



ANSWER BOOK

Circuits and Kirchhoff's laws

Electricity · Year 12

AQA 3.5.1.4 · CIE 9.2, 10.2 · OCR A 4.1.1, 4.2.5, 4.3.1

10 questions · 30 marks

NAVY EDITION

SECTION A · Warm-up

- A1** The sum of the currents into a junction equals the sum of the currents out of it. This expresses conservation of charge. [2]
- A2** $R = 20 + 30 = 50 \, \Omega$. [2]
- A3** $1/R = 1/20 + 1/20$, so $R = 10 \, \Omega$. [2]

SECTION B · Standard

- B1** (a) $1/R = 1/6.0 + 1/3.0$, so $R = 2.0 \, \Omega$. (b) $I = V/R = 12/2.0 = 6.0 \, \text{A}$. [3]
- B2** (a) $R = 4.0 + 8.0 = 12 \, \Omega$, so $I = 12/12 = 1.0 \, \text{A}$. (b) $V_1 = IR_1 = 4.0 \, \text{V}$, $V_2 = IR_2 = 8.0 \, \text{V}$. [4]
- B3** $I_{\text{out}} = 3.0 + 2.0 = 5.0 \, \text{A}$. [3]
- B4** $P = I^2 R = 2.0^2 \times 5.0 = 20 \, \text{W}$. [3]

SECTION C · Stretch

- C1** Parallel part: $1/R = 1/6.0 + 1/3.0 = 2.0 \, \Omega$. (a) Total = $4.0 + 2.0 = 6 \, \Omega$. (b) $I = 12/6 = 2.0 \, \text{A}$. (c) pd across the pair = $I \times 2.0 = 4.0 \, \text{V}$, so $I_6 = 4.0/6.0 = 0.67 \, \text{A}$ and $I_3 = 1.33 \, \text{A}$. [4]
- C2** (a) $E = Pt = 60 \times 300 = 18000 \, \text{J}$. (b) Since $E = QV$, $Q = E/V = 18000/230 = 78.3 \, \text{C}$. [4]
- C3** Around any closed loop, the sum of the emfs equals the sum of the potential differences (the sum of all pd changes around the loop is zero). This expresses conservation of energy. [3]