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01120126 2
Section A

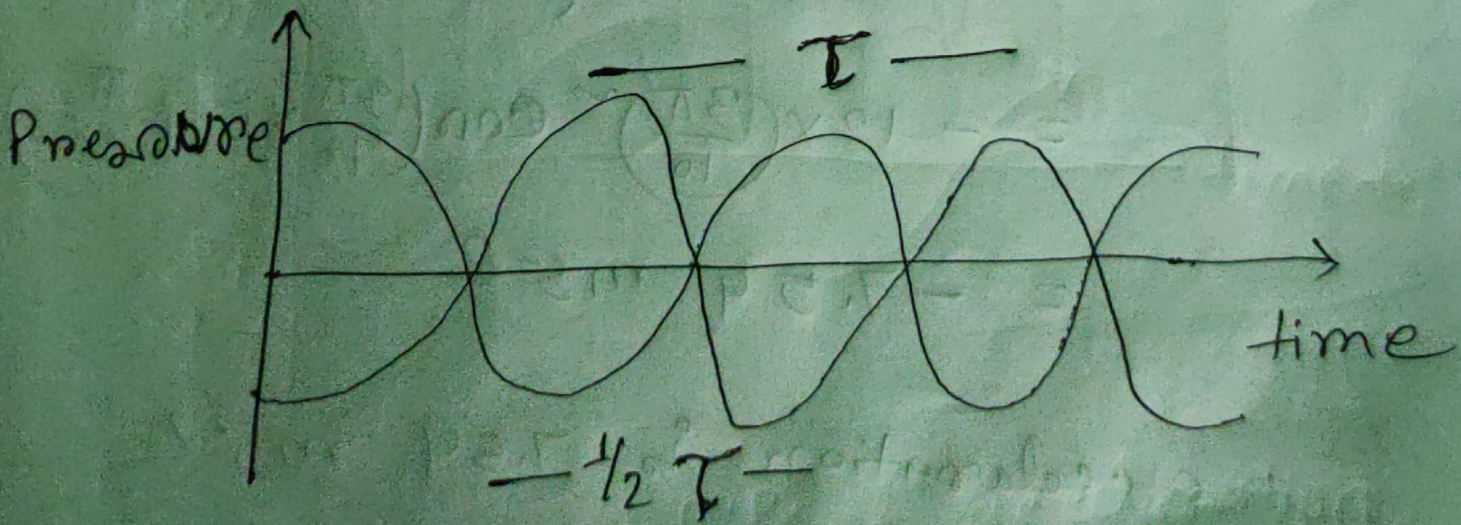
22.11.2020

Question-02

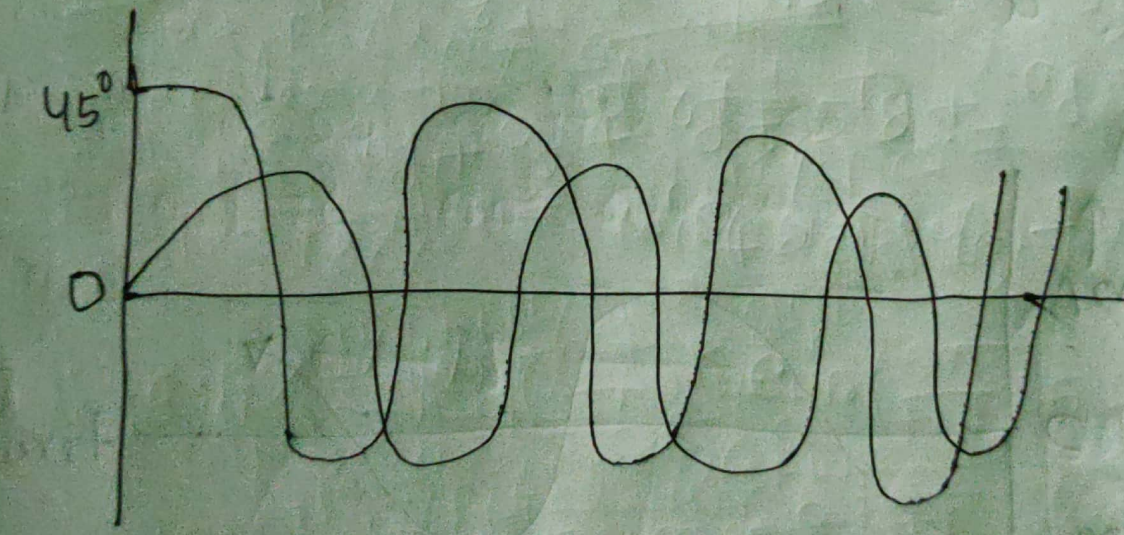
The wave that cuts the origin first of the horizontal axis, the wave is called leading wave.

(i)

Phase difference of two wavers for $\delta = 180°$.



(ii) The leading and lagging nature of two waves when $\delta = 45°$.



