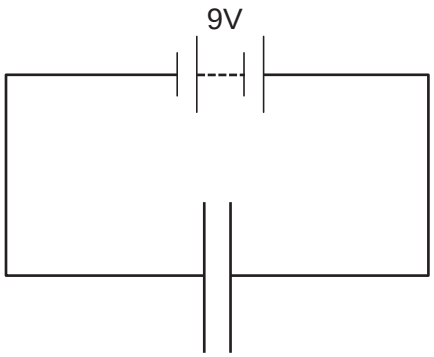
Electric Fields

TOPIC QUESTIONS (1)

Level	A Level
Subject	Physics
Exam Board	CIE
Paper Type	Multiple Choice

Time Allowed : 50min

1. In the circuit below, the distance between the two parallel plates is 2.0×10^{-3} m. An electron is situated between the plates.



What is the force on the electron?

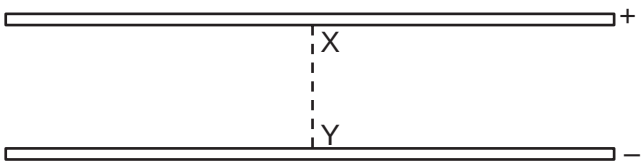
A 3.2×10^{-22} N

B 2.9×10^{-21} N

C 8.9×10^{-18} N

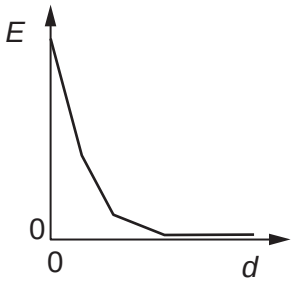
D 7.2×10^{-16} N

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

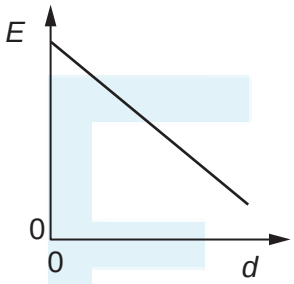


Which of the following graphs shows the variation of electric field strength *E* with distance *d* from X along the line XY?

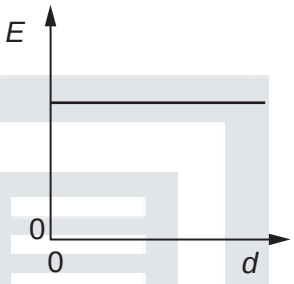
A



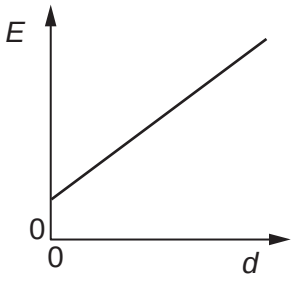
B



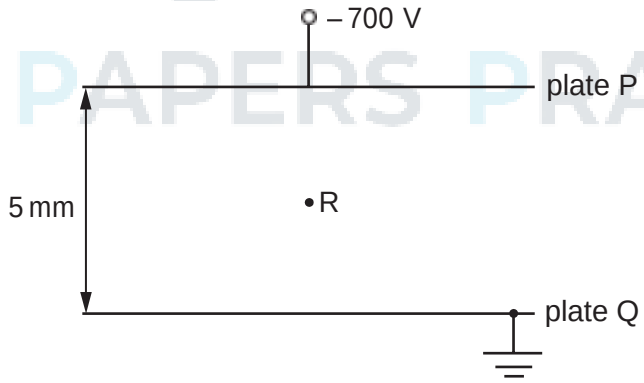
C



D



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



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

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

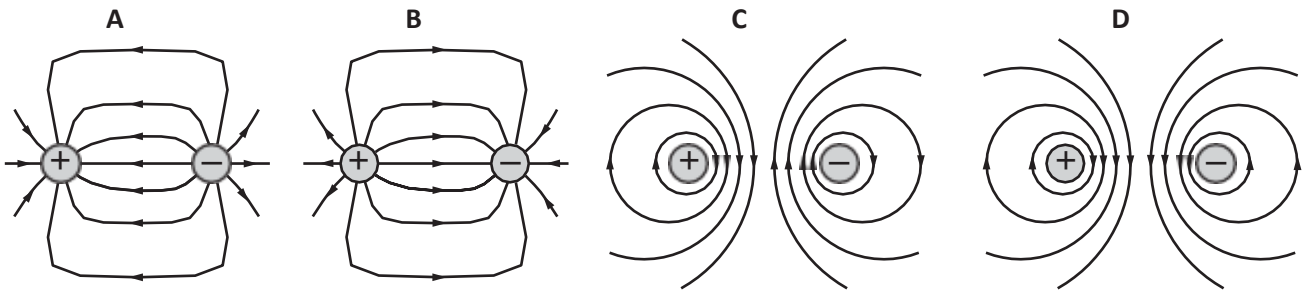
B $1.4 \times 10^{2}\ N\ C^{-1}$ from Q towards P

