H2 Physics Revision Topic : Electric Fields

Multiple Choice Questions Name: _____

1 Two horizontal metal plates A and B are situated a distance *d* apart in a vacuum.

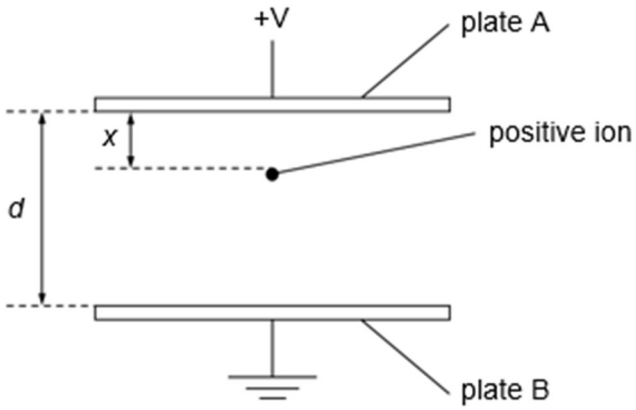


Plate A is at a potential of +V and plate B is earthed. A positive ion is initially placed at rest in the region of the uniform electric field where its distance *x* from plate A is zero.

Any change in gravitational potential energy of the positive ion is negligible compared with any change in electric potential energy.

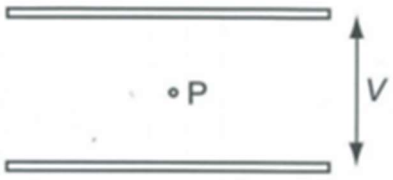
Which of the following statements is correct as it moves from $x = \frac{d}{4}$ to $x = \frac{3d}{4}$?

A The energy gained by the positive ion is directly proportional to d.
B The energy gained by the positive ion is directly proportional to d^2.
C The energy gained by the positive ion is independent of d.
D The energy gained by the positive ion is inversely proportional to d.

2 Which statement is true of an electric field strength and gravitational field strength of a point source?

A Both are always directed towards the source.
B Both are inversely proportional to the distance from the source.
C Both are inversely proportional to the square of the distance from the source.
D Both can be directed towards or away from the source.

3 A small positively charged particle P is balanced halfway between two horizontal plates when a potential difference *V* is applied between the plates.



When *V* is increased, P rises towards the upper plate.

When *V* is decreased, P falls towards the lower plate.

Which statement is correct?

A Decreasing *V* increases both the electric and the gravitational potential energy of the particle.

B Decreasing *V* increases the electric potential energy and decreases the gravitational potential energy of the particle.

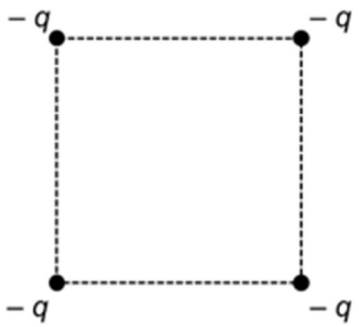
C Increasing *V* increases both the electric and the gravitational potential energy of the particle.

D The change of electric potential energy of the particle must equal the change of gravitational potential energy of the particle.

4 Point charges, each of magnitude q, are arranged at the corners of a square.

For which arrangement will the magnitude of the resultant electric field strength at the centre of the square be the largest?

A



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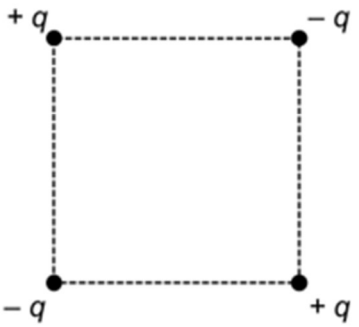

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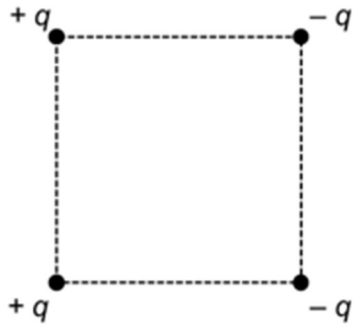

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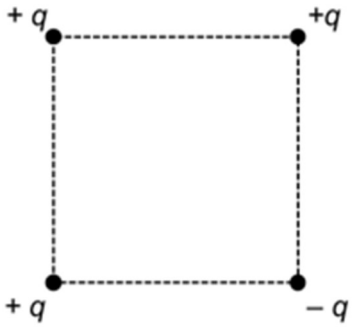
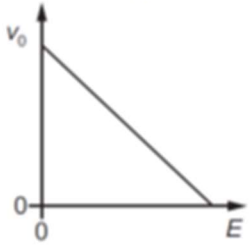


5 A positively charged oil droplet falls in air that has a uniform electric field pointing vertically upwards. The droplet has a terminal speed v_0 and the electric field strength is E.

