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PHY 103W

Patel B

Ans: to the que: No - 4

(a)

A plane progressive wave in a longitudinal or transverse wave that travels with or without medium, without the change in its amplitude. This wave is not damped by external forces.

Ans: to the que: NO-4

(b)

Standrad form of a progressive wave is,

$$y = a\sin\frac{2\pi}{\lambda}(vt - x) \quad \ldots (i)$$

given equation is-

$$y = 0.02\sin(30t - 4x)$$

$$\Rightarrow y = 0.02\sin 4\left(\frac{30}{4}t - x\right) \quad \ldots (ii)$$

Comparing (ii) with (i),

amplitude $a = 0.02$ m

$$\frac{2\pi}{\lambda} = 4 \Rightarrow \lambda = \frac{2\pi}{4}$$

$$\Rightarrow \lambda = \frac{\pi}{2}\ m$$

$$V = \frac{30}{4}\ ms^{-1}$$

$$= 7.5\ ms^{-1}$$

So, the velocity is $7.5\ ms^{-1}$

and,

we know,

$$f = \frac{V}{\lambda} = \frac{7.5}{\frac{\pi}{2}} = \frac{7.5 \times 2}{\pi}$$

$$= 4.78 \text{ Hz}.$$

So the frequency is 4.78 Hz.

Ans: to the que: NO - 5

(a)

Simple Harmonic Motion or SHM is defined as a motion in which the restoring force is directly proportional to the displacement of the body from its mean position. The direction of this restoring force is always towards the mean position.

Ans: to the que: NO-5

(b)

Given equation is,

$$Y = 12\sin\left(\frac{2\pi}{10}t + \frac{\pi}{4}\right) \quad \text{..... (i)}$$

Standrad form of equation -

$$Y = a\sin(\omega t + \delta) \quad \text{..... (ii)}$$

Comparing (i) with (ii)

$$\omega = \frac{2\pi}{10}$$

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

$$\Rightarrow f = \frac{1}{10}\ Hz$$

So, the amplitude is 12 unit.

frequency is $\frac{1}{10}$ Hz

Velocity and acceleration at $t = 2.5_s$

$$y = 12\sin\left(\frac{2\pi}{10}t + \frac{\pi}{4}\right)$$

$$\Rightarrow \frac{d}{dt}(y) = v = 12\cos\left(\frac{2\pi}{10}t + \frac{\pi}{4}\right) \times \frac{2\pi}{10}$$

when $t = 2.5s$

$$v = 12\cos\left(\frac{2\pi}{10} \times 2.5 + \frac{\pi}{4}\right) \times \frac{2\pi}{10}$$

$$= -5.33 \text{ unit/s}$$

$$\Rightarrow \frac{d}{dt}(v) = a = -12\sin\left(\frac{2\pi}{10}t + \frac{\pi}{4}\right) \times \frac{2\pi}{10} \times \frac{2\pi}{10}$$

at $t = 2.5s$,

$$a = -12\sin\left(\frac{2\pi}{10} \times 2.5 + \frac{\pi}{4}\right) \times \frac{(2\pi)^2}{100}$$

$$= -8.485 \times \left(\frac{(2\pi)^2}{100}\right)$$

$$= -3.34985 \text{ unit/s}^2$$

Ans: to the que: NO-6

(a)

Friction is a force that resists the relative motion between two objects or materials. The causes of the resistive force of friction are:-

- Molecular Adhesion
- Surface Roughness
- Plowing effect.

Ans: to the que: NO-6

(b) (i)

we know,

Co-efficient of static friction, $\mu_s = \frac{f_s}{R_N}$

$= \frac{68}{8 \times 9.8}$

Here,
f_s = frictional force
R_N = Normal force

$= 0.867$

b(ii)

We know,

$$\Sigma F = F - F_k = ma$$

$$\Rightarrow F - \mu_K \cdot R = ma$$

$$\Rightarrow F - \mu_K \cdot mg = ma$$

$$\Rightarrow \mu_K = \frac{F - ma}{mg}$$

$$= \frac{68 - 8 \times 14}{8 \times 9.8}$$

$$= -0.5612$$

μ_K is always less than μ_s. However its not possible to have negative friction, and therefore kinetic friction a acceleration & μ_K can't be less than 0, Because kinematic friction is always positive and acts against the applied force.