Motion in Two & Three Dimensions

Choose the correct answers :

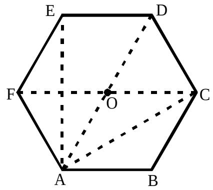
1. At what angle should two forces $\sqrt{5}$ N and $\sqrt{10}$ N act so that their resultant is 5 N ?
(1) 30º (2) 45º
(3) 150º (4) 135º

2. Given vector $\vec{A}=2\hat{i}+3\hat{j}$, the angle between $\vec{A}$ and y-axis is
(1) $\tan^{-1}(3/2)$ (2) $\tan^{-1}(2/3)$
(3) $\sin^{-1}(2/3)$ (4) $\cos^{-1}(3/2)$

3. Let $\vec{C}=\vec{A}+\vec{B}$
(1) $|\vec{C}|$ is always greater than $|\vec{A}|$
(2) It is possible to have $|\vec{C}|<|\vec{A}|$ and $|\vec{C}|<|\vec{B}|$
(3) $|\vec{C}|$ is always equal to $|\vec{A}|+|\vec{B}|$
(4) $|\vec{C}|$ is never equal to $|\vec{A}|+|\vec{B}|$

4. Let the angle between two non-zero vectors $\vec{A}$ and $\vec{B}$ be 120º and its resultant be $\vec{C}$
(1) $|\vec{C}|$ must be equal to $|\vec{A}-\vec{B}|$
(2) $|\vec{C}|$ must be less than $|\vec{A}-\vec{B}|$
(3) $|\vec{C}|$ must be greater than $|\vec{A}-\vec{B}|$
(4) $|\vec{C}|$ may be equal to $|\vec{A}-\vec{B}|$

5. ABCDEF is regular hexagon. The resultant of $\vec{AB}+\vec{AC}+\vec{AD}+\vec{AE}+\vec{AF}$ is equal to



(1) zero (2) $4\vec{AO}$
(3) $6\vec{AO}$ (4) $8\vec{AO}$

6. If $|\vec{A}|=|\vec{B}|=|\vec{A}+\vec{B}|$, then the angle between vectors $\vec{A}$ and $\vec{B}$ is
(1) 0º (2) 60º
(3) 90º (4) 120º

7. $\vec{A}$ and $\vec{B}$ are two vectors such that $|\vec{A}+\vec{B}|=|\vec{A}-\vec{B}|$. The angle between $\vec{A}$ and $\vec{B}$ is
(1) 0º (2) 90º
(3) 45º (4) 60º

8. Minimum number of non-coplanar vectors, whose sum can be zero, is
(1) 2 (2) 3
(3) 4 (4) 6

9. At what angle must the two forces $(x+y)$ and $(x-y)$ act so that their resultant is $\sqrt{x^2+y^2}$?
(1) $\cos^{-1}\left[-\frac{x^2+y^2}{x^2-y^2}\right]$ (2) $\cos^{-1}\left[-\frac{x^2+y^2}{2(x^2-y^2)}\right]$
(3) $\cos^{-1}\left[-\frac{x^2-y^2}{x^2+y^2}\right]$ (4) $\cos^{-1}\left[-\frac{2(x^2-y^2)}{x^2+y^2}\right]$

10. If the sum and difference of two vectors $\vec{P}$ and $\vec{Q}$ are perpendicular, then their magnitudes will satisfy the relation
(1) $P=2Q$ (2) $2P=Q$
(3) $P=Q$ (4) None of these

11. If $\vec{A}=\vec{B}+\vec{C}$ and the magnitudes of $\vec{A}$, $\vec{B}$ and $\vec{C}$ are 17, 15 and 8 units, the angle between $\vec{A}$ and $\vec{C}$ is
(1) $\cos^{-1}(8/17)$ (2) $\cos^{-1}(15/17)$
(3) $\cos^{-1}(8/15)$ (4) $(\pi/2)$

12. The boat is moving with the velocity $3\hat{i}+4\hat{j}$ with respect to the ground. The water is flowing with a velocity $-3\hat{i}-4\hat{j}$ with respect to the ground. The relative velocity of boat with respect to water is
(1) $8\hat{j}$ (2) $-6\hat{i}-8\hat{j}$
(3) $6\hat{i}+8\hat{j}$ (4) $5\sqrt{2}$

