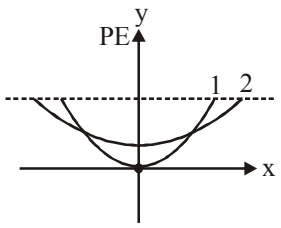
CLASS TEST

SECTION-I

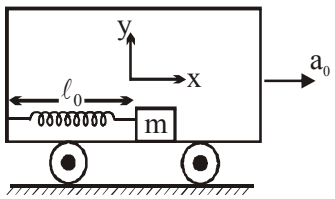
Single Correct Answer Type **13 Q. [3 M (–1)]**

1. There are two potential energy (PE) displacement curves as shown for two different particles (of same mass) doing SHM about same mean position x = 0 on x-axis then we can say.



(A) $\omega_1 > \omega_2$ (B) $\omega_1 < \omega_2$ (C) $\omega_1 = \omega_2$ (D) none

2. A spring block system is fixed in a train suddenly train starts moving with constant acceleration a_0 . Taking origin at initial position of block, what is equation of motion for block in reference frame of train. Force constant of spring is k. Neglect frction between block and train.



(A) $-\frac{ma_0}{k}+\frac{ma_0}{k}\cos\left(\sqrt{\frac{k}{m}}\right)t$ (B) $\frac{ma_0}{k}-\frac{ma_0}{k}\cos\left(\sqrt{\frac{k}{m}}\right)t$

(C) $-\frac{ma_0}{k}-\frac{ma_0}{k}\cos\left(\sqrt{\frac{k}{m}}\right)t$ (D) $\frac{ma_0}{k}+\frac{ma_0}{k}\cos\left(\sqrt{\frac{k}{m}}\right)t$

3. A particle is subjected to two simple harmonic motions, one along the x-axis and the other on a line making an angle of 45° with the x-axis. The two motions are given by $x = x_0 \sin \omega t$ and $s = s_0 \sin \omega t$:-

(A) Path of the particle is straight line. (B) Path of the particle is parabola.

(C) Path of the particle is ellipse (D) Path of the particle is circle

4. Pendulum A is a physical pendulum made from a thin rigid and uniform rod whose length is ℓ. One end of this rod is attached to the ceiling by a frictionless hinge so that rod is free to swing back and forth.

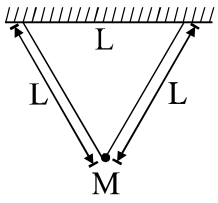
Pendulum B is a simple pendulum whose length is also ℓ. The ratio $\frac{T_A}{T_B}$ for small angular oscillations-

(A) $\sqrt{\frac{3}{2}}$ (B) $\sqrt{\frac{2}{3}}$ (C) $\frac{2}{3}$ (D) $\frac{3}{2}$

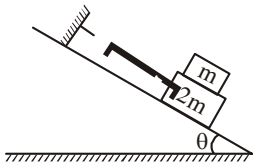
5. A man is swinging on a swing made of 2 ropes of equal length L and in direction perpendicular to the plane of paper. The time period of the small oscillations about the mean position is :

(A) $2\pi\sqrt{\frac{L}{2g}}$ (B) $2\pi\sqrt{\frac{\sqrt{3}L}{2g}}$

(C) $2\pi\sqrt{\frac{L}{2\sqrt{3}g}}$ (D) $\pi\sqrt{\frac{L}{g}}$

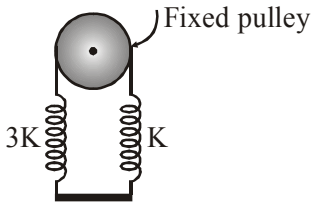


6. The coefficient of friction between block of mass m and 2m is $\mu = 2 \tan\theta$. There is no friction between block of mass 2m and inclined plane. The maximum amplitude of two block system for which there is no relative motion between both the blocks.



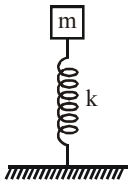
(A) $\frac{2mg\sin\theta}{k}$ (B) $\frac{3mg\sin\theta}{k}$ (C) $\frac{6mg\sin\theta}{k}$ (D) $\frac{8mg\sin\theta}{k}$

7. A bar of mass m is suspended horizontally on two vertical springs of spring constant k and 3k. The bar bounces up and down while remaining horizontal. Find the time period of oscillation of the bar (Neglect mass of springs and friction everywhere).



