SIMPLE HARMONIC MOTION

DPP 01

Q.1 A block of mass m attached to a massless spring is performing oscillatory motion of amplitude 'A' on a frictionless horizontal plane. If half of the mass of the block breaks off when it is passing through its equilibrium point, the amplitude of oscillation for the remaining system become fA. The value of f is

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

Q.2 A particle is executing simple harmonic motion (SHM) of amplitude A, along the x-axis, about $x = 0$. When its potential energy (PE) equals kinetic energy (KE), the position of the particle will be

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

Q.3 A particle executes simple harmonic motion with an amplitude of 5 cm. When the particle is at 4 cm from the mean position, the magnitude of its velocity in SI units is equal to that of its acceleration. Then, its periodic time in second is

(A) $\frac{8\pi}{3}$ (B) $\frac{4\pi}{3}$ (C) $\frac{3\pi}{8}$ (D) $\frac{7\pi}{3}$

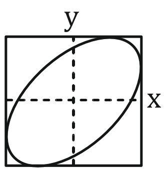
Q.4 A cylindrical plastic bottle of negligible mass is filled with 310ml of water and left floating in a pond with still water. If pressed downward slightly and released, it starts performing simple harmonic motion at angular frequency ω. If the radius of the bottle is 2.5 cm then ω is close to (density of water $= 10^3\ kg/m^3$)

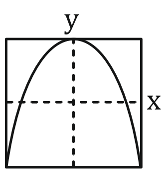
(A) $7.95 rads^{-1}$ (B) $3.75 rads^{-1}$ (C) $5.00 rads^{-1}$ (D) $1.25 rads^{-1}$

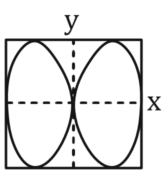
Q.5 A particle undergoing simple harmonic motion has time dependent displacement given by $x(t) = A\sin\frac{\pi t}{90}$. The ratio of kinetic to potential energy of this particle at $t = 210$ s will be

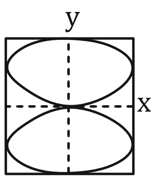
(A) $\frac{1}{9}$ (B) 2 (C) $\frac{1}{3}$ (D) 3

Q.6 x and y displacements of a particle are given as $x(t) = a\sin\omega t$ and $y(t) = a\sin 2\omega t$. Its trajectory will look like

(A) 

(B) 

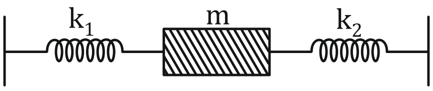
(C) 

(D) 

Q.7 Two particles are executing simple harmonic motion of the same amplitude A and frequency ω along the X-axis. Their mean position is separated by distance $X_0 (X_0 > A)$. If the maximum separation between them is $(X_0 + A)$, the phase difference between their motion is

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{6}$

Q.8 Two springs, of force constants k_1 and k_2 are connected to a mass m as shown. The frequency of oscillation of the mass is f. If both k_1 and k_2 are made four times their original values, the frequency of oscillation becomes



(A) 2f (B) f/2 (C) f/4 (D) 4f

Q.9 A particle of mass m executes simple harmonic motion with amplitude a and frequency υ. The average kinetic energy during its motion from the position of equilibrium to the end is

(A) $2\pi^2 ma^2\upsilon^2$ (B) $\pi^2 ma^2\upsilon^2$ (C) $\frac{1}{4}ma^2\upsilon^2$ (D) $4\pi^2 ma^2\upsilon^2$

Q.10 If x, v and a denote the displacement, the velocity and the acceleration of a particle executing simple harmonic motion of time period T, then, which of the following does not change with time?

(A) $a^2T^2 + 4\pi^2v^2$ (B) aT/x (C) $aT + 2\pi v$ (D) aT/v

ANSWER KEY

1.	(A)	**2.**	(B)	**3.**	(A)	**4.**	(A)	**5.**	(C)	**6.**	(C)	**7.**	(B)
8.	(A)	**9.**	(B)	**10.**	(B)								