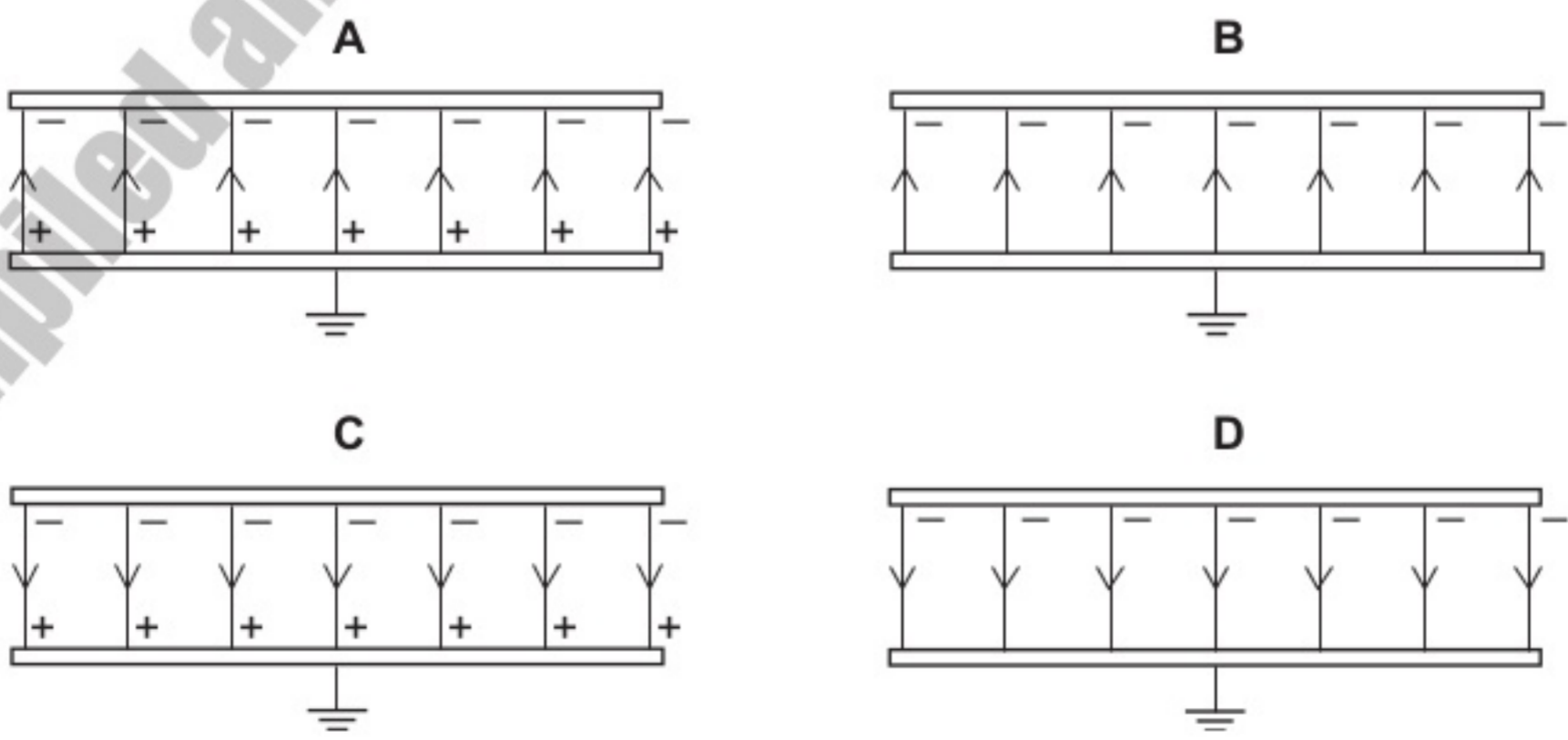
The potential difference between the base of the cloud and the ground is 200MV. A raindrop with a charge of $4.0 \times 10^{-12} \text{ C}$ is in the region between the cloud and the ground.

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

29 Two parallel, conducting plates with air between them are placed close to one another. The top plate is given a negative charge and the bottom one is earthed.

Which diagram best represents the distribution of charges and the field in this situation?



30 In a uniform electric field, which statement is correct?

9702/01/O/N/04

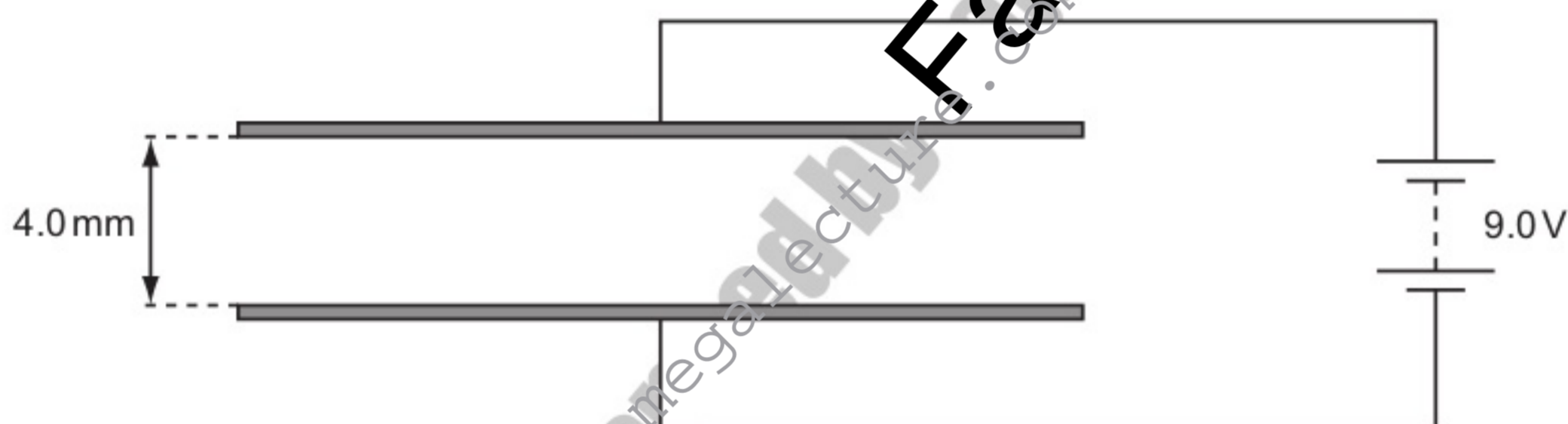
- A All charged particles experience the same force.
- B All charged particles move with the same velocity.
- C All electric field lines are directed towards positive charges.
- D All electric field lines are parallel.

31 Which of the following describes the electric potential difference between two points in a wire that carries a current?

9702/01/O/N/04

- 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

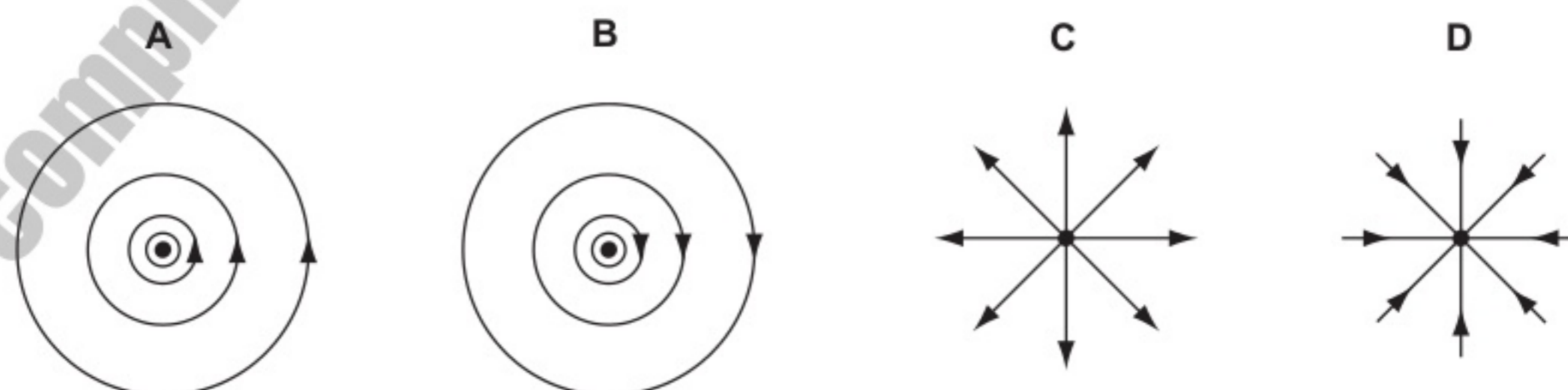
30 The diagram shows a pair of metal plates 4.0 mm apart connected to a 9.0V battery. 9702/01/M/J/05



What is the electric field between the plates?

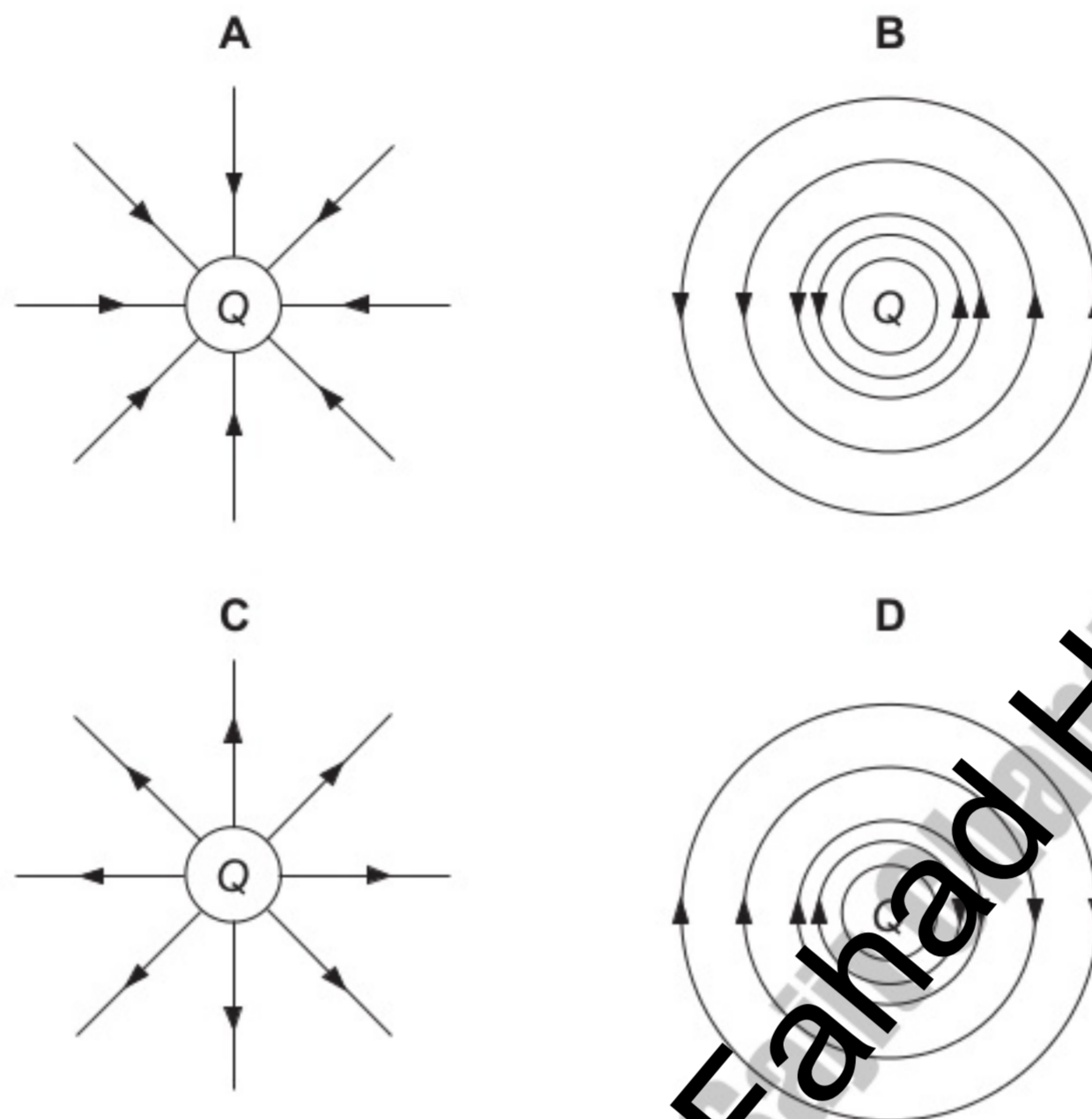
- A $4.4 \times 10^{-4} \text{ NC}^{-1}$
- B $3.6 \times 10^{-2} \text{ NC}^{-1}$
- C 36 NC^{-1}
- D $2.3 \times 10^3 \text{ NC}^{-1}$

28 Which diagram represents the electric field of a negative point charge, shown by ●? 9702/01/M/J/07



31 Which diagram represents the electric field in the vicinity of a positive electric charge of magnitude Q ?

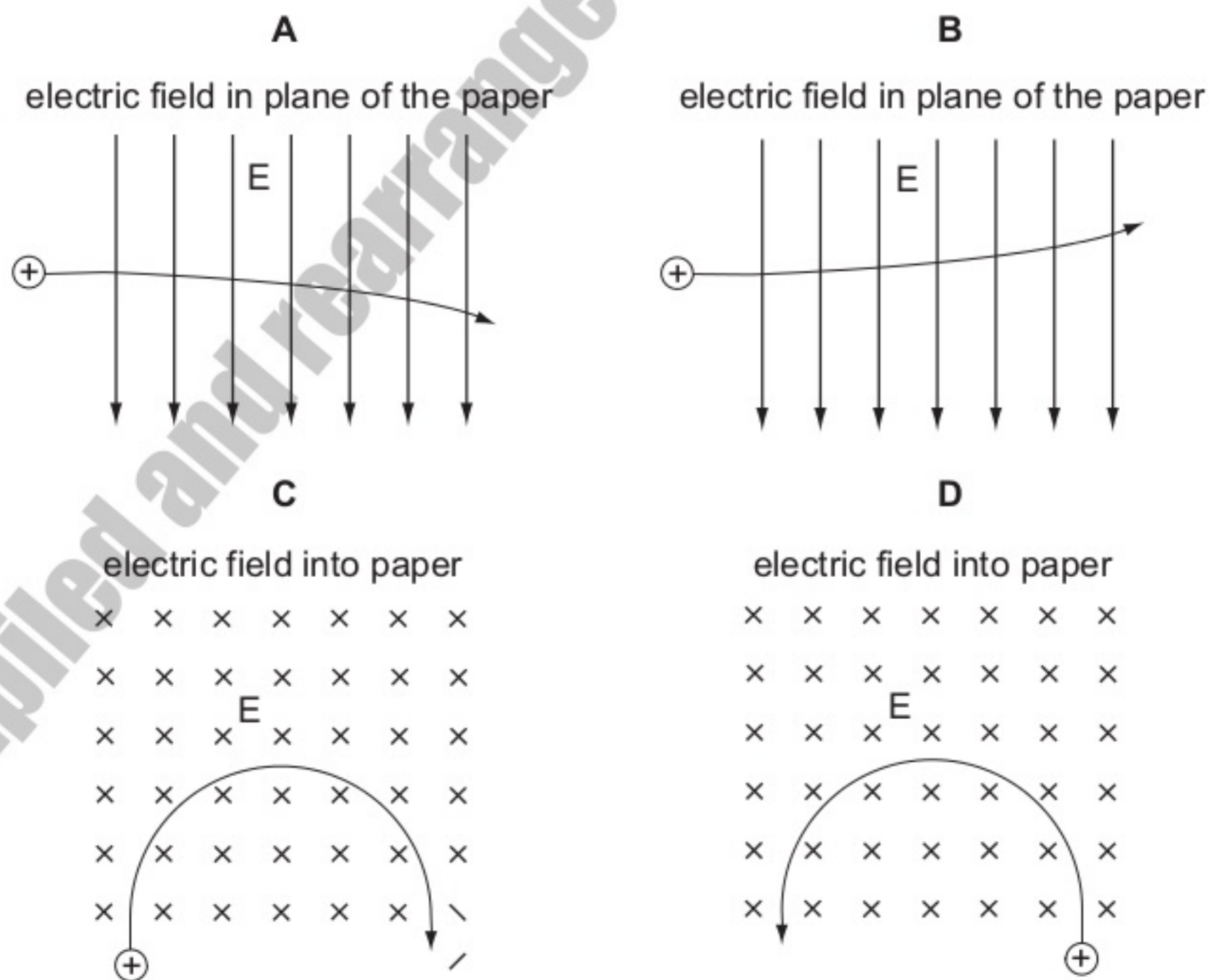
9702/01/M/J/05



30 A positively charged particle is projected into a region of uniform electric field E .

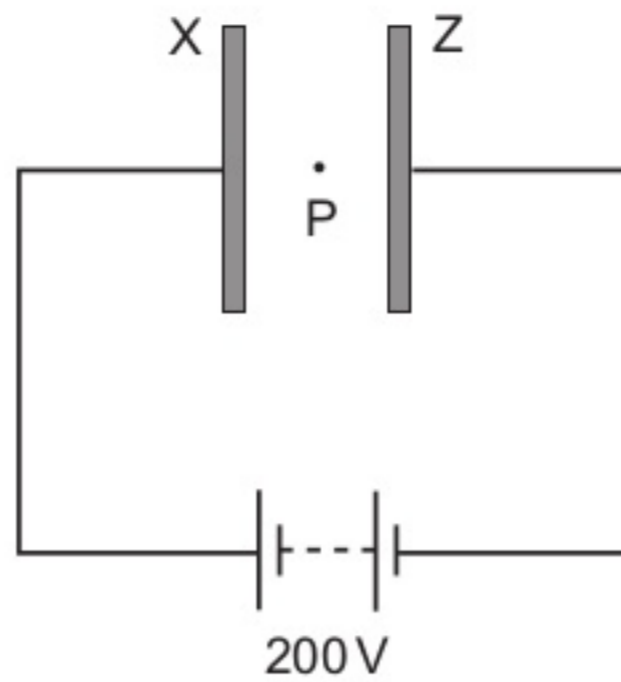
9702/01/O/N/05

Which diagram represents the motion of the particle in the electric field?



