Exam Papers Practice

Electric & Magnetic Fields

Question Paper

Course	HL IB Physics
Section	Fields
Topic	Electric & Magnetic Fields
Difficulty	Medium

To be used by all students preparing for HL IB Physics
Students of other boards may also find this useful

Question 1

Two separated, identical conducting spheres X and Y of charge −8 μC and +12 μC respectively, are brought into brief contact and then separated. What is the final charge distribution on X and Y?

	X / μC	Y / μC
A.	-8	+12
B.	+10	+10
C.	+2	+2
D.	-4	+6

[1 mark]

Question 2

Which of the following statements about electric fields and potential differences is incorrect?

A. The presence of a potential difference requires an electric field

B. Work on or by an electron across a potential difference V is eV

C. Work on or by an electron across a potential difference is path dependent

D. The electric field is a vector field

[1 mark]

Question 3

A proton of mass m_p and charge q is accelerated from rest across a potential difference, V of 5×10^{-2} V. What is the best estimate for the magnitude of the proton's final velocity, v_p?

A. $v_p = \sqrt{\frac{2qV}{m_p}}$

B. $v_p = \frac{2qV}{m_p}$

C. $v_p = \frac{qV}{2m_p}$

D. $v_p = qV$

[1 mark]

Question 4

A point charge q is placed near a large spherical charge $Q = 10q$. What is the magnitude of the force experienced by q and Q and the magnitude of the electric field E created by Q at the position of q?

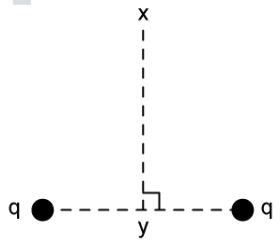
	Magnitude of force experienced by q	Magnitude of force experienced by Q	Magnitude of E created by Q at position of q
A.	F	F	$\frac{F}{q}$
B.	$10F$	$0.1F$	$\frac{F}{q}$
C.	F	F	$\frac{F}{Q}$
D.	$0.1F$	$10F$	$\frac{F}{Q}$

[1 mark]

Question 5

Two identical point charges q create a resultant electric field at **X**.

The line XY is a perpendicular bisector of the line joining both point charges.



Which vector most accurately depicts the direction of the resultant electric field at **X**?

A. →

B. ↑

C. ←

D. ↓

[1 mark]

Question 6

Two charges, $Q_1 = q$ and $Q_2 = 4q$ are separated by a distance r and exert a force of magnitude F on each other. By what factor does the magnitude of the force change if the charge on Q_1 doubles and the separation distance trebles?

A. $\frac{1}{9}$

B. $\frac{2}{3}$

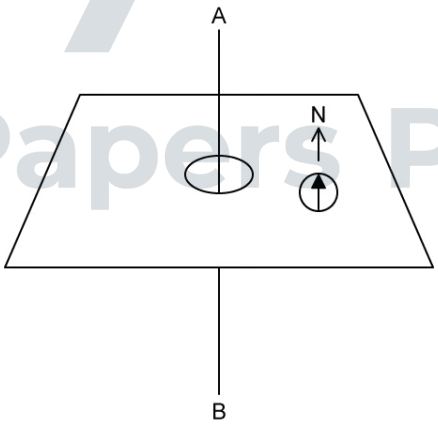
C. $\frac{2}{9}$

D. 2

[1 mark]

Question 7

A plotting compass is placed next to a vertical wire AB. When there is no current in the wire, the compass points North due to an external magnetic field.



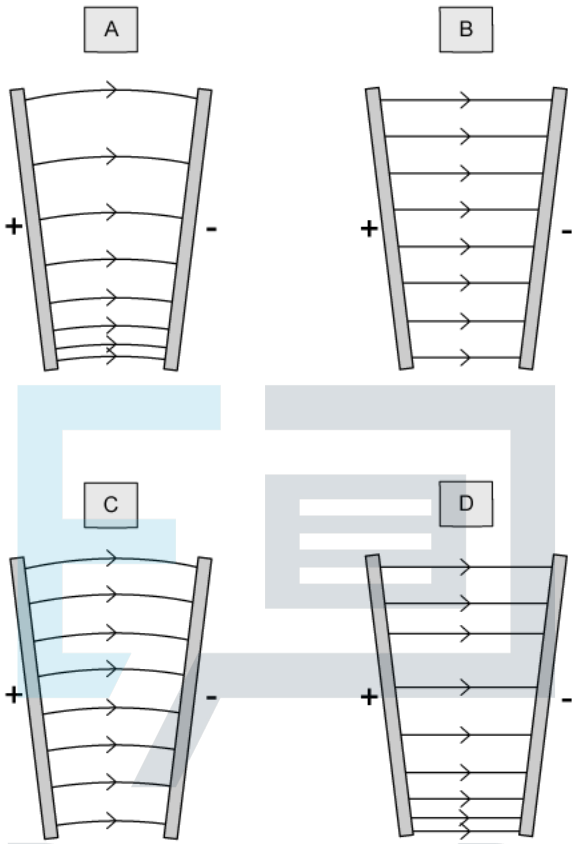
Which diagram shows a possible direction for the compass to point when a current passes from A to B?

[1 mark]

Question 8

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

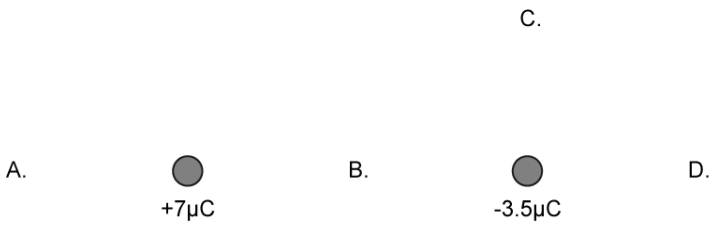
Which diagram shows the electric field between the plates?