C $1.4 \times 10^{5}\ N\ C^{-1}$ from P towards Q

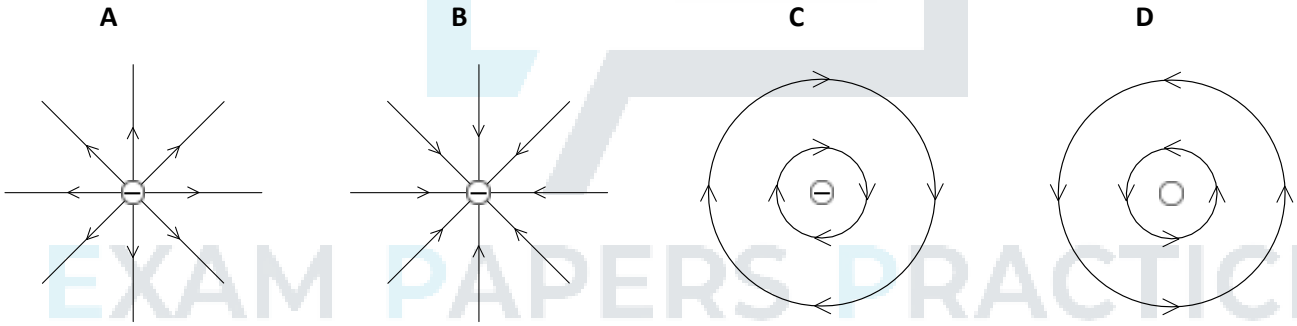
D $1.4 \times 10^{5}\ N\ C^{-1}$ from Q towards P

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

   Which diagram best represents the associated electric field?



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



6. 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?

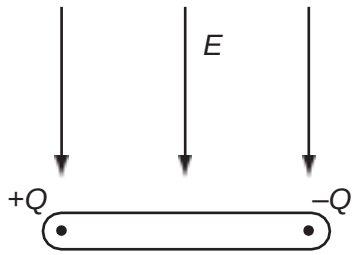
   a. $1.0 \times 10^4\,\text{V m}^{-1}$ downwards

   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

7. 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.



Which row is correct?

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

8. The diagram shows a pair of parallel metal plates 4.0 mm apart connected to a 9.0 V battery.

What is the electric field strength between the plates?

