Electricity and magnetism

Cambridge IGCSE Physics

> *The syllabus introduces every one with the words “recall and use”, and 0625 provides no formula sheet in any paper. Compiled by GioPhysics from the published syllabus. This is an independent study aid, not a Cambridge document; the official syllabus is the authority.*

4.1 Simple phenomena of magnetism

No equations. Magnetism at 0625 is field patterns, induced magnetism and the properties of magnetic materials.

4.2.2 Electric current

SUPP.

Electric current

$$I = Q / t$$

$Q = It$ · $t = Q / I$

- I — current (A, mA)
- Q — charge (C)
- t — time (s)

Conventional current is from positive to negative; free electrons flow from negative to positive.

4.2.3 Electromotive force and potential difference

SUPP.

Electromotive force

$$E = W / Q$$

- E — e.m.f. (V)
- W — electrical work done by the source (J)
- Q — charge moved around the complete circuit (C)

SUPP.

Potential difference

$$V = W / Q$$

$W = QV$

- V — potential difference (V, mV, kV)
- W — work done by the charge in the component (J)
- Q — charge passing through (C)

4.2.4 Resistance

CORE

Resistance

$$R = V / I$$

$V = IR$ · $I = V / R$

- R — resistance (Ω)
- V — potential difference (V)
- I — current (A)

SUPP.

Resistance of a metallic conductor

$$R \propto l \cdot R \propto 1 / A$$

- l — length of the wire (m)
- A — cross-sectional area (m^2)

A proportionality, not a formula: 0625 does not use resistivity. Core candidates state the relationship qualitatively.

4.2.5 Electrical energy and electrical power

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Electrical power

$$P = IV$$

$I = P / V$ · $V = P / I$

- P — power (W, kW)
- I — current (A)
- V — potential difference (V)

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Electrical energy

$$E = IVt$$

- E — energy transferred (J, kWh)
- I — current (A)
- V — potential difference (V)
- t — time (s)

The syllabus also expects the kilowatt-hour to be defined and used to calculate the cost of running an appliance.

4.3.2 Series and parallel circuits

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Resistors in series

$$R = R_1 + R_2 + \dots$$

- R — combined resistance (Ω)

CORE

Cells in series

$$\text{combined e.m.f.} = E_1 + E_2 + \dots$$

- E — e.m.f. of each source (V)

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Current in a series circuit

current is the same at every point

- I — current (A)

SUPP.

Resistors in parallel

$$1 / R = 1 / R_1 + 1 / R_2$$

- R — combined resistance (Ω)

Two resistors. The combined resistance is always less than either resistor alone — which Core candidates state without calculating.

SUPP.

Currents at a junction

sum of currents in = sum of currents out

- I — current in each branch (A)

SUPP.

Potential differences in a series circuit

$$\text{total p.d.} = V_1 + V_2 + \dots$$

- V — p.d. across each component (V)

Across parallel branches the p.d. is the same as across any one branch.

4.3.3 Action and use of circuit components

SUPP.

Two resistors as a potential divider

$$R_1 / R_2 = V_1 / V_2$$

- R_1, R_2 — the two resistances (Ω)
- V_1, V_2 — the p.d. across each (V)

4.4 Electrical safety

No new equations. Fuse ratings and trip settings are chosen using P = IV from 4.2.5.

4.5.6 The transformer

CORE

Transformer turns and voltage

$$V_p / V_s = N_p / N_s$$

V_p, V_s — primary and secondary p.d. (V)
N_p, N_s — turns on primary and secondary coils

SUPP.

Transformer at 100% efficiency

$$I_p V_p = I_s V_s$$

I_p, I_s — primary and secondary current (A)
V_p, V_s — primary and secondary p.d. (V)

SUPP.

Power loss in transmission cables

$$P = I^2 R$$

P — power dissipated in the cable (W)
I — current (A)
R — resistance of the cable (Ω)

Used to explain why losses are smaller when transmission voltage is greater.