31 Two large parallel plates X and Z are placed 5.0 mm apart and connected as shown to the terminals of a 200 volt d.c. supply.

9702/01/O/N/05



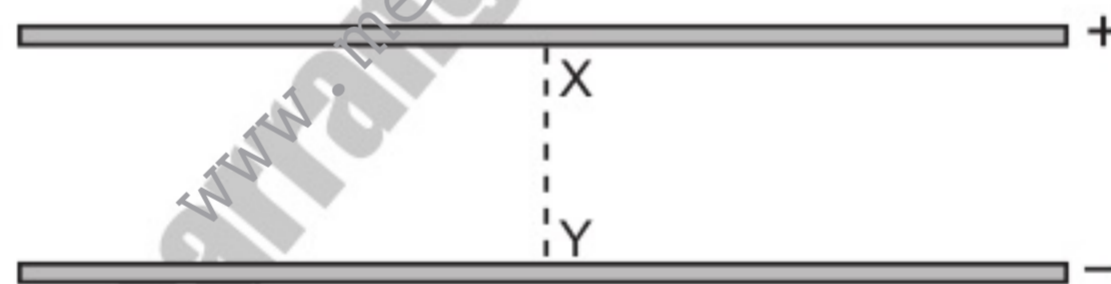
A small oil drop at P carries one excess electron.

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

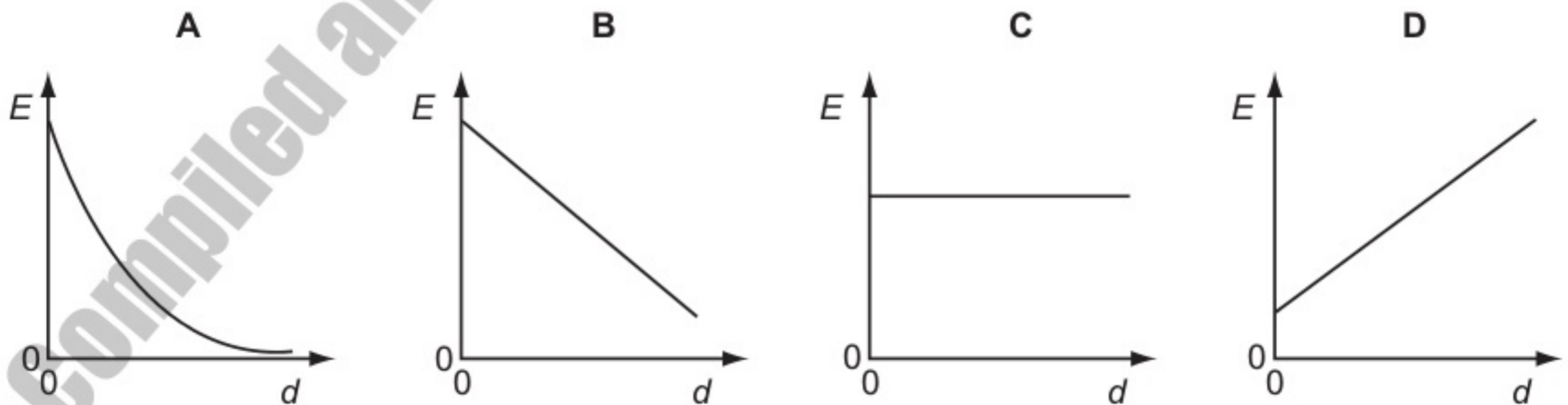
- A $6.4 \times 10^{-15} \text{ N}$
- B $6.4 \times 10^{-18} \text{ N}$
- C $1.6 \times 10^{-19} \text{ N}$
- D $4.0 \times 10^{-24} \text{ N}$

30 An electric field exists in the space between two charged metal plates.

9702/01/O/N/06

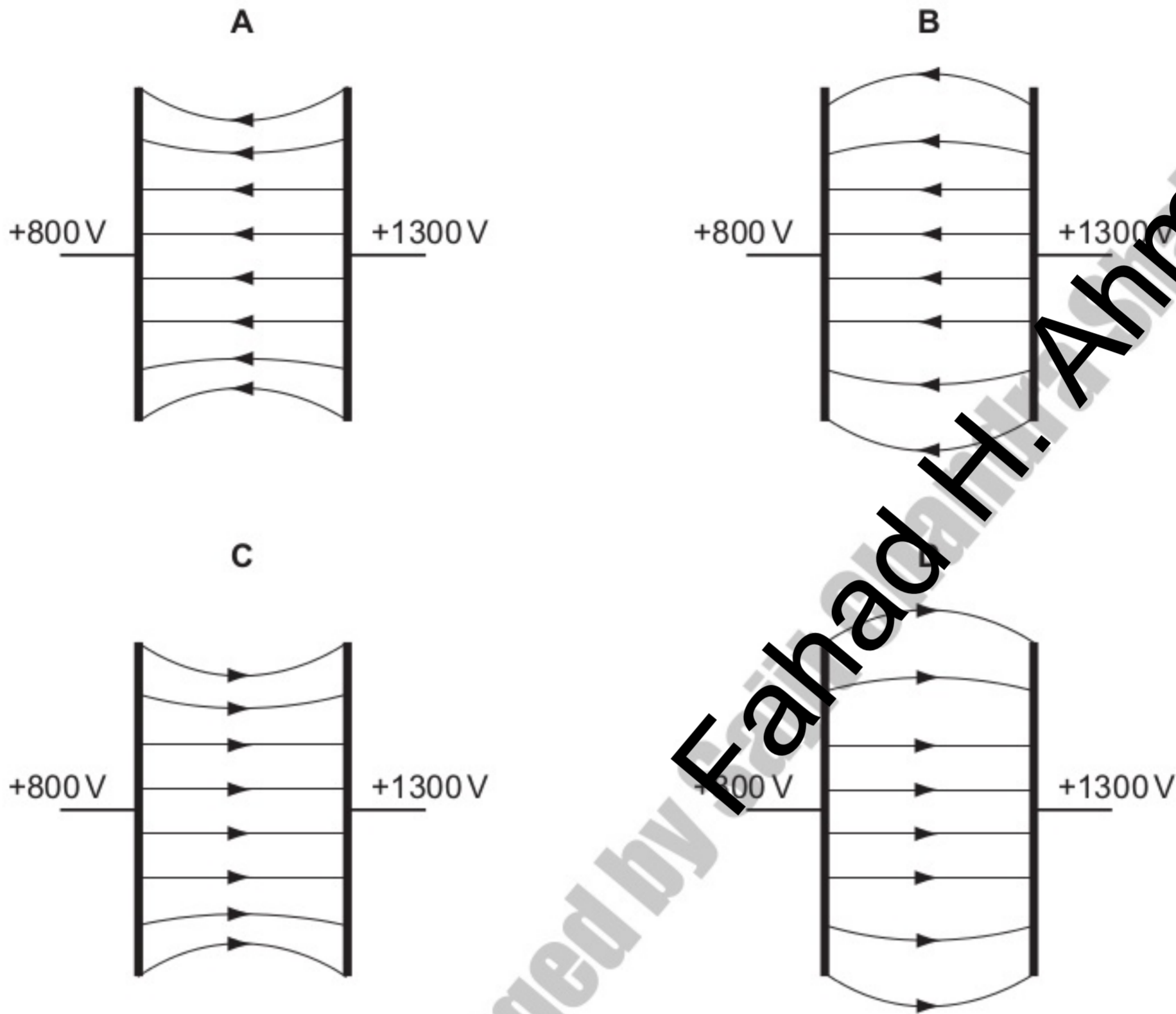


Which graph shows the variation of electric field strength E with distance d from X along the line XY?



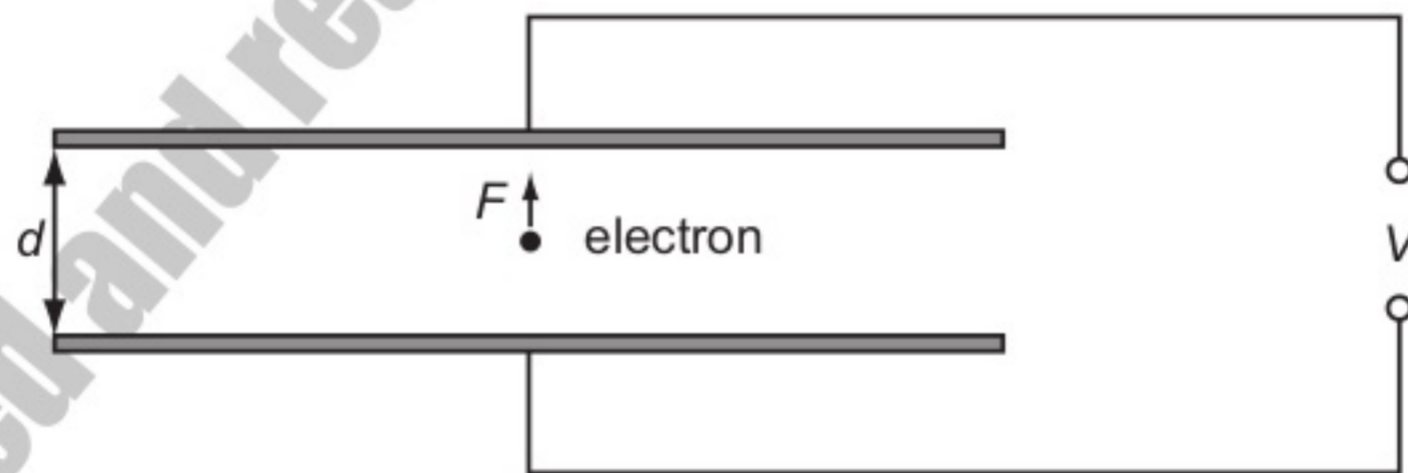
29 Two parallel metal plates are at potentials of +800V and +1300V.

Which diagram best shows the electric field between the metal plates?



30 An electron of charge e is introduced between two metal plates a distance d apart. 9702/01/M/J/06

A potential difference V is applied to the plates as shown in the diagram.



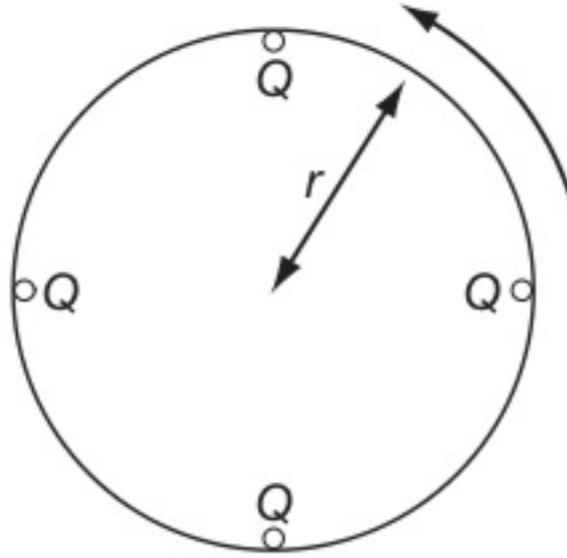
Which expression gives the electric force F on the electron?

- A $\frac{eV}{d}$
- B eVd
- C $\frac{V}{ed}$
- D $\frac{dV}{e}$

31 Four point charges, each of charge Q , are placed on the edge of an insulating disc of radius r .

The frequency of rotation of the disc is f .

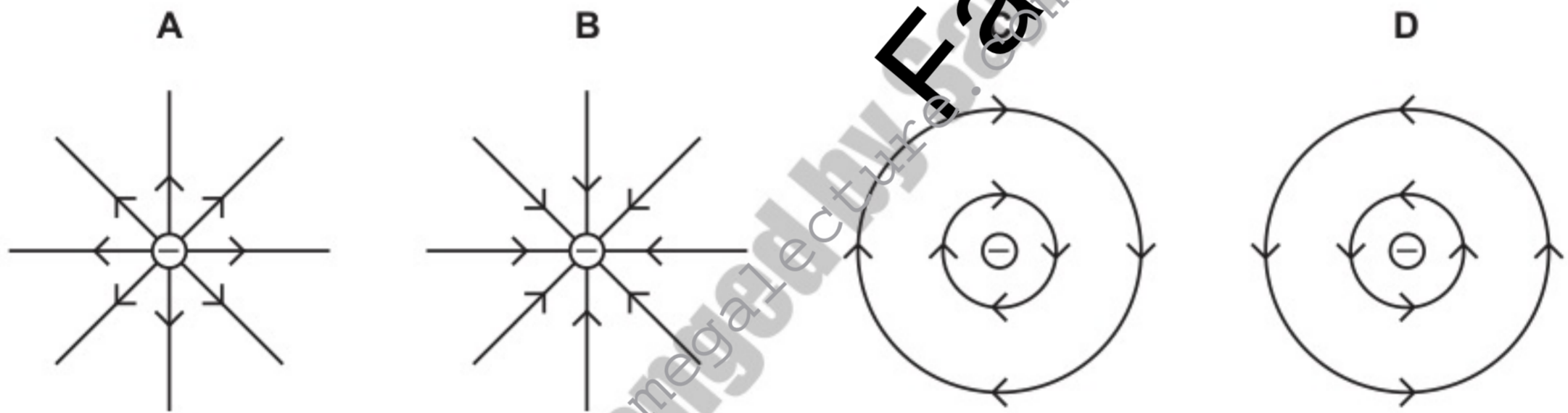
9702/01/O/N/06



What is the equivalent electric current at the edge of the disc?

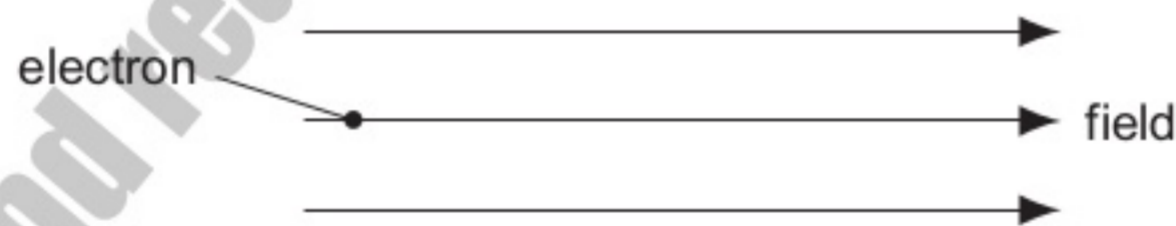
- A $4Qf$ B $\frac{4Q}{f}$ C $8\pi rQf$ D $\frac{2Qf}{\pi r}$

29 Which diagram shows the electric field pattern of an isolated negative point charge? 9702/01/O/N/06



26 An electron is situated in a uniform electric field as shown in the diagram.

9702/01/O/N/07

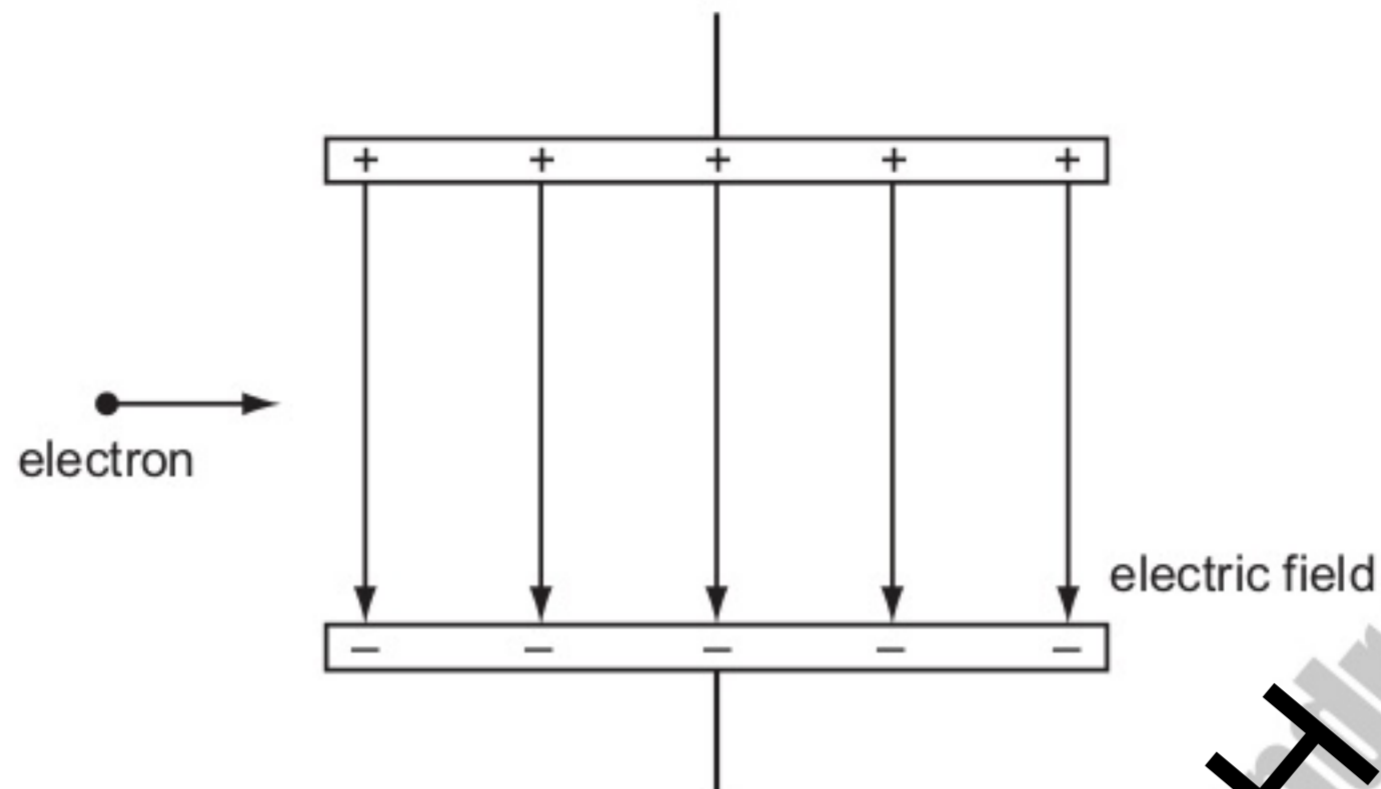


What is the direction of the electric force acting on the electron?

