

EXERCISE – II**MULTIPLE CHOICE QUESTIONS****1. B,C,D**

$$mg = Kx_o \quad x_o = \frac{10}{500} = 2\text{cm}$$

$$\omega = \sqrt{\frac{500}{1}} = 10\sqrt{5} \frac{\text{rad}}{\text{sec}}$$

$$\therefore \text{Maximum velocity} = A\omega = 3 \times 10^{-2} \times 10\sqrt{5}$$

$$= 30\sqrt{5} \text{ cm/sec.} \Rightarrow \text{Max}^m \text{ Acc}^n = A\omega^2 = 15 \text{ m/s}^2$$

2. A

$$2 \times \frac{1}{2} KA^2 = \frac{1}{2} KA'^2 \Rightarrow A' = \sqrt{2}A \Rightarrow T = 2\pi\sqrt{\frac{m}{K}}$$

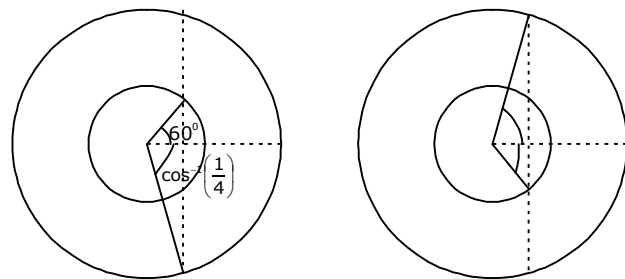
$$\mathbf{3. B} \quad y = 2 \sin\left(\frac{10}{3}t - \frac{\pi}{2}\right)$$

4. B, C

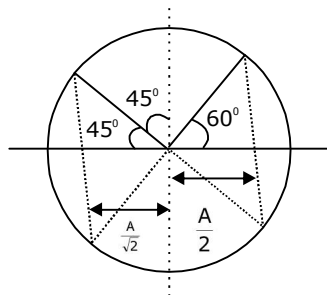
$$\text{Phase by } \omega = \frac{\omega \times 2\pi}{3\omega} = \frac{2\pi}{3}$$

$$\text{Phase by } 2\omega = \phi + 2\omega \times \frac{2\pi}{3\omega},$$

$$\phi + \frac{4\pi}{3} - \frac{2\pi}{3} = 0, 2\pi, 4\pi \quad \phi = \frac{2\pi}{3}, \frac{4\pi}{3}, \dots$$

5. A**6. A,B,C**

$$x = 5 \sin\left(4\pi t + \tan^{-1} \frac{4}{3}\right)$$

7. C**8. B**

$$v^2 = 108 - 9x^2 \Rightarrow v^2 = 9[12 - x^2]$$

$$\Rightarrow 2v \frac{dv}{dx} = -2x \times 9 \Rightarrow a = -9x \Rightarrow \omega^2 = 9$$

9. A,B,C,D

$$A\omega^2 = g \Rightarrow 0.40 \omega^2 = 10$$

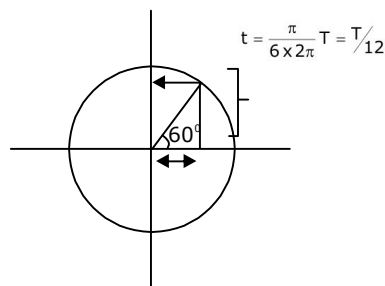
b) Negative Extreme

10. B,C,D

$$u = 5x^2 - 20x \Rightarrow F = \frac{-du}{dx} = -10(x - 2)$$

M.P. at $x = 2\text{m}$ **11. A,B**

$$\omega^2 R \sin 60 = \frac{a}{2}$$

**12. A,B,C**

$$\frac{1}{2}mv^2 = \frac{1}{2}m\omega^2(A^2 - x^2) = \frac{1}{2}m\omega^2A^2(0.64)$$

$$\frac{1}{2}m\omega^2A^2 - \frac{1}{2}m\omega^2x^2 = \frac{1}{2}m\omega^2A^2(0.64)$$