[1 mark]

Question 9

Two point charges are at rest as shown. Four positions, each of distance *r* from the nearest point charge, are marked in the image.



At which position is the electric field strength greatest?

[1 mark]

Question 10

A helium nucleus is accelerated from rest across a potential difference of 5.0 kV.

If m_p and m_n is the rest mass of a proton and neutron respectively, which expression for the final velocity of the nucleus is correct?

A. $\sqrt{\frac{2e}{m_p + m_n}}$

B. $50\sqrt{\frac{2e}{m_p + m_n}}$

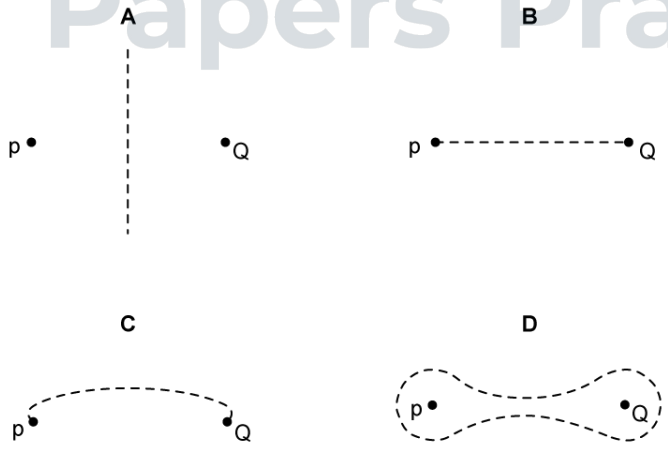
C. $100\sqrt{\frac{e}{m_p + m_n}}$

D. $\sqrt{\frac{e}{m_p + m_n}}$

[1 mark]

Question 11

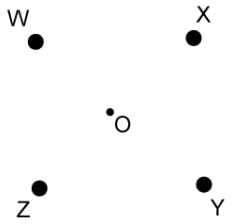
Which diagram shows a correct equipotential line due to two point charges P and Q of equal sign?



[1 mark]

Question 12

Four point charges, W, X, Y and Z, are fixed to the edges of a square with midpoint O.



W, X and Z are negatively charged, and Y is positively charged. What is the direction of the resultant electric field at O?

A. Towards W

B. Towards X

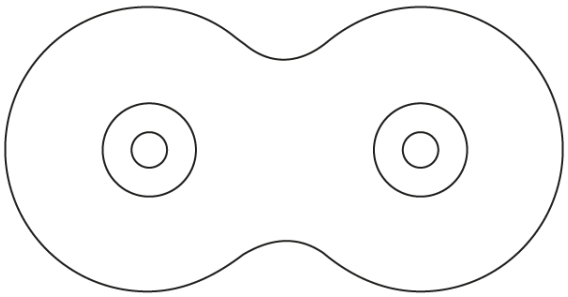
C. Horizontally right

D. Towards Z

[1 mark]

Question 13

The diagram shows equipotential lines around two sources.



Possible combinations of sources for this potential field are:

I. Two equal point charges of the opposite sign
II. Two equal point charges of same sign
III. Two equal point masses

What is/are the possible source(s) for the equipotential lines?

A. I and III only

B. II and III only

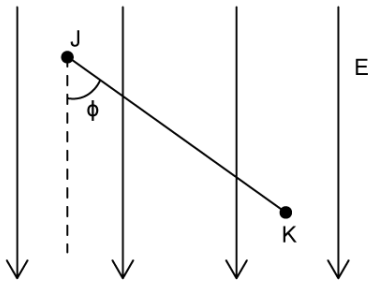
C. I only

D. II only

[1 mark]

Question 14

A particle of charge q is at point J in a uniform electric field of strength E. It is moved along a straight line joining point J to point K which is at an angle of Φ to the field lines, as shown in the diagram below.



If the length of the path is JK, what is the change in electric potential energy of the charge q between J and K?

A. $EqJK \cos \Phi$

B. $EqJK \sin \Phi$

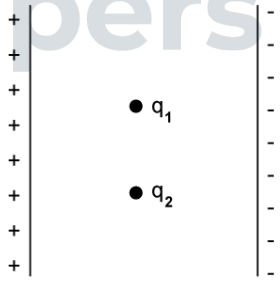
C. $Eq \tan \Phi$

D. $EqJK$

[1 mark]

Question 15

Two positively charged particles, q_1 and q_2, are released from rest half-way between two oppositely charged parallel plates in a vacuum. The particles strike the negatively charged plate at the same time.



Neglecting gravitational effects, which of the following statements is correct?

A. The particles have the same charge only

B. The particles have the same mass only

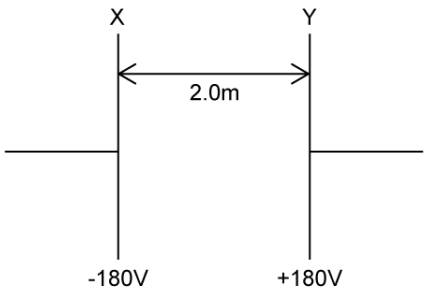
C. The particles have the same mass and charge

D. The particles have the same charge to mass ratio

[1 mark]

Question 16

Two charged parallel metal plates, X and Y, are separated by a distance of 2.0 m. X is charged to a potential of −180 V and Y is charged to a potential of +180 V.



What is the magnitude and direction of the electric field strength at a point exactly mid-way between plates X and Y?

	Magnitude of electric field strength / V m^{-1}	Direction
A.	180	To the right
B.	180	To the left
C.	360	To the right
D.	360	To the left

[1 mark]