CENTRE OF MASS

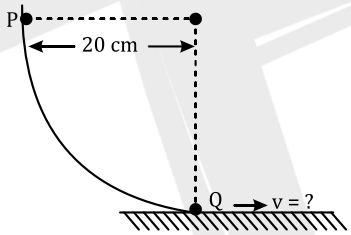
1. A body of mass 1 kg collides head on elastically with a stationary body of mass 3 kg. After collision, the smaller body reverses its direction of motion and moves with a speed of 2 m/s. The initial speed of the smaller body before collision is ___ ms^{-1}.

2. A nucleus disintegrates into two smaller parts, which have their velocities in the ratio 3: 2. The ratio of their nuclear sizes will be $\left(\frac{x}{3}\right)^{\frac{1}{3}}$. The value of ' x ' is:

3. A ball of mass 200 g rests on a vertical post of height 20 m. A bullet of mass 10 g, travelling in horizontal direction, hits the centre of the ball. After collision both travels independently. The ball hits the ground at a distance 30 m and the bullet at a distance of 120 m from the foot of the post. The value of initial velocity of the bullet will be (if $g = 10\ m/s^2$) :

(A) 120 m/s (B) 60 m/s (C) 400 m/s (D) 360 m/s

4. As per the given figure, a small ball P slides down the quadrant of a circle and hits the other ball Q of equal mass which is initially at rest. Neglecting the effect of friction and assume the collision to be elastic, the velocity of ball Q after collision will be : ($g = 10\ m/s^2$)



(A) 0 (B) 0.25 m/s (C) 2 m/s (D) 4 m/s

5. A machine gun of mass 10 kg fires 20 g bullets at the rate of 180 bullets per minute with a speed of 100 m s^{-1} each. The recoil velocity of the gun is:

(A) 0.02 m/s (B) 2.5 m/s (C) 1.5 m/s (D) 0.6 m/s

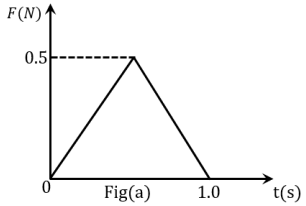
6. 100 balls each of mass m moving with speed v simultaneously strike a wall normally and reflected back with same speed, in time ts. The total force exerted by the balls on the wall is

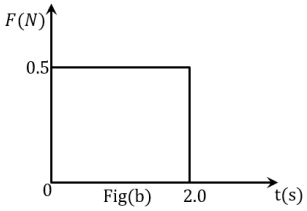
(A) $\frac{100mv}{t}$ (B) $\frac{200mv}{t}$ (C) 200mvt (D) $\frac{mv}{100t}$

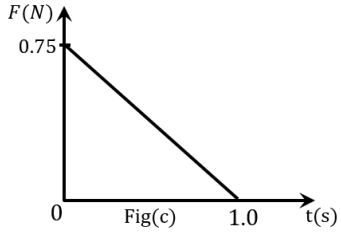
7. A solid sphere of mass 1 kg rolls without slipping on a plane surface. Its kinetic energy is 7×10^{-3} J. The speed of the centre of mass of the sphere is ___ cms^{-1}.

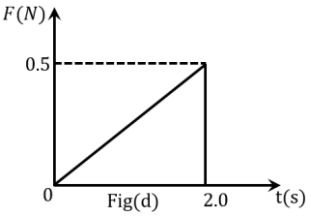
8. A ball is dropped from a height of 20 m. If the coefficient of restitution for the collision between ball and floor is 0.5, after hitting the floor, the ball rebounds to a height of ___ m.

9. Figures (a), (b), (c) and (d) show variation of force with time.

(A) 

(B) 

(C) 

(D) 

The impulse is highest in figure.

(A) Fig (c) (B) Fig (b) (C) Fig (a) (D) Fig (d)

10. A particle of mass m moving with velocity v collides with a stationary particle of mass 2m. After collision, they stick together and continue to move together with velocity

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

11. An average force of 125 N is applied on a machine gun firing bullets each of mass 10 g at the speed of 250 m s^{-1} to keep it in position. The number of bullets fired per second by the machine gun is:

(A) 50 (B) 25 (C) 100 (D) 5

12. A nucleus disintegrates into two nuclear parts, in such a way that ratio of their nuclear sizes is $1: 2^{1/3}$. Their respective speed have a ratio of n: 1. The value of n is _____.

