Electric Fields

TOPIC QUESTIONS

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

Time Allowed : 30min

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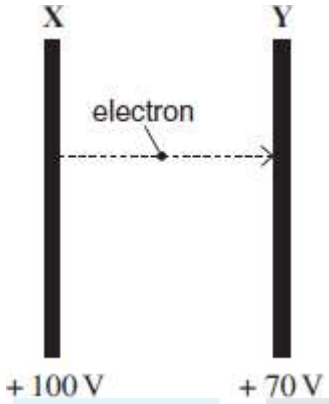
1. Two fixed parallel metal plates **X** and **Y** are at constant potentials of + 100 V and + 70 V respectively. An electron travelling from **X** to **Y** experiences a change of potential energy ΔE_p.



Which line, **A** to **D**, in the table shows correctly the direction of the electrostatic force F on the electron and the value of ΔE_p?

	Direction of F	ΔE_p
A	towards **X**	+ 30 eV
B	towards **Y**	- 30 eV
C	away from **X**	+ 30 eV
D	away from **Y**	- 30 eV

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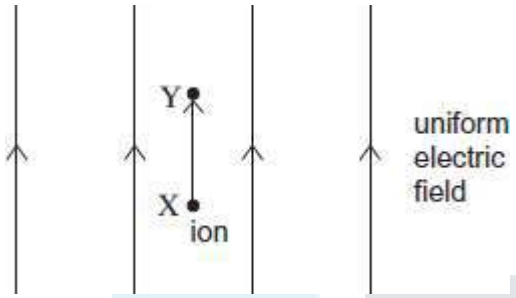
2. A uniform electric field of electric field strength E is aligned so it is vertical. An ion moves vertically through a small distance Δd from point X to point Y in the field.
There is a uniform gravitational field of field strength g throughout the region.



Which line, **A** to **D**, in the table correctly gives the gravitational potential difference, and theelectric potential difference, between X and Y?

	Gravitational potential difference	Electric potential difference
A	$g\Delta d$	$E\Delta d$
B	$g\Delta d$	$\frac{E}{\Delta d}$
C	$\frac{g}{\Delta d}$	$E\Delta d$
D	$\frac{g}{\Delta d}$	$\frac{E}{\Delta d}$

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

Which line, **A** to **D**, in the table gives correctly the electric field strength, *E*, and the potential, *V*, ata point midway between the plates?

	electric field strength E / Vm^{-1}	potential V / V
A	1.0×10^4 upwards	25
B	1.0×10^4 downwards	25
C	1.0×10^4 upwards	50
D	1.0×10^4 downwards	50

4. Two identical positive point charges, P and Q, separated by a distance *r*, repel each other with a force *F*. If *r* is decreased so that the electrical potential energy of Q is doubled, what is the force ofrepulsion?

A 0.5 *F*

B *F*

C 2*F*

D 4*F*

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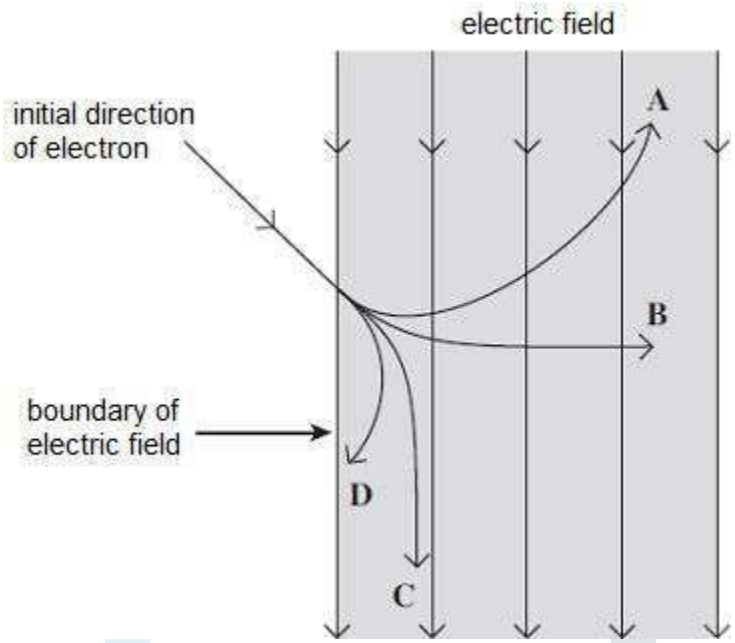
5. Which path, **A** to **D**, shows how an electron moves in the uniform electric field represented in the diagram?