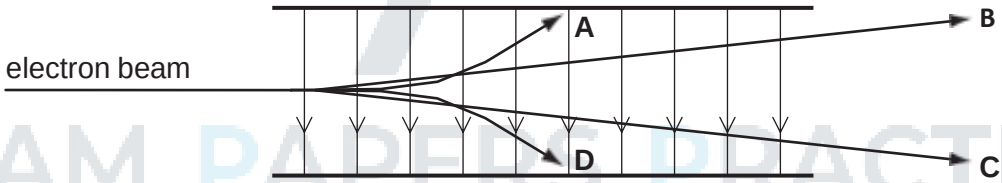
A $4.4 \times 10^{-4}\,\text{N C}^{-1}$

B $3.6 \times 10^{-2}\,\text{N C}^{-1}$

C $36\,\text{N C}^{-1}$

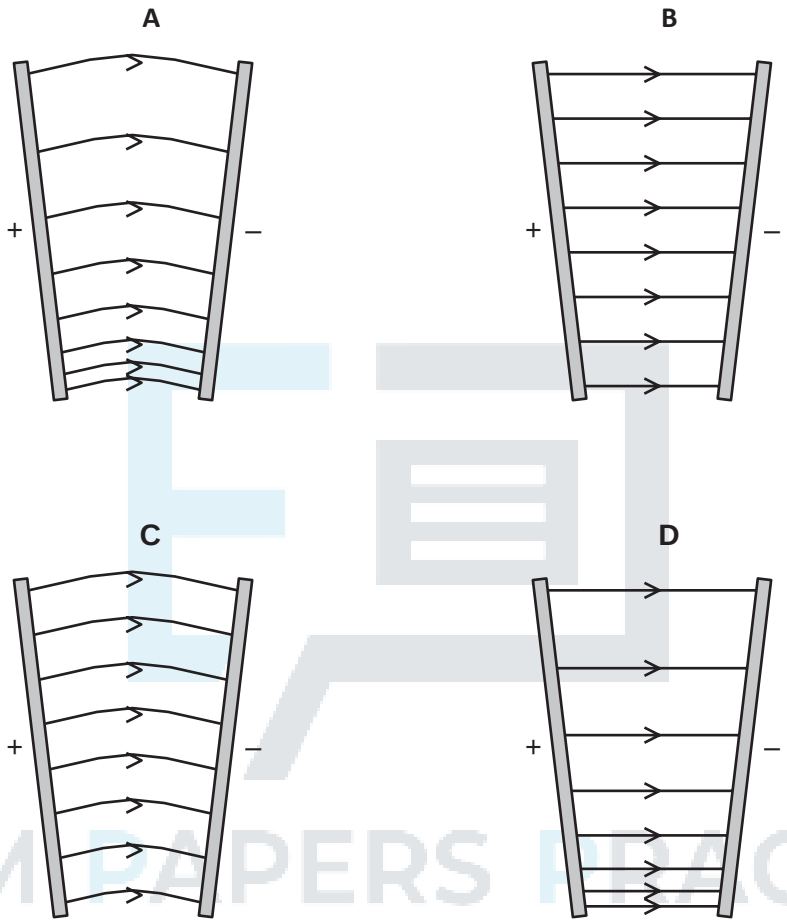
D $2.3 \times 10^{3}\,\text{N C}^{-1}$

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

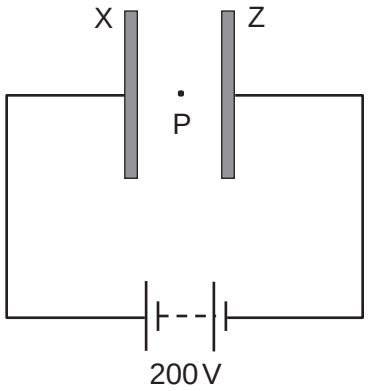


10. A potential difference is applied between two metal plates that are not parallel.

Which diagram shows the electric field between the plates?



11. 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.



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 6.4×10^{-15} N

B 6.4×10^{-18} N

C 1.6×10^{-19} N

D 4.0×10^{-24} N

12. The diagram shows a pair of metal plates 4.0 mm apart connected to a 9.0 V battery.

What is the electric field between the plates?