13. Two bodies are having kinetic energies in the ratio 16: 9. If they have same linear momentum, the ratio of their masses respectively is:

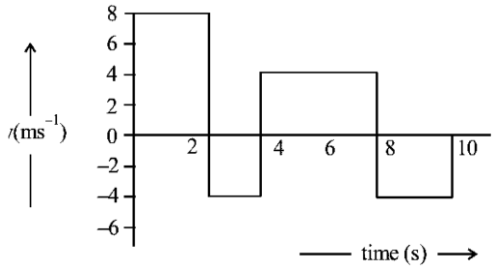
(A) 3: 4 (B) 9: 16 (C) 16: 9 (D) 4: 3

14. A bullet of 10 g leaves the barrel of gun with a velocity of 600 m s^{-1}. If the barrel of gun is 50 cm long and mass of gun is 3 kg, then value of impulse supplied to the gun will be:

(A) 6 N s (B) 3 N s (C) 36 N s (D) 12 N s

MOTION IN ONE DIMENSION

15. The velocity time graph of a body moving in a straight line is shown in figure.



The ratio of displacement to distance travelled by the body in time 0 to 10 s is

(A) 1: 1 (B) 1: 4 (C) 1: 2 (D) 1: 3

16. A car travels a distance of ' x ' with speed V_1 and then same distance ' x ' with speed V_2 in the same direction. The average speed of the car is:

(A) $\frac{v_1v_2}{2(v_1+v_2)}$ (B) $\frac{v_1+v_2}{2}$ (C) $\frac{2x}{v_1+v_2}$ (D) $\frac{2v_1v_2}{v_1+v_2}$

17. The distance travelled by a particle is related to time t as $x = 4t^2$. The velocity of the particle at $t = 5$ s is

(A) 40 ms^{-1} (B) 25 ms^{-1} (C) 20 ms^{-1} (D) 8 ms^{-1}

18. A tennis ball is dropped on to the floor from a height of 9.8 m. It rebounds to a height 5.0 m. Ball comes in contact with the floor for 0.2 s. The average acceleration during contact is ms^{-2}. [Given $g = 10\ ms^{-2}$]

19. A horse rider covers half the distance with 5 m/s speed. The remaining part of the distance was travelled with speed 10 m/s for half the time and with speed 15 m/s for other half of the time. The mean speed of the rider averaged over the whole time of motion is x/7 m/s. The value of x is

20. An object is allowed to fall from a height R above the earth, where R is the radius of earth. Its velocity when it strikes the earth's surface, ignoring air resistance, will be:

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

21. A vehicle travels 4 km with speed of 3 km/h and another 4 km with speed of 5 km/h, then its average speed is:

(A) 4.25 km/h (B) 3.50 km/h (C) 4.00 km/h (D) 3.75 km/h

22. A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is:

(A) 30 (B) 15π (C) 5π (D) $10\sqrt{2}$

23. An object moves with speed v_1, v_2, and v_3 along a line segment AB, BC and CD respectively as shown in figure. Where AB = BC and AD = 3AB, then average speed of the object will be:

(A) $\frac{(v_1+v_2+v_3)}{3}$ (B) $\frac{v_1v_2v_3}{3(v_1v_2+v_2v_3+v_3v_1)}$ (C) $\frac{3v_1v_2v_3}{v_1v_2+v_2v_3+v_3v_1}$ (D) $\frac{(v_1+v_2+v_3)}{3v_1v_2v_3}$

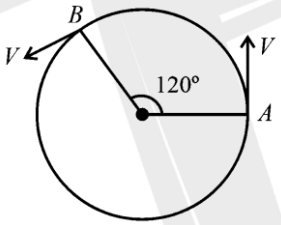
24. For a train engine moving with speed of 20 ms^{-1}. the driver must apply brakes at a distance of 500 m before the station for the train to come to rest at the station. If the brakes were applied at half of this distance, the train engine would cross the station with speed $\sqrt{x}ms^{-1}$. The value of x is (Assuming same retardation is produced by brakes)

25. A particle of mass 10 g moves in a straight line with retardation 2x, where x is the displacement in SI units. Its loss of kinetic energy for above displacement is $\left(\frac{10}{x}\right)^{-n}$ J. The value of n will be

26. A particle starts with an initial velocity of 10.0 ms^{-1} along x-direction and accelerates uniformly at the rate of 2.0 m s. The time taken by the particle to reach the velocity of 60.0 m s^{-1} is

(A) 25 s (B) 3 s (C) 6 s (D) 30 s

27. As shown in the figure, a particle is moving with constant speed πms^{-1}. Considering its motion from A to B, the magnitude of the average velocity is: **[06 Apr 2023]**



(A) $\sqrt{3}$ m s^{-1} (B) πms^{-1} (C) $1.5\sqrt{3}$ m s^{-1} (D) $2\sqrt{3}$ m s^{-1}

28. Given below are two statements:

Statement I: Area under velocity-time graph gives the distance travelled by the body in a given time.

Statement II: Area under acceleration-time graph is equal to the change in velocity in the given time.

In the light of given statements, choose the correct answer from the options given below.

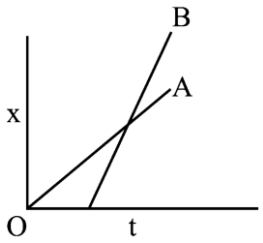
(A) Both Statement I and Statement II are true

(B) Both Statement I and Statement II are false

(C) Statement I is correct but Statement II is false

(D) Statement I is incorrect but Statement II is true

29. The position-time graphs for two students A and B returning from the school to their homes are shown in figure.



(a) A lives closer to the school

(b) B lives closer to the school

(c) A takes lesser time to reach home

(d) A travels faster than B

(e) B travels faster than A

Choose the correct answer from the options given below

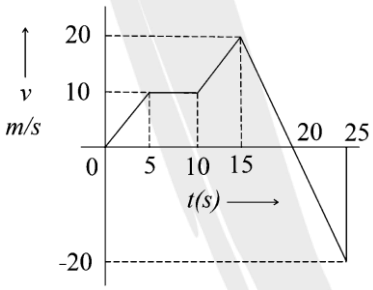
(A) (A), (C) and (D) only (B) (A), (C) and (E) only

(C) (B) and (E) only (D) (A) and (E) only

30. A person travels x distance with velocity v_1 and then x distance with velocity v_2 in the same direction. The average velocity of the person is v, then the relation between v, v_1 and v_2 will be

(A) $v = \frac{v_1+v_2}{2}$ (B) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2}$ (C) $v = v_1 + v_2$ (D) $\frac{2}{v} = \frac{1}{v_1} + \frac{1}{v_2}$

31. Form the v – t graph shown, the ratio of distance to displacement in 25 s of motion is:



(A) 1 (B) $\frac{1}{2}$ (C) $\frac{5}{3}$ (D) $\frac{3}{5}$

32. A ball is thrown vertically upward with an initial velocity of 150 m s^{-1}. The ratio of velocity after 3 s and 5 s is $\frac{x+1}{x}$. The value of x is. {take, g = 10 m s^{-2}}

(A) 10 (B) -5 (C) 6 (D) 5

33. Given below are two statements:

Statement I: A truck and a car moving with same kinetic energy are brought to rest by applying breaks which provide equal retarding forces. Both come to rest in equal distance.

Statement II: A car moving towards east takes a turn and moves towards north, the speed remains unchanged. The acceleration of the car is zero. In the light of given statements, choose the most appropriate answer from the options given below

(A) Statement I is correct but statement II is incorrect

(B) Statement I is incorrect but statement II is correct

(C) Both statement I and Statement II are correct

(D) Both statement I and statement II are incorrect

34. Two trains A and B of length l and 4l are travelling into a tunnel of length L in parallel tracks from opposite directions with velocities 108 km^{-1} and 72 km h^{-1}, respectively. If train A take 35 s less time than train B to cross the tunnel then, length L of tunnel is: (Given L = 60l)

(A) 1200 m (B) 900 m (C) 1800 m (D) 2700 m

35. The distance travelled by an object in time t is given by $s = (2.5)t^2$. The instantaneous speed of the object at t = 5 s will be:

(A) 25 m s^{-1} (B) 5 m s^{-1} (C) 62.5 m s^{-1} (D) 12.5 m s^{-1}

36. A passenger sitting in a train A moving at 90 km h^{-1} observes another train B moving in the opposite direction for 8 s. If the velocity of the train B is 54 km h^{-1}, then length of train B is:

(A) 120 m (B) 320 m (C) 80 m (D) 200 m

37. The position of a particle related to time is given by $x = (5t^2 - 4t + 5)$m. The magnitude of velocity of the particle at t = 2 s will be:

(A) 06 m s^{-1} (B) 14 m s^{-1} (C) 10 m s^{-1} (D) 16 m s^{-1}

MOTION IN TWO DIMENSIONS

38. The maximum vertical height to which a man can throw a ball is 136 m. The maximum horizontal distance upto which he can throw the same ball is

(A) 192 m (B) 136 m (C) 272 m (D) 68 m

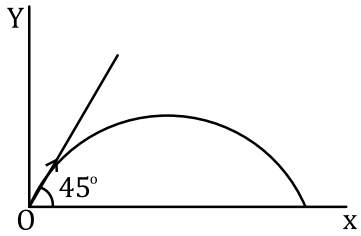
39. Two objects are projected with same velocity ' u ' however at different angles α and β with the horizontal. If $\alpha + \beta = 90°$, the ratio of horizontal range of the first object to the 2^{nd} object will be:

(A) 4: 1 (B) 2: 1 (C) 1: 2 (D) 1: 1

40. A stone is projected at angle 30° to the horizontal. The ratio of kinetic energy of the stone at point of projection to its kinetic energy at the highest point of flight will be:

(A) 1: 2 (B) 1: 4 (C) 4: 1 (D) 4: 3

41. A particle of mass 100 g is projected at time t = 0 with a speed 20 ms^{-1} at an angle 45° to the horizontal as given in the figure. The magnitude of the angular momentum of the particle about the starting point at time $t = 2s$ is found to be $\sqrt{K}kgm^2/s$. The value of K is (Take g = 10 ms^{-2})



42. The initial speed of a projectile fired from ground is u. At the highest point during its motion, the speed of projectile is $\frac{\sqrt{3}}{2}u$. The time of flight of the projectile is:

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

43. The speed of a swimmer is 4 km h^{-1} in still water. If the swimmer makes his strokes normal to the flow of river of width 1 km, he reaches a point 750 m down the stream on the opposite bank. The speed of the river water is kmh^{-1}.

44. A child stands on the edge of the cliff 10 m above the ground and throws a stone horizontally with an initial speed of 5 ms^{-1}. Neglecting the air resistance, the speed with which the stone hits the ground will be ms^{-1} (given, g = 10 ms^{-2}).

(A) 20 (B) 15 (C) 30 (D) 25

45. A particle is moving with constant speed in a circular path. When the particle turns by an angle 90°, the ratio of instantaneous velocity to its average velocity is $\pi: x\sqrt{2}$. The value of x will be

(A) 2 (B) 5 (C) 1 (D) 7

46. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A: When a body is projected at an angle 45°, its range is maximum.

Reason R: For maximum range, the value of sin 2θ should be equal to one.

In the light of the above statements, choose the correct answer from the options given below:

(A) A is false but R is true

(B) A is true but R is false

(C) Both A and R are correct and R is the correct explanation of A

(D) Both A and R are correct but R is NOT the correct explanation of A

47. A child of mass 5 kg is going round a merry-go-round that makes 1 rotation in 3.14 s. The radius of the merry-go-round is 2 m. The centrifugal force on the child will be

(A) 80 N (B) 40 N (C) 100 N (D) 50 N

48. Two projectiles A and B are thrown with initial velocities of 40 m s^{-1} and 60 m s^{-1} at angles 30° and 60° with the horizontal respectively. The ratio of their ranges respectively is ($g = 10$ m s^{-2})

(A) 4: 9 (B) 2: $\sqrt{3}$ (C) $\sqrt{3}$: 2 (D) 1: 1

49. The trajectory of projectile, projected from the ground is given by $y = x - \frac{x^2}{20}$. Where x and y are measured in meter. The maximum height attained by the projectile will be.

(A) 200 m (B) 10 m (C) 5 m (D) $10\sqrt{2}$ m

50. The range of the projectile projected at an angle of 15° with horizontal is 50 m. If the projectile is projected with same velocity at an angle of 45° with horizontal, then its range will be

(A) 100 m (B) $100\sqrt{2}$ m (C) $50\sqrt{2}$ m (D) 50 m

51. Two projectiles are projected at 30° and 60° with the horizontal with the same speed. The ratio of the maximum height attained by the two projectiles respectively is:

(A) $\sqrt{3}$: 1 (B) 1: $\sqrt{3}$ (C) 2: $\sqrt{3}$ (D) 1: 3

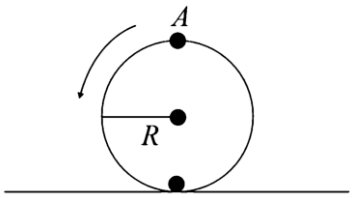
52. A projectile fired at 30° to the ground is observed to be at same height at time 3 s and 5 s after projection, during its flight. The speed of projection of the projectile is ms^{-1}.

