28 Worksheet (A2)

1 An alternating voltage is given by the equation $V = V_0 \sin 2\pi ft$ where $V_0 = 5.0$ V and $f = 10$ Hz.

a Calculate the period of the alternating voltage. [2]

b Calculate the values of t during the first cycle of the voltage (from $t = 0$) for which the value of V is:

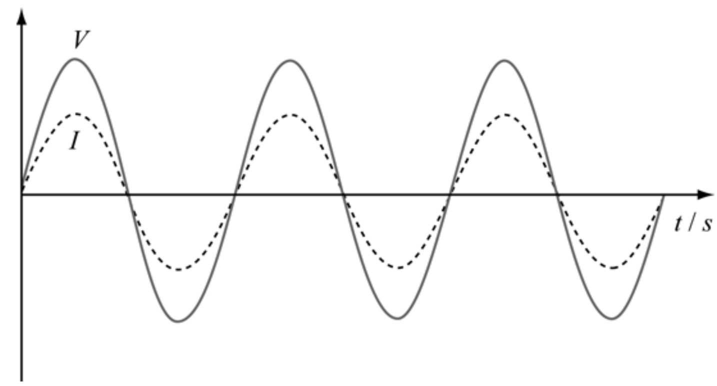
i 0 [1]

ii $+V_0$ [2]

iii $-V_0$ [1]

iv $+V_{rms}$ [2]

2 The graph shows how an alternating voltage V and an alternating current I change with time t.



a V and I are in phase with each other. Explain what is meant by **in phase**. [1]

b Copy the graph and add a waveform to show how the power dissipated varies with t. [3]

3 An electric drill is marked 230 V r.m.s., 690 W.
Calculate:

a **i** the r.m.s. current in the wire connecting the drill to the mains [2]

ii the peak current in the wire connecting the drill to the mains [1]

iii the peak value of the potential difference across the drill. [1]

b Sketch a graph of the power drawn by the drill over one cycle of the current. Mark on the graph the values of peak power and average power. [3]

4 The diagram shows the variation of voltage with time across a resistor.

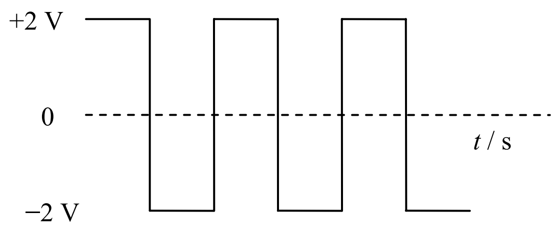
a State and explain whether the current in the resistor is a.c. or d.c. [2]

b Explain why the power dissipated in the resistor is the same as the power produced by a steady voltage of 2 V. [1]

c For the voltage variation shown, state:

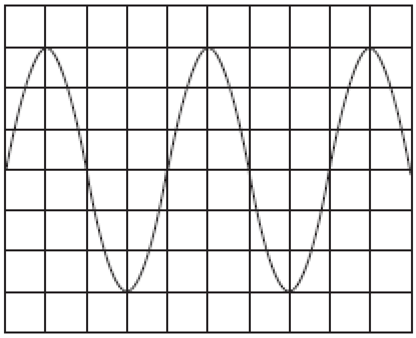
i the peak value [1]

ii the r.m.s. value. [1]



5 Calculate the value of the average power dissipated in a resistor when the alternating supply to the resistor has a peak current of 2.5A and a peak voltage of 6.0 V. [2]

6 The diagram shows the trace obtained on the screen of an oscilloscope connected to a signal generator. The time-base of the oscilloscope is set at 20 ms per division and the Y-gain at 1.5 V per division.

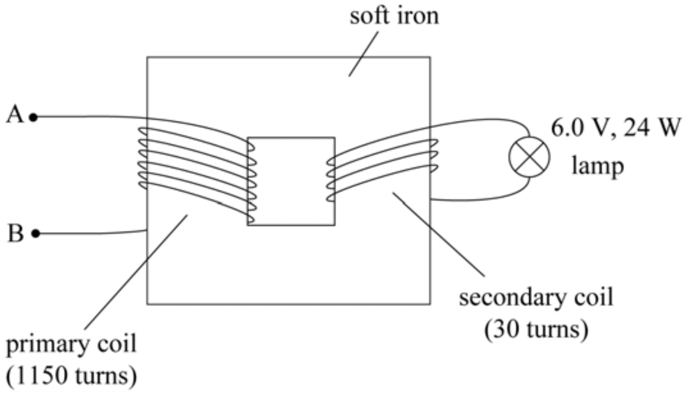


a For the signal generator, calculate:
i the frequency [2]
ii the r.m.s. voltage. [2]

b The equation of the waveform can be written in the form $V = V_0 \sin(\omega t)$. Determine the values of V_0 and ω. [2]

7 The diagram shows a step-down transformer.

The primary coil has 1150 turns and the secondary coil has 30 turns. The ends of the secondary coil are connected to a lamp labelled '6.0 V, 24 W'. The ends **AB** of the primary coil are connected to an alternating voltage supply. The potential difference across the lamp is 6.0 V.



a Calculate the current in the lamp. [2]
b Calculate the input voltage to the primary coil. [2]
c Calculate the current in the primary coil, assuming the transformer is 100% efficient. [2]
d Calculate the maximum p.d. across the lamp during one cycle of the a.c. [2]
e A student suggests that to avoid the production of heat in the transformer the wires should be coated in a material that is a poor conductor of heat. Explain why this is not a sensible suggestion. [1]

8 An electrician uses a transformer to step the 230 V r.m.s. mains voltage down to 115 V r.m.s. The secondary coil has 500 turns and is connected to a resistor of 5000 Ω.
a Calculate the number of turns on the primary coil. [1]
b Calculate the current in the secondary coil. [1]
c Calculate the current in the primary coil. Assume that the transformer is 100 % efficient. [1]
d The electrician connects cables to the secondary coil that break down when the p.d. between the wire and earth is larger than 130 V. Explain whether the cables will break down when the transformer is switched on. [2]

9 A consumer receives 1000 W of power at 100 V r.m.s. through a 5.0 Ω cable.
a Calculate the rate of heat production in the cable. [2]
b Explain why transmitting the same amount of power at a higher voltage produces less heat dissipation in the cable. [2]

Total: $\frac{\quad}{50}$ Score: %