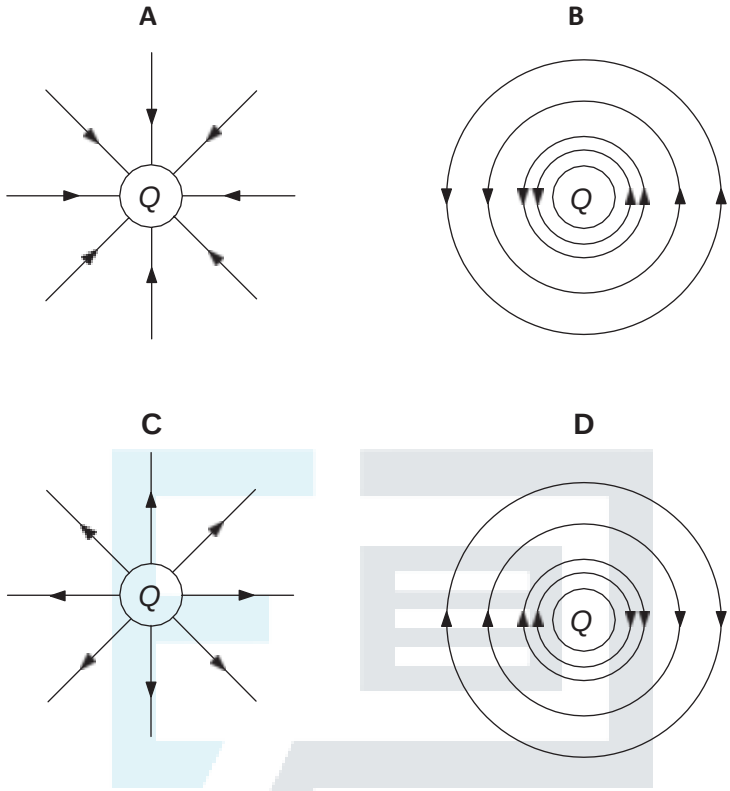
A 4.4×10^{-4} N C^{-1}

B 3.6×10^{-2} N C^{-1}

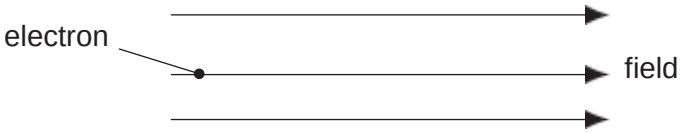
C 36 N C^{-1}

D 2.3×10^{3} N C^{-1}

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



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



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

A downwards

B to the left

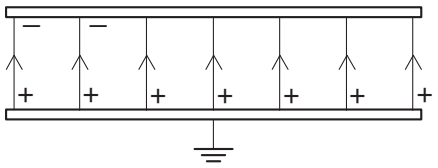
C to the right

D upwards

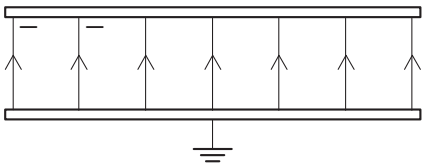
15. Two parallel, conducting plates with air between them are placed close to one another. The top plate is given a negative charge and the bottom one is earthed.

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

A



B



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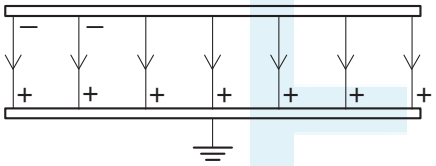
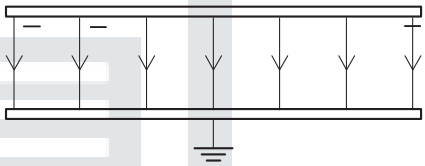
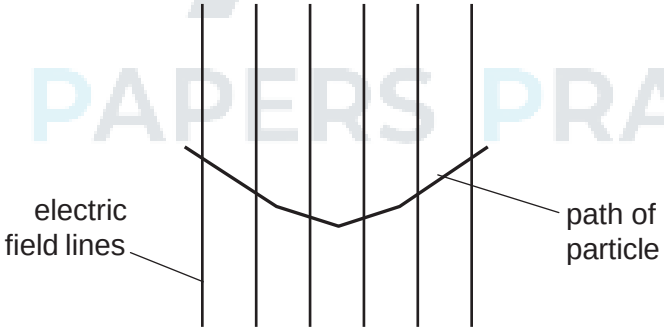


D



16. 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

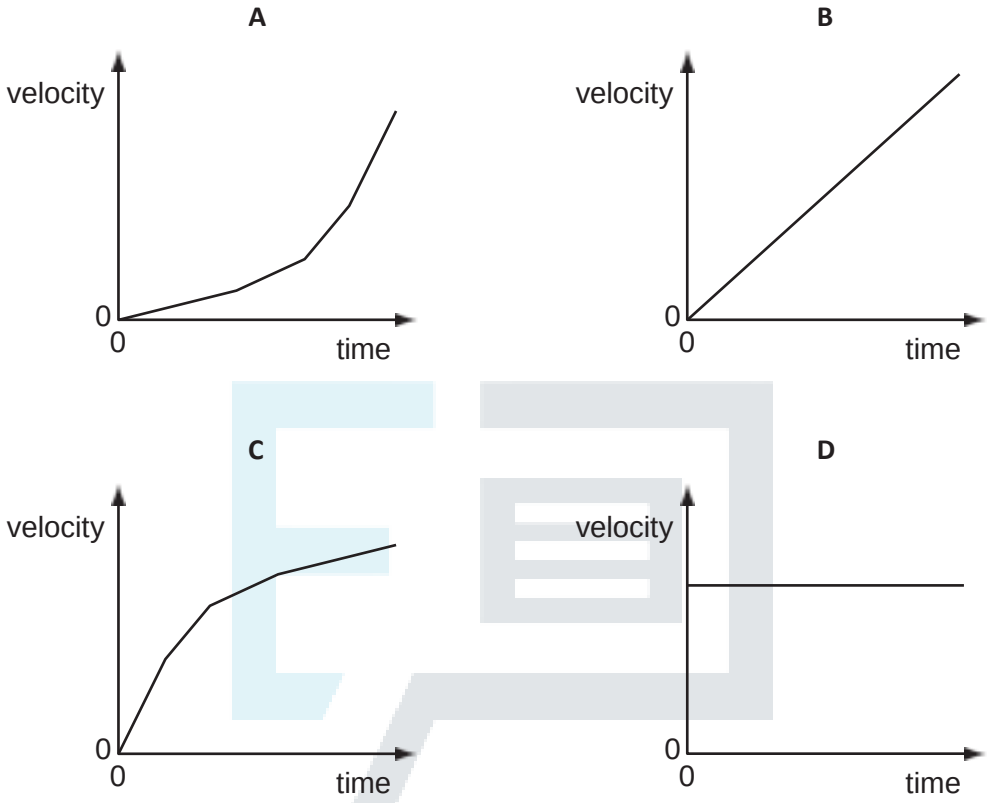
B a positive charge travelling right to left in a field directed downwards