13. If $\vec{A}$ and $\vec{B}$ are perpendicular vectors such that $\vec{A}=5\hat{i}+7\hat{j}-3\hat{k}$ and $\vec{B}=2\hat{i}+2\hat{j}-a\hat{k}$, then value of a is
(1) 8 (2) – 8
(3) 12 (4) – 2

14. If $\vec{A}=4\hat{k}-5\hat{j}+3\hat{i}$ and $\vec{B}=4\hat{i}+2\hat{k}-3\hat{j}$, then the vector $\vec{A}\times\vec{B}$ is
(1) $2\hat{i}-10\hat{j}+11\hat{k}$ (2) $2\hat{i}+10\hat{j}+11\hat{k}$
(3) $2\hat{i}+11\hat{j}+10\hat{k}$ (4) $2\hat{i}+10\hat{j}-11\hat{k}$

15. If $\vec{A}=3\hat{i}+4\hat{j}$ and $\vec{B}=7\hat{i}+24\hat{j}$ then the vector having same magnitude as $\vec{B}$ and parallel to $\vec{A}$, is
(1) $20\hat{i}+15\hat{j}$ (2) $15\hat{i}+20\hat{j}$
(3) $35\hat{i}+120\hat{j}$ (4) $10\hat{i}+28\hat{j}$

16. A projectile is launched with an initial velocity $\vec{v}_0$ = (2 m/s) $\vec{i} + (3\text{m/s})\vec{j}$. At the top of the trajectory, the velocity of the particle is

(1) $\sqrt{2^2+3^2}$ m/s (2) 2 ms^{-1}

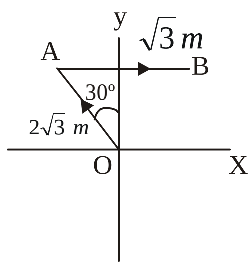
(3) 3 ms^{-1} (4) 5 ms^{-1}

17. If the vectors $\vec{A} = 2\hat{i}+4\hat{j}$ and $\vec{B} = 5\hat{i}-p\hat{j}$ are parallel to each other, the magnitude of $\vec{B}$ is

(1) $5\sqrt{5}$ (2) 10

(3) 15 (4) $2\sqrt{5}$

18. A particle starts from the origin and moves towards *A* and *OA* = $2\sqrt{3}$ m making an angle of 30º to the vertical i.e. *y*-axis Now, it moves horizontally a distance of $\sqrt{3}$ m and reaches the point *B*. The displacement of the particle is



(*Figure not to scale*)

(1) zero (2) 3 m

(3) $\sqrt{21}$ m (4) 10 m

19. A particle has an initial velocity of $3\hat{i}+4\hat{j}$ and an acceleration of $0.4\hat{i}+0.3\hat{j}$. Its speed after 10 s is

(1) 14 units (2) $14\sqrt{2}$ units

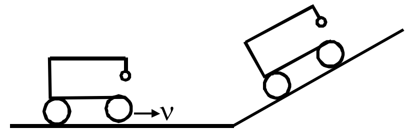
(3) $7\sqrt{2}$ units (4) 7 units

20. If the position of a particle at time *t* is given by *x* = *a* sin ω*t* and *y* = a cos 2ω*t*, then the trajectory of the particle is

(1) a straight line (2) a hyperbola

(3) a parabola (4) an ellipse

21. A small cart with a sphere suspended over it (see figure) by a string approaches an inclined plane at a speed *v*. In which direction, with respect to vertical or inclined plane, will the string be deflected when cart climbs the inclined plane?



(1) it will remain vertical

(2) it will become horizontal

(3) it will be ⊥ to the inclined plane

(4) none of these

22. Two forces, each of magnitude *F*, act at a point making an angle θ with each other. The magnitude of the resultant force will be

(1) 2*F* sin (θ/2) (2) 2*F* cos (θ/2)

(3) *F* sin (θ/2) (4) *F* cos (θ/2)

23. If $\hat{i}$ denotes a unit vector along incident ray, $\hat{r}$ denotes a unit vector along refracted ray into a medium of refractive index μ, and $\hat{n}$ denotes a unit vector normal to the boundary of the medium directed towards incident medium, then the law of refraction is