The magnitude of the force due to air resistance acting on the droplet is proportional to the speed of the droplet.

Which graph shows the variation with E of v_0?

A



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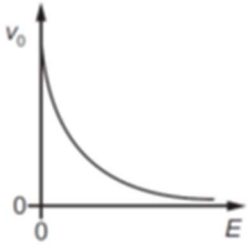

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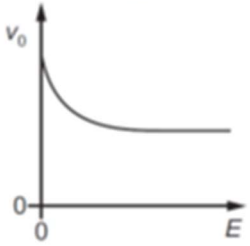

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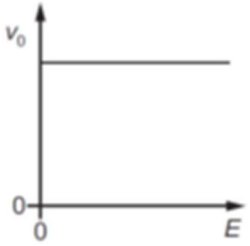
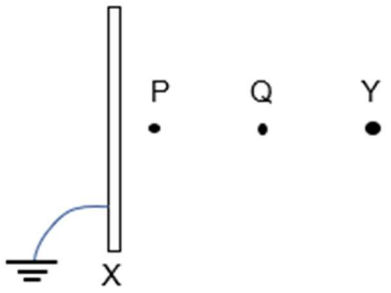


6 The diagram shows a point charge situated at Y in front of an earthed metal sheet X. Two points P and Q are situated between X and Y and have electric field strengths E_P and E_Q respectively.



Which of the following expressions is correct?

A $E_P = 0$

B $E_Q = 0$

C $E_Q > E_P$

D $E_P > E_Q$

7 A charged oil droplet of mass m is falling, initially freely, in a vacuum between two horizontal metal plates that are separated by a distance x.

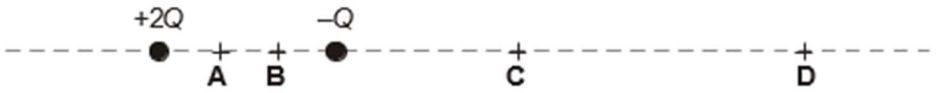
A potential difference (p.d.) V is then applied across the plates. This results in the oil droplet continuing to accelerate downwards but with a reduced acceleration a.

The polarity of the applied p.d. is then reversed so that the direction of the electric force on the droplet is reversed. This results in the downwards acceleration of the oil droplet increasing to $5a$.

What is the magnitude of the charge on the oil droplet?

A $\frac{max}{V}$ **B** $2\frac{max}{V}$ **C** $3\frac{max}{V}$ **D** $4\frac{max}{V}$

8 Two charges +2*Q* and −*Q* are situated as shown below.
At which point is the resultant electric field strength due to the two charges zero?

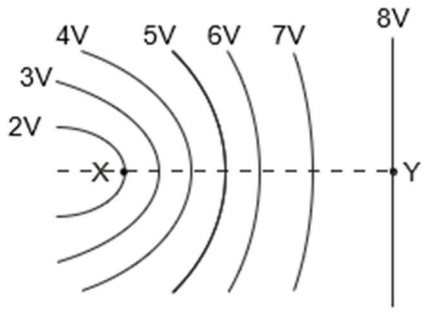


9 Two identical spherical drops of water, each carrying a charge of $+3.0 \times 10^{-11}$ C and with an electric potential of 500 V on its surface, combine to form a single spherical drop.