C a negative charge travelling right to left in a field directed upwards

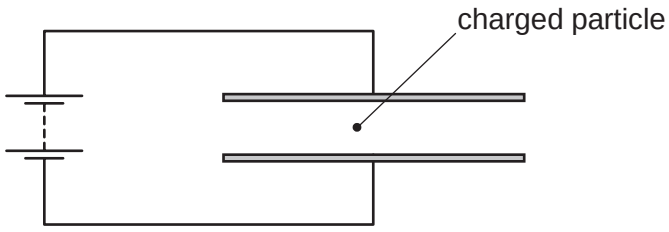
D a negative charge travelling left to right in a field directed downwards

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

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



18. 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 $2F$

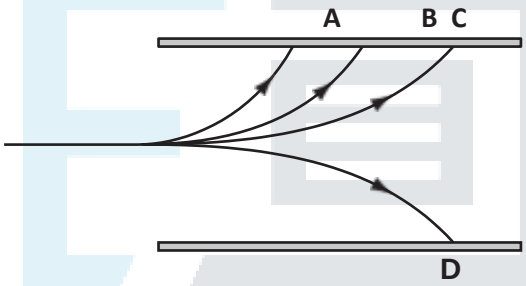
19. A charged particle moves in a uniform electric field between two parallel metal plates.

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

20. 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?



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

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

A downwards into the paper

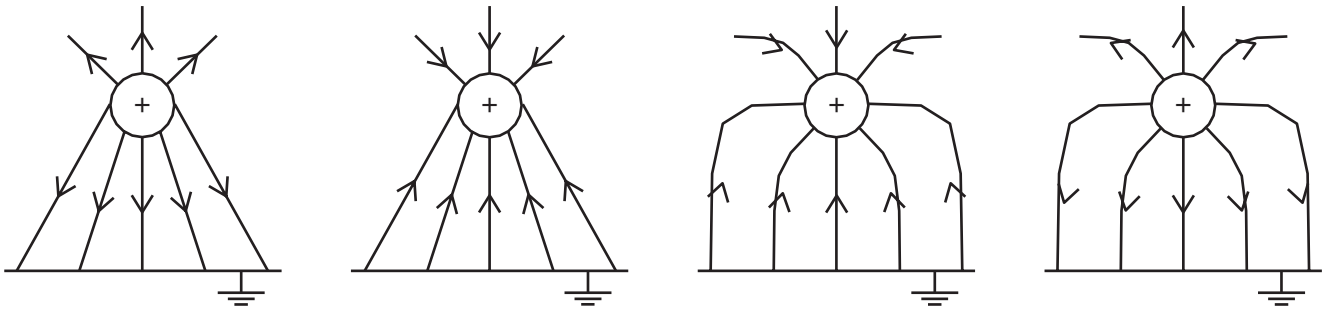
B upwards out of the paper

C to the left

D to the right

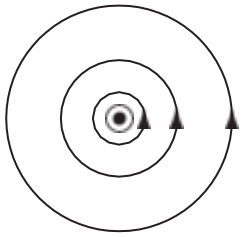
22. Which diagram shows the electric field between a positively charged metal sphere and an earthed metal plate?

