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5.4 Magnetic Effects of Electric Currents

Medium

PHYSICS

IB HL

EXAM PAPERS PRACTICE

5.4 Magnetic Effects of Electric Currents

Question Paper

Course	DP IB Physics
Section	5. Electricity & Magnetism
Topic	5.4 Magnetic Effects of Electric Currents
Difficulty	Medium

Time allowed: 20

Score: /10

Percentage: /100

Question 1

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*

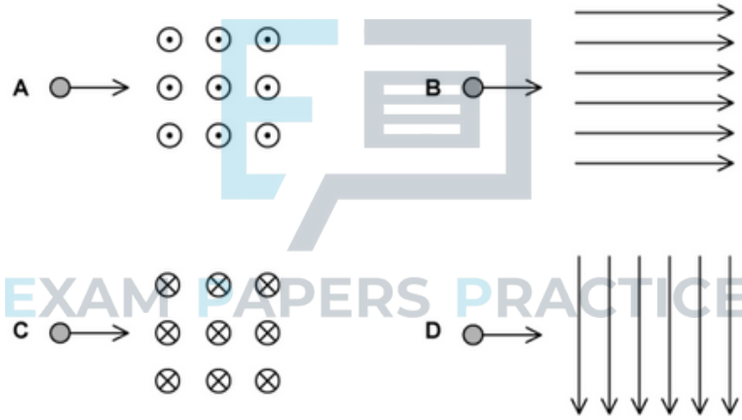
D. Zero

[1 mark]

Question 2

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 3

Which of the following statements about magnetic fields is **incorrect**?

A. The strength of a magnetic field is also known as the magnetic flux density

B. There is a force on a conductor carrying a current at 90° to magnetic field lines

C. The magnetic flux density is measured in units of Tesla, T

D. There is a force on a current carrying conductor parallel to magnetic field lines

[1 mark]

Question 4

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 5

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

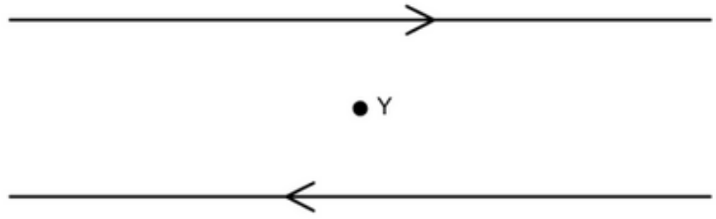
C. $(1.6 \times 10^{-19})\, Bv$

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

[1 mark]

Question 6

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

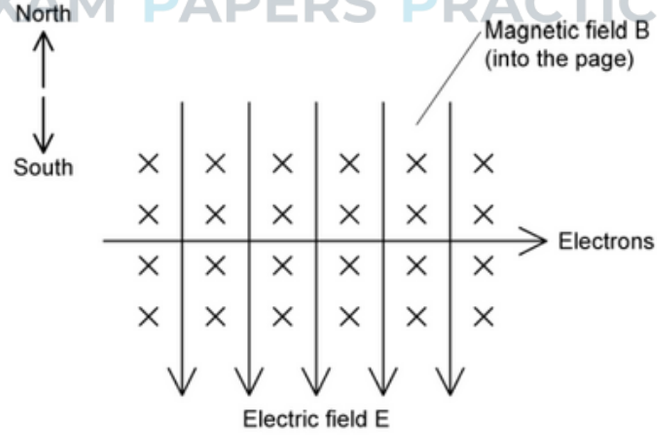
C. An electric field parallel to the wires

D. A magnetic field parallel to the wires

[1 mark]

Question 7

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*

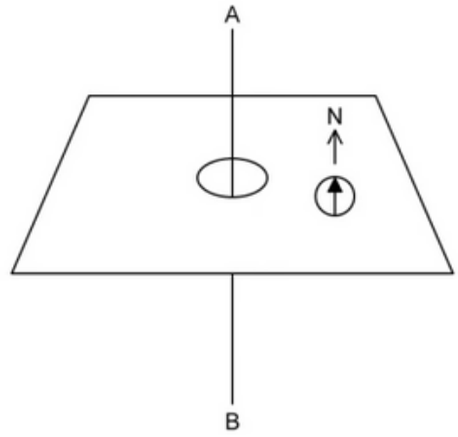
C. The magnetic force on the electron beam is in the direction indicated 'south'

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

[1 mark]

Question 8

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 9

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

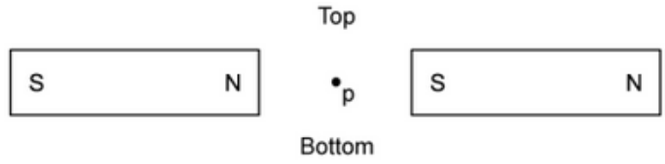
C. $\frac{F}{4}$

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

[1 mark]

Question 10

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]