(Given $g = 10$ m s^{-2})

53. A projectile is projected at 30° from horizontal with initial velocity 40 m s^{-1}. The velocity of the projectile at t = 2 s from the start will be:

(A) $40\sqrt{3}$ m s^{-1} (B) Zero (C) 20 m s^{-1} (D) $20\sqrt{3}$ m s^{-1}

54. A disc is rolling without slipping on a surface. The radius of the disc is R. At t = 0, the top most point on the disc is A as shown in figure. When the disc completes half of its rotation, the displacement of point A from its initial position is



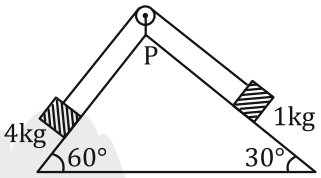
(A) 2R (B) $R\sqrt{(\pi^2 + 4)}$ (C) $R\sqrt{(\pi^2 + 1)}$ (D) $2R\sqrt{(1 + 4\pi^2)}$

55. A vehicle of mass 200 kg is moving along a levelled curved road of radius 70 m with angular velocity of 0.2rads^{-1}. The centripetal force acting on the vehicle is:

(A) 560 N (B) 2800 N (C) 2240 N (D) 14 N

Newtons Laws of Motion

56. As per given figure, a weightless pulley P is attached on a double inclined frictionless surface. The tension in the string (massless) will be (if $g = 10\ m/s^2$)



(A) $(4\sqrt{3}+1)$N (B) $4(\sqrt{3}+1)$N (C) $4(\sqrt{3}-1)$N (D) $(4\sqrt{3}-1)$N

57. Given below are two statements: **[24 Jan, 2023]**

Statement-I: An elevator can go up or down with uniform speed when its weight is balanced with the tension of its cable.

Statement-II: Force exerted by the floor of an elevator on the foot of a person standing on it is more than his/her weight when the elevator goes down with increasing speed.

In the light of the above statements, choose the correct answer from the options given below:

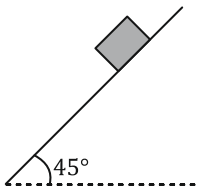
(A) Both statement I and statement II are false

(B) Statement I is true but Statement II is false

(C) Both Statement I and Statement II are true

(D) Statement I is false but Statement II is true

58. Consider a block kept on an inclined plane (inclined at 45°) as shown in the figure. If the force required to just push it up the incline is 2 times the force required to just prevent it from sliding down, the coefficient of friction between the block and inclined plane (μ) is equal to:



(A) 0.33 (B) 0.60 (C) 0.25 (D) 0.50

59. A block of mass m slides down the plane inclined at angle 30° with an acceleration $\frac{g}{4}$. The value of coefficient of kinetic friction will be:

(A) $\frac{2\sqrt{3}+1}{2}$ (B) $\frac{1}{2\sqrt{3}}$ (C) $\frac{\sqrt{3}}{2}$ (D) $\frac{2\sqrt{3}-1}{2}$

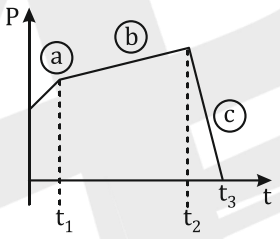
60. Force acts for 20 s on a body of mass 20 kg, starting from rest, after which the force ceases and then body describes 50 m in the next 10 s. The value of force will be:

(A) 40 N (B) 5 N (C) 20 N (D) 10 N

61. The time taken by an object to slide down 45° rough inclined plane is n times as it takes to slide down a perfectly smooth 45° incline plane. The coefficient of kinetic friction between the object and the incline plane is

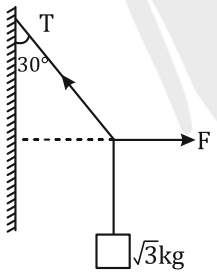
(A) $\sqrt{\frac{1}{1-n^2}}$ (B) $\sqrt{1-\frac{1}{n^2}}$ (C) $1+\frac{1}{n^2}$ (D) $1-\frac{1}{n^2}$

62. The figure represents the momentum time (p-t) curve for a particle moving along an axis under the influence of the force. Identify the regions on the graph where the magnitude of the force is maximum and minimum respectively? If $(t_3 - t_2) < t_1$.