A **B**

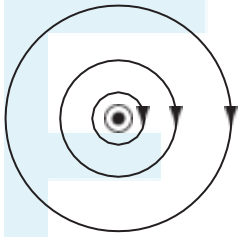


23. Which diagram represents the electric field of a negative point charge, shown by • ?

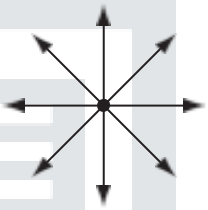
A



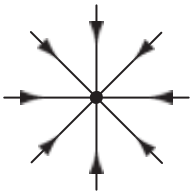
B



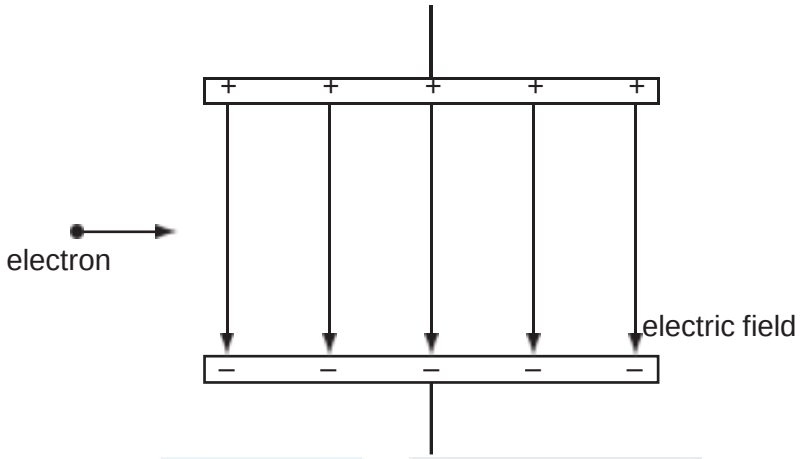
C



D



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



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

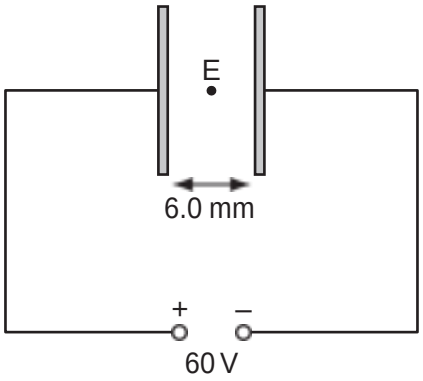
25. The electric field strength between a pair of parallel plates is *E*. The separation of the plates is doubled and the potential difference between the plates is increased by a factor of four.

What is the new electric field strength?

A *E* B 2*E* C 4*E* D 8*E*

26. Two vertical conducting plates X and Y are positioned so that they are separated by a distance of 6.0 mm in air. A 60 V d.c. supply is connected as shown.

plate X plate Y



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

A 1.0×10^4 V m^{-1} towards X

B 1.0×10^4 V m^{-1} towards Y

C 2.0×10^4 V m^{-1} towards X

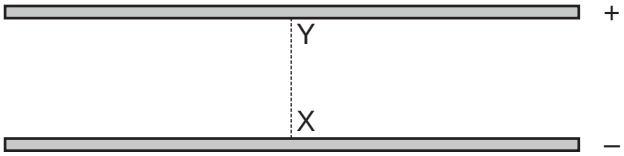
D 2.0×10^4 V m^{-1} towards Y

27. Two parallel metal plates have a potential difference between them of 12 V. The distance between the plates is 1.0 mm.

What are the electric field strength between the plates and the work done on a charge of +3.9 μC to move the charge from the negative plate to the positive plate?