(1) $\hat{i}\times\hat{n} = \mu(\hat{r}\times\hat{n})$ (2) $\hat{i}\times\hat{n} = \mu(\hat{n}\times\hat{r})$

(3) $\hat{i}.\hat{n} = \mu(\hat{r}.\hat{n})$ (4) $\mu(\hat{i}\times\hat{n}) = \hat{r}\times\hat{n}$

24. Rain water is falling vertically downwards with a velocity *v*. When the velocity of the wind is zero, water is collected at a rate *R*. When the wind starts blowing horizontally at a speed *u*, the rate of collection of water in the same vessel is

(1) $\sqrt{u^2+v^2}R$ (2) $\frac{v}{u}R$

(3) $\frac{uR}{v}$ (4) *R*

25. A particle is moving along a circular path of radius 5 m with a uniform speed 5 ms^{-1}. What will be the average acceleration when the particle completes half revolution ?

(1) Zero (2) 10 ms^{-2}

(3) 10π ms^{-2} (4) $\frac{10}{\pi}ms^{-2}$

26. The position vector of a particle is

$\vec{r} = (a\cos\omega t)\hat{i} + (a\sin\omega t)\hat{j}$

The velocity of the particle is

(1) parallel to position vector

(2) perpendicular to position vector

(3) directed towards the origin

(4) directed away from the origin

27. For a motion in a plane with constant acceleration, $\vec{a}$, initial velocity $\vec{v}_0$ and final velocity $\vec{v}$ after time t, we have
(1) $\vec{v}\,.(\vec{v}-\vec{a}t)=\vec{v}_0\,.(\vec{v}_0+\vec{a}t)$
(2) $\vec{v}.(\vec{v}+\vec{a}t)=\vec{v}_0.(\vec{v}+\vec{a}t)$
(3) $\vec{v}\,.\,\vec{v}_0=\vec{a}\,.\,\vec{v}_0 t$
(4) $\vec{v}_0\,.\,\vec{v}_0=\vec{a}\,.\,\vec{v}_0 t$

28. A point moves in the plane XY according to the law $x = k \sin \omega t$. and $y = k(1 - \cos \omega t)$ where k and ω are positive constants. The distance s traversed by the particle during time t is
(1) zero (2) $k\omega t$
(3) $2\,k\omega t$ (4) $k\omega/2$

29. To a person going east in a car with a velocity of 25 km/hr a train appears to move towards north with a velocity at $25\sqrt{3}$ km/hr. The actual velocity of the train will be
(1) 25 km/hr (2) 50 km/hr
(3) 5 km/hr (4) $5\sqrt{3}$ km/hr

30. The resultant of two forces acting at an angle of 120º is 10 N and is perpendicular to one of the forces. The other force is
(1) $20/\sqrt{3}$ N (2) $10/\sqrt{3}$ N
(3) 20 N (4) $20\sqrt{3}$ N

31. A particle, moving with velocity equal to 0.4 ms^{-1}, is subjected to an acceleration of 0.15 ms^{-2} for 2 sec, in a direction at right angle to its direction of motion. The magnitude of velocity after the application of the acceleration would be
(1) 0.7 ms^{-1} (2) 0.6 ms^{-1}
(3) 0.5 ms^{-1} (4) 0.4 ms^{-1}

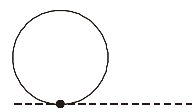
32. Rain is falling from North with speed of 4 km/hr, making an angle of 30º with the vertical. What should be the magnitude and direction of velocity of a person walking in rain so that to him the rain appears to fall vertically ?
(1) 2 km/hr towards north
(2) 3 km/hr towards south
(3) 4 km/hr towards north
(4) 2 km/hr towards south

33. A body is thrown horizontally with a velocity of 14.7 ms^{-1}, from the top of a building. After 3 seconds, the direction of velocity of the body with the vertical would be
(1) 0º (2) $\tan^{-1}(2.0)$
(3) $\cos^{-1}(0.5)$ (4) $\tan^{-1}(0.5)$

34. A person goes 30 km northward, then 20 km westward and finally $30\sqrt{2}$ km along south-east direction. His resultant displacement is
(1) $10\sqrt{2}$ km towards south
(2) $10\sqrt{2}$ km towards south-east
(3) $20\sqrt{2}$ km towards south
(4) 10 km towards east

35. A train is travelling at 80 km/hr due East. From a close position (where road and railway track are close), a car is driven due North at a speed of 60 km/hr. The distance between the train and the car after 3 minutes would be
(1) 3 km (2) 4 km
(3) 5 km (4) 6 km

36. A thin circular ring of radius R is moving along a straight line. At an instant, a point P is in contact with the surface. From this instant what will be the displacement of P when the ring has turned through three-fourths of its circumference ?