- A downwards into the paper
 B upwards out of the paper
 C to the left
 D to the right

29 An electron, travelling horizontally at constant speed in a vacuum, enters a vertical electric field between two charged parallel plates as shown.

9702/01/M/J/07

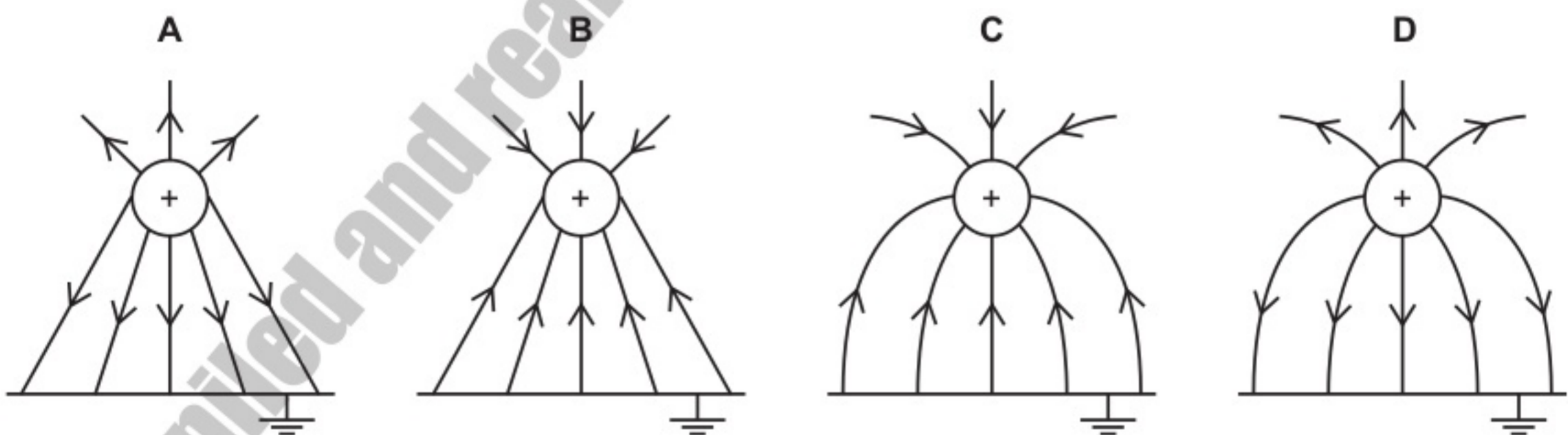


What are the horizontal and vertical components of the motion of this electron when it is in the field?

	horizontal component of motion	vertical component of motion
A	constant speed	acceleration upwards
B	constant speed	acceleration downwards
C	acceleration to the right	acceleration downwards
D	acceleration to the right	acceleration upwards

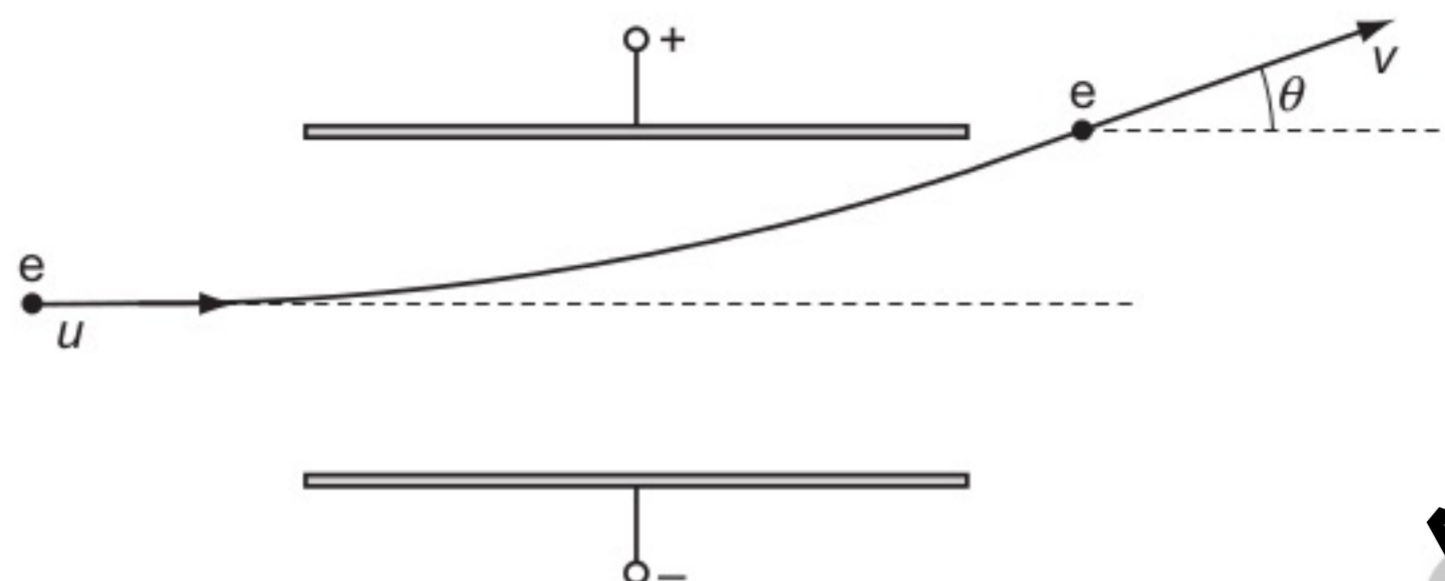
27 Which diagram shows the electric field between a positively charged metal sphere and an earthed metal plate?

9702/01/O/N/07



- 30 An electron enters the space between two parallel charged plates with an initial velocity u .

9702/01/M/J/08

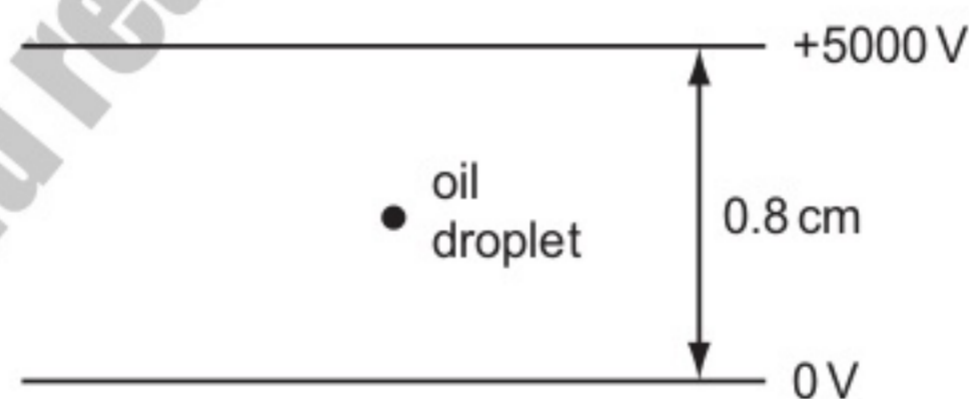


While in the electric field, its direction changes by θ and it emerges with a velocity v .

What is the relation between v and u ?

- A $v = \frac{u}{\cos \theta}$ B $v = u \cos \theta$ C $v = \frac{u}{\sin \theta}$ D $v = u \sin \theta$
- 28 Which electrical quantity would be the result of a calculation in which energy transfer is divided by charge?
- A current
B potential difference
C power
D resistance
- 31 The diagram shows an oil droplet that has become charged by gaining five electrons. The droplet remains stationary between charged plates.

9702/01/O/N/07



What is the magnitude and direction of the electrostatic force on the oil droplet?

- A 5.0×10^{-15} N upwards
B 5.0×10^{-15} N downwards
C 5.0×10^{-13} N upwards
D 5.0×10^{-13} N downwards

- 30** A particle has a charge of 4.8×10^{-19} C. The particle remains at rest between a pair of horizontal, parallel plates having a separation of 15 mm. The potential difference between the plates is 660 V. 9702/01/O/N/08

What is the weight of the particle?

- A** 2.1×10^{-14} N
- B** 2.1×10^{-15} N
- C** 2.1×10^{-17} N
- D** 1.1×10^{-23} N

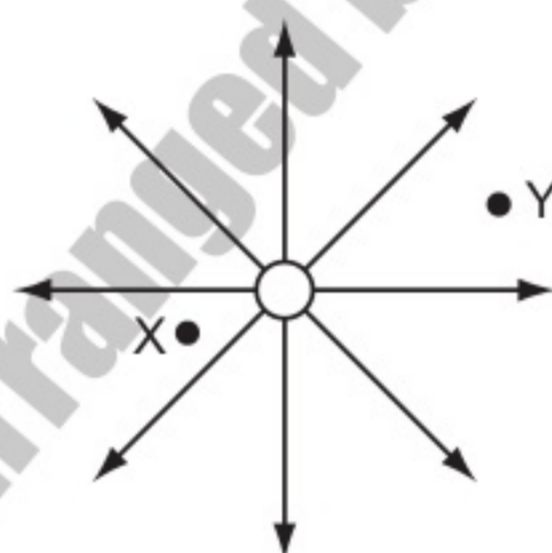
- 27** A small charge q is placed in the electric field of a large charge Q . 9702/11/O/N/09

Both charges experience a force F .

What is the electric field strength of the charge Q at the position of the charge q ?

- A** $\frac{F}{Qq}$ **B** $\frac{F}{Q}$ **C** FqQ **D** $\frac{F}{q}$

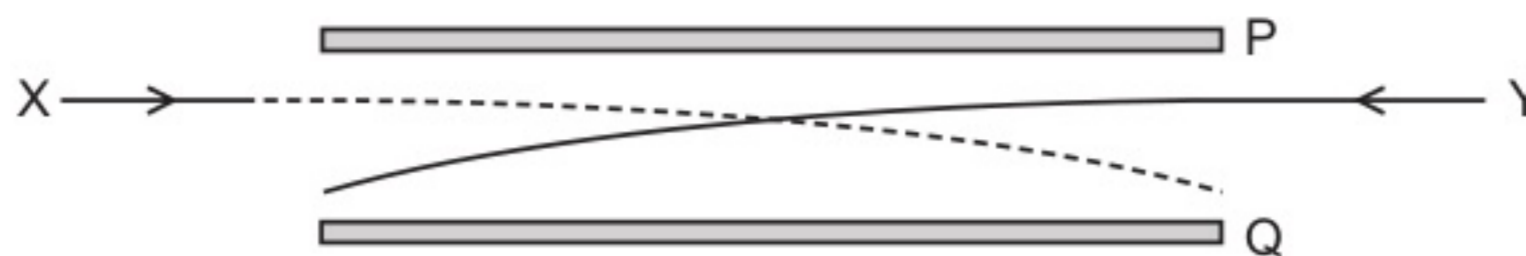
- 29** The diagram shows the electric field near a point charge and two electrons X and Y. 9702/01/O/N/08



Which row describes the forces acting on X and Y?

	direction of force	magnitude of force on X
A	radially inwards	less than force on Y
B	radially inwards	greater than force on Y
C	radially outwards	less than force on Y
D	radially outwards	greater than force on Y

- 27 The diagram shows the paths of two charged particles, X and Y, during their passage between a pair of oppositely charged metal plates, P and Q. 9702/01/M/J/09



The plates are charged such that the electric field between them is directed from Q to P.

Which charges on X and Y will produce the observed paths?

	X	Y
A	-	-
B	-	+
C	+	-
D	+	+

- 28 There is a potential difference between a pair of parallel plates. 9702/01/M/J/09

Which values of potential difference and separation of the plates will produce an electric field strength of the greatest value?

	potential difference	separation
A	$2V$	$2d$
B	$2V$	$\frac{d}{2}$
C	$\frac{V}{2}$	$2d$
D	$\frac{V}{2}$	$\frac{d}{2}$

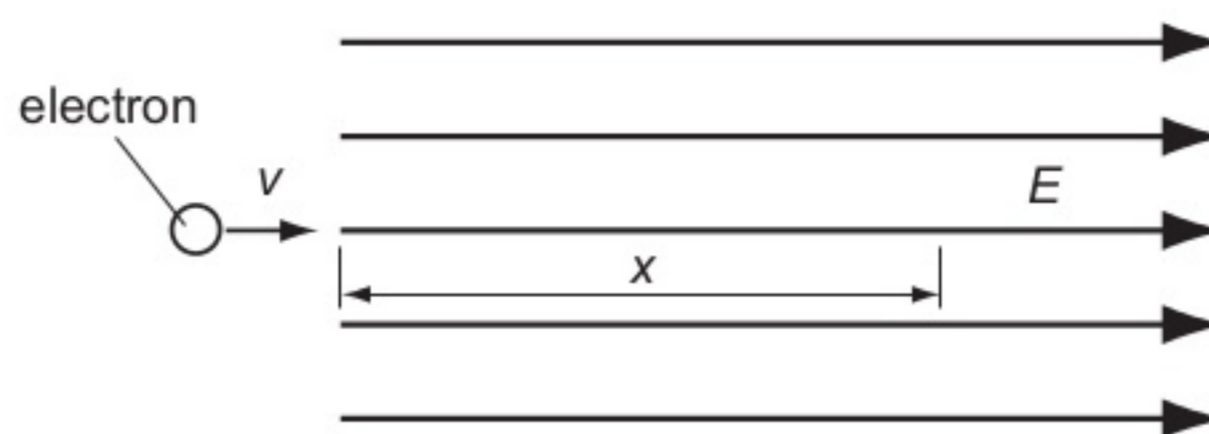
- 29 The electric field at a certain distance from an isolated alpha particle is $3.0 \times 10^7 \text{ N C}^{-1}$. 9702/11/O/N/09

What is the force on an electron when at that distance from the alpha particle?

- A** $4.8 \times 10^{-12} \text{ N}$
- B** $9.6 \times 10^{-12} \text{ N}$
- C** $3.0 \times 10^7 \text{ N}$
- D** $6.0 \times 10^7 \text{ N}$

- 29 The diagram shows an electron, with charge e , mass m , and velocity v , entering a uniform electric field of strength E .

9702/01/M/J/09



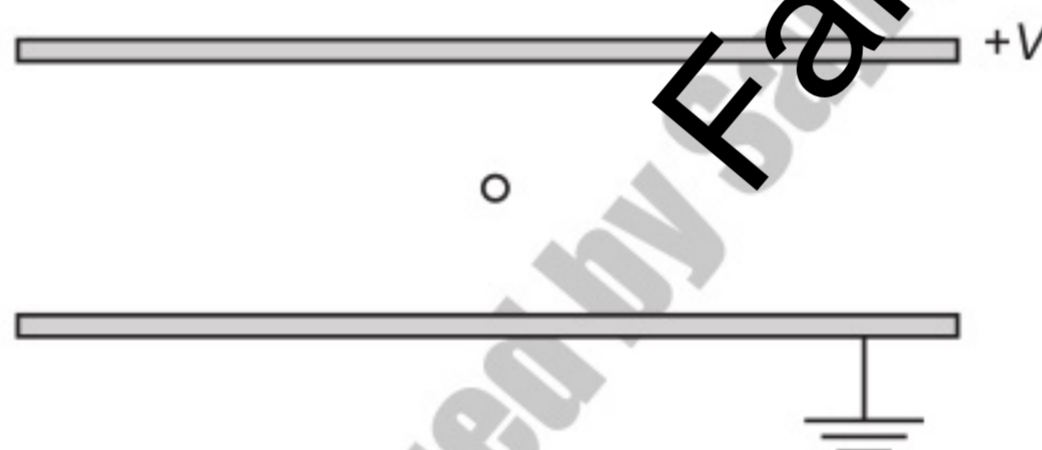
The direction of the field and the electron's motion are both horizontal and to the right.

Which expression gives the distance x through which the electron travels before it stops momentarily?

- A $x = \frac{mv}{E}$ B $x = \frac{mv}{Ee}$ C $x = \frac{mv^2}{2E}$ D $x = \frac{mv^2}{2Ee}$

- 28 The diagram shows two parallel horizontal metal plates held at a potential difference V .

9702/11/O/N/09



A small charged liquid drop, midway between the plates, is held in equilibrium by the combination of its weight and the electric force acting on it.

The acceleration of free fall is g and the electric field strength is E .

What is the ratio of the charge to mass of the drop, and the polarity of the charge on the drop?