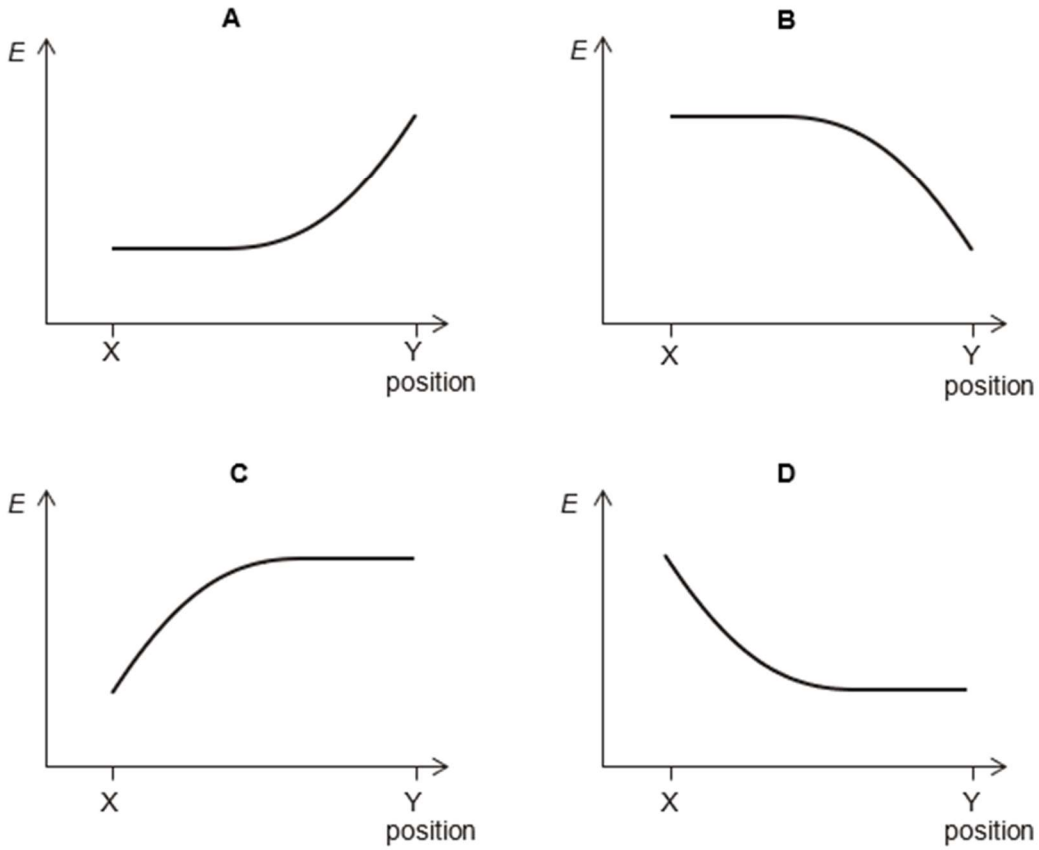
What is the approximate potential on the surface of the new drop formed?

A 1000 V **B** 790 V **C** 540 V **D** 500 V

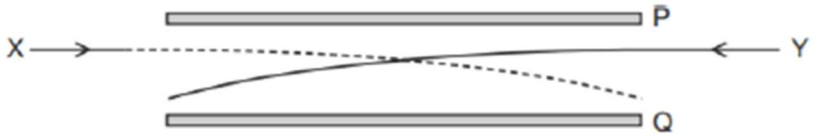
10 The diagram below shows some equipotential lines in the region of an electric field.



Which graph best shows the magnitude *E* of the electric field strength along the line XY?



11 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.

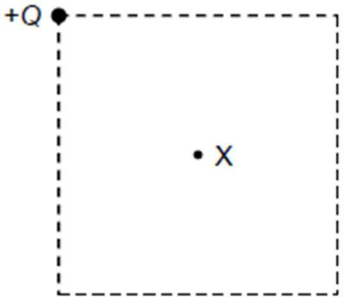


The plates are charged such that the electric field between them is directed from P to Q.

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

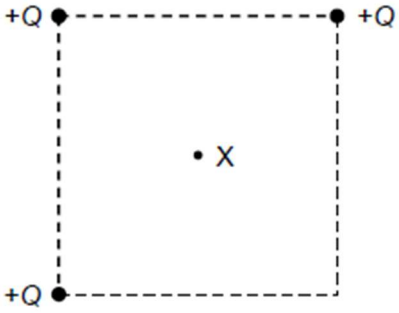
	X	Y
A	positive	positive
B	positive	negative
C	negative	positive
D	negative	negative

12 A point charge +*Q* is placed at the top-left hand corner of a square as shown.



At the centre X of the square, the electric field strength is *E* and the electric potential is *V*.

Two additional point charges of the same magnitude +*Q* are placed at the top-right and bottom-left corners of the square as shown.



What are the electric field strength and the electric potential at the centre X of the square?

	electric field strength	electric potential
A	*E*	1.5*V*
B	*E*	3*V*
C	2*E*	3*V*
D	3*E*	3*V*

13 The diagram shows two charged horizontal metal plates X and Z with a potential difference set up between them. A small sphere Y with charge *Q* is suspended and remain stationary at the midpooint between the plates.

What will happen to sphere Y when its charge increases?

A Sphere Y will accelerate downwards and hit plate Z

B Sphere Y will move down nearer to plate Z and remain staionary.

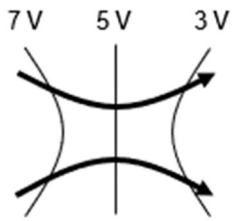
C Sphere Y will accelerate upwards and hit plate X.

D Sphere Y will move up nearer to plate X and remain staionary.