Put $A = 10 \text{ cm.} \Rightarrow x = 6 \text{ cm.}$ **13. B,D**

$$x = 3 \sin 100t + 4(1 + \cos 100t)$$

$$x = 5 \sin\left(100t + \tan^{-1} \frac{4}{3}\right) + 4$$

M.P. is at 4 with $A = 5$ **14. A**

$$F = -Kx \quad \text{Slope} = -K$$

15. C,D

$$x = a \sin \omega t \dots (1)$$

$$y - a = -a \cos \omega t \dots (2)$$

$$(1)^2 + (2)^2 \Rightarrow (y - a)^2 + x^2 = a^2$$

16. B,C,D

$$v^2 = \omega^2(A^2 - x^2) \quad F = -Kx$$

$$\frac{v^2}{\omega^2} + x^2 = A^2 \quad \text{---- Ellipse}$$

$$v^2 = (A^2 - \omega^2 x^2), a = -\omega^2 x, a^2 = \omega^4 x^2$$

$$v^2 = \left(A^2 - \frac{a^2}{\omega^2}\right) \Rightarrow v^2 + \frac{a^2}{\omega^2} = A^2 \quad \text{---- Ellipse}$$

17. A,B,C

$$v = \omega A \quad \& \quad \omega = \frac{10}{2.5} = 4$$

$$(a) T = \frac{2\pi}{\omega} = \frac{\pi}{2} = 1.57$$

$$(b) a = \omega^2 A = 40$$

$$(c) v = \omega \sqrt{A^2 - x^2} = 2\sqrt{21}$$

18. A,C

$$v = \sqrt{\frac{900}{3}} \sqrt{(2^2 - 1^2)} = 10\sqrt{3} \times \sqrt{3} = 30 \text{ m/s}$$

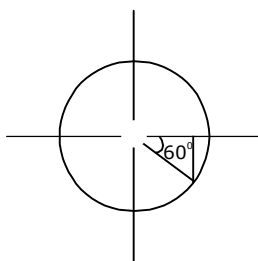
$$\text{M.C. } 3 \times 30 = 9 \times v \Rightarrow v = 10 \text{ m/s}$$

$$10 = \sqrt{\frac{900}{9}} \sqrt{(A^2 - 1^2)} \Rightarrow A = \sqrt{2} \text{ m}$$

19. B,D

$$\frac{\pi}{2} + \frac{\pi}{3} = \frac{5\pi}{6} \Rightarrow x = A \sin\left(\frac{2\pi t}{T} + \frac{5\pi}{6}\right)$$

$$x = A \cos\left(\frac{2\pi}{T} \cdot t + \frac{\pi}{3}\right)$$

**20. B**

$$T = 2\pi \sqrt{\frac{m}{K}} \text{ ----> not dependent on } q_{\text{eff}}$$

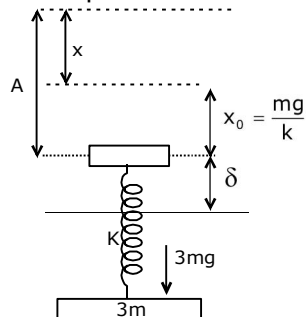
the velocity of particle

$$\text{at M.P.} = V_0 \therefore V_0 = A\omega_0$$



$$A = \frac{V_0}{\omega_0}$$

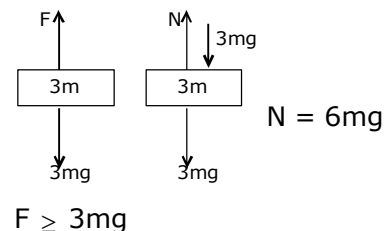
Initial phase is zero.

**21.**

$$kx \geq 3mg \quad \delta = \frac{2mg}{k}$$

$$x \geq \frac{3gm}{k} \quad F = k\delta + kx = 3mg$$

$$A = \frac{4mg}{k}$$

**22. A,C**

$$V_{\text{rms}} = \sqrt{\frac{\int v^2 \cdot dt}{\int dt}}$$

23. B,C

$$\text{KE Average} = \frac{1}{4} KA^2 = m\pi^2 f^2 A^2$$

$$\text{PE Average} = m\pi^2 f^2 A^2$$

24. B,C

$$\frac{1}{2} KA^2 = \frac{1}{2} \times 2 \times 10^6 \times 10^{-4} = 100$$

 $\therefore 60 \text{ J P.E. at M.P.}$

$$\text{Max}^m \text{K.E.} = 100 \text{ joule}$$

$$\text{Max}^m \text{P.E.} = 160 \text{ joule}$$

25. B