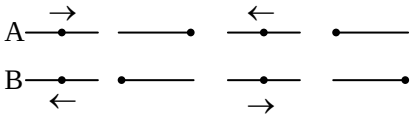
LEVEL # 1

Questions based on Basic concept & displacement

Q.1 The example of S.H.M. is -
(A) motion of an electron around the nucleus.
(B) motion of the earth around the sun
(C) a car moving in a circular path
(D) A glass ball rolling freely in a shallow hemispherical bowl.

Q.2 The figure represents two S.H.M. The parameter which has different values in the two motions is –



(A) amplitude (B) frequency
(C) phase (D) Maximum velocity

Q.3 Both the equations $y_1 = A \sin \omega t$ and. $y_2 = \frac{A}{2} \sin \omega t + \frac{A}{2} \cos \omega t$ represent S.H.M. The ratio of the amplitudes of the two motions is
(A) 1 (B) 2 (C) 0.5 (D)

Q.4 The displacement of particle executing S.H.M. is given by $y = 5 \sin 20\pi t$. Its frequency is
(A) 10 Hz (B) 20π Hz
(C) 0.1 Hz (D) 20Hz

Q.5 The equation of a simple harmonic oscillator with amplitude 5 cm and period 2 sec is if particle is starting from the mean positions is –
(A) $y = 5 \sin \pi t$ (B) $y = 2 \sin 2\pi t/5$
(C) $y = 5 \cos \pi t$ (D) $y = 5 \sin 2\pi t/5$

Q.6 A particle is executing S.H.M. of amplitude 'a' and time period = 4 second. Then the time taken by it to move from the extreme position to half the amplitude is
(A) 1 sec (B) $\frac{1}{3}$ sec (C) $\frac{2}{3}$ sec (D) $\frac{4}{3}$ sec

Q.7 The phase of a particle executing S.H.M is $\pi/2$ when it has
(A) maximum displacement
(B) maximum velocity
(C) maximum energy
(D) none of the above

Q.8 The equation of motion of a particle executing SHM is (k is a positive constant)
(A) $\frac{d^2x}{dt^2} - \frac{k}{m}x = 0$ (B) $\frac{dx}{dt} - \frac{k}{m}x = 0$
(C) $\left(\frac{dx}{dt}\right)^2 - \frac{k}{m}x = 0$ (D) $\frac{d^2x}{dt^2} + \frac{k}{m}x = 0$

Q.9 The equation of S.H.M. of a particle is $\frac{d^2y}{dt^2} + ky = 0$, where λ is a positive constant. The time period of motion is given by
(A) $\frac{2\pi}{\sqrt{k}}$ (B) $\frac{2\pi}{k}$ (C) $2\pi k$ (D) $2\pi\sqrt{k}$

Questions based on Velocity

Q.10 The time-period of a particle undergoing S.H.M. is 16 sec. It starts its motion from the mean position. After 2 sec, its velocity 0.4 m/s. The amplitude is
(A) 1.44 m (B) 0.72 m
(C) 2.88 m (D) 0.66 m

Q.11 A simple pendulum performs S.H.M. about x = 0 with an amplitude a and time period T. The speed of the pendulum at x = a/2 will be –
(A) $\frac{\pi a\sqrt{3}}{T}$ (B) $\frac{\pi a\sqrt{3}}{2T}$
(C) $\frac{\pi a}{T}$ (D) $\frac{3\pi^2 a}{T}$

Q.12 The displacement of a particle executing S.H.M. is given by $y = 0.25 \sin 200t$ cm. The maximum speed of the particle is
(A) 200 cm/sec (B) 100 cm/sec
(C) 50 cm/sec (D) 0.25 cm/sec

Q.13 A particle is executing S.H.M. with amplitude 'a' and has maximum velocity ' v '. Its speed at displacement a/2 will be -
(A) 0.866 v (B) v/2
(C) v (D) v/4

Q.14 A particle is executing S.H.M. having amplitude 'a'. The position of particle where its velocity becomes half of its maximum velocity is
(A) a/2 (B) $\frac{a\sqrt{3}}{2}$ (C) $\frac{a}{\sqrt{3}}$ (D) a

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Q.15 A particle performing S.H.M. having amplitude 'a' possesses velocity $\frac{\sqrt{3}}{2}$ times the velocity at the mean position. The displacement of the particle shall be

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

Q.16 A particle executes S.H.M. with a time period of 3s. The time taken by the particle to go directly from its mean position to half of its amplitude is-

(A) 1s (B) $\frac{3}{4}$s (C) $\frac{1}{3}$s (D) $\frac{1}{4}$s

Q.17 The displacement, velocity amplitude of particular executing S.H.M. is related by the expression

(A) $V = \omega\sqrt{a^2 - x^2}$ (B) $V = (a^2 - x^2)\omega$

(C) $v = (a^2 + x^2)\omega$ (D) $v = \left(\sqrt{a^2 + x^2}\right)\omega$

Questions based on Acceleration

Q.18 The maximum acceleration of a body moving in S.H.M. is a_0 and maximum velocity v_0. The amplitude is given by

(A) $\frac{v_0^2}{a_0}$ (B) $a_0 \times v_0$

(C) $\frac{a_0^2}{v_0}$ (D) $\frac{1}{a_0 v_0}$

Q.19 A particle executes S.H.M. Then the graph of acceleration as a function of displacement is
(A) a straight line (B) a circle
(C) an ellipse (D) a hyperbola

Q.20 The maximum speed of a particle executing S.H.M. is 1m/s and maximum acceleration is $1.57 m/s^2$. Its time period is
(A) 4 sec (B) 2 sec
(C) 1.57 sec (D) 1/1.57 sec

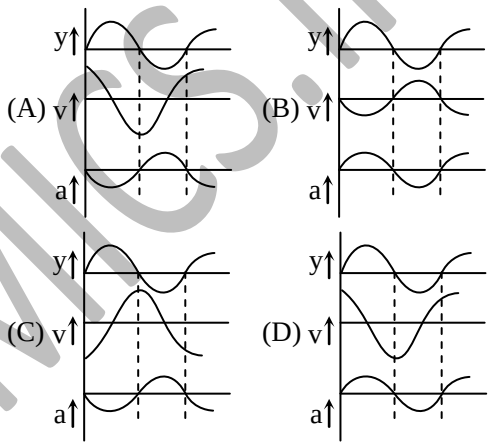
Q.21 A particle executing S.H.M. has maximum velocity 'α' and maximum acceleration β, the period of oscillation shall be
(A) $2\pi(\alpha/\beta)$ (B) $2\pi(\beta/\alpha)$
(C) $2\pi(\alpha/\beta)^{1/2}$ (D) $2\pi(\beta/\alpha)^{1/2}$

Q.22 The maximum displacement of a particle executing S.H.M. is 1 cm and the maximum acceleration is $(1.57)^2$cm per sec^2. Then the time period is
(A) 0.25 sec (B) 4.00 sec
(C) 1.57 sec (D) $(1.57)^2$ sec

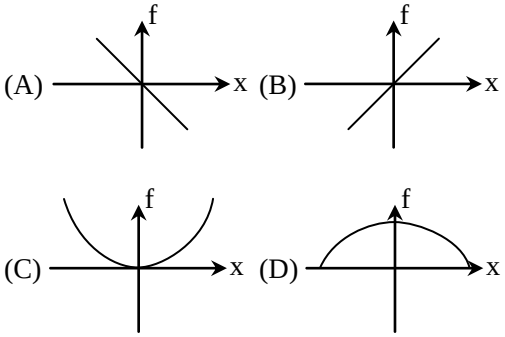
Q.23 A block of mass 'm' rests on a piston executing S.H.M. of period 1sec. The amplitude of oscillations so that the mass is separated from the piston is
(A) 0.25 m (B) 0.5 m (C) 1m (D) zero

Q.24 A small body of mass 0.10kg is undergoing simple harmonic motion of amplitude 1.0 metre and period of 0.20 sec the maximum value of the force acting on it
(A) 99N (B) 66N (C) 33N (D) 11 N

Q.25 Which of the following diagrams correctly relate displacement velocity and acceleration with time for a particle executing SHM



Q.26 The variation of the acceleration (f) of the particle executing S.H.M. with its displacement (X) is represented by the curve -



Questions based on Energy

Q.27 For a particle executing SHM, which of the following statements does not hold good ?
(A) the total energy of the particle always remains the same
(B) the restoring force is always directed towards a fixed point
(C) the restoring force is maximum at the extreme positions
(D) the velocity of the particle is minimum at the centre of motion of the particle

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Q.28 A particle is executing SHM with an amplitude 4cm. The displacement at which its energy is half kinetic and half potential is

(A) 1 cm (B) $(2)^{1/2}$ cm

(C) 2 cm (D) $2(2)^{1/2}$ cm.

Q.29 For a simple harmonic vibrator of frequency n, the frequency of kinetic energy changing completely to potential energy is

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

Q.30 The total energy of a particle executing S.H.M. is proportional to

(A) displacement from equilibrium position

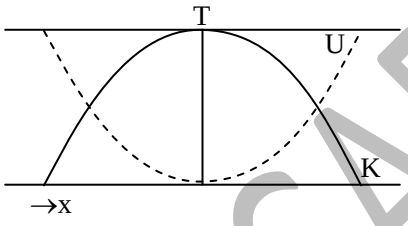
(B) frequency of oscillation

(C) velocity in equilibrium position

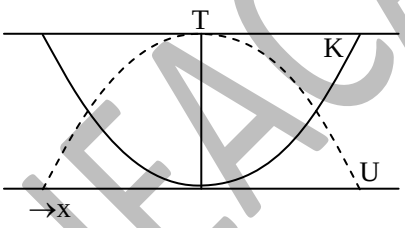
(D) square of amplitude of motion

Q.31 A particle is executing S.H.M. along a straight line. The graph showing the variation of kinetic, potential and total energy K, U and T respectively with displacement is -

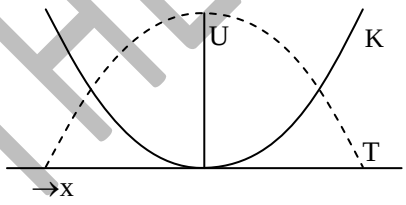
(A)



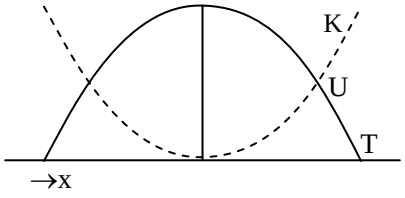
(B)



(C)



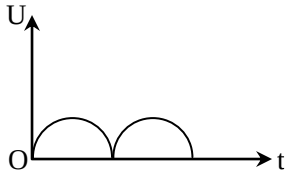
(D)



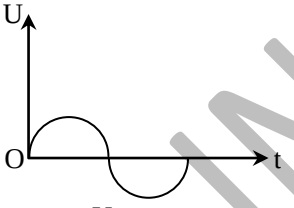
(A) A (B) B (C) C (D) D

Q.32 In SHM, potential energy (U) V/s. time (t) graphs is

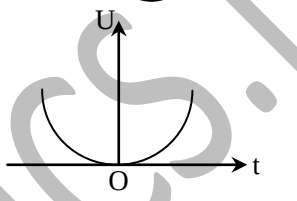
(A)



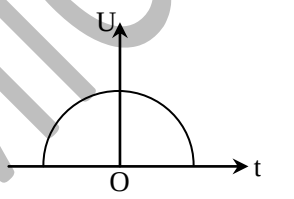
(B)



(C)



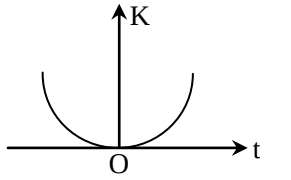
(D)