14 In the diagrams, the thin lines show equipotential lines and the bold arrows show the electric field lines and their directions.

Which set of equipotential lines and field lines is correct?

A



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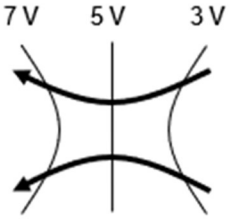

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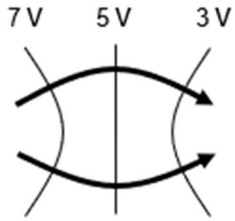

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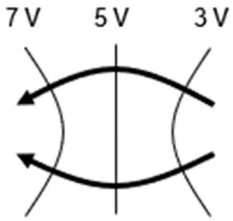
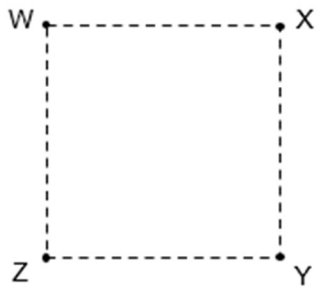


15

The diagram shows the positions W, X, Y and Z at the corners of a square.

A point charge +Q is fixed at position W while another point charge –Q is moved from position X to position Y.



Which statement is correct?

A The electric potential at Z will increase.

B The magnitude of the electric field strength at Z will increase.

C The attractive force between the two charges will increase.

D The electric potential energy of the system will decrease.

16

Two protons are 1.0×10^{-14} m apart.

Approximately how many times is the electrostatic force between them greater than the gravitational force between them?

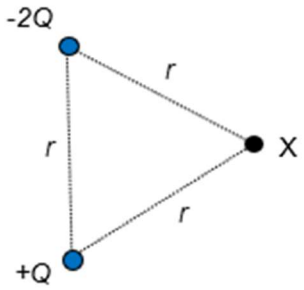
A 10^{23}

B 10^{30}

C 10^{36}

D 10^{42}

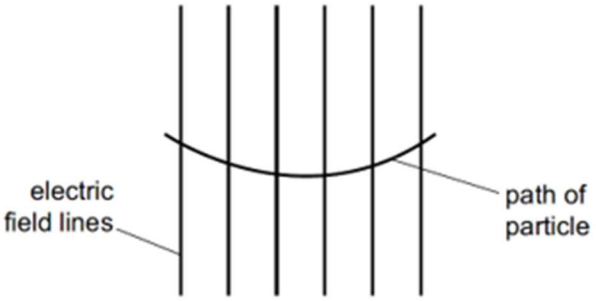
17 Two point charges of charged -2*Q* and +*Q* are arranged at two corners of an equilateral triangle of side *r* in vacuum.



What can be deduced about the electric potential *V*, and the magnitude and direction of electric field strength *E* at point X?

	V	magnitude of *E*	direction of *E*
A	$-\frac{Q}{4\pi\varepsilon_0 r}$	$\frac{Q}{4\pi\varepsilon_0 r^2} < \lvert E\rvert < \frac{3Q}{4\pi\varepsilon_0 r^2}$	←
B	$-\frac{2Q}{4\pi\varepsilon_0 r}$	$\lvert E\rvert < -\frac{3Q}{4\pi\varepsilon_0 r^2}$	→
C	$-\frac{Q}{4\pi\varepsilon_0 r}$	$\lvert E\rvert < \frac{Q}{4\pi\varepsilon_0 r^2}$	←
D	$-\frac{Q}{4\pi\varepsilon_0 r}$	$\lvert E\rvert = \frac{Q}{4\pi\varepsilon_0 r^2}$	→

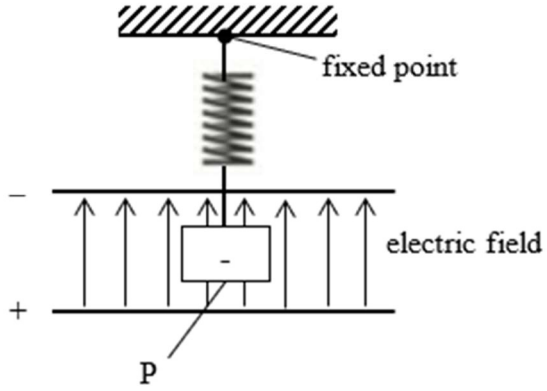
18 The diagram shows the path of a charged particle through a uniform electric field, having vertical field lines.



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.

19 A spring, suspended from a fixed point, carries a negatively charged body P which hangs in a vertical electric field.



What happens to the elastic potential energy and to the electric potential energy of the system as P is lowered?

	elastic potential energy	electric potential energy
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases