InkPhysics

ANSWER BOOK

Alternating currents

Magnetic fields · Year 13

AQA 3.7.5.5 · CIE 21.1 · OCR A 6.3.3

10 questions · 30 marks

NAVY EDITION

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SECTION A · Warm-up

A1 The rms value is the value of steady direct current that would dissipate the same average power in a resistor as the alternating current does. [2]

A2 $V_{rms} = V_{peak}/\sqrt{2} = 10/\sqrt{2} = 7.07$ V. [2]

A3 Peak-to-peak = 2 × peak = 30 V. [2]

SECTION B · Standard

B1 $V_{peak} = V_{rms} \times \sqrt{2} = 230 \times \sqrt{2} = 325.3$ V. [3]

B2 $I_{rms} = I_{peak}/\sqrt{2} = 4.0/\sqrt{2} = 2.83$ A. [3]

B3 (a) $I_{rms} = V_{rms}/R = 12/6.0 = 2.0$ A. (b) Mean power = $V_{rms}I_{rms} = 12 \times 2.0 = 24$ W. (c) Peak power = $V_{peak}I_{peak} = 48$ W (twice the mean). [4]

B4 $V_{rms} = 4.0/\sqrt{2} = 2.83$ V. [3]

SECTION C · Stretch

C1 T = 4.0 × 5.0 ms = 20 ms, so f = 1/T = 50 Hz. $V_{peak} = 3.0 \times 2.0 = 6.0$ V, so $V_{rms} = 6.0/\sqrt{2} = 4.24$ V. [4]

C2 Mean power = $V_{rms}^2/R = 230^2/100 = 529$ W. A steady 230 V DC gives the same power, because the rms value is defined as the equivalent DC value for heating. [4]

C3 The rms value gives the equivalent steady (DC) value for delivering power, so it represents the useful heating or working effect of the AC. Using it lets AC and DC be compared directly and makes power calculations ($P = V_{rms}I_{rms}$) straightforward. [3]