6. An electric field acts into the plane of the paper. An electron enters the field at 90° to the fieldlines.

The force on the electron is

A zero.

B along the direction of the field.

C at 90° to the field.

D opposite to the direction of the field.

7. A positive charge of 2.0×10^{-4} C is placed in an electric field at a point where the potential is +500 V.

   What is the potential energy of the system?

   A 1.0×10^{-1} J

   B 1.0×10^{-1} J C^{-1}

   C 4.0×10^{-7} J

   D 4.0×10^{-7} J C^{-1}

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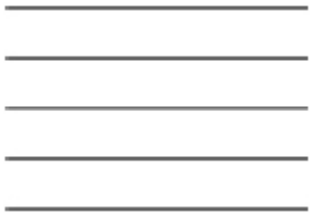
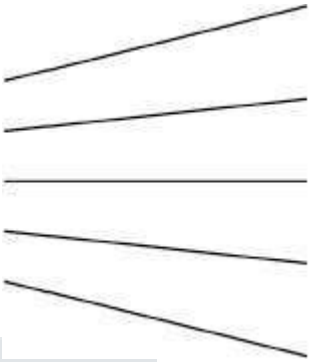
8. Which diagram shows lines of equipotential in steps of equal potential difference near an isolatedpoint charge?

A



B



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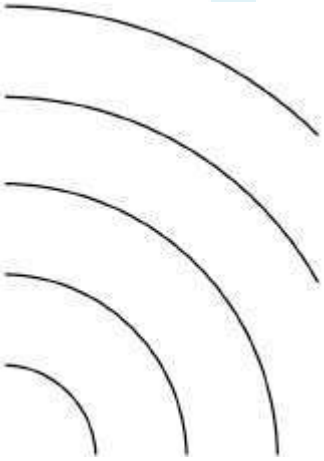
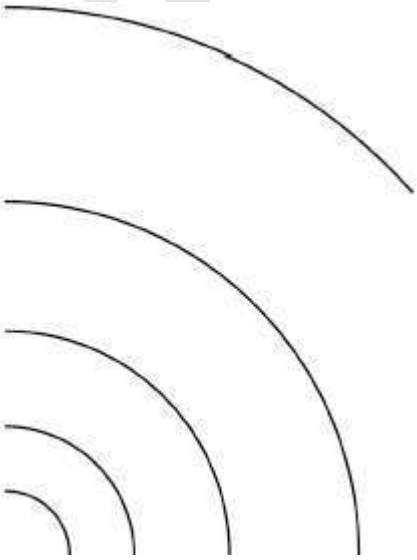


D



9. Two fixed charges of magnitude $+Q$ and $+3Q$ repel each other with a force F. An additional charge of $-2Q$ is given to each charge.

   What are the magnitude and the direction of the force between the charges?

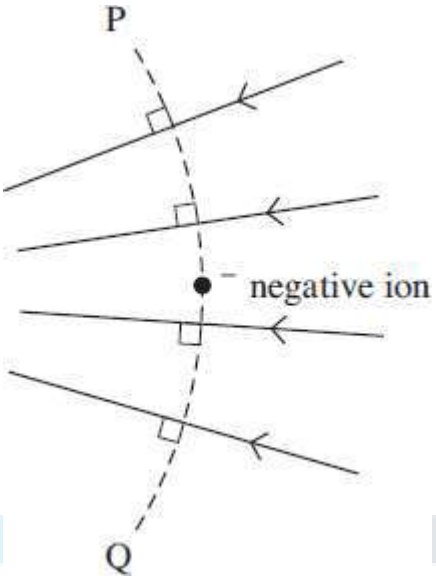
	Magnitude of force	Direction of force
A	$\frac{F}{3}$	repulsive
B	$5F$	attractive
C	$5F$	repulsive
D	$\frac{F}{3}$	attractive

10. At a distance L from a fixed point charge, the electric field strength is E and the electric potentialis V.

    What are the electric field strength and the electric potential at a distance $3L$ from the charge?

	Electric field strength	Electric potential
A	$\frac{E}{3}$	$\frac{V}{9}$
B	$\frac{E}{3}$	$\frac{V}{3}$
C	$\frac{E}{9}$	$\frac{V}{3}$
D	$\frac{E}{9}$	$\frac{V}{9}$

11. The diagram shows a negative ion at a point in an electric field, which is represented by thearrowed field lines.



Which one of the following statements correctly describes what happens when the ion isdisplaced?