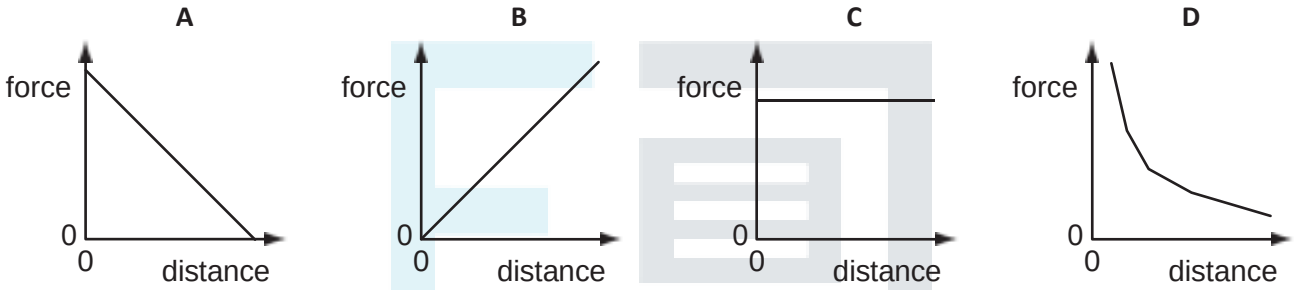
	electric field strength / N C^{-1}	work done / J
A	12	4.7×10^{-5}
B	12	47
C	12 000	4.7×10^{-5}
D	12 000	47

28. Two charged parallel metal plates produce an electric field.



A charged particle moves from X to Y.

Which graph shows the variation of the force on the particle with distance from X along the line XY?



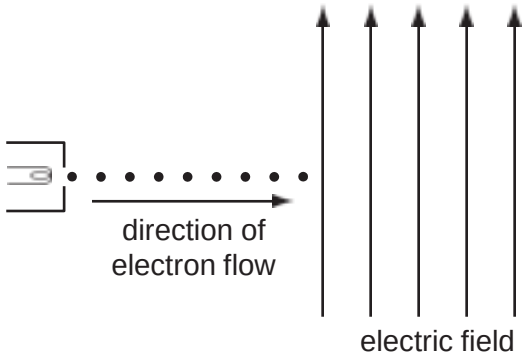
29. A small charge q is placed in the electric field of a large charge Q.

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 $\frac{F}{q}$

30. The diagram shows a vertical uniform electric field in a vacuum.



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?

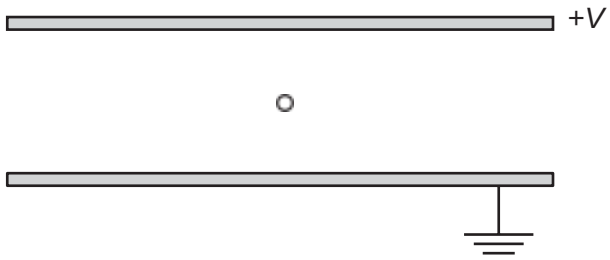
	path of electrons	speed of electrons
A	deflected downwards	increased
B	deflected downwards	unchanged
C	deflected upwards	increased
D	deflected upwards	unchanged

31. A small charge q is placed in the electric field of a large charge Q. 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 $\frac{F}{q}$

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



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

33. The electric field at a certain distance from an isolated alpha particle is 3.0×10^{7} N C^{-1}.

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

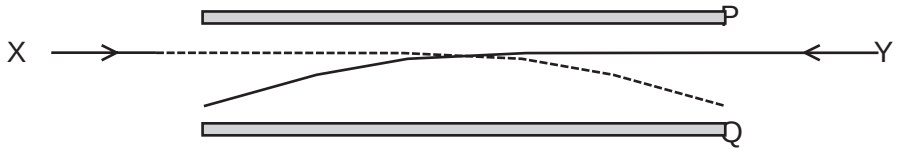
A 4.8×10^{-12} N

B 9.6×10^{-12} N

C 3.0×10^{7} N

D 6.0×10^{7} N

34. 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.



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	+	+

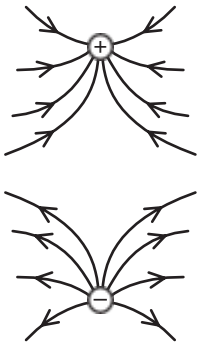
35. There is a potential difference between a pair of parallel plates.