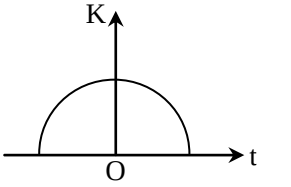
(A) A (B) B (C) C (D) D

Q.33 In S.H.M., the graph between kinetic energy K and time ' t ' is

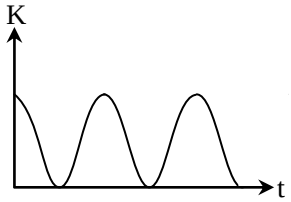
(A)



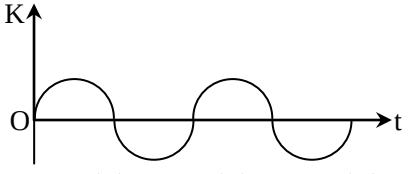
(B)



(C)



(D)



(A) A (B) B (C) C (D) D

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Questions based on Simple pendulum & time period

Q.34 The length of a simple pendulum is equal to the radius of the earth (R). Its time-period will be -

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

(C) $2\pi\sqrt{\frac{2R}{g}}$ (D) indeterminate

Q.35 A simple pendulum has T = 2 sec at a place where g = 9.81 m/s^2. Its time-period T' will be how much at another place where g' = 4.36 m/s^2?

(A) 3 sec (B) 1.5 sec
(C) 4/3 sec (D) 2/3 sec

Q.36 A simple pendulum has some time period T. What will be the % change in its time-period if its amplitude is decreased by 6%

(A) 6%
(B) 3%
(C) 1.5%
(D) It will remain unchanged

Q.37 A hollow metal sphere is filled with water and hung by a long thread. A small hole is drilled at the bottom through which water slowly flows out. Now the sphere is made to oscillate, the period of oscillation of the pendulum -

(A) remains constant
(B) continuously decreases
(C) continuously increases
(D) first increases and then decreases

Q.38 If a simple pendulum oscillates in water instead of air then the time period will -

(A) decrease slightly
(B) increase slightly
(C) remain the same
(D) decrease considerably

Q.39 Maximum angular displacement is θ of pendulum of length ℓ. Maximum kinetic energy of sphere having mass m is-

(A) $mg\ell$ (B) $mg\ell/2$

(C) $mg\ell\ (1-\cos\theta)$ (D) $\frac{mg\ell\sin\theta}{2}$

Questions based on Spring-Block System

Q.40 A mass m is suspended from the two coupled springs connected in series. The force constant for springs are k_1 and k_2. The time period of the suspended mass will be -

(A) $T = 2\pi\sqrt{\left(\frac{m}{k_1-k_2}\right)}$

(B) $T = 2\pi\sqrt{\left(\frac{m}{k_1+k_2}\right)}$

(C) $T = 2\pi\sqrt{\left(\frac{m(k_1+k_2)}{k_1k_2}\right)}$

(D) $T = 2\pi\sqrt{\left(\frac{mk_1k_2}{k_1+k_2}\right)}$

Q.41 A spring having a spring constant 'k' is loaded with a mass 'm'. The spring is cut into two equal parts and one of these is loaded again with the same mass. The new spring constant is -

(A) k/2 (B) k (C) 2k (D) k^2

Q.42 A spring-mass system oscillates with a frequency ' f '. If it is taken in an elevator slowly accelerating upwards, the frequency will

(A) increase (B) decrease
(C) remain same (D) become zero

Q.43 A spring of force constant k is cut out into two peaces whose lengths are in the ratio 1 : 2. What is the force constant of the longer piece

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

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ANSWER KEY

LEVEL # 1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	D	C	D	A	A	C	A	D	A	A	A	C	A	B	A	D	A	A	A	A
Q.No.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	A	B	A	A	A	A	D	D	C	D	A	A	C	B	A	D	D	B	C	C
Q.No.	41	42	43																	
Ans.	C	C	B																	

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