

YEAR 2 | MODULE 6 | PACK 04

Gravitational and magnetic-field links

Official past-paper questions

2017-2023 | OCR A H556 | 6.2.2(c)-(d); applications with 5.4 and 6.3

9 marks | 3 question entries

Later applications - use after the required topics

Use: attempt the session after learning its content. Try without notes; record any help used. Mark the session, identify the reason for lost marks, then revisit those questions after a few days.

Format: all MCQs appear first with their complete answer boxes. Written extracts retain the original paper's answer space. Only the subparts named in the source reference are assigned.

Keep this short links session until you have covered gravitation and magnetic forces. It is separate from the core Electric Fields test.

Sources: the 2024 and 2025 exams are not used in these topic packs. These files contain official examination questions only; no sample, specimen or practice papers.

Name: _____

First attempt: _____ Score: _____ / 9

[Official data, formulae and relationships booklet](#)

Question index

EF identifiers are stable across the question packs and mark schemes; Q numbers refer to this pack. All MCQs appear first.

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Q01 | EF16

1 mark

June 2022 | H556/02 | Q15

Requires: Gravitational field patterns and the inverse-square law.

- 15 An electron has both mass and charge. The electron has a gravitational field and an electric field around it.

Which statement is **not** correct?

- A Both field patterns look the same.
- B Both field patterns show parallel field lines around the electron.
- C Both field strengths obey an inverse square law with distance from the electron.
- D The direction of both fields is the same at any point around the electron.

Your answer

[1]

Q02 | EF17

1 mark

June 2017 | H556/02 | Q13

Requires: Magnetic forces on moving charges and crossed-field velocity selectors.

- 13 A beam of charged particles is not deflected when it passes through a region where both electric and magnetic fields are present.

Which statement is **not** correct?

- A All the particles have the same speed.
- B The resultant force on each particle is zero.
- C The magnetic force is equal to the electric force on each particle.
- D The magnetic field and the electric field are in the same direction.

Your answer

[1]

Q03 | EF18

7 marks

June 2017 | H556/03 | Q2(a)-(b)

Requires: Magnetic forces on moving charges; Year 1 drift velocity.

- 2 A small thin rectangular slice of semiconducting material has width a and thickness b and carries a current I . The current is due to the movement of electrons. Each electron has charge $-e$ and mean drift velocity v . A uniform magnetic field of flux density B is perpendicular to the direction of the current and the top face of the slice as shown in Fig. 2.1.

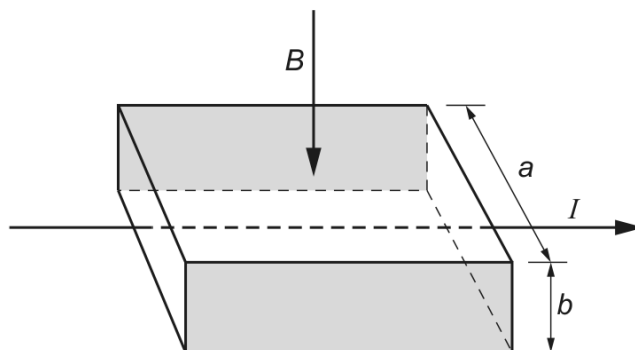


Fig. 2.1

- (a) As soon as the current is switched on, the moving electrons in the current are forced towards the shaded rear face of the slice where they are stored. This causes the shaded faces to act like charged parallel plates. Each electron in the current now experiences both electric and magnetic forces. The resultant force on each electron is now zero.

Write the expressions for the electric and magnetic forces acting on each electron and use these to show that the magnitude of the potential difference V between the shaded faces is given by

$$V = Bva.$$

[3]

Only (a)-(b) are assigned. The full Hall-effect context, labelled dimensions and numerical data are retained. The separate magnetic-field measurement discussion in (c) is omitted.

Q03 | EF18 - continued

7 marks

June 2017 | H556/03 | Q2(a)-(b)

(b) Here are some data for the slice in a particular experiment.

number of conducting electrons per cubic metre, $n = 1.2 \times 10^{23} \text{ m}^{-3}$

$a = 5.0 \text{ mm}$

$b = 0.20 \text{ mm}$

$I = 60 \text{ mA}$

$B = 0.080 \text{ T}$

Use this data to calculate

(i) the mean drift velocity v of electrons within the semiconductor

$v = \dots\dots\dots \text{ m s}^{-1}$ [3]

(ii) the potential difference V between the shaded faces of the slice.

$V = \dots\dots\dots \text{ V}$ [1]

Only (a)-(b) are assigned. The full Hall-effect context, labelled dimensions and numerical data are retained. The separate magnetic-field measurement discussion in (c) is omitted.