	$\frac{\text{charge}}{\text{mass}}$	polarity
A	$\frac{g}{E}$	positive
B	$\frac{g}{E}$	negative
C	$\frac{E}{g}$	positive
D	$\frac{E}{g}$	negative

26 A small charge q is placed in the electric field of a large charge Q .

9702/12/O/N/09

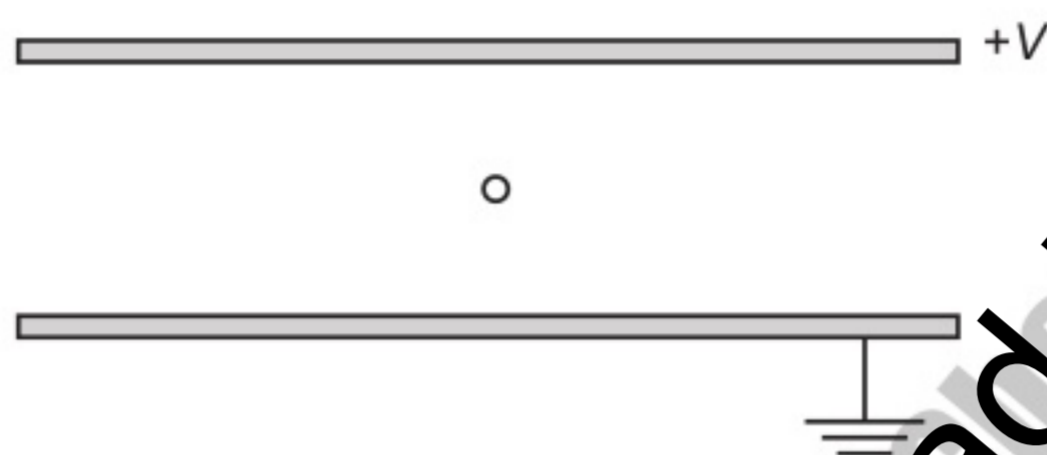
Both charges experience a force F .

What is the electric field strength of the charge Q at the position of the charge q ?

- A $\frac{F}{Qq}$ B $\frac{F}{Q}$ C FqQ D $\frac{F}{q}$

27 The diagram shows two parallel horizontal metal plates held at a potential difference V .

9702/12/O/N/09



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28 The electric field at a certain distance from an isolated alpha particle is $3.0 \times 10^7 \text{ NC}^{-1}$.

What is the force on an electron when at that distance from the alpha particle?

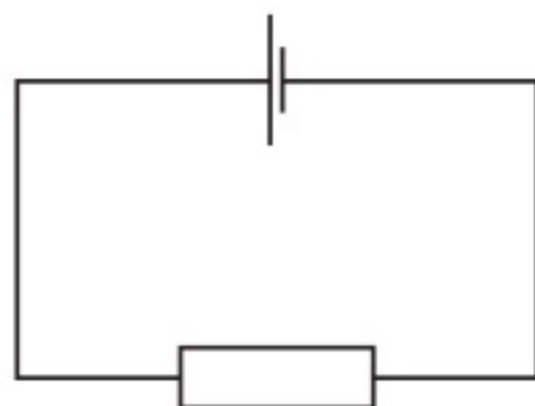
9702/12/O/N/09

- A $4.8 \times 10^{-12} \text{ N}$
 B $9.6 \times 10^{-12} \text{ N}$
 C $3.0 \times 10^7 \text{ N}$
 D $6.0 \times 10^7 \text{ N}$

29 A cell is connected to a resistor.

9702/12/O/N/09

At any given moment, the potential difference across the cell is less than its electromotive force.

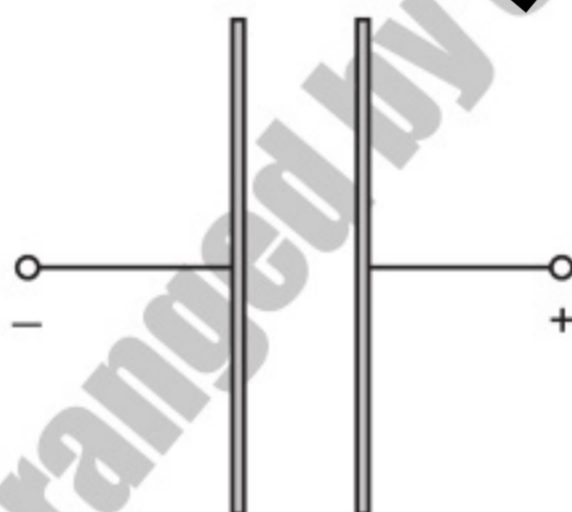


Which statement explains this?

- A The cell is continually discharging.
- B The connecting wire has some resistance.
- C Energy is needed to drive charge through the cell.
- D Power is used when there is a current in the resistor.

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

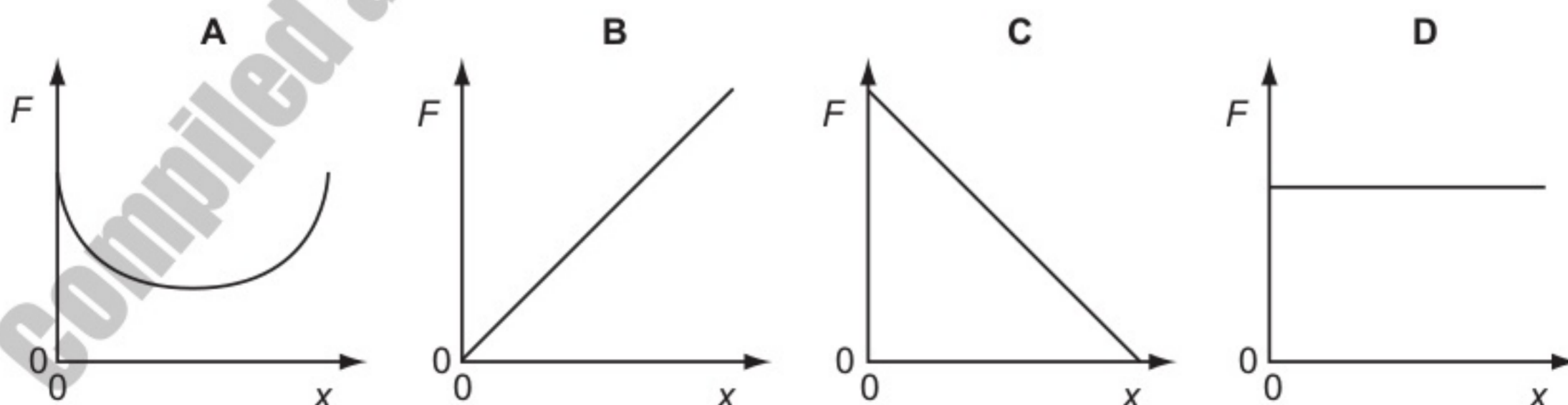
9702/11/M/J/10



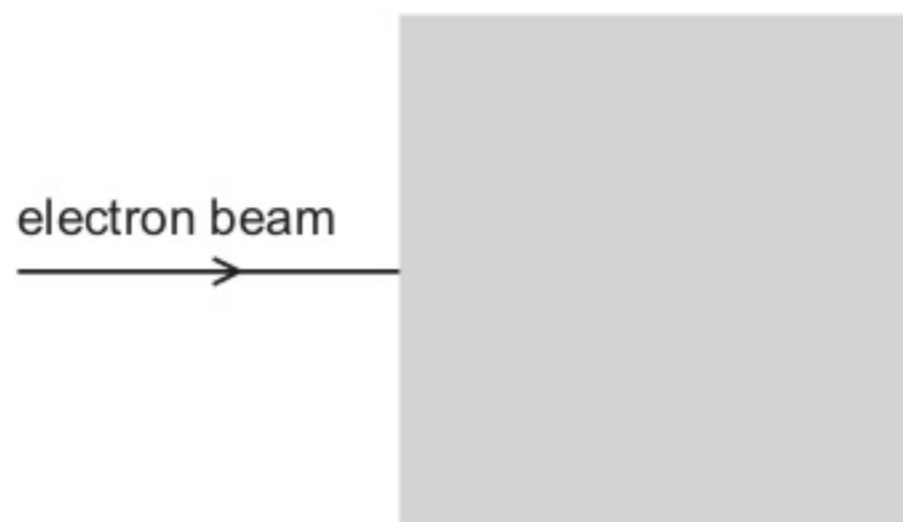
An electron is released from rest from the surface of the negatively-charged plate.

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?



- 29 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). 9702/11/M/J/10

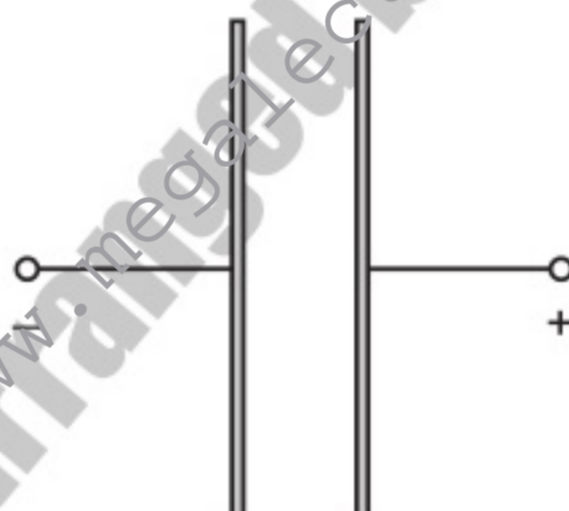


A horizontal beam of electrons enters the field, travelling from left to right.

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

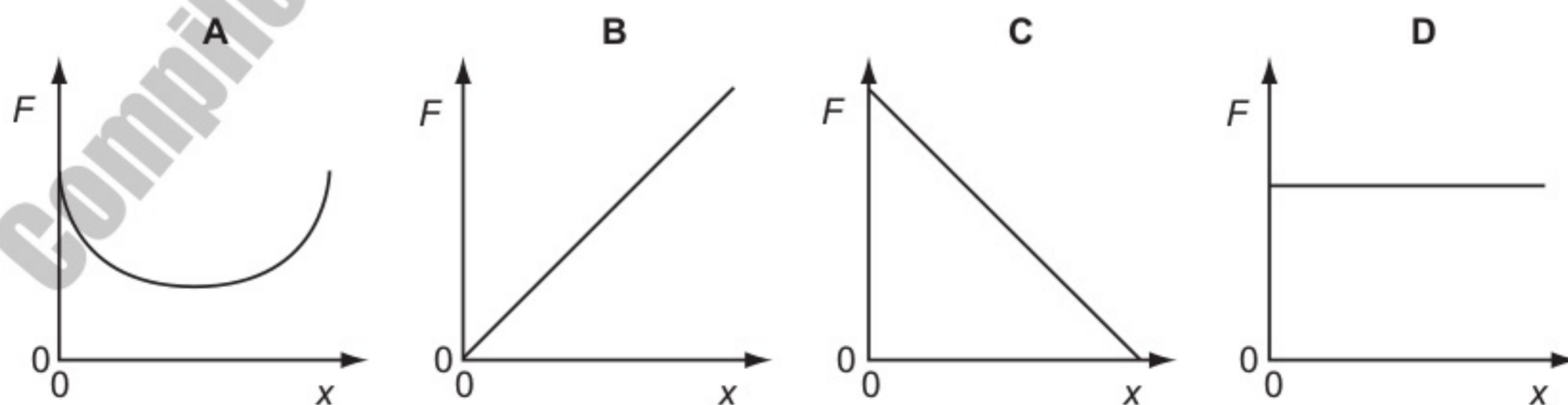
- 26 Two oppositely-charged parallel plates are arranged as shown. 9702/12/M/J/10



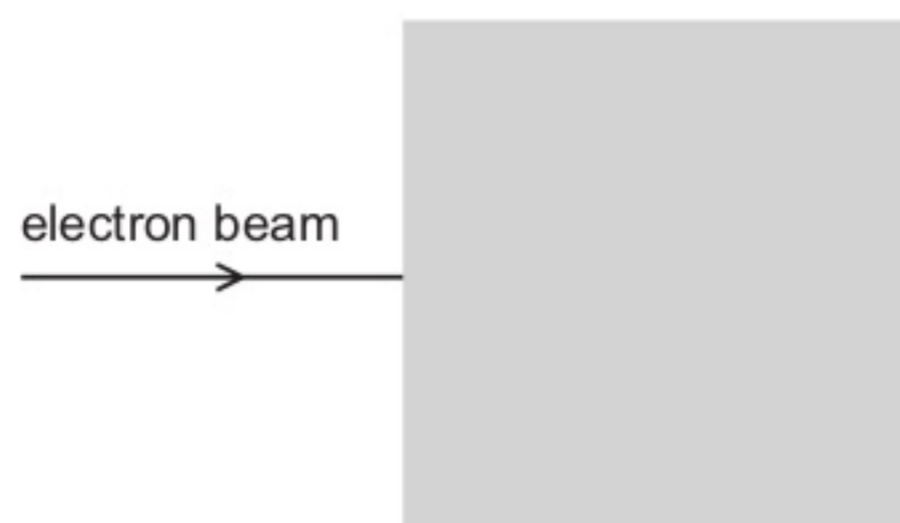
An electron is released from rest from the surface of the negatively-charged plate.

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



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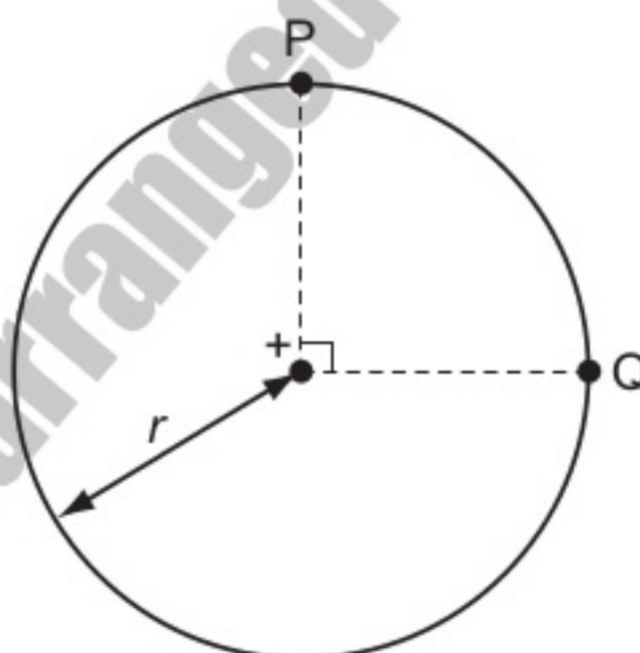


A horizontal beam of electrons enters the field, travelling from left to right.

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
- 28 The diagram shows two points P and Q which lie, 90° apart, on a circle of radius r . 9702/12/M/J/10

A positive point charge at the centre of the circle creates an electric field of magnitude E at both P and Q.



Which expression gives the work done in moving a unit positive charge from P to Q?

- A 0
 - B $E \times r$
 - C $E \times \left(\frac{\pi r}{2}\right)$
 - D $E \times (\pi r)$
- 32 When will 1 C of charge pass a point in an electrical circuit? 9702/12/M/J/12
- A when 1 A moves through a potential difference of 1 V
 - B when a power of 1 W is used for 1 s
 - C when the current is 5 mA for 200 s
 - D when the current is 10 A for 10 s

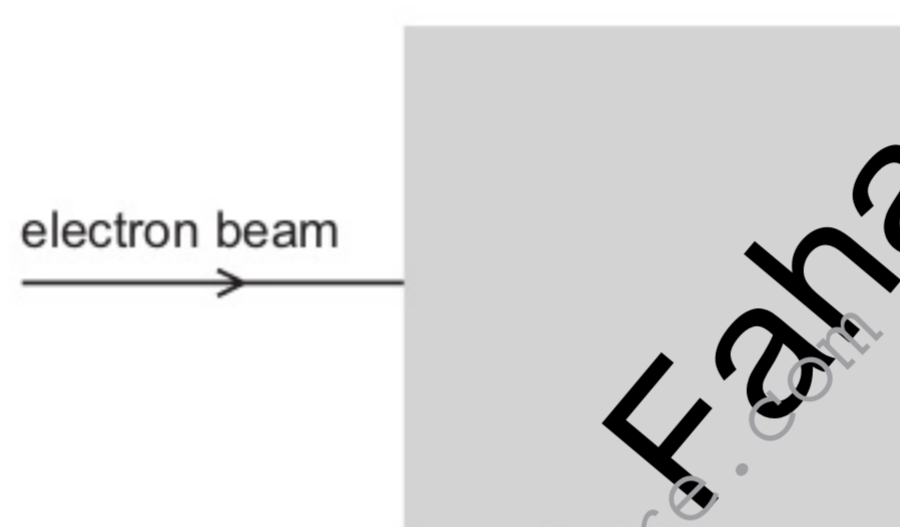
- 29 Which row describes the circumstances under which forces act on a charged particle in a uniform electric field?

9702/12/M/J/10

	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

- 26 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).

9702/13/M/J/10



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
- 28 An electron is in an electric field of strength $5 \times 10^4 \text{ V m}^{-1}$. The field is the only influence on the electron.

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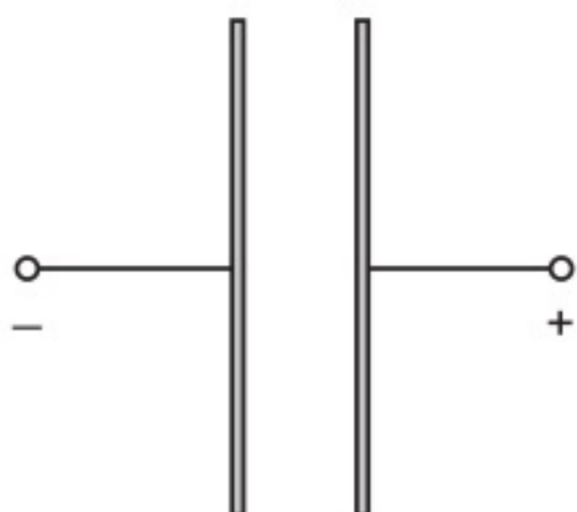
The mass and charge of an electron are known.

Which quantity can be calculated without any more information?