(A) c and a (B) b and c (C) c and b (D) a and b

63. A block of $\sqrt{3}$ kg is attached to a string whose other end is attached to the wall. An unknown force F is applied so that the string makes an angle of 30° with the wall. The tension T is:
(Given $g = 10\ ms^{-2}$)

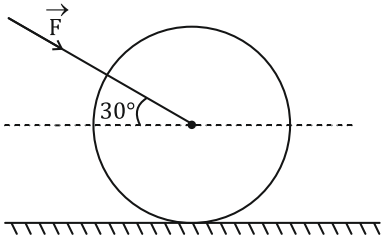


(A) 20 N (B) 25 N (C) 10 N (D) 15 N

64. A stone tied to 180 cm long string at its end is making 28 revolutions in horizontal circle in every minute. The magnitude of acceleration of stone is $\frac{1936}{x} ms^{-2}$. The value of x _____.

(Take $\pi = \frac{22}{7}$)

65. As shown in figure, a 70 kg garden roller is pushed with a force of $\vec{F} = 200$ N at an angle of 30° with horizontal. The normal reaction on the roller is (Given $g = 10\ m\ s^{-2}$)



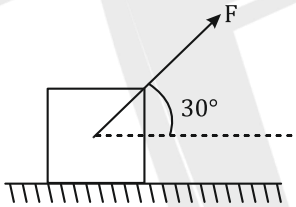
(A) $800\sqrt{2}$ N (B) 600 N (C) 800 N (D) $200\sqrt{3}$ N

66. A lift of mass M = 500 kg is descending with speed of 2 ms^{-1}. Its supporting cable begins to slip thus allowing it to fall with a constant acceleration of 2 ms^{-2}. The kinetic energy of the lift at the end of fall through to a distance of 6 m will be ____kJ.

67. A block of mass 5 kg is placed at rest on a table of rough surface. Now, if a force of 30 N is applied in the direction parallel to surface of the table, the block slides through a distance of 50 m in an interval of time 10 s. Coefficient of kinetic friction is (given, g = 10 ms^{-2}):

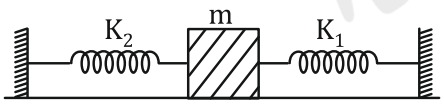
(A) 0.60 (B) 0.75 (C) 0.50 (D) 0.25

68. As shown in the figure a block of mass 10 kg lying on a horizontal surface is pulled by a force F acting at an angle 30°, with horizontal. For $\mu_s = 0.25$, the block will just start to move for the value of F : [Given g = 10 ms^{-2}]



(A) 33.3 N (B) 25.2 N (C) 20 N (D) 35.7 N

69. A mass m is attached to two springs as shown in figure. The spring constants of two springs are K_1 and K_2. For the frictionless surface, the time period of oscillation of mass m is



(A) $2\pi\sqrt{\frac{m}{K_1+K_2}}$ (B) $\frac{1}{2\pi}\sqrt{\frac{K_1-K_2}{m}}$ (C) $2\pi\sqrt{\frac{m}{K_1-K_2}}$ (D) $\frac{1}{2\pi}\sqrt{\frac{K_1+K_2}{m}}$

70. A small block of mass 100 g is tied to a spring of spring constant 7.5 N m^{-1} and length 20 cm. The other end of spring is fixed at a particular point A. If the block moves in a circular path on a smooth horizontal surface with constant angular velocity 5 rad s^{-1} about point A, then tension in the spring is

(A) 0.75 N (B) 0.25 N (C) 0.50 N (D) 1.5 N

71. At any instant the velocity of a particle of mass 500 g is $(2t\hat{i} + 3t^2\hat{j})ms^{-1}$. If the force acting on the particle at $t = 1$ s is $(\hat{i} + x\hat{j})$N. Then the value of x will be:

(A) 3 (B) 4 (C) 2 (D) 6

72. Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**

Assertion A: An electric fan continues to rotate for some time after the current is switched off.

Reason R: Fan continues to rotate due to inertia of motion.

In the light of above statements, choose the most appropriate answer from the options given below.