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

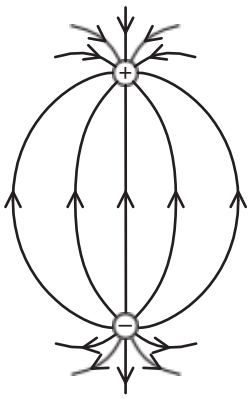
	potential difference	separation
A	$2V$	$2d$
B	$2V$	$\frac{d}{2}$
C	$\frac{V}{2}$	$2d$
D	$\frac{V}{2}$	$\frac{d}{2}$

36. Which diagram best represents the electric field between two point charges of equal magnitudeand opposite sign?

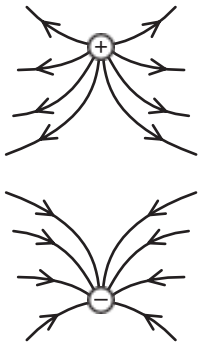
A



B



C



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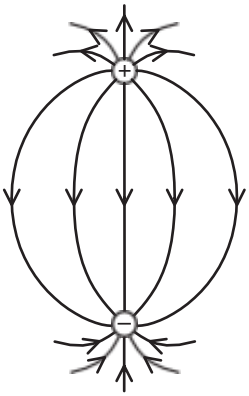
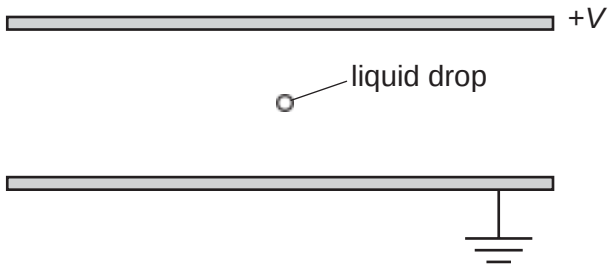


37. The diagram shows two parallel horizontal metal plates. There is a potential difference *V* betweenthe plates.



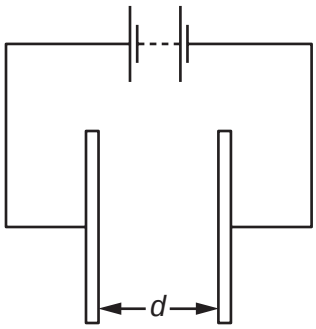
A small charged liquid drop, midway between the plates, is held in equilibrium by the combination of its weight and the electric force acting on it.

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

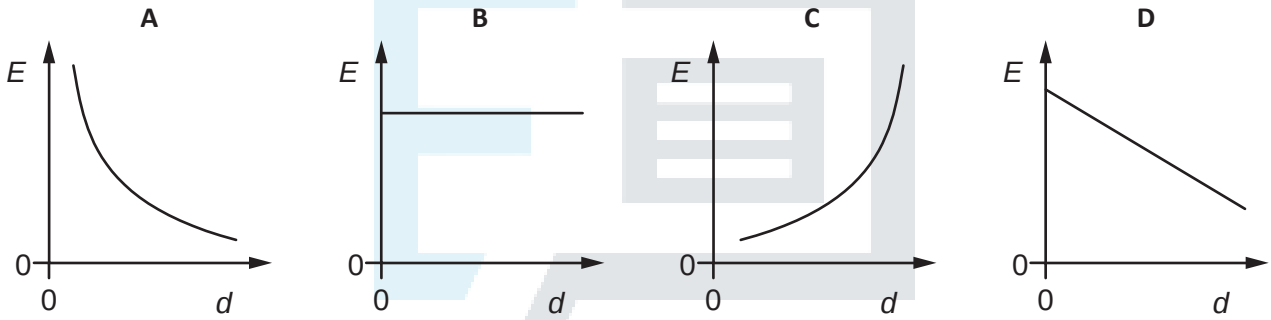
What is the polarity of the charge on the drop, and the ratio of charge to mass of the drop?

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

38. The diagram shows two metal plates connected to a constant high voltage.



Which graph shows the variation of the electric field strength *E* midway between the two plates as the distance *d* between the two plates is increased?

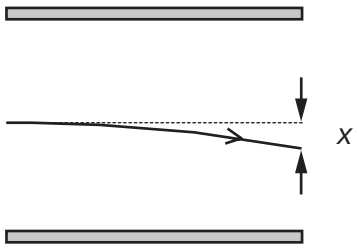


39. Regions of unbalanced charge are produced inside a cloud as shown.

For the region X, which diagram correctly represents the direction of the electric field and the initial direction in which electrons would move?

	A	B	C	
electric field				
direction of movement of electrons				

40. The path of an electron with initial speed v in the uniform electric field between two parallel platesis shown.



The vertical deflection x is measured at the right-hand edge of the plates.

The distance between the plates is halved. The potential difference between the plates remainsthe same.

What will be the new deflection of the electron with the same initial speed v?

A x $\sqrt{\ }$ B $2x$ C 2x D 4x