- A** the force on the electron
B the momentum of the electron
C the kinetic energy of the electron
D the speed of the electron

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

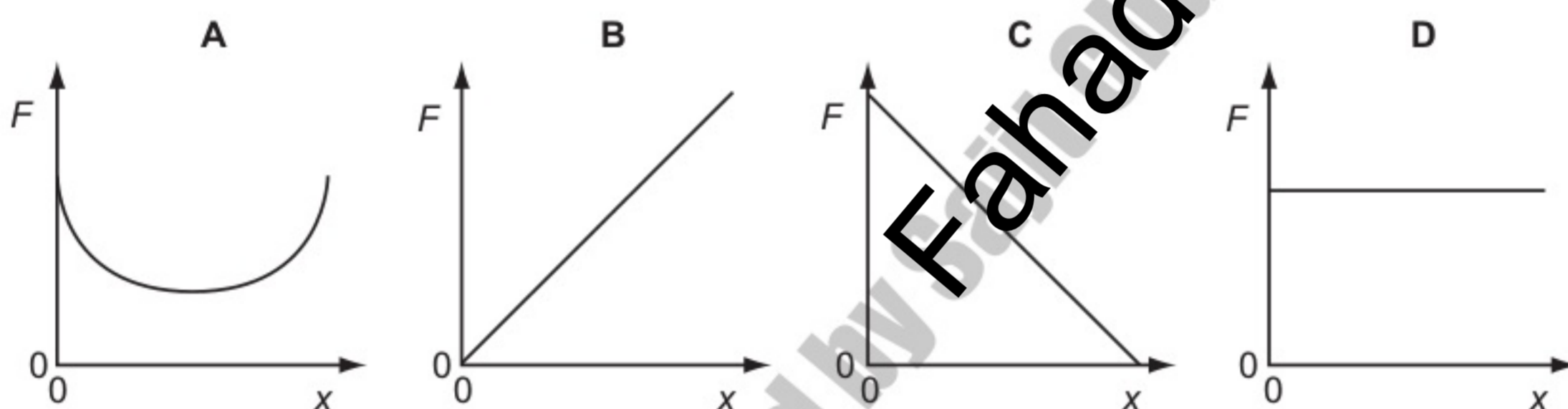
9702/13/M/J/10



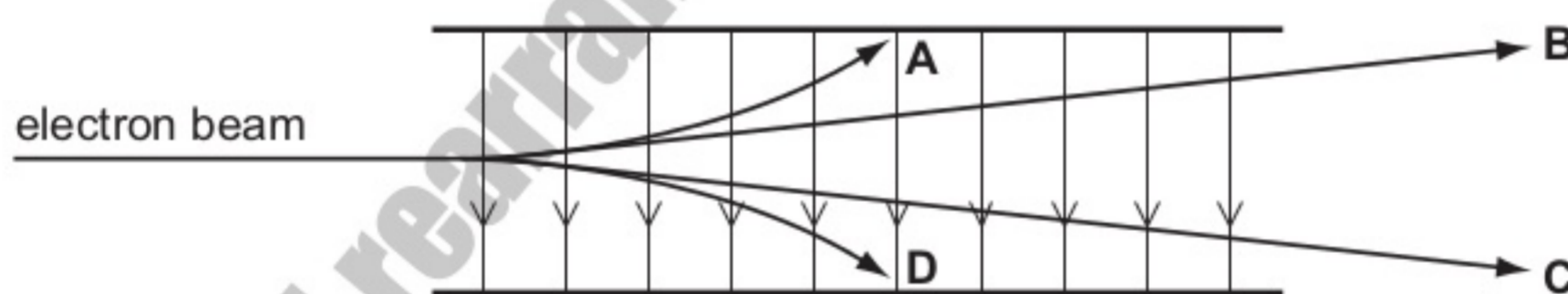
An electron is released from rest from the surface of the negatively-charged plate.

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?



30 Which path shows a possible movement of an electron in the electric field shown? 9702/12/O/N/11



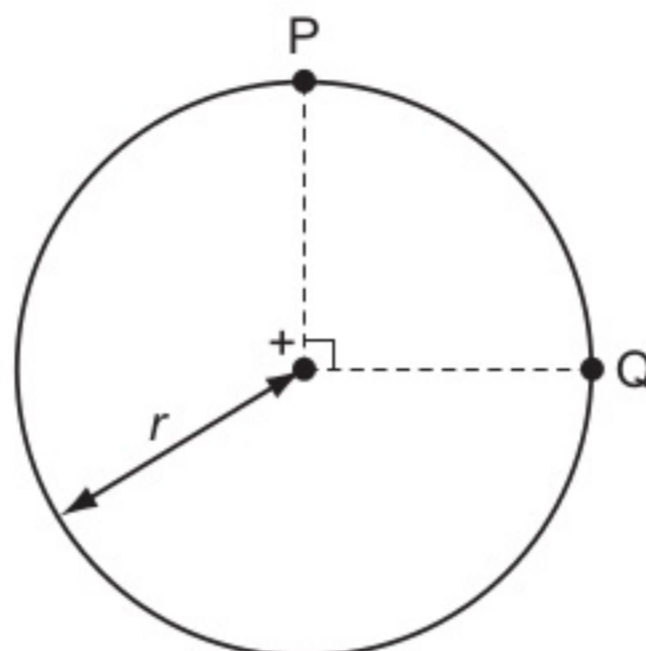
28 Which row describes the circumstances under which forces act on a charged particle in a uniform electric field?

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	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

29 The diagram shows two points P and Q which lie, 90° apart, on a circle of radius r . 9702/13/M/J/10

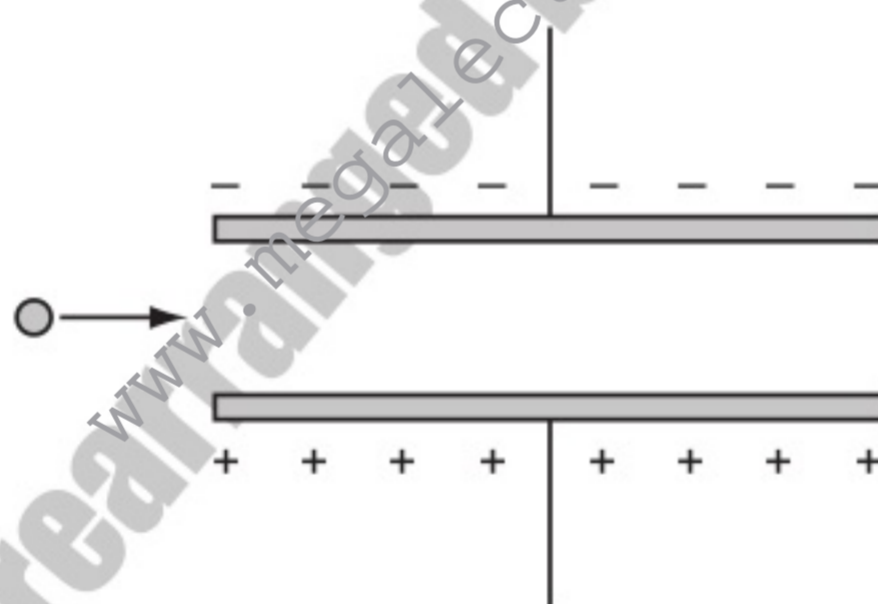
A positive point charge at the centre of the circle creates an electric field of magnitude E at both P and Q.



Which expression gives the work done in moving a unit positive charge from P to Q?

- A 0 B $E \times r$ C $E \times \left(\frac{\pi r}{2}\right)$ D $E \times (\pi r)$

30 The diagram shows a charged particle as it approaches a pair of charged parallel plates in a vacuum. 9702/13/M/J/11

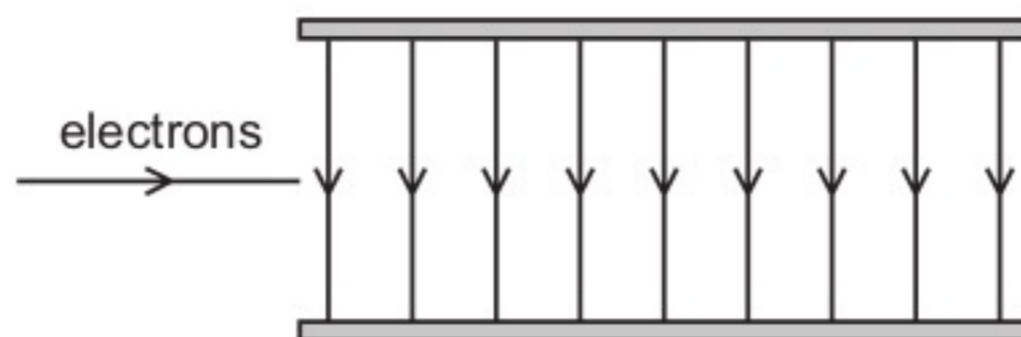


Which row describes the horizontal and vertical components of its motion as it travels between the plates?

	horizontal component	vertical component
A	constant acceleration	constant acceleration
B	constant acceleration	constant velocity
C	constant velocity	constant acceleration
D	constant velocity	constant velocity

- 29 Electrons are accelerated and then directed into the uniform electric field between two parallel plates in a vacuum.

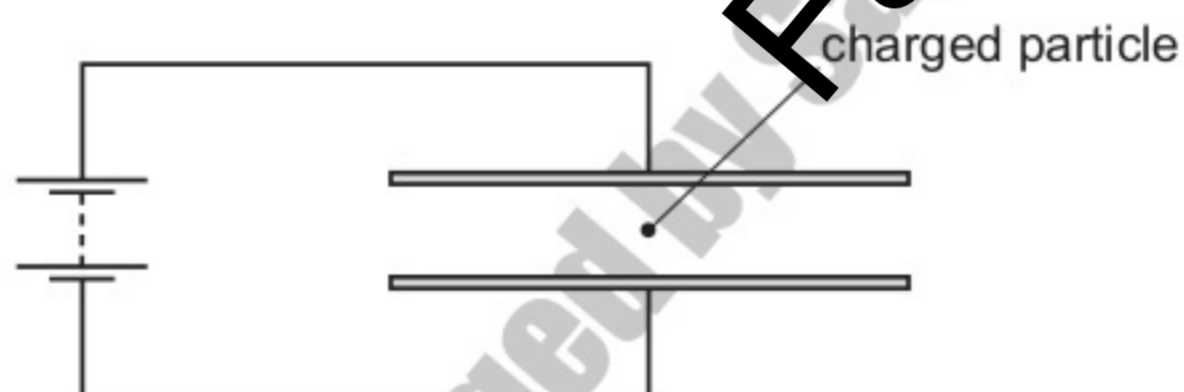
9702/11/O/N/10



What best describes the shape of the path followed by the electrons in the field?

- A a downwards curve along a line that is part of a circle
 B a downwards curve along a line that is **not** part of a circle
 C an upwards curve along a line that is part of a circle
 D an upwards curve along a line that is **not** part of a circle
- 30 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.

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The separation of the plates is doubled.

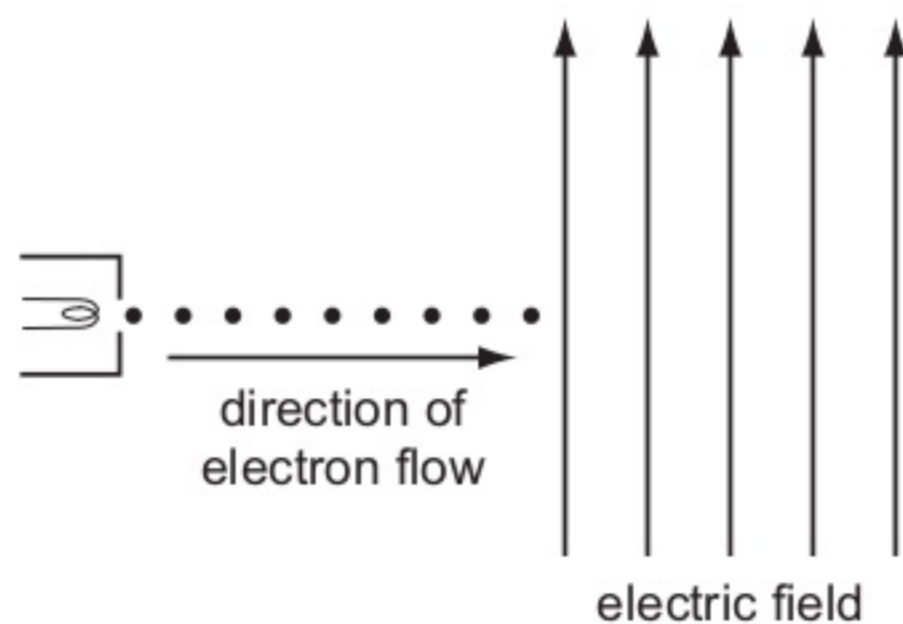
What will be the new force on the particle?

- A $\frac{F}{4}$ B $\frac{F}{2}$ C F D $2F$
- 32 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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28 The diagram shows a vertical uniform electric field in a vacuum.

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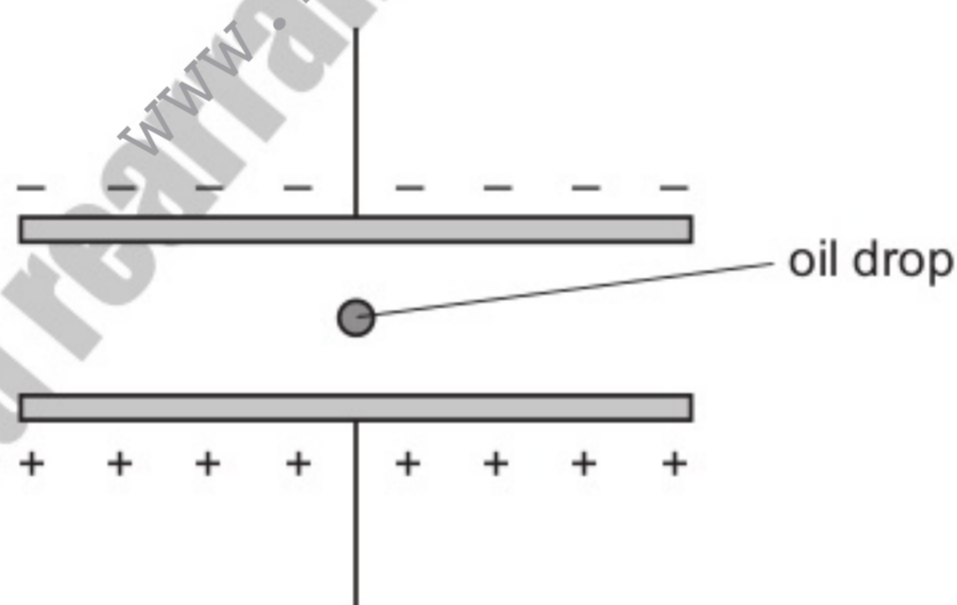
An electron gun injects a beam of electrons horizontally into the field.

Which changes, if any, have occurred to the path and speed of the electrons by the time the beam leaves the field?

	path of electrons	speed of electrons
A	deflected downwards	increased
B	deflected downwards	unchanged
C	deflected upwards	increased
D	deflected upwards	unchanged

29 A very small oil drop of mass m carries a charge $+q$.

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The potential difference across the plates is V and the separation is d .

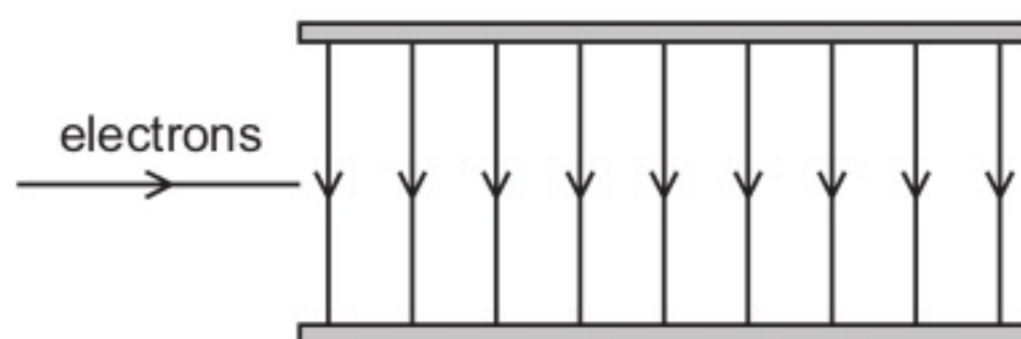
The weight of the drop is balanced by the electric force. (Buoyancy forces may be considered to be negligible.)

Which formula gives the charge on the drop?

- A** $q = \frac{mgd}{V}$ **B** $q = \frac{mgV}{d}$ **C** $q = \frac{Vd}{mg}$ **D** $q = \frac{V}{mgd}$

- 28 Electrons are accelerated and then directed into the uniform electric field between two parallel plates in a vacuum.

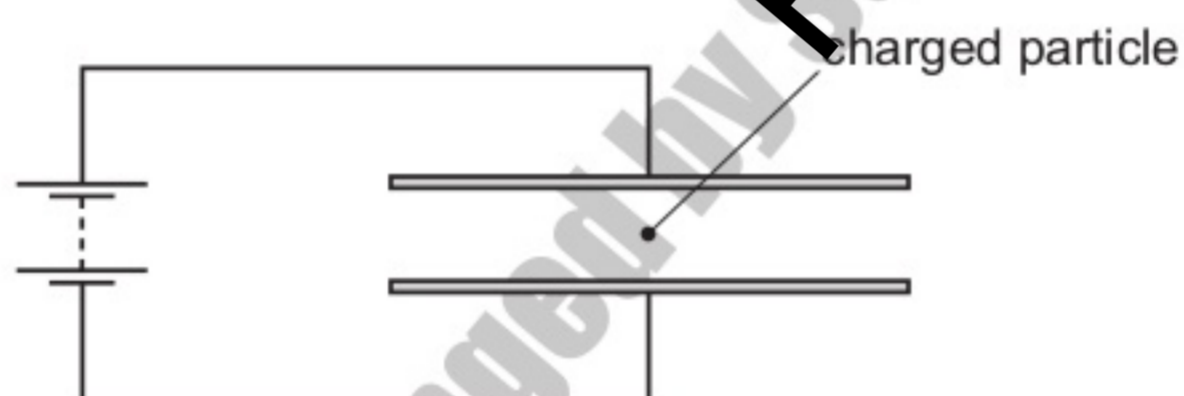
9702/13/O/N/10



What best describes the shape of the path followed by the electrons in the field?

