Exam Papers Practice

Motion in Electromagnetic Fields

Question Paper

Course	HL IB Physics
Section	Fields
Topic	Motion in Electromagnetic 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

A current of 3.0 mA flows in a wire of length 2.0 m. It is placed in a magnetic field of flux density 4 T such that the angle between the current and the field is 90°.

What is the magnitude of the magnetic force on the wire?

A. 0.012 N

B. 0.024 N

C. 8 N

D. 24 N

[1 mark]

Question 2

A proton, *p*, moves normally across a magnetic field of flux density *B* T with a speed of *v* m s^{-1}.

What is the magnitude of force exerted on the particle?

A. *Bpv*

B. *BIL*

C. $(1.6 \times 10^{-19})\ Bv$

D. $(1.6 \times 10^{-19})\ Bv \sin \theta$

[1 mark]

Question 3

A negatively charged particle is at rest in a magnetic field *B*. The force on the particle is:

A. At right angles to *B*

B. Opposite to *B*

C. Parallel to *B*

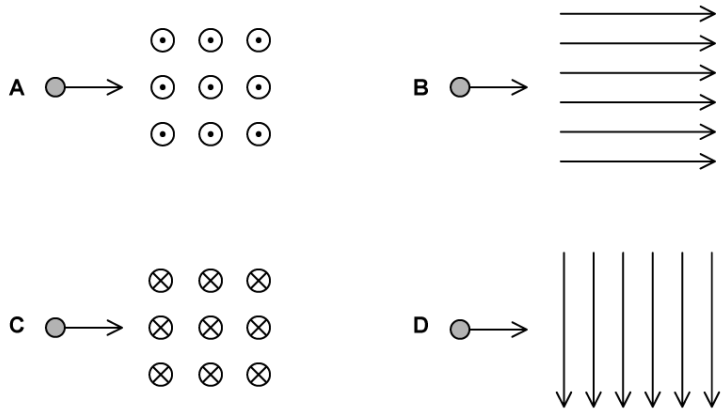
D. Zero

[1 mark]

Question 4

An electron enters a region of a magnetic field.

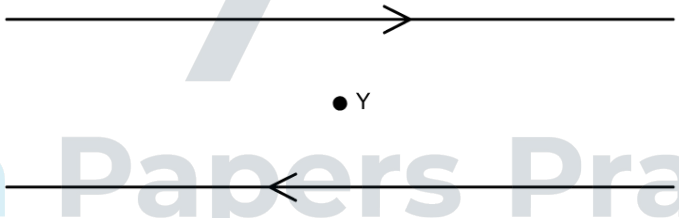
In which case is the initial force on the electron directed towards the bottom of the page?



[1 mark]

Question 5

Two long parallel wires carry equal currents in opposite directions. What field do the two wires produce at point *Y*, which is midway between the wires and on the plane of the paper?



A. A magnetic field at right angles to the plane of the page

B. An electric field at right angles to the plane of the page

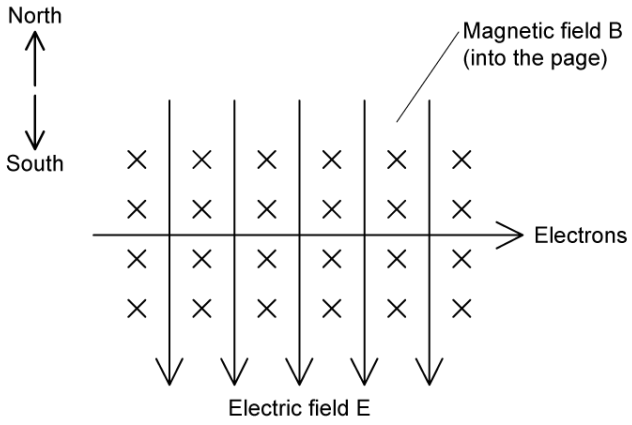
C. An electric field parallel to the wires

D. A magnetic field parallel to the wires

[1 mark]

Question 6

A beam of electrons enters a region in which there are uniform magnetic and electric fields directed at right angles to each other. The field strengths are adjusted such that the beam remains undeflected, as shown in the diagram below.



Which of the following statements is **incorrect**?

A. Conventional current flows from right to left in this diagram

B. The velocity of the electron beam *v* is equal to the ratio of the magnetic flux density *B* to the electric field strength *E*

C. The magnetic force on the electron beam is in the direction indicated 'south'

D. The electric force on the electron beam is in the direction indicated 'north'

[1 mark]

Question 7

An alpha particle travelling at speed *v* perpendicular to a magnetic field of strength *B* experiences a force *F*.

What is the force acting on an electron travelling at $\frac{v}{2}$ perpendicular to a magnetic field of strength $\frac{B}{2}$?

A. 0

B. $\frac{-F}{6}$

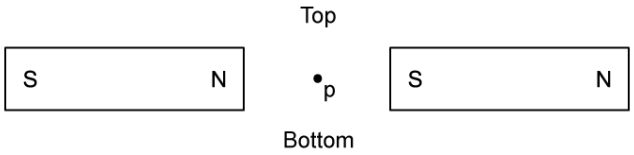
C. $\frac{F}{4}$

D. $\frac{-F}{8}$

[1 mark]

Question 8

A proton *p* is at downwards from top to bottom between the poles of two horizontal magnets.



The magnetic force on the proton is:

A. From top to bottom

B. From left to right

C. zero

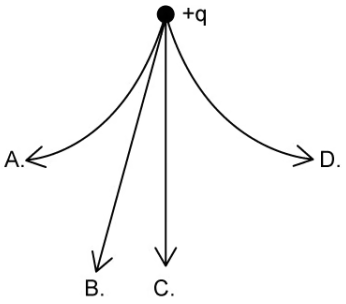
D. Out of the page

[1 mark]

Question 9

A small point charge +*q* descends vertically into a region where there is an electric field. The equipotentials of this field are shown.

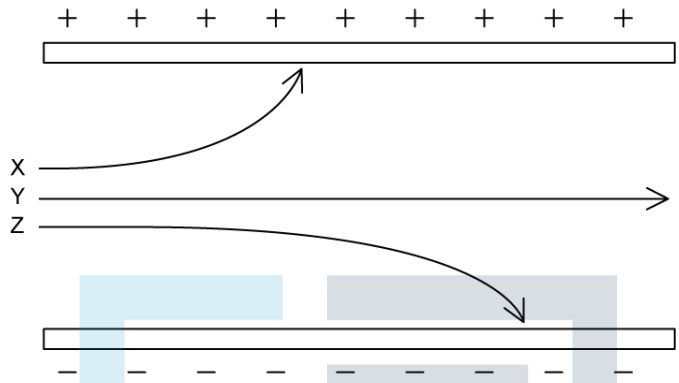
What is the subsequent path followed by the particle?



[1 mark]

Question 10

A charged particle in an electric field will experience a force on it that will cause it to move. The three particles X, Y and Z are experiencing a force which deflects their motion as shown. What three particles could X, Y and Z be?



	X	Y	Z
A.	beta-minus particle	photon	nucleus
B.	alpha particle	neutron	photon
C.	neutron	electron	alpha-particle
D.	electron	beta-plus particle	neutron

[1 mark]

Question 11

A proton with velocity of $1.5 \times 10^{7}\ m\ s^{-1}$ moves normally into a uniform magnetic field of flux density 0.30 T. Which is the best estimate of the radius of curvature of the path of the proton?

A. 5×10^{-38} m

B. 5×10^{-3} m

C. 5×10^{-1} m

D. 5 m

[1 mark]