Question -01

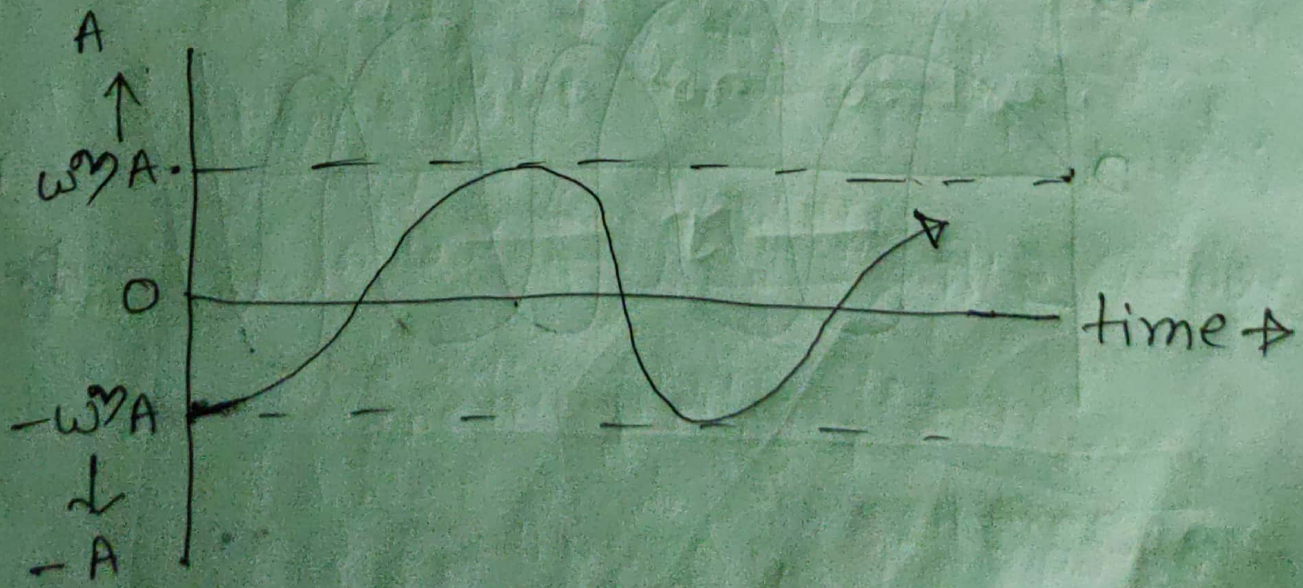
$$x = A\cos(-\omega t - \phi)$$

$$\Rightarrow \frac{dx}{dt} = \frac{d}{dt}\{A\omega\cos(-\omega t - \phi)\}$$

$$\therefore v = A\omega^2 \sin(-\omega t - \phi)$$

$$\Rightarrow \frac{d^2x}{dt^2} = \frac{d}{dt} A\omega^2 \sin(-\omega t - \phi)$$

$$\therefore a = -A\omega^3 \cos(-\omega t - \phi)$$



graph of accelaration.

Question-03

Here give,

$$m = 250\,gm = 250 \times 10^{-3}\,kg$$
$$= 0.25\,kg$$

$$K = 400\ dynes/cm$$
$$= 400 \times 10^{-3}\,N/m = 0.4\,N/m$$

$$A = 100\,cm = 100 \times 10^{-2}\,m$$
$$= 1\,m.$$

(i) the Time Period,

$$T = 2\pi\sqrt{\frac{m}{K}} = 2\pi\sqrt{\frac{0.25}{0.4}}$$
$$= 4.97\,S.\ (Result)$$

(ii) frequency,

$$f = \frac{1}{T} = \frac{1}{4.97} = 0.2\,Hz.$$
(Result)

(iii) angular frequency,

$$\omega = \sqrt{\frac{k}{m}} = \sqrt{\frac{0.4}{0.25}}$$

$$= 1.26 \text{ rad/s.}$$

(Result)

(iv) maximum velocity

$$V_{max} = A\omega$$

$$= 1 \times 1.26$$

$$= 1.2 \text{ m/s.} \quad \text{(Result)}$$

(v) maximum acceleration,

$$a_{max} = A\omega^2$$

$$= A \cdot \frac{k}{m}$$

$$= 1 \times \frac{0.4}{0.25}$$

$$= 1.6 \text{ m/s}^2. \quad \text{(Result)}$$

Question-04

Here given,

$$y = 12 \sin\left(\frac{3\pi t}{10} + \frac{\pi}{4}\right)$$

(i) Here Amplitude $A = 12\,m$.

(ii) frequency,

$$\omega = 2\pi f$$

$$\Rightarrow \frac{3\pi}{10} = 2\pi f$$

$$\Rightarrow f = \frac{3\pi}{20\pi} = 0.15\ Hz.$$

(iii) displacement at $t = 1.25\,s$.

$$y = 12 \sin\left(\frac{3\pi \times 1.25}{10} + \frac{\pi}{4}\right)$$

$$= 11.09\,m \quad \text{(Result)}$$

(iv) velocity at $t = 2.5$ s

$$v = -A\omega \sin(\omega t + \phi)$$

$$= -12 \times \frac{3\pi}{10} \sin\left(\frac{3\pi}{10} \times 2.5 + \frac{\pi}{4}\right)$$

$$= 0 \text{ ms}^{-1}$$

∴ velocity is 0 ms-1.

(v) acceleration at $t = 5$ s.

$$a = -A\omega^2 \cos(\omega t + \phi)$$

$$= -12 \times \left(\frac{3\pi}{10}\right)^2 \cos\left(\frac{3\pi}{10} \times 5 + \frac{\pi}{4}\right)$$

$$= -7.54 \text{ ms}^{-2}$$

∴ acceleration is 7.54 ms-2

(Result)

Question-05

Here given,

$$m = 1.68 \times 10^{-27} \text{ kg}$$

$$f = 10^4 \text{ Hz}$$

$$A = 10^{-10} \text{ m}$$

$F_{max} = ?$

we know that,

$$F_{max} = m.a_{max}$$

$$= m.(A\omega^2)$$

$$= m.A.(2\pi f)^2$$

$$= (1.68 \times 10^{-27}) \times 10^{-10} \times (2\pi \times 10^4)^2$$

$$= 6.63 \times 10^{-28} \text{ (Result)}$$