- A a downwards curve along a line that is part of a circle
 B a downwards curve along a line that is **not** part of a circle
 C an upwards curve along a line that is part of a circle
 D an upwards curve along a line that is **not** part of a circle
- 29 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.

9702/13/O/N/10



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 $2F$
- 30 An electron is in an electric field of strength $5 \times 10^4 \text{ V m}^{-1}$. The field is the only influence on the electron.

9702/13/O/N/10

The mass and charge of an electron are known.

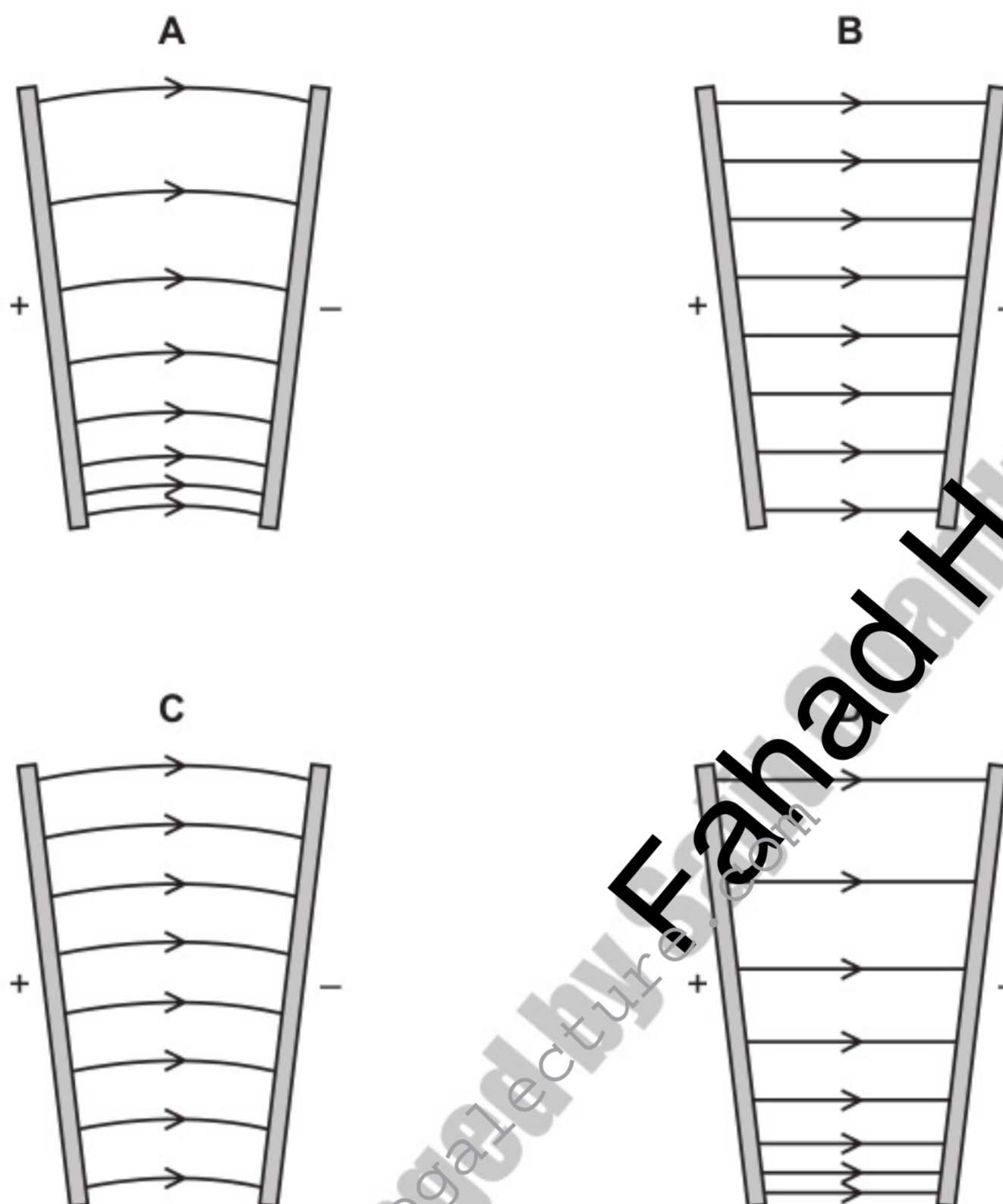
Which quantity can be calculated without any more information?

- A the force on the electron
 B the momentum of the electron
 C the kinetic energy of the electron
 D the speed of the electron

28 A potential difference is applied between two metal plates that are **not** parallel.

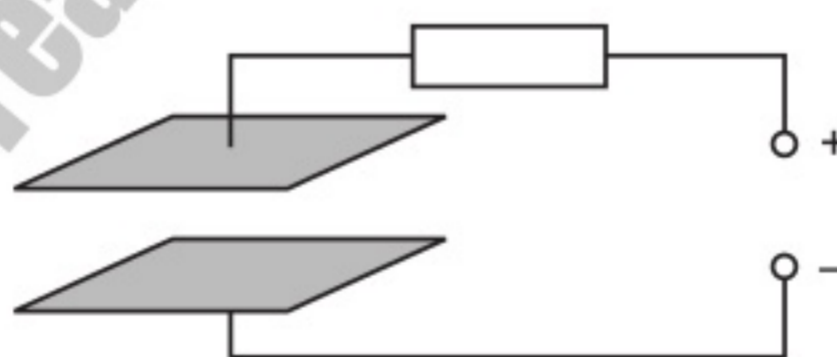
9702/11/M/J/11

Which diagram shows the electric field between the plates?



30 The diagram shows two parallel metal plates connected to a d.c. power supply through a resistor.

9702/12/M/J/11



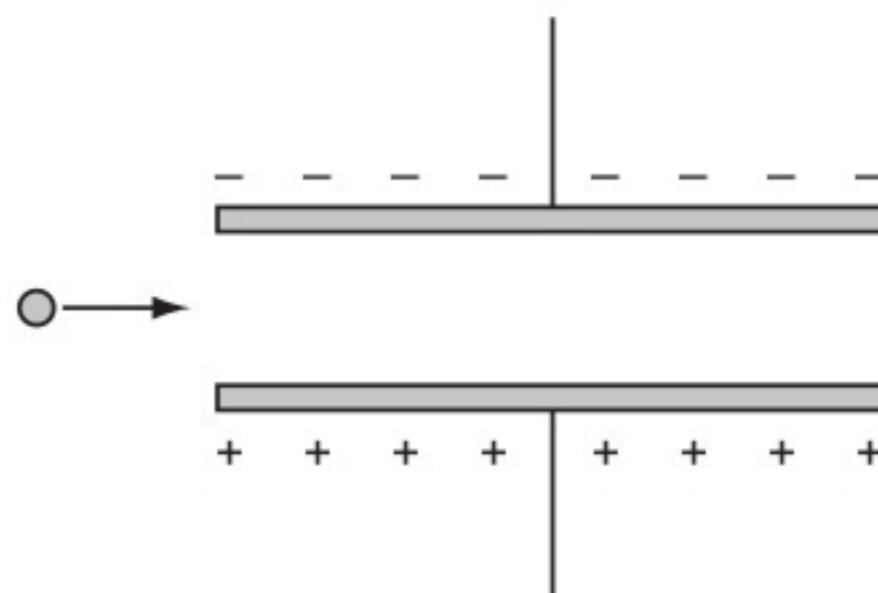
There is a uniform electric field in the region between the plates.

Which change would cause a **decrease** in the strength of the electric field?

- A a small increase in the distance between the plates
- B a small increase in the potential difference between the plates
- C a small increase in the value of the resistor
- D a small increase to the area of both plates

- 29 The diagram shows a charged particle as it approaches a pair of charged parallel plates in a vacuum.

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Which row describes the horizontal and vertical components of its motion as it travels between the plates?

	horizontal component	vertical component
A	constant acceleration	constant acceleration
B	constant acceleration	constant velocity
C	constant velocity	constant acceleration
D	constant velocity	constant velocity

- 30 Two parallel plates, a distance 25 mm apart, have a potential difference between them of 12 kV.

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What is the force on an electron when it is in the uniform electric field between the plates?

- A** 4.8×10^{-20} N
- B** 7.7×10^{-20} N
- C** 4.8×10^{-17} N
- D** 7.7×10^{-14} N

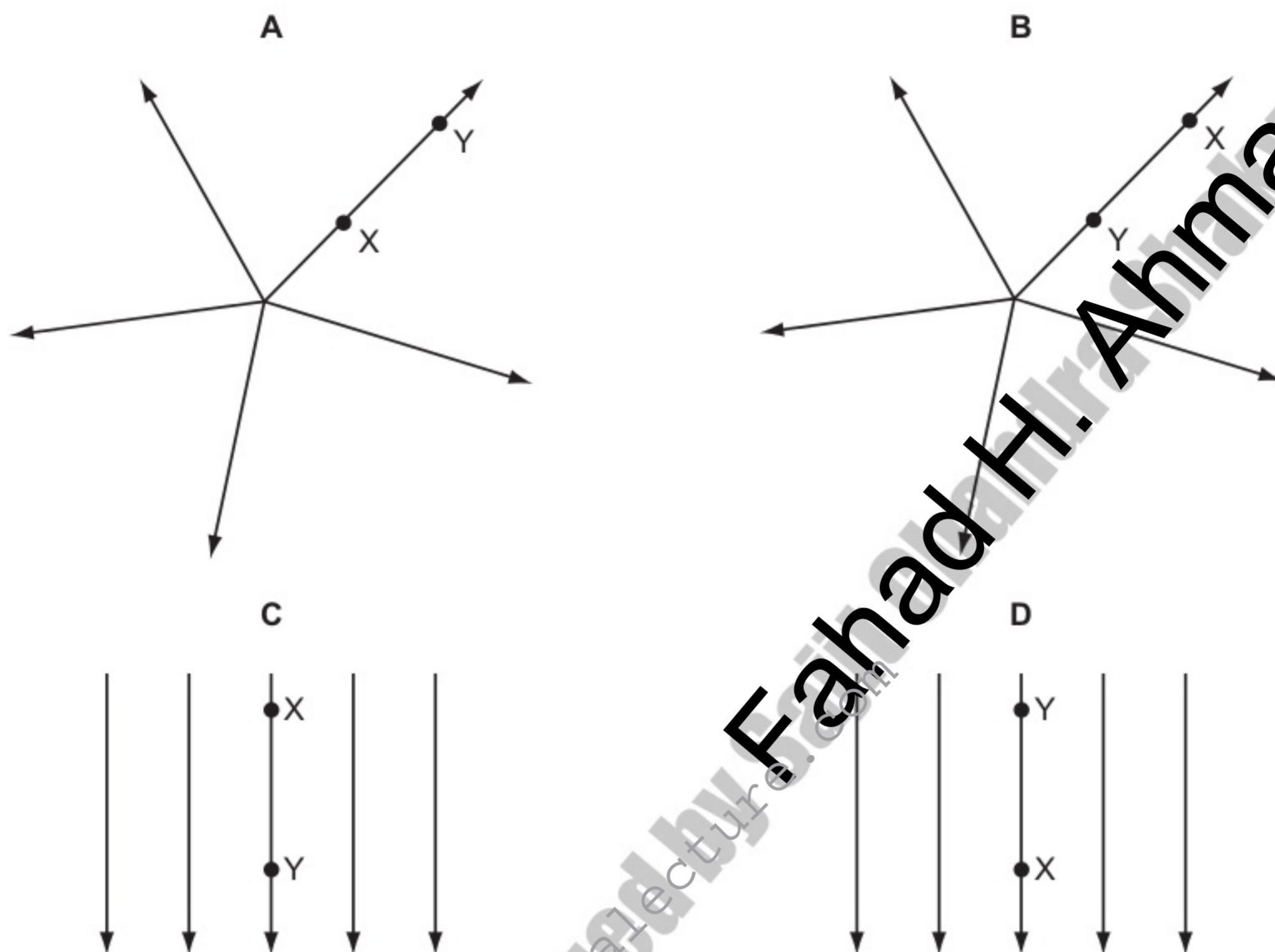
- 31 A battery is marked 9.0V.

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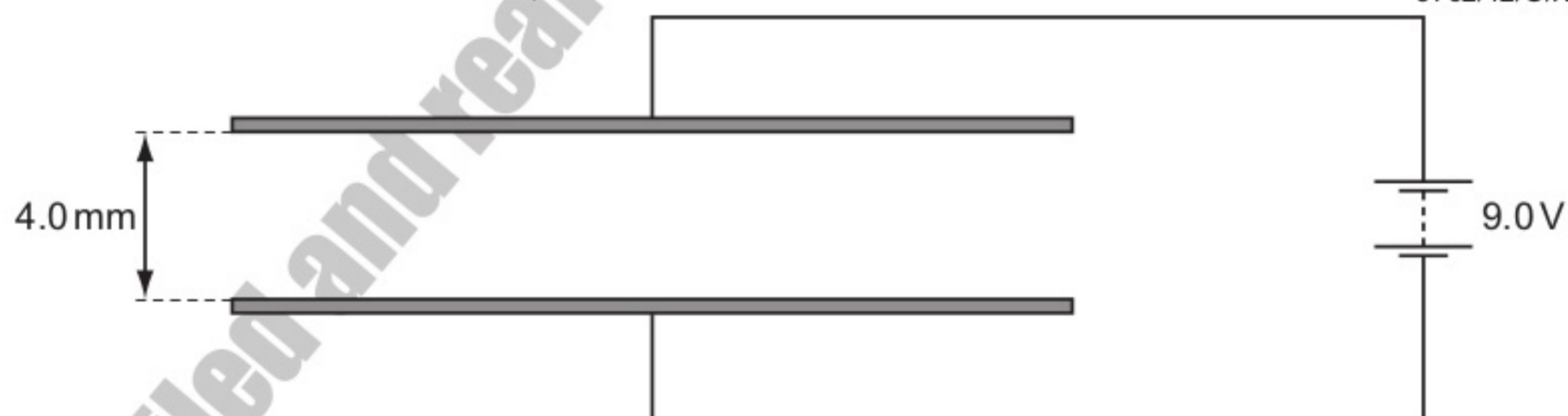
What does this mean?

- A** Each coulomb of charge from the battery supplies 9.0J of electrical energy to the whole circuit.
- B** The battery supplies 9.0J to an external circuit for each coulomb of charge.
- C** The potential difference across any component connected to the battery will be 9.0V.
- D** There will always be 9.0V across the battery terminals.

- 31 In each electric field diagram, a positively charged particle is moved from X to Y. 9702/12/M/J/11
- In which diagram would the particle experience an increasing repulsive force?



- 29 The diagram shows a pair of parallel metal plates 4.0mm apart connected to a 9.0V battery. 9702/12/O/N/11



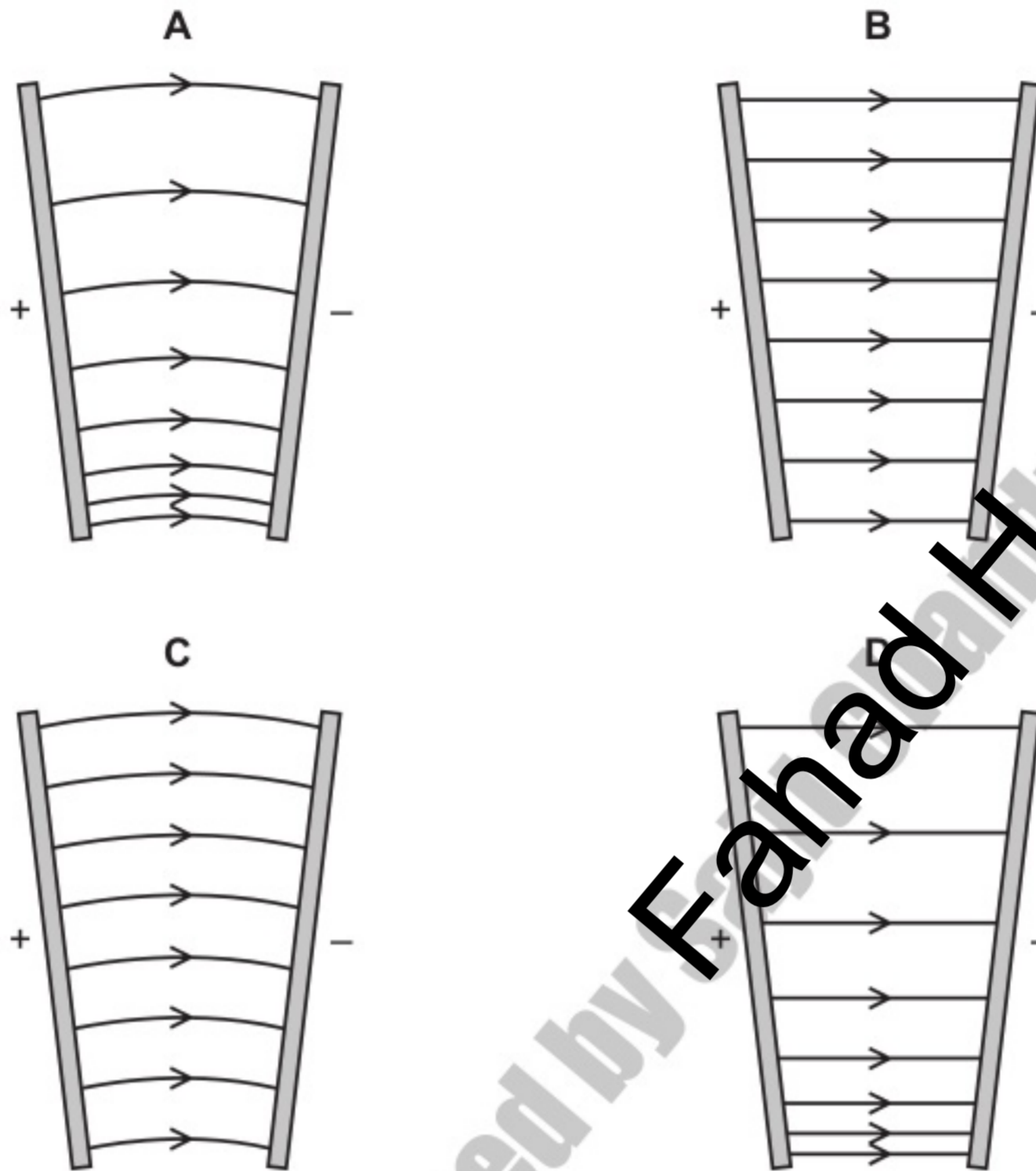
What is the electric field strength between the plates?