(A) $2\pi\sqrt{\frac{m}{k}}$ (B) $2\pi\sqrt{\frac{m}{3k}}$ (C) $\pi\sqrt{\frac{2m}{3k}}$ (D) $\pi\sqrt{\frac{3m}{4k}}$

8. A block of mass m is attached to a spring of force constant k whose other end is fixed to a horizontal surface. Initially the spring is in its natural length and the block is released from rest. If average force acting on the surface by the spring till the instant when the block has zero acceleration for the first time in time T is F. Then find F ($T = \frac{\pi}{2}\sqrt{\frac{m}{k}}$) :-

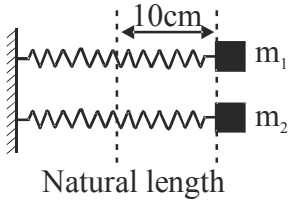


(A) $\frac{mg}{\pi}$ (B) $\frac{2mg}{\pi}$ (C) $\frac{3mg}{\pi}$ (D) $\frac{4mg}{\pi}$

9. A particle of mass 10 gm is placed in a potential field given by $V = (50\ x^2 + 100)$ J/kg. The frequency of oscillation in cycle/sec is :-

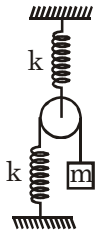
(A) $\frac{10}{\pi}$ (B) $\frac{5}{\pi}$ (C) $\frac{100}{\pi}$ (D) $\frac{50}{\pi}$

10. The drawing shows a top view of a frictionless horizontal surface, where there are two identical springs with particles of mass m_1 and m_2 attached to them. Each spring has a spring constant of 1200 N/m. The particles are pulled to the right and then released from the positions shown in the drawing. How much time passes before the particles are again side by side for the first time if $m_1 = 3.0$ kg and $m_2 = 27$ kg ?



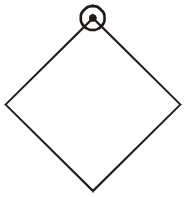
(A) $\frac{\pi}{40}$ sec (B) $\frac{\pi}{20}$ sec (C) $\frac{3\pi}{40}$ sec (D) $\frac{\pi}{10}$ sec

11. Figure shows a system consisting of a massless pulley and two springs of equal constants k each, a block is attached with an ideal string as shown. If the block is slightly displaced vertically down from it's equilibrium position and then released, the time period of vertical oscillations is :



(A) $2\pi\sqrt{\frac{m}{k}}$ (B) $2\pi\sqrt{\frac{m}{2k}}$ (C) $2\pi\sqrt{\frac{2m}{k}}$ (D) $2\pi\sqrt{\frac{5m}{k}}$

12. A square frame of mass m and side ℓ is suspended as shown. Find the time period of small oscillations in vertical plane :-



(A) $2\pi\sqrt{\frac{\ell}{g}}$ (B) $2\pi\sqrt{\frac{5\sqrt{2}}{6}\frac{\ell}{g}}$ (C) $2\pi\sqrt{\frac{\ell}{\sqrt{2}g}}$ (D) $2\pi\sqrt{\frac{5\sqrt{2}}{3}\frac{\ell}{g}}$

13. A particle starts from rest and performs SHM of amplitude A. Find the ratio of time taken by it from mean to $\frac{A\sqrt{3}}{2}$ to time taken by it from A to $\frac{A}{2}$:-

(A) 1 (B) $\frac{1}{2}$ (C) 2 (D) $\frac{1}{4}$

Multiple Correct Answer Type 2 Q. [4 M (–1)]

14. Acceleration of a particle which is at rest at x = 0 is $\vec{a} = (4 - 2x)\hat{i}$. Select the correct alternatives (s) :-

(A) particle further comes to rest at x = 4 (B) particle oscillates about x = 2

(C) maximum speed of particle is 4 units (D) all of the above

15. Tick the correct alternative (s)

(A) The displacement of the particle varies with time as $x = 12 \sin \omega t - 16 \sin^3 \omega t$. The motion of particle is SHM with amplitude 4 units.