(A) A is correct but R is not correct

(B) A is not correct but R is correct

(C) Both A and R are correct and R is the correct explanation of A

(D) Both A and R are correct but R is NOT the correct explanation of A

73. A coin placed on a rotating table just slips when it is placed at a distance of 1 cm from the centre. If the angular velocity of the table is halved, it will just slip when placed at a distance of ___ from the centre:

(A) 8 cm (B) 4 cm (C) 1 cm (D) 2 cm

74. A body of mass 500 g moves along x-axis such that it's velocity varies with displacement x according to the relation $v = 10\sqrt{x}\ m\ s^{-1}$ the force acting on the body is:

(A) 125 N (B) 25 N (C) 166 N (D) 5 N

75. The position vector of a particle related to time t is given by $\vec{r} = (10t\hat{i} + 15t^2\hat{j} + 7\hat{k})$m. The direction of net force experienced by the particle is:

(A) Positive x-axis (B) In $x - y$ plane (C) Positive y-axis (D) Positive z-axis

WORK POWER ENERGY

76. A spherical body of mass 2 kg starting from rest acquires a kinetic energy of 10000 J at the end of 5^{th} second. The force acted on the body is N.

77. A body of mass 1 kg begins to move under the action of a time dependent force $\vec{F} = (t\hat{i} + 3t^2\hat{j})$N. Where $\hat{i}$ and $\hat{j}$ are the unit vectors along x and y axis. The power developed by above force, at the time $t = 2$ s. will be W.

78. An object of mass ' m ' initially at rest on a smooth horizontal plane starts moving under the action of force $F = 2$ N. In the process of its linear motion, the angle θ (as shown in figure) between the direction of force and horizontal varies as $\theta = kx$, where k is a constant and x is

the distance covered by the object from its initial position. The expression of kinetic energy of the object will be $E = \frac{n}{k}\sin\theta$. The value of n is

79. A 0.4 kg mass takes 8 s to reach ground when dropped from a certain height ' P ' above surface of earth. The loss of potential energy in the last second of fall is J. [Take $g = 10\ m/s^2$]

80. A body of mass 2 kg is initially at rest. It starts moving unidirectionally under the influence of a source of constant power P. Its displacement in 4 s is $\frac{1}{3}\alpha^2\sqrt{P}m$. The value of α will be .....

81. A small particle moves to position $5\hat{i} - 2\hat{j} + \hat{k}$ from its initial position $2\hat{i} + 3\hat{j} - 4\hat{k}$ under the action of force $5\hat{i} + 2\hat{j} + 7\hat{k}$ N. The value of work done will be J.

82. A force $F = (5 + 3y^2)$ acts on a particle in the y direction, where F is newton and y is in meter. The work done by the force during a displacement from $y = 2$ m to $y = 5$ m is j.

83. A small particle of mass m moves in such a way that its potential energy $U = \frac{1}{2}m\omega^2r^2$ where ω is constant and r is the distance of the particle from origin. Assuming Bohr's quantization of momentum and circular orbit, the radius of n^{th} orbit will be proportional to

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

84. A body is dropped on ground from a height h_1 and after hitting the ground, it rebounds to a height h_2. If the ratio of velocities of the body just before and after hitting ground is 4, then percentage loss in kinetic energy of the body is $\frac{x}{4}$. The value of x is

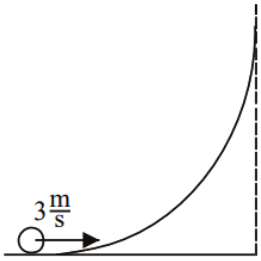
85. The momentum of a body is increased by 50%. The percentage increase in the kinetic energy of the body is - %.

86. A bullet of mass 0.1 kg moving horizontally with speed 400 m s^{-1} hits a wooden block of mass 3.9 kg kept on a horizontal rough surface. The bullet gets embedded into the block and moves 20 m before coming to rest. The coefficient of friction between the block and the surface is

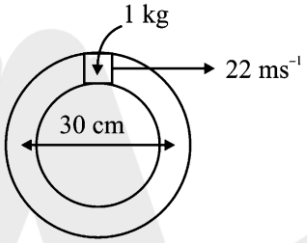
(A) 0.90 (B) 0.50 (C) 0.65 (D) 0.25

87. A body of mass 5 kg is moving with a momentum of 10 kg m s s^{-1}. Now a force of 2 N acts on the body in the direction of its motion for 5 s. The increase in the Kinetic energy of the body is J.