(1) $\sqrt{9\pi^2+2}\times(R/2)$ (2) $\sqrt{3\pi^2+4}\times(R/2)$
(3) $\sqrt{9\pi^2+4}\times(R/2)$ (4) $\sqrt{3\pi^2+1}\times(R/2)$

37. Three persons A, B and C, standing at the corners of an equilateral triangle of side a each, start moving with same magnitude of velocity, such that velocity of A is always directed towards B, that of B towards C and that of C towards A. They will meet after time t, equal to
(1) $\dfrac{2a}{\sqrt{3}\,v}$ (2) $\dfrac{2a}{3v}$
(3) $\dfrac{\sqrt{3}\,a}{2v}$ (4) $\dfrac{3a}{2v}$

38. A cannon shell lands 2 km away from the cannon. a second shell, fired identically, breaks into two equal parts. If one part ofalls vertically downward, how far from the cannon will the other land ?
(1) 2 km (2) 3 km
(3) 4 km (4) 5 km

39. A toy car travels in a horizontal circle of radius $2a$, kept on the track by a radial elastic string. Its period is T. The length of the unstretched string is found to be a. When the car is speeded up, the string stretches until the car is moving in a circle of radius $3a$. Assuming that the string obeys Hooke's law, the period of revolution now is
(1) $T(3/4)$ (2) T
(3) $T\sqrt{4/3}$ (4) $T\sqrt{3/4}$

40. A particle starts from origin at $t = 0$. It moves in a plane with velocity $\vec{v} = v_0\hat{i} + (a\omega \cos \omega t)\vec{j}$. The equation of trajectory of the particle is
(1) $y = a \sin \omega t$ (2) $y = a \cos \omega t$
(3) $y = a \sin\left[\frac{\omega x}{v_0}\right]$ (4) $y = a \cos\left[\frac{\omega x}{v_0}\right]$

41. A motor boat which has a speed of 13 km/hr in still water crosses a river of width 1 km, along its shortest path, in 5 minutes. The speed of water in the river is
(1) 6 km/hr (2) 5 km/hr
(3) 8 km/hr (4) 4 km/hr

42. A car with a vertical wind-shield is moving in a rain storm with a speed of 40 km/hr along a straight road. The rain drops are falling vertically with a constant speed of 20 ms^{-1}. The angle at which the rain drops strike the wind-shield is
(1) $\tan^{-1}(4/9)$ (2) $\tan^{-1}(5/9)$
(3) $\tan^{-1}(9/4)$ (4) $\tan^{-1}(9/5)$

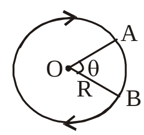
43. An open truck is moving on a horizontal straight road with a velocity of 54 km/hr. On it, a gun is fixed, making an angle of 60° with the vertical. With what speed should the bullet leave the barrel of the gun so that it rises vertically ?
(1) 30 ms^{-1} (2) $10\sqrt{3}$ ms^{-1}
(3) 15 ms^{-1} (4) 20 ms^{-1}

44. A body of mass 100 g, attached to a string of length 100 cm and with one of its ends fixed, is whirled in a vertical circular path with a fixed speed of 10 ms^{-1}. If g = 10 ms^{-2} and tension in the string at an instant is 9.5 N, then the angle which the string makes, at that instant, with the vertical is
(1) 60° (2) 90°
(3) 120° (4) 180°

45. A stone tied to a string of length L is whirled in a vertical circle, with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of the change in its velocity, as it reaches a position where the string is horizontal, is
(1) $\sqrt{u^2-2gL}$ (2) $\sqrt{u^2-gL}$
(3) $\sqrt{2gL}$ (4) $\sqrt{2(u^2-gL)}$

