InkPhysics

ANSWER BOOK

Current, charge and the direction problem

Electricity · Year 12

AQA 3.5.1.1 · CIE 9.1, 9.2 · OCR A 4.1.1, 4.2.2

10 questions · 29 marks

NAVY EDITION

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SECTION A · Warm-up

A1 $I = \Delta Q/\Delta t = 30/10 = 3.0$ A. [2]

A2 One coulomb is the charge that passes a point when a current of one ampere flows for one second ($1\ C = 1\ A\ s$). [2]

A3 $V = W/Q = 12/4.0 = 3.0$ V. [2]

SECTION B · Standard

B1 (a) $Q = It = 0.50 \times 120 = 60$ C. (b) $N = Q/e = 60/(1.60 \times 10^{-19}) = 3.75 \times 10^{20}$. [3]

B2 $R = V/I = 6.0/0.25 = 24\ \Omega$. [3]

B3 $W = QV = 8.0 \times 12 = 96$ J. [3]

B4 $Q = It = 2.0 \times 300 = 600$ C. [3]

SECTION C · Stretch

C1 (a) $Q = It = 3.0 \times 3600 = 10800$ C. (b) $W = QV = 10800 \times 230 = 2.48 \times 10^{6}$ J. (c) $N = Q/e = 6.75 \times 10^{22}$. [4]

C2 Conventional current is defined as the direction in which positive charge would flow, from the positive terminal to the negative terminal in the external circuit. In a metal the charge carriers are electrons, which are negative and therefore drift in the opposite direction to the conventional current. [4]

C3 The convention was fixed long before the electron was discovered, and all the established laws and circuit rules were written in terms of it. They work correctly as they are, so changing the convention would cause confusion for no benefit; the direction is simply treated as that of positive charge flow. [3]