88. A hollow spherical ball of uniform density rolls up a curved surface with an initial velocity 3 m s^{-1} (as shown in figure). Maximum height with respect to the initial position covered by it will be cm (take, $g = 10$ m s^{-2})



89. A closed circular tube of average radius 15 cm, whose inner walls are rough, is kept in vertical plane. A block of mass 1 kg just fit inside the tube. The speed of block is 22 m s^{-1}, when it is introduced at the top of tube. After completing five oscillations, the block stops at the bottom region of tube. The work done by the tube on the block is J. (Given g = 10 m s^{-2}).



90. If the maximum load carried by an elevator is 1400 kg(600 kg-Passengers +800 kg-elevator), which is moving up with a uniform speed of 3 m s^{-1} and the frictional force acting on it is 2000 N, then the maximum power used by the motor is kW. (g = 10 m s^{-2})

91. A force $\vec{F} = (2 + 3x)\hat{i}$ acts on a particle in the x direction where F is in Newton and x is in meter. The work done by this force during a displacement from x = 0 to x = 4 m is J.

92. To maintain a speed of 80 km h^{-1} by a bus of mass 500 kg on a plane rough road for 4 km distance, the work done by the engine of the bus will be kJ. [The coefficient of friction between tyre of bus and road is 0.04]

93. The ratio of powers of two motors is $\frac{3\sqrt{x}}{\sqrt{x+1}}$, that are capable of raising 300 kg water in 5 minutes and 50 kg water in 2minutes respectively from a well of 100 m deep. The value of x will be

(A) 16 (B) 2 (C) 2.4 (D) 4

94. A body of mass (5 ± 0.5)kg is moving with a velocity of $(20 \pm 0.4)ms^{-1}$. Its kinetic energy will be

(A) (1000 ± 0.14)J (B) (500 ± 0.14)J (C) (500 ± 140)J (D) (1000 ± 140)J

95. A car accelerates from rest of u m s^{-1}. The energy spent in this process is E J. The energy required to accelerate the car from u m s^{-1} to 2u m s s^{-1} is nE J. The value of n is ___.

96. A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be: (Given g = acceleration due to gravity on the earth.)

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

97. A block of mass 10 kg is moving along x-axis under the action of force $F = 5x$ N. The work done by the force in moving the block from $x = 2$ m to 4 m will be ____J.

ANSWER KEY

1.	(4)	**2.**	(2)	**3.**	(D)	**4.**	(C)	**5.**	(D)	**6.**	(B)	**7.**	(10)
8.	(5)	**9.**	(B)	**10.**	(A)	**11.**	(A)	**12.**	(2)	**13.**	(B)	**14.**	(A)
15.	(D)	**16.**	(D)	**17.**	(A)	**18.**	(120)	**19.**	(50)	**20.**	(B)	**21.**	(D)
22.	(D)	**23.**	(C)	**24.**	(200)	**25.**	(2)	**26.**	(A)	**27.**	(C)	**28.**	(D)
29.	(D)	**30.**	(D)	**31.**	(C)	**32.**	(D)	**33.**	(A)	**34.**	(C)	**35.**	(A)
36.	(B)	**37.**	(D)	**38.**	(C)	**39.**	(D)	**40.**	(D)	**41.**	(800)	**42.**	(B)
43.	(3)	**44.**	(B)	**45.**	(A)	**46.**	(C)	**47.**	(B)	**48.**	(A)	**49.**	(C)
50.	(A)	**51.**	(D)	**52.**	(80)	**53.**	(D)	**54.**	(B)	**55.**	(A)	**56.**	(B)
57.	(B)	**58.**	(A)	**59.**	(B)	**60.**	(B)	**61.**	(D)	**62.**	(C)	**63.**	(A)
64.	(125)	**65.**	(C)	**66.**	(7)	**67.**	(C)	**68.**	(B)	**69.**	(A)	**70.**	(A)
71.	(A)	**72.**	(C)	**73.**	(B)	**74.**	(B)	**75.**	(C)	**76.**	(40)	**77.**	(100)
78.	(2)	**79.**	(300)	**80.**	(4)	**81.**	(40)	**82.**	(132)	**83.**	(A)	**84.**	(375)
85.	(125)	**86.**	(D)	**87.**	(30)	**88.**	(75)	**89.**	(245)	**90.**	(48)	**91.**	(32)
92.	(784)	**93.**	(A)	**94.**	(D)	**95.**	(3)	**96.**	(B)	**97.**	(30)		