**6-2 Oscilloscopes Answers**

1. 0.9 cm displacement for a 4.5 V input

(a) (i) y-gain = $\frac{4.5\ \text{V}}{0.9\ \text{cm}}$ = 5.0 V cm$^{-1}$ ✓

(ii) p.d. of 12 V gives a displacement = $\frac{12\ \text{V}}{5.0\ \text{V cm}^{-1}}$ = 2.4 cm ✓

(b) Peak-to-peak = 6.5 cm, y-gain = 0.5 V cm$^{-1}$

(i) Peak-to-peak voltage = 6.5 cm x 0.5 V cm$^{-1}$ = 3.25 V

So peak voltage, $V_0$ = 3.25 V = $\frac{1.625\ \text{V}}{2}$ = 1.6 V to 2 sf ✓(answer) ✓(peak-to peak used)

(ii) $V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{1.6}{\sqrt{2}}$ = 1.1 V to 2 sf ✓(working) ✓(answer)

2. (a) time for 2 cycles = 4.4 cm x 10 ms cm$^{-1}$ = 44 ms

Therefore time for 1 cycle = 44 ms = 22ms = 2.2 x 10$^{-2}$ s ✓

(b) $f = \frac{1}{T} = \frac{1}{2.2 \times 10^{-2}}$ = 45 Hz ✓

3. (a) y-gain = 5.0 V cm$^{-1}$

peak-to peak occupies 5 divisions i.e. 5 cm

peak-to-peak voltage = 5 cm x 5.0 V cm$^{-1}$ = 25 V

therefore peak voltage, $V_0$ = $\frac{25\ \text{V}}{2}$ = 12.5 V ✓

$V_{rms} = \frac{V_0}{\sqrt{2}} = \frac{12.5}{\sqrt{2}}$ = 8.8 V to 2 sf ✓(working) ✓(answer)

(b) 3 cycles occupies 6 divisions i.e. 6 cm

So the time for 3 cycles = 6 cm x 5 ms cm$^{-1}$ = 30 ms

Time for 1 cycle = $\frac{30\ \text{ms}}{3}$ = 10 ms = 10 x 10$^{-3}$ s ✓

$f = \frac{1}{T} = \frac{1}{10 \times 10^{-3}}$ = 1.0 x 10$^2$ Hz or 100 Hz ✓

4. (a) 10 V at 5.0 V cm$^{-1}$ gives $\frac{10\ \text{V}}{5.0\ \text{V cm}^{-1}}$ = 2 cm (above the centre line) ✓

Shown in purple in sketch below

(b) 10 V r.m.s.

Hence $V_0 = \sqrt{2} \times 10\ \text{V} = 14\ \text{V}$

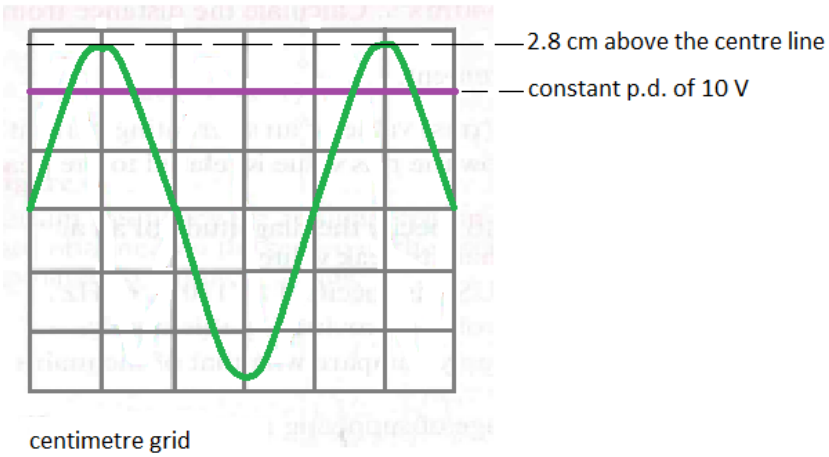
At 5.0 V cm$^{-1}$ this gives $\frac{14\ \text{V}}{5.0\ \text{V cm}^{-1}}$ = 2.8 cm (above the centre line) ✓✓

f = 50 Hz

$f = \frac{1}{T}$ Hence $T = \frac{1}{f} = \frac{1}{50} = 0.02\ \text{s}$

At 5 ms cm$^{-1}$ this gives $\frac{0.02\ \text{s}}{5 \times 10^{-3}\ \text{s cm}^{-1}}$ = 4 cm per cycle ✓

Shown in green in sketch below




✓(10 V line) ✓(sinusoidal line) ✓(shape shows correct peak and time values)