ALTERNATING CURRENT & VOLTAGE/ TUTORIAL ANSWERS

ANSWERS FOR TUTORIAL 1

1. Peak = $\sqrt{2}$ xd.c. value
   = $\sqrt{2}$ x230
   = 325
   The peak value is 325V

2. $V_{r.m.s.} = V_{peak} / \sqrt{2}$
   = 141/ $\sqrt{2}$
   = 99.7
   The r.m.s. voltage is 100V

3. P=VI gives 500 = 250I. Thus I= 2

   V_{peak} = 250x$\sqrt{2}$ = 354

   I_{peak} = 2$\sqrt{2}$ = 2.82

   The motor is designed to handle a maximum voltage of 354V and a maximum current of 2.82A

4. Period = 4 Divs x 250μs/Div
   = 0.001s
   Frequency = 1/0.001 = 1000Hz

5. a) Calculate the potential energy released when the mass falls through 5m.

$$E_p = mgh$$
$$E_p = 10 \times 9.8 \times 5 = 490$$
$$\Rightarrow E_p = Pt$$
$$\Rightarrow P = \frac{490}{10}$$
$$\Rightarrow P = 49W$$

The power given out is 49W

$$P = IV$$
$$\Rightarrow V = \frac{49}{3.5} = 14$$
$$\Rightarrow V_p = V \times \sqrt{2} = 14 \times \sqrt{2} = 19.8$$

b)

The peak voltage output is 19.8V

6.

The energy supplied in 10seconds is given by

This energy is released over 10 hours (36000s)

$$E = ItV = 7.5 \times 10 \times 230 = 17250J \qquad P = \frac{E}{t} = \frac{17250}{36000} = 0.48$$
$$I = \frac{I_p}{\sqrt{2}} \Rightarrow \frac{10.6}{\sqrt{2}} = 7.5A$$
$$I = \frac{I_p}{\sqrt{2}} = I = \frac{8.5}{\sqrt{2}} = 6.0A$$
$$P = I^2R = 6^2 \times 50 = 1800W$$
$$Pt = mc\Delta T = 1800 \times 15 \times 60 = 9.7 \times 4.19 \times 10^3$$
$$\Rightarrow \Delta T = 40^\circ C$$

The power used by the clock is 0.48W

7.

The water temperature is raised by 40°C.