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QUESTION WORKBOOK

Alternating currents

Magnetic fields · Year 13

AQA 3.7.5.5 · CIE 21.1.1, 21.1.2, 21.1.3, 21.1.4 · OCR A 4.4.1(b)(ii)

18 questions · 49 marks

PRINT EDITION

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SECTION A · Warm-up

A1 Define the root mean square (rms) value of an alternating current. [2]

A2 A sinusoidal alternating voltage has a peak value of 10 V. Calculate its rms value. [2]

A3 A sinusoidal alternating voltage has a peak value of 15 V. State its peak-to-peak value. [1]

A4 The frequency of the UK mains supply is 50 Hz. Calculate its period and its angular frequency. [2]

A5 On an oscilloscope with the time base set to 5.0 ms per division, one full cycle of a sinusoidal signal spans 4.0 divisions. Calculate the frequency of the signal. [2]

SECTION B · Standard

B1 The UK mains supply has an rms voltage of 230 V. Calculate the peak voltage of the supply. [2]

B2 A sinusoidal alternating current has a peak value of 4.0 A. Calculate its rms value. [2]

B3 A sinusoidal alternating supply of rms voltage 12 V is connected across a 6.0 Ω resistor. Calculate the rms current, the mean power dissipated and the peak power. [4]

B4 An oscilloscope trace shows a sinusoidal alternating voltage with a peak value of 4.0 V. Calculate the rms voltage. [2]

B5 An alternating pd is described by $v = 325 \sin(100\pi t)$, with v in volts and t in seconds. State the peak voltage, and determine the frequency and the rms voltage of the supply. [3]

B6 The current in a 15 Ω resistor is sinusoidal with a peak value of 2.6 A. Calculate the mean power dissipated in the resistor. [3]

B7 On an oscilloscope screen, the trace of a sinusoidal voltage spans 6.4 divisions from its lowest point to its highest point. The y-gain is set to 0.50 V per division. Determine the rms voltage of the signal. [3]

SECTION C · Stretch

C1 On an oscilloscope, one complete cycle of a sinusoidal signal spans 4.0 divisions with the time base set to 5.0 ms per division. The amplitude of the trace is 3.0 divisions with the voltage gain set to 2.0 V per division. Determine the period, the frequency and the rms voltage of the signal. [4]

C2 A 100 Ω resistor is connected to the 230 V rms mains supply. Calculate the mean power dissipated in the resistor and explain why a steady 230 V DC supply would dissipate the same power. [3]

C3 Explain why rms values, rather than peak values, are normally quoted for alternating voltages and currents. [3]

C4 A camping inverter supplies 12 V rms and a maximum rms current of 7.0 A. A camper wants a heating element that delivers at least 60 W and considers two elements, of resistance 2.0 Ω and 3.0 Ω. Deduce which element, if either, the camper should choose. [4]

C5 A lamp of constant resistance 6.0 Ω is connected first to a 12 V dc battery and then to a sinusoidal supply of peak voltage 12 V. Deduce which supply makes the lamp brighter and state the factor between the two powers. [4]

C6 The heating effect of the 50 Hz mains supply reaches a maximum 100 times every second. Explain why. [3]