(B) A particle oscillates according to equation $x = 7 \cos \frac{\pi t}{2}$ where t is in seconds. The point moves from the point of equilibrium to maximum displacement in 1 second

(C) If a simple pendulum of length ℓ_0 has maximum angular displacement θ_0, then the maximum speed of the bob is $2\sqrt{g\ell_0} \sin \frac{\theta}{2}$

(D) None of the above

Linked Comprehension Type (1 Para × 3Q.) [3 M (-1)]

(Single Correct Answer Type)

Paragraph for Question 16 to 18

Two particles A and B are performing SHM along x and y-axis respectively with equal amplitude and frequency of 2 cm & 1Hz respectively. Equilibrium positions of the particles A and B are at the coordinates (3 cm, 0) and (0, 4 cm) respectively. At t = 0, B is at its equilibrium position and moving towards the origin, while A is nearest to the origin and moving away from the origin.

16. Equation of motion of particle A can be written as-

(A) x = (2 cm) cos 2πt (B) x = (3 cm) – (2 cm) cos 2πt

(C) x = (2 cm) sin 2πt (D) x = (3 cm) – (2 cm) sin 2πt

17. Equation of motion of particle B can be written as-

(A) y = (2 cm) cos 2πt (B) y = (4 cm) – (2 cm) cos 2πt

(C) y = (2 cm) sin 2πt (D) y = (4 cm) – (2 cm) sin 2πt

18. Minimum and maximum distance between A and B during the motion is-

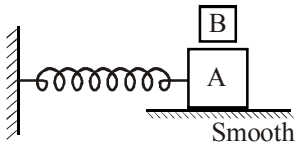
(A) $\sqrt{5}$ cm and $\sqrt{61}$ cm (B) 3 cm and 7 cm

(C) 1 cm and 5 cm (D) 9 cm and 16 cm

SECTION-IV

Matrix Match Type (4 × 5) **2 Q. [8 M (for each entry +2(0)]**

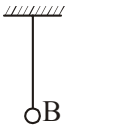
1. In the figure shown below block A is executing SHM on a smooth level ground. Another block B is kept gently on A in any of the positions mentioned in column-I. The block B sticks to A. Match with appropriate descriptions in column II.

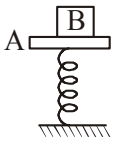


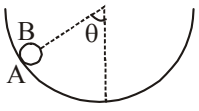
	Column I		**Column II**
(A)	Block B placed on the block A when A is at right extreme.	(P)	Momentum of (A + B) can be assumed to be conserved at the time block A is placed on block B
(B)	Block B placed on the block A when A is at mean position.	(Q)	Mechanical energy is conserved.
(C)	Block B placed on the block A when A is midway between extreme and mean.	(R)	Time period of SHM increases.
		(S)	Amplitude of SHM decreases.

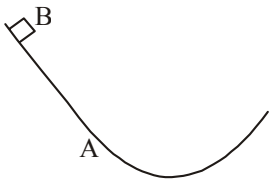
2.

	Column I		**Column II**
(A)	A bob B hanging from a string A of length 3m is projected to left with a speed of 10 m/s	(P)	The acceleration of centre of mass of B at some time can be equal to g
(B)	The plat form is pushed down by a distance $2x_0$ below mean and released x_0 is compression in mean position	(Q)	The force exerted by A on B can be zero at some point
(C)	A spherical solid ball B is released on a perfectly rough spherical surface A as shown $\theta = \frac{\pi}{3}$	(R)	The speed of the body B varies sinusoidaly with time when force exerted by A on B is not zero
(D)	Block B is released on a smooth track A as shown	(S)	The motion of B is oscillatory
		(T)	The motion of B is periodic









CLASS TEST # 01 (TNAS) **ANSWER KEY**

SECTION-I

Single Correct Answer Type **13 Q. [3 M (–1)]**

1. Ans. (A) **2. Ans. (A)** **3. Ans. (A)** **4. Ans. (B)**
5. Ans. (B) **6. Ans. (B)** **7. Ans. (B)** **8. Ans. (B)**
9. Ans. (B) **10. Ans. (C)** **11. Ans. (D)** **12. Ans. (B)**
13. Ans. (A)

Multiple Correct Answer Type **2 Q. [4 M (–1)]**

14. Ans. (A, B) **15. Ans. (A,B,C)**

Linked Comprehension Type **(1 Para × 3Q.) [3 M (-1)]**
(Single Correct Answer Type)

16. Ans. (B) **17. Ans. (D)** **18. Ans. (B)**

SECTION-IV

Matrix Match Type (4 × 5) **2 Q. [8 M (for each entry +2(0)]**

1. Ans. (A) P,Q,R; (B) P,R,S; (C) P,R,S **2. Ans. (A) P,Q; (B) P,Q,R; (C) S,T; (D) P,Q**