

Oscilloscope questions – the solutions

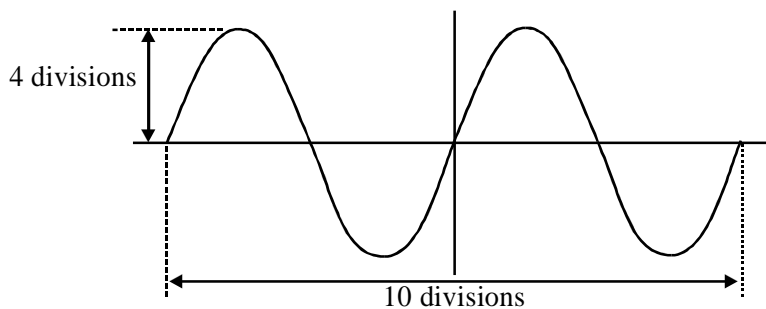
1. (a) (i) 10(V) (1)
 (ii) 5.0(V) (1)
 (iii) $T = 150 \text{ V (ms) (1)}$ $f = \frac{1}{T} = 667 \text{ Hz (1)}$ 4
- (b) (i) $I = \frac{V}{R} = 0.050(\text{A}) (1)$ [or substitute in $P = \frac{V^2}{R} (1)$]
 $E_1 = VIt = 25 \times 10^{-4} \text{ J (1)}$
- (ii) $I = 0.10(\text{A}) (1)$ $E_2 = 5.0 \times 10^{-4} \text{ J (1)}$ [or substitute in $P = \frac{V^2}{R} (1)$]
- (iii) $E_t = 7.5 \times 10^{-4} \text{ J (1)}$
- (iv) $P = 667 (1) \times 7.5 \times 10^{-4} = 0.50 \text{ Js}^{-1} (1)$ (accept J) max 5

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2. (i) $V_0 = 8.0 \text{ V (1)}$
 (ii) $V_{\text{rms}} = 8/\sqrt{2} = 5.7 \text{ (V) (1)}$
 (allow e.c.f. from (i))
 (iii) $T = 3.0 \text{ ms (1)}$
 (iv) $f = \frac{1}{T} = 330 (333) \text{ Hz (1)}$
 (allow e.c.f. from (iii))

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3.



sinusoidal wave

(line gradient must be changing and distance between crests and troughs symmetric) (1)

correct amplitude (1)

calculation of time period shown or implied (1) (1)

two cycles drawn (1) (allow e.c.f. if incorrect time period *calculated*)

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4. (a) (i) the emf (of the battery) (1)
 (ii) the voltage across the battery when current flows
 [or terminal voltage or pd supplied to the circuit]
 (iii) $V = (3 \times 0.5) = 1.5 \text{ (V) (1)}$
 current = $(1.5/14) = 0.11 \text{ A (1)}$ (0.107 A)
 (iv) ($\epsilon = V + Ir$ and emf = $3.5 \times 0.5 = 1.75 \text{ (V)}$ gives)

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$$1.75 = 1.5 + 0.107r \text{ (1)}$$

$$r = 2.3 \Omega$$

[or use of $\epsilon = I(R + r)$ with $I = 0.107$ gives $r = 2.4 \Omega$
and $I = 0.11$ gives $r = 1.9 \Omega$]

(allow C.E. for value of I from (iii))

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(b) (i) peak value = $3.5\sqrt{2} = 4.9 \text{ V}$ (1)

(ii) oscilloscope screen to show
vertical line of height 2.5 divisions above central axis (1)
and below central axis (1)

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5. (a) (i) $T = 40(\text{ms})$ (1)

$$f\left(= \frac{1}{T}\right) = 25 \text{ Hz (1)}$$

(allow C.E. for value of T)

(ii) peak voltage (= 3×15) = 45 (V) (1)

$$\text{rms voltage} = \frac{45}{\sqrt{2}} = 32 \text{ V (1)}$$

(31.8 V)

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(b) (i) $I_{\text{rms}} = \frac{31.8}{540} = 59 \text{ mA (1)}$

(58.9 mA)

(use of 32 V gives 59(.2) mA)

(allow C.E. for value of V_{rms} from (a))

(ii) $V_{\text{rms}} = 59 \times 10^{-3} \times 90 = 5.3(1) \text{ V (1)}$

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(allow C.E. for value of I_{rms} from (i)) [or $V_2 = V_1 \frac{R_2}{R_1 + R_2}$]

(c) $V_{\text{peak}} = 5.31 \times \sqrt{2} = 7.5(1) \text{ (V) (1)}$

best choice: 5 V per division (1)

(allow C.E. for incorrect V_{rms} and for suitable reason)

reason: others would give too large or too small a trace (1)

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