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General Physics- II, Quiz 10
PHYS10000AA, Fall Semester-107
2019-06-13

St. ID:_____, Name:_____

Note: You can use pencil or any pen in answering the problems. Dictionary, calculators and mathematics tables are allowed. Please hand in both solution and this problem sheet.
ABSOLUTELY NO CHEATING!

Problems (total 2 problems, 100%)

1. The current in the circuit shown in Figure P32.3 equals 60.0% of the peak current at t = 7.00 ms. What is the lowest source frequency that gives this current. (50%)
   Ans: f = 14.6 Hz
   The current as a function of time is

$$i = \frac{\Delta v}{R} = \left(\frac{\Delta V_{\max}}{R}\right)\sin \omega t.$$

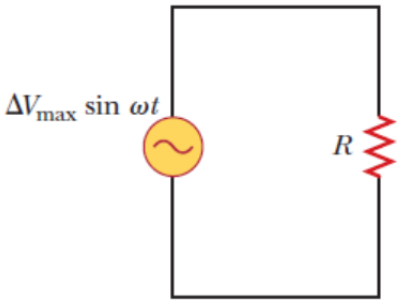

Figure P32.3

   Given the value of t, we want to identify a point with

$$0.600\frac{\Delta V_{\max}}{R} = \frac{\Delta V_{\max}}{R}\sin(\omega t)$$

   Or $\omega t = \sin^{-1} 0.600$

   To find the lowest frequency we choose the smallest angle satisfying this relation:

$$(0.007\ 00\ \text{s})\omega = \sin^{-1}(0.600) = 0.644\ \text{rad}$$

   Thus, $\omega = 91.9\ \text{rad/s} = 2\pi f$ so $\boxed{f = 14.6\ \text{Hz}}$

2. In the AC circuit shown in Figure P32.3, R = 70.0 V and the output voltage of the AC source is $\Delta V_{\max} \sin \omega t$. (a) If $\Delta V_R = 0.250\ \Delta V\text{max}$ for the first time at t = 0.010 0 s, what is the angular frequency of the source? (b) What is the next value of t for which $\Delta V_R = 0.250\ \Delta V\text{max}$? (50%)
   Ans: (a) ω= 25.3 rad/s (b) t= 0.114 s

   (a) From Equation 32.5, $\Delta v_R = \Delta V_{\max} \sin \omega t$. To find the angular frequency, we write

$$\Delta v_R = 0.250(\Delta V_{\max})$$

so $\sin \omega t = 0.250$

or $\omega t = \sin^{-1}(0.250)$

The smallest angle for which this is true is $\omega t = 0.253 \text{ rad}$. Thus, if $t = 0.010\,0$ s,

$$\omega = \frac{0.253 \text{ rad}}{0.010\,0 \text{ s}} = \boxed{25.3 \text{ rad/s}}$$

(b) The second time when $\Delta v_R = 0.250(\Delta V_{\max})$, $\omega t = \sin^{-1}(0.250)$ again. For this occurrence, $\omega t = \pi - 0.253 \text{ rad} = 2.89 \text{ rad}$ (to understand why this is true, recall the identity $\sin(\pi - \theta) = \sin\theta$ from trigonometry). Thus,

$$t = \frac{2.89 \text{ rad}}{25.3 \text{ rad/s}} = \boxed{0.114 \text{ s}}$$