- A $4.4 \times 10^{-4} \text{ NC}^{-1}$
- B $3.6 \times 10^{-2} \text{ NC}^{-1}$
- C 36 NC^{-1}
- D $2.3 \times 10^3 \text{ NC}^{-1}$

29 A potential difference is applied between two metal plates that are **not** parallel.

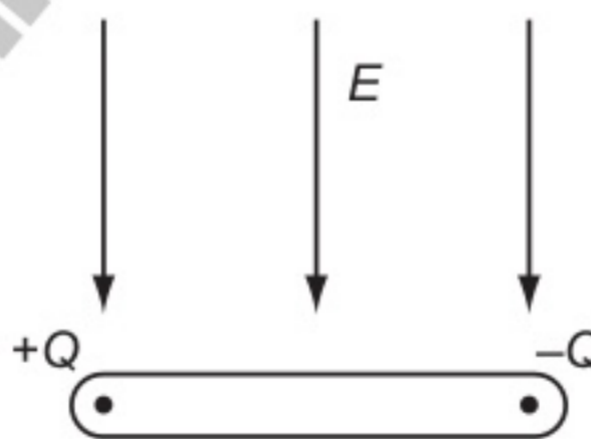
9702/13/M/J/11

Which diagram shows the electric field between the plates?



32 The diagram shows an insulating rod with equal and opposite point charges at each end. An electric field of strength E acts on the rod in a downwards direction.

9702/11/O/N/11



Which row is correct?

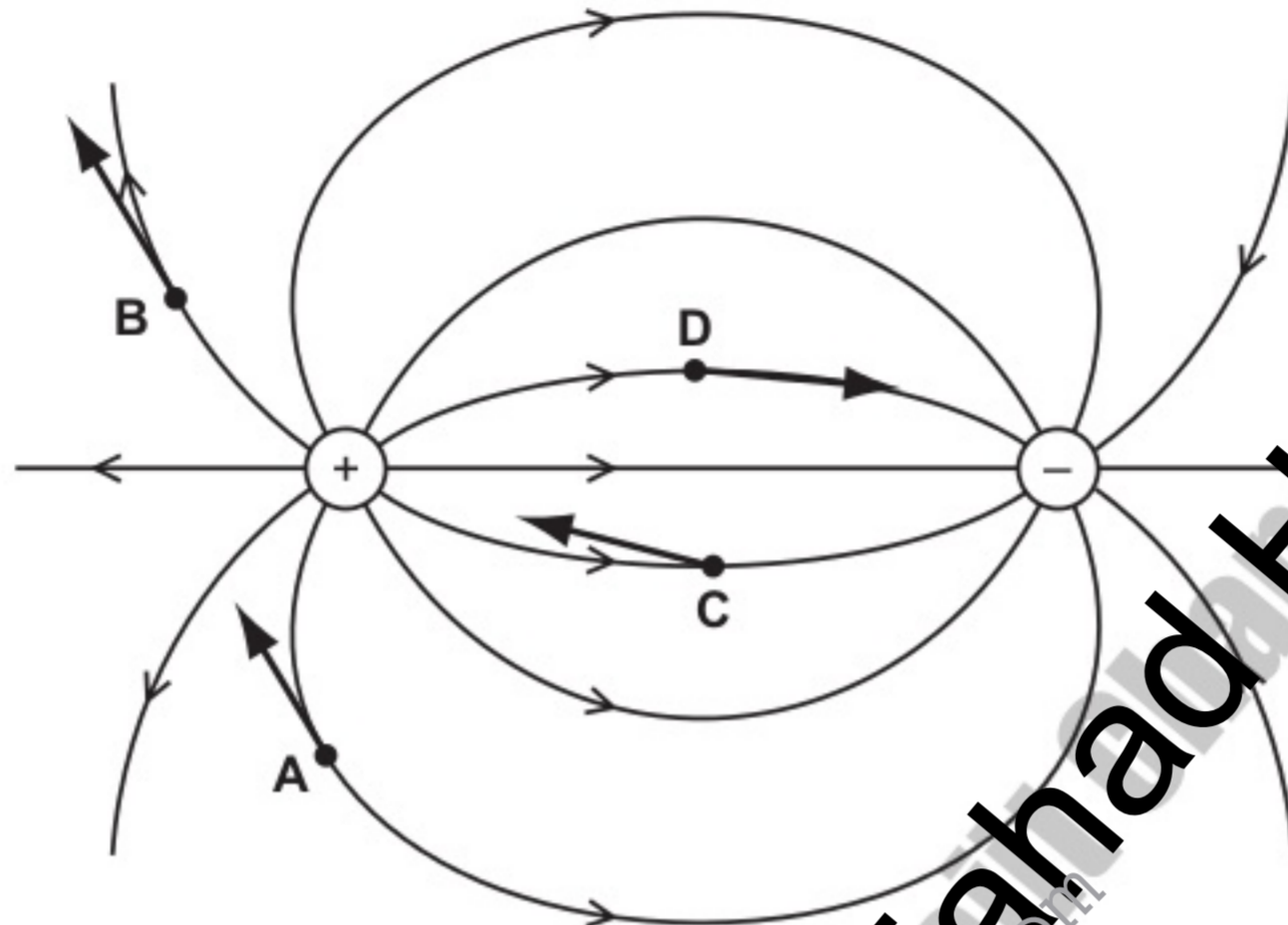
	resultant force	resultant torque
A	zero	clockwise
B	downwards	clockwise
C	zero	anti-clockwise
D	downwards	anti-clockwise

31 The diagram shows a non-uniform electric field near a positively charged and a negatively charged sphere.

9702/12/O/N/11

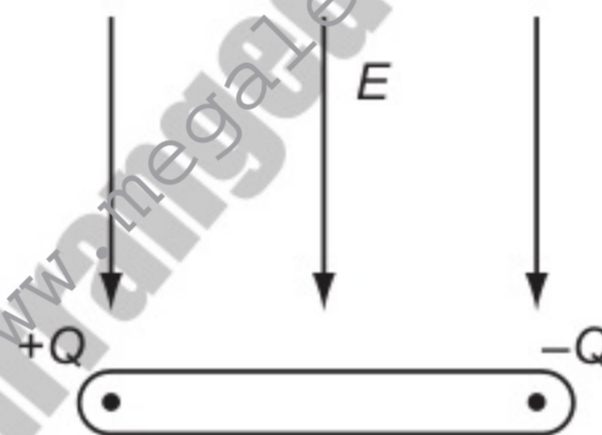
Four electrons, **A**, **B**, **C** and **D**, are shown at different positions in the field.

On which electron is the direction of the force on the electron shown correctly?



31 The diagram shows an insulating rod with equal and opposite point charges at each end. An electric field of strength E acts on the rod in a downwards direction.

9702/13/O/N/11

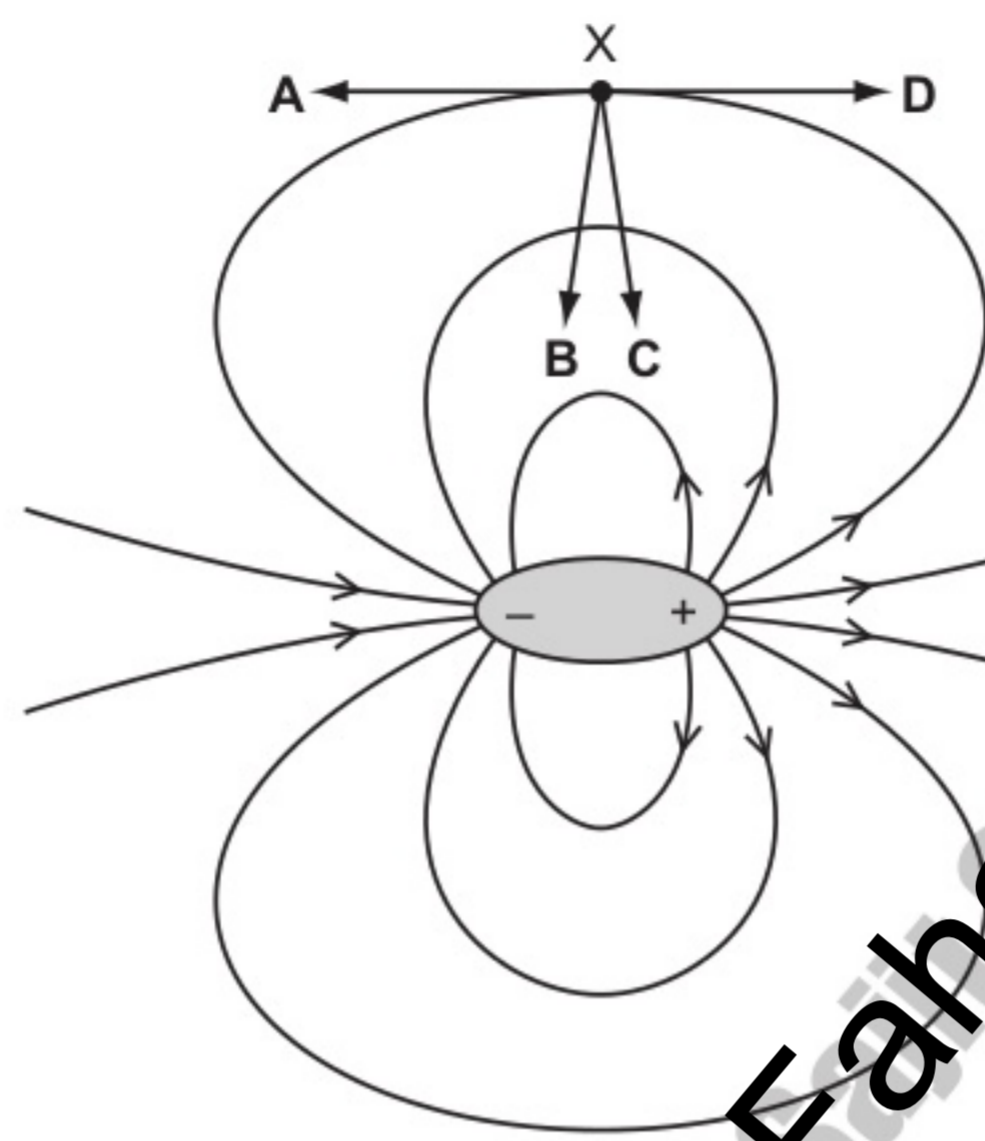


Which row is correct?

	resultant force	resultant torque
A	zero	clockwise
B	downwards	clockwise
C	zero	anti-clockwise
D	downwards	anti-clockwise

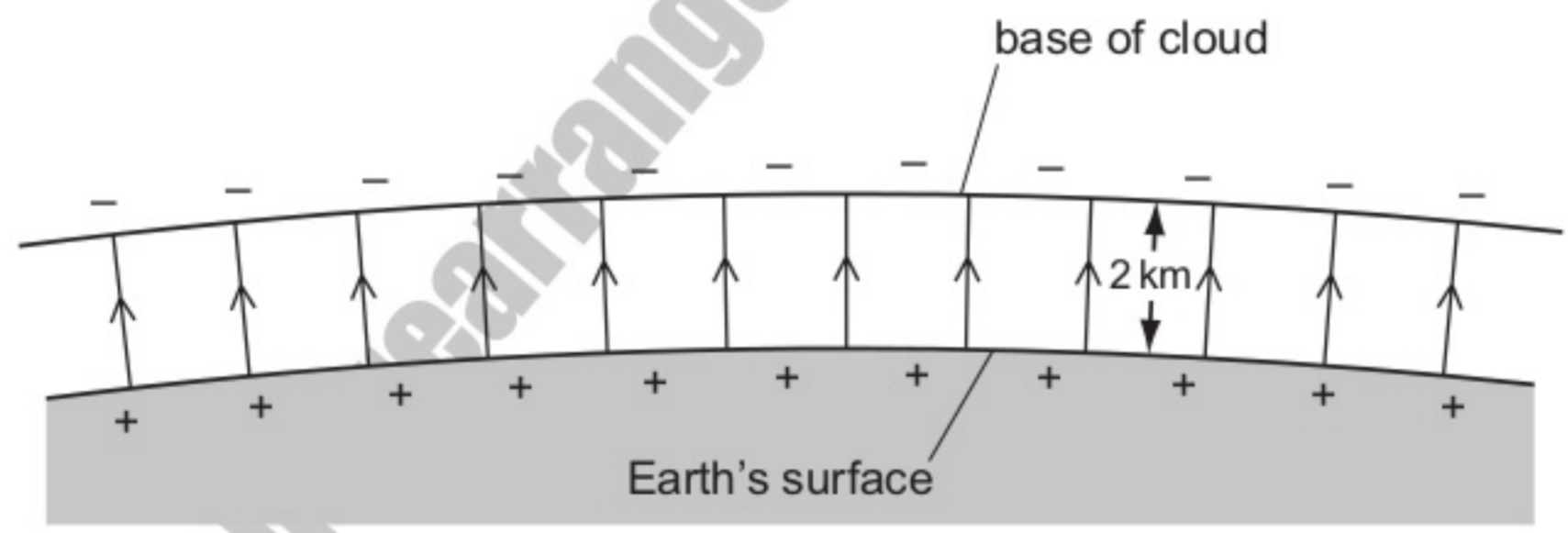
31 A dipole is a pair of one negative charge and one positive charge of equal magnitude. The electric field of a dipole is shown below. 9702/11/M/J/12

In which direction does the force act on an electron when at point X?



Fahad H. Ahmad

32 Lightning can occur between a charged cloud and the Earth's surface when the electric field strength in the intervening atmosphere reaches 25 kNC^{-1} . The diagram shows the electric field between the base of a cloud and the Earth's surface. 9702/11/M/J/12

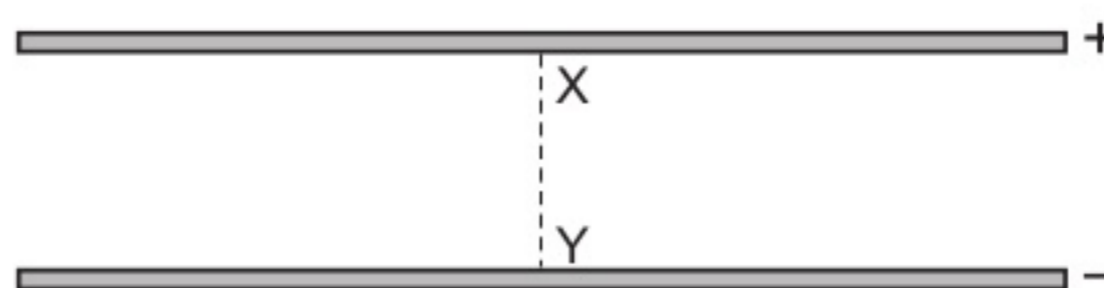


What is the minimum potential difference between the Earth and the base of a cloud, 2 km high, for lightning to occur?

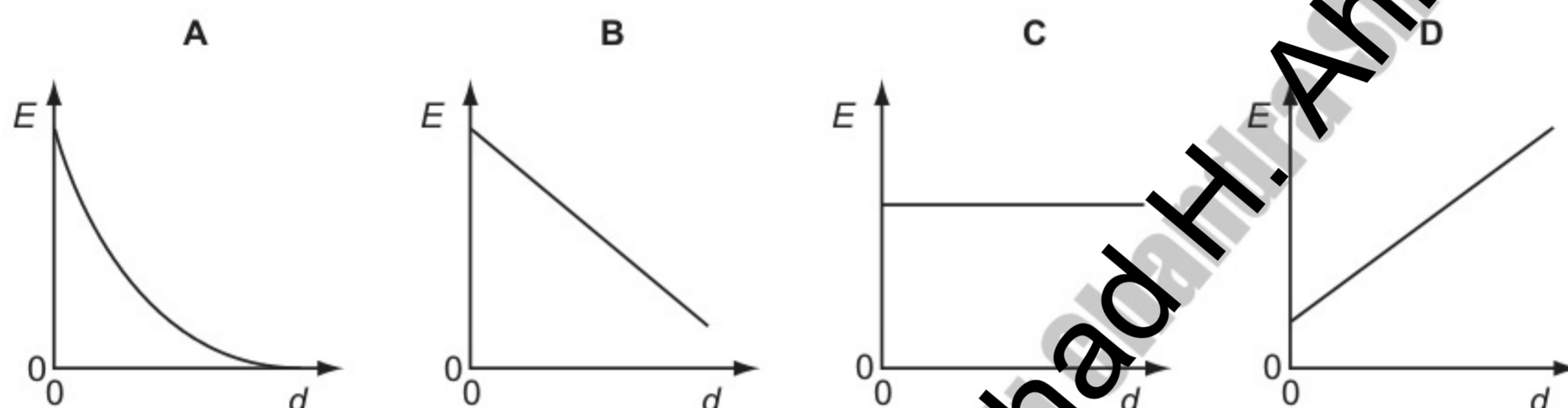
- A** 12.5MV **B** 25MV **C** 50MV **D** 100MV

31 An electric field exists in the space between two charged metal plates.

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Which graph shows the variation of electric field strength E with distance d from X along the line XY ?



32 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.

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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

31 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.

