Magnetic fields

Cambridge International AS & A Level Physics

> *Unlike IGCSE, 9702 gives you a data sheet: it is page 2 of Papers 1, 2 and 4, with more formulae on page 3 of Paper 4. Everything marked GIVEN is printed for you; everything else you must recall. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.*

20.2 Force on a current-carrying conductor

A LEVEL

Force on a current-carrying conductor

$$F = BIL \sin \theta$$

- F — force (N)
- B — magnetic flux density (T)
- I — current (A)
- L — length in the field (m)
- θ — angle between the conductor and the field (°)

Direction from Fleming's left-hand rule.

20.3 Force on a moving charge

A LEVEL

Force on a moving charge

$$F = BQv \sin \theta$$

- F — force (N)
- B — magnetic flux density (T)
- Q — charge (C)
- v — speed (m s^{-1})

A LEVEL

Hall voltage

$$VH = BI / (ntq)$$

- VH — Hall voltage (V)
- n — number density of charge carriers (m^{-3})
- t — thickness (m)
- q — charge on each carrier (C)

The syllabus asks you to derive it as well as use it.

20.5 Electromagnetic induction

A LEVEL

Magnetic flux

$$\Phi = BA$$

- Φ — magnetic flux (Wb)
- B — flux density normal to the area (T)
- A — area (m^2)

A LEVEL

Faraday's and Lenz's laws

$$E = - d(N\Phi) / dt$$

- E — induced e.m.f. (V)
- NΦ — flux linkage (Wb)

The magnitude is the rate of change of flux linkage; the minus sign is Lenz's law.