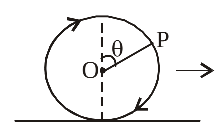
46. Consider point P on wheel at contact on the ground, which is rolling on ground without slipping. Then, the displacement of the point P, when wheel completes half rotation, is (radius of wheel = 1 m)
(1) 2 m (2) $\sqrt{\pi^2 + 4}$ m
(3) π m (4) $\sqrt{\pi^2 + 2}$ m

47. A person is moving in a circular path of radius R with a constant speed v. The change in velocity of the person from position at A to position at B is



(1) $2v \cos \theta$ (2) $2v \sin \theta$
(3) $2v \cos(\theta/2)$ (4) $2v \sin(\theta/2)$

48. A thin wheel or circular wire of radius R is rolling along a straight horizontal path. It has a mark P on its circumference. When the line joining P and centre of wheel makes angle θ with the vertical, then speed of P is



(1) $v \cos(\theta/2)$ (2) $v \sin(\theta/2)$
(3) $2v \cos(\theta/2)$ (4) $2v \sin(\theta/2)$

49. A stone is thrown with velocity v, making an angle θ with the horizontal. At some instant, its velocity u is perpendicular to initial velocity v. Then u is
(1) $v \sin \theta$ (2) $v \cos \theta$
(3) $v \tan \theta$ (4) $v \cot \theta$

50. A body of mass 1 kg is moving in a circular path with a non-uniform speed which is time-varying as $v = 6t^2 - 2t$ (radius of circulr path is 2 m). Acceleration of the body at time t = 1 second is
(1) 8 m/s^2 (2) 10 m/s^2
(3) 6 m/s^2 (4) $\sqrt{164}$ m/s^2

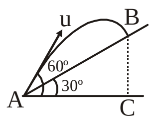
51. A particle is fired with velocity u making angle θ with the horizontal. The angular momentum of the particle about origin will be

(1) throughout increasing
(2) throughout decreasing
(3) first increasing then decreasing
(4) first decreasing then increasing

52. From the top of a tower 19.6 m high, a ball is thrown horizontally. If the line joining the point of projection to the point where it hits the ground makes an angle of 45° with the horizontal, then the initial velocity of the ball is

(1) 9.8 ms^{-1} (2) 4.9 ms^{-1}
(3) 14.7 ms^{-1} (4) 2.8 ms^{-1}

53. Time taken by the projectile to reach from *A* to *B* is *t*. Then the distance *AB* is equal to



(1) $\frac{ut}{\sqrt{3}}$ (2) $\frac{\sqrt{3}\,ut}{2}$
(3) $\sqrt{3}\,ut$ (4) $2\,ut$

54. When a projectile is thrown at an angle of 45° with the horizontal, then the trajectory of its path is given by the relation $y = x - 0.1x^2$ where x and y are in metre. If $g = 10\ ms^{-2}$, then the horizontal range of the projectile

(1) is 10 m (2) is 25 m
(3) is 2.5 m (4) cannot be calculated

55. A stone of mass 100 g, attached to a string of length 1.0 m and of negligible mass is being whirled in a vertical circular path. One end of the string is fixed. At an instant, when the speed of the stone is 5 ms^{-1}, tension in the string is 2.5 N. At this instant,

(1) the stone is at highest position of motion
(2) the stone is at bottom of circular path
(3) the string is horizontal
(4) the string makes angle of 45° with the vertical

56. A person is standing on a boat which is moving horizontally with a velocity of 5 m/sec. The person throws a ball vertically into air with a velocity of 5 m/s. Another person who is standing on the ground, observes the path of the ball is projectile. The range of the projectile motion is (take $g = 10\ m/s^2$)

(1) 5 m (2) 10 m
(3) zero (4) 2.5 m

57. If a body is thrown upward with initial velocity *u*, making an initial angle of 30° with the horizontal, then its velocity at any instant of time *t* is

(1) $\sqrt{u^2+g^2t^2-ugt}$ (2) $\sqrt{u^2+g^2t^2+ugt}$

(3) $\sqrt{u^2+ugt-g^2t^2}$ (4) $\sqrt{u^2-g^2t^2-ugt}$

58. The angle made by the resultant velocity after *t* seconds for a projectile is α with the horizontal. If initial velocity of projectile at an angle θ with the horizontal is *u* then tan α =

(1) $\