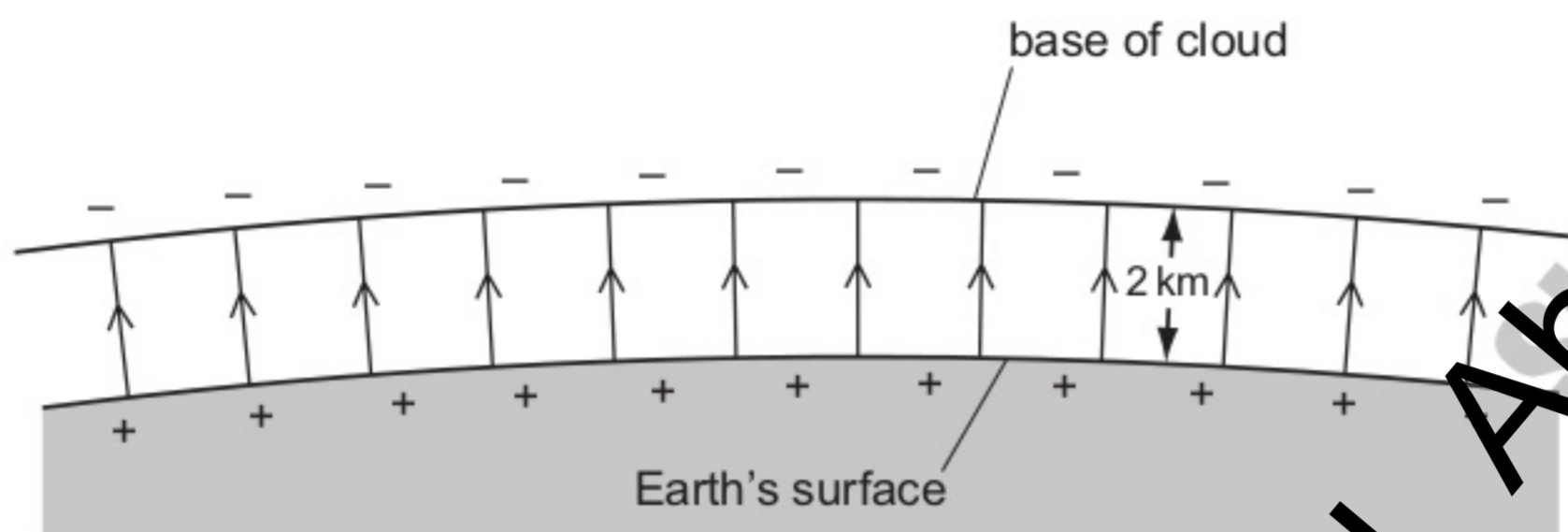
9702/11/O/N/11

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

33 Lightning can occur between a charged cloud and the Earth's surface when the electric field strength in the intervening atmosphere reaches 25 kNC^{-1} . The diagram shows the electric field between the base of a cloud and the Earth's surface.

9702/13/M/J/12



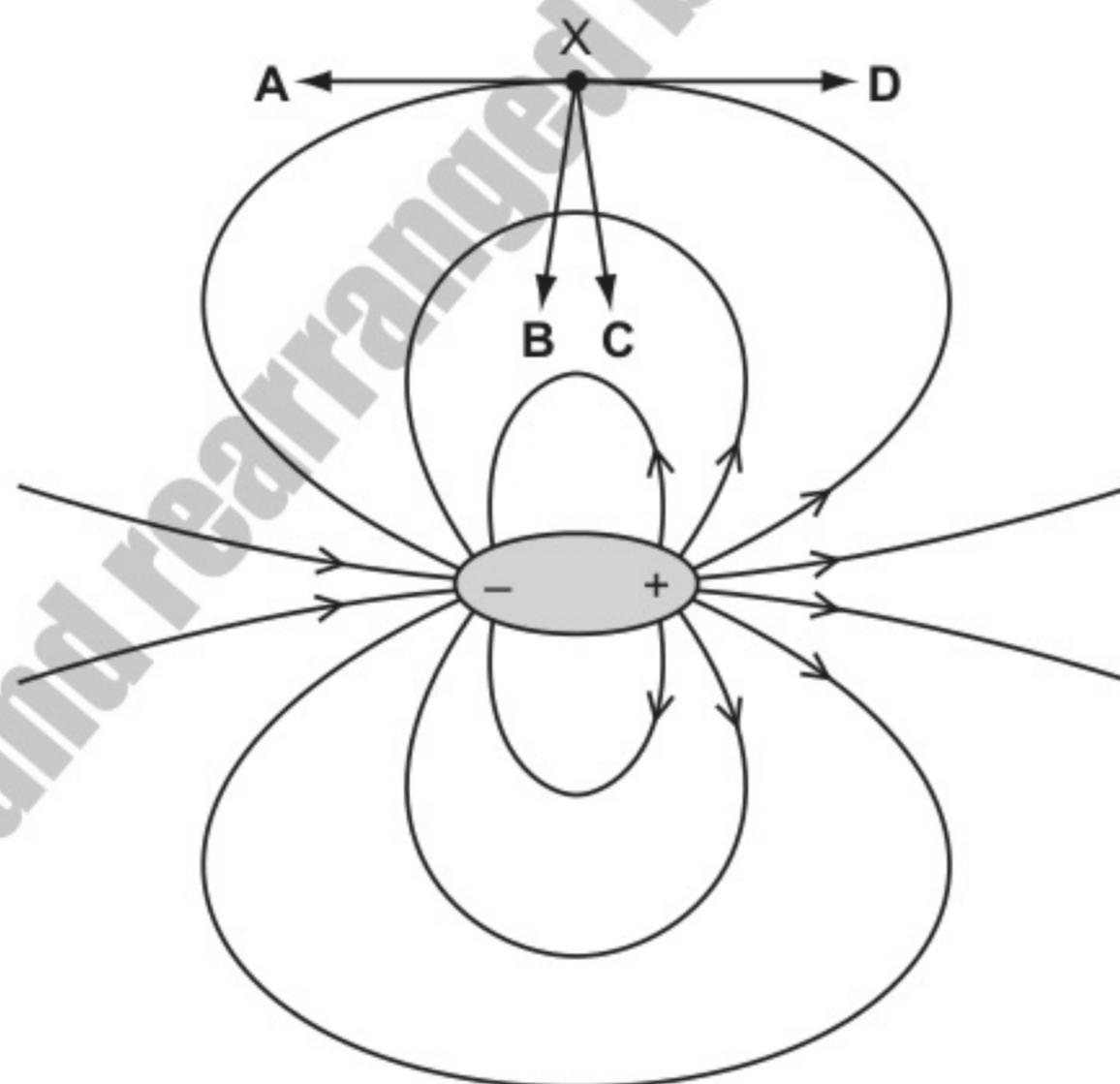
What is the minimum potential difference between the Earth and the base of a cloud, 2 km high, for lightning to occur?

- A 12.5MV B 25MV C 50MV D 100MV

31 A dipole is a pair of one negative charge and one positive charge of equal magnitude. The electric field of a dipole is shown below.

9702/13/M/J/12

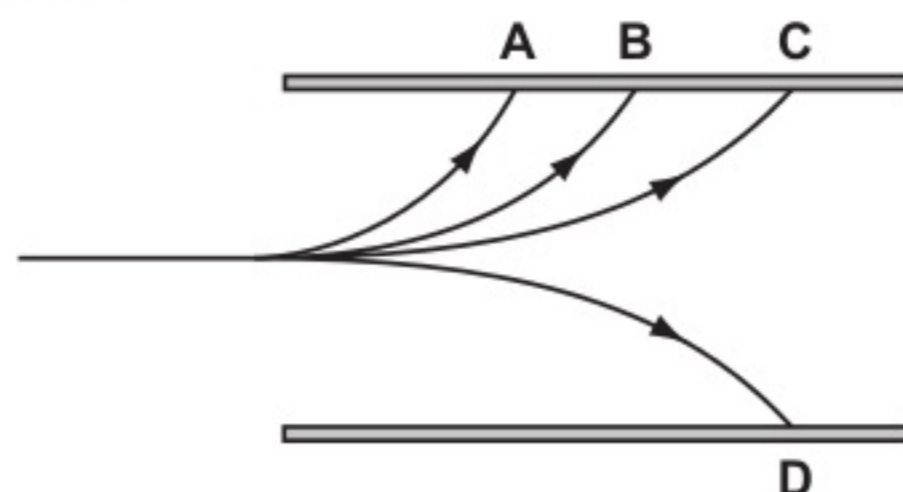
In which direction does the force act on an electron when at point X?



33 A single proton travelling with a constant horizontal velocity enters a uniform electric field between two parallel charged plates. In the diagram, **B** shows the path taken by the proton.

Which path is taken by a helium nucleus that enters the electric field at the same point and with the same velocity as the proton?

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32 A charged particle moves in a uniform electric field between two parallel metal plates.

To calculate the force acting on the particle due to the electric field, which quantity is **not** required?

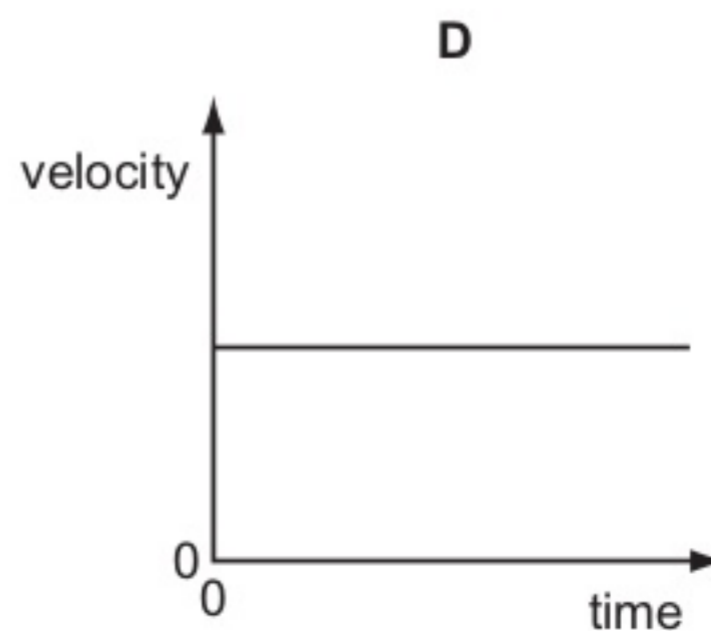
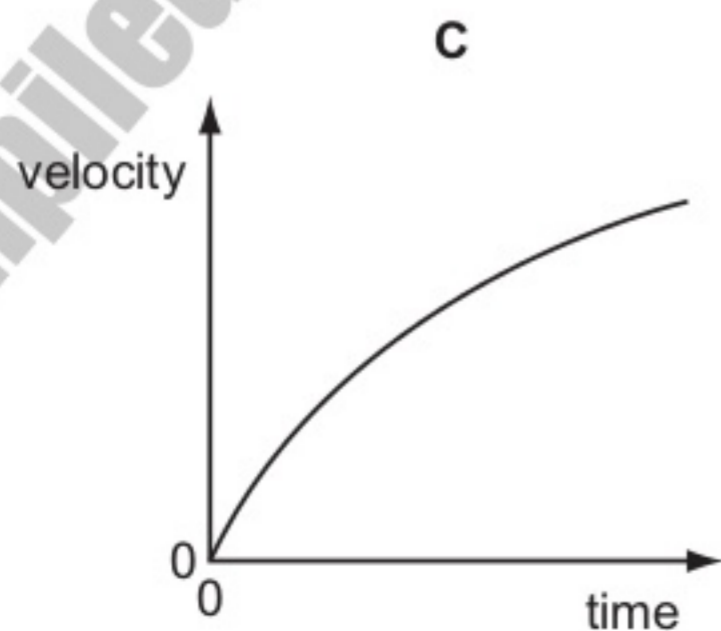
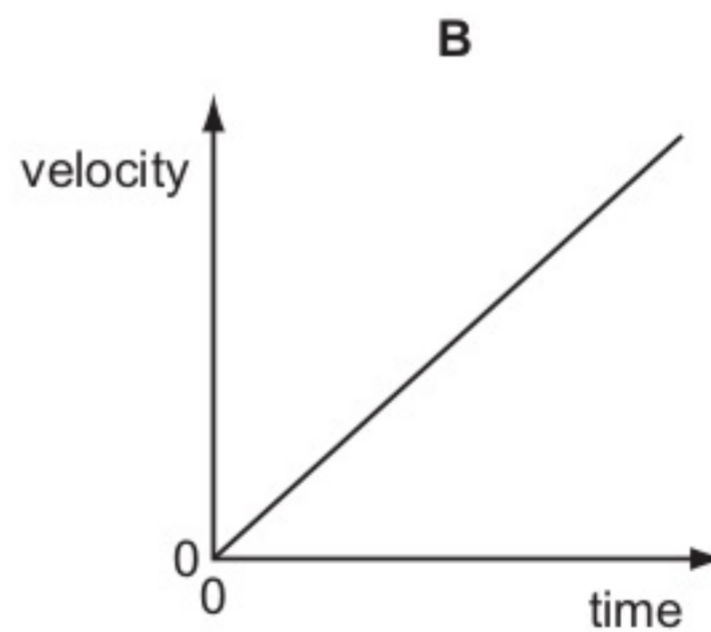
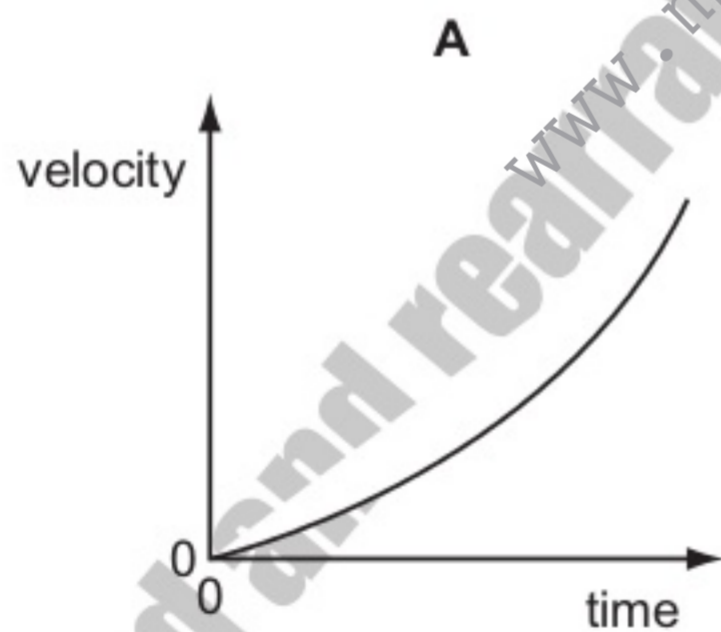
- A** particle charge
- B** particle speed
- C** plate separation
- D** potential difference between the plates

9702/12/O/N/12

30 An electron is initially at rest in a uniform electric field.

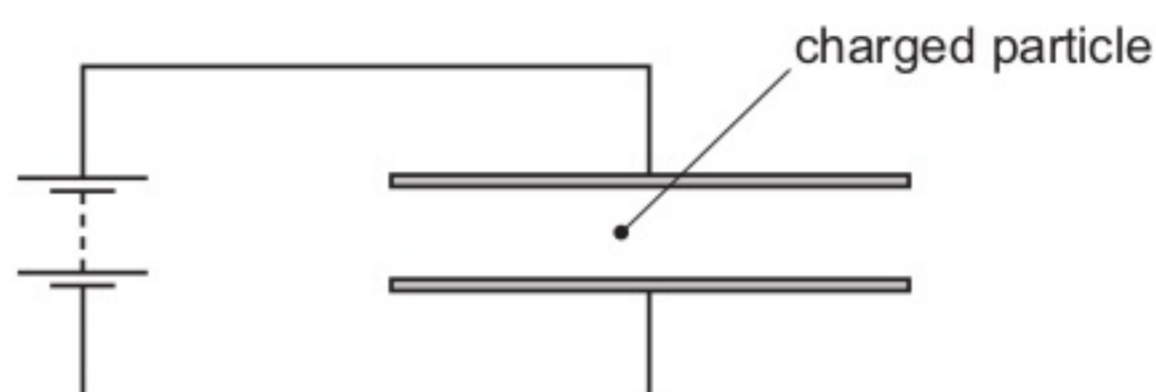
9702/11/O/N/12

Which graph shows the variation with time of the velocity of the electron?



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

9702/11/O/N/12



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

The separation of the plates is doubled.

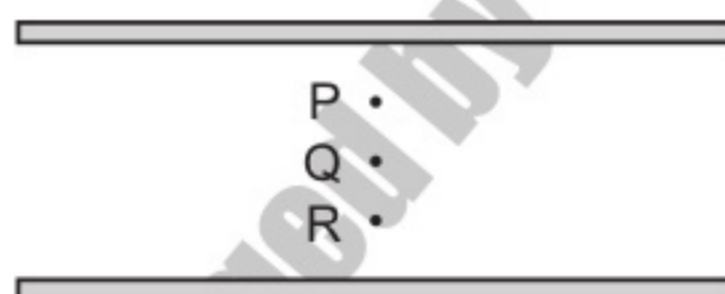
What will be the new force on the particle?

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

- 30 The diagram shows two parallel plates.

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The plates are charged so that there is an electric field between them. P, Q and R are points which are $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of the distance from the top plate to the bottom plate.



What is the electric field strength at point P?

- A the same as that at point Q
 B twice that at point R
 C half that at point R
 D one third that at point Q

- 31 A positive charge of $2.6 \times 10^{-8} \text{ C}$ is in an electric field of constant field strength $300\,000 \text{ V m}^{-1}$.

How much work must be done on the charge in order to move it a distance of 4.0 mm in the opposite direction to the direction of the field?

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- A $3.1 \times 10^{-5} \text{ J}$
 B $2.0 \times 10^{-3} \text{ J}$
 C $3.1 \times 10^{-2} \text{ J}$
 D 2.0 J