When the negative ion is displaced

A to the left the magnitude of the electric force on it decreases.

B to the right its potential energy increases.

C along the line PQ towards Q its potential energy decreases.

D along the line PQ towards P the magnitude of the electric force on it is unchanged.

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12. When a charge moves between two points in an electric field, or a mass moves between two pointsin a gravitational field, energy may be transferred.
Which one of the following statements is correct?

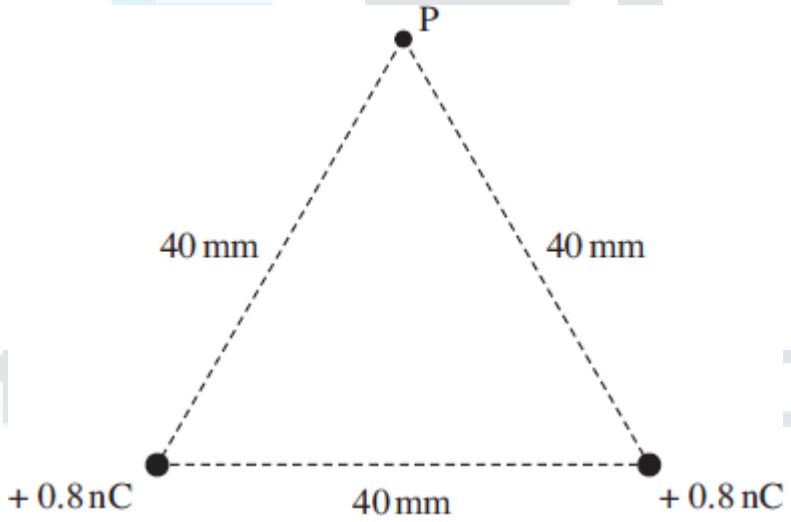
A No energy is transferred when the movement is parallel to the direction of the field.

B The energy transferred is independent of the path followed.

C The energy transferred is independent of the start and finish points.

D Energy is transferred when the movement is perpendicular to the field lines.

13. Two charges, each of + 0.8 nC, are 40 mm apart. Point P is 40 mm from each of the charges.



What is the electric potential at P?

A zero

B 180 V

C 360 V

D 4500 V

14. Which one of the following statements about a parallel plate capacitor is **incorrect**?

A The capacitance of the capacitor is the amount of charge stored by the capacitor when thepd across the plates is 1V.

B A uniform electric field exists between the plates of the capacitor.

C The charge stored on the capacitor is inversely proportional to the pd across the plates.

D The energy stored when the capacitor is fully charged is proportional to the square of the pdacross the plates.

15. Which line, **A** to **D**, in the table correctly describes the trajectory of charged particles which enter separately, at right angles, a uniform electric field, and a uniform magnetic field?

	uniform electric field	**uniform magnetic field**
A	parabolic	circular
B	circular	parabolic
C	circular	circular
D	parabolic	parabolic

16. An electron moves through a distance of 0.10 m parallel to the field lines of a uniform electricfield of strength 2.0 kN C^{-1}.

What is the work done on the electron?

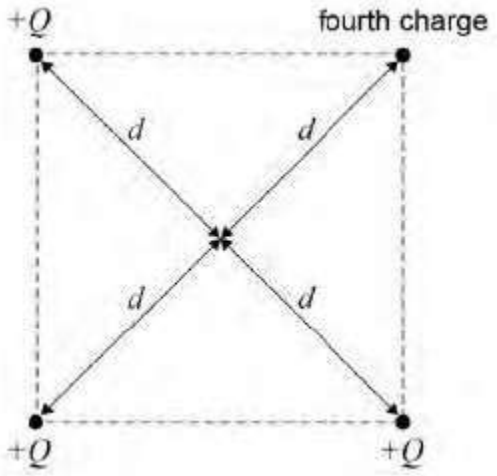
A zero

B 1.6×10^{-17} J

C 3.2×10^{-17} J

D 1.6×10^{-21} J

17. Four positive charges are fixed at the corners of a square as shown.



The total potential at the centre of the square, a distance d from each charge, is $\frac{5Q}{4\pi\varepsilon_o d}$

Three of the charges have a charge of +Q

What is the magnitude of the fourth charge?

A $-\frac{7Q}{4}$

B Q

C $\sqrt{2}Q$

D $2Q$

18. A charged spherical conductor has a radius r. An electric field of strength E exists at the surfacedue to the charge.

What is the potential of the spherical conductor?

A $r^2 E$

B $r E^2$

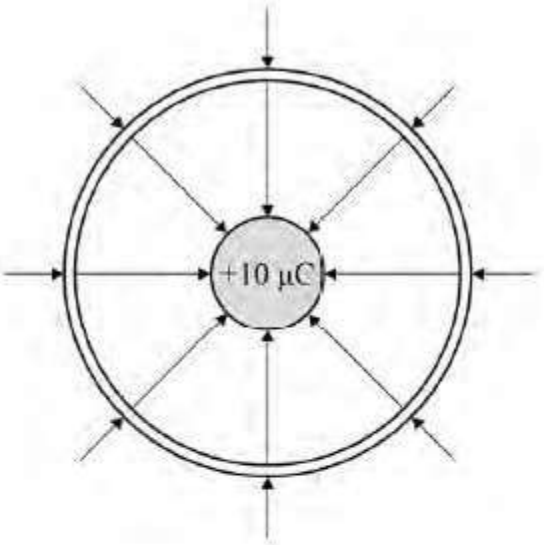
C $\frac{E}{r}$

D $r E$

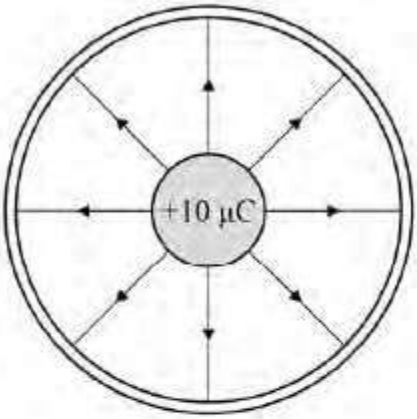
19. A conducting sphere holding a charge of +10 μC is placed centrally inside a second uncharged
conducting sphere.

Which diagram shows the electric field lines for the system?

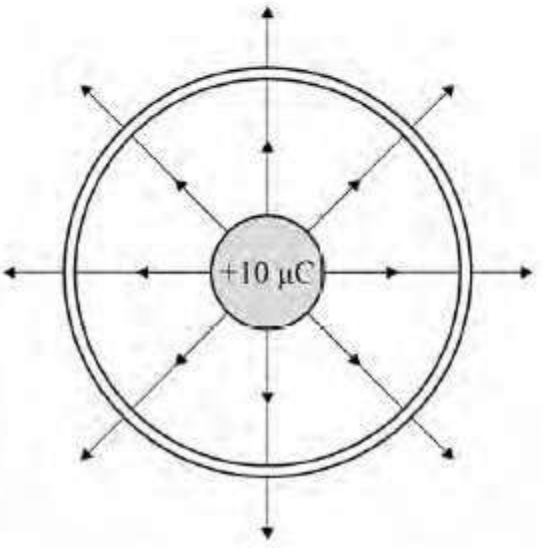
A



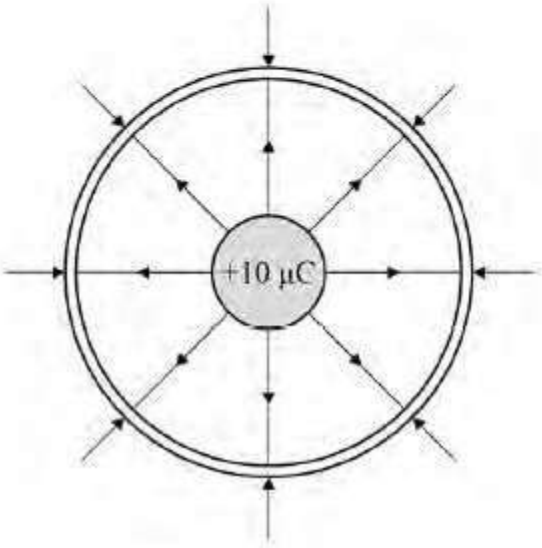
B



C



D



20. The ionisation potential for the atoms of a gas is V. Electrons of mass m and charge e travellingat a speed v can just cause ionisation of atoms in the gas.

What is V?

A

$\frac{eV}{2m}$

B

$\frac{2eV}{m}$

C $\sqrt{\frac{eV}{2m}}$

D $\sqrt{\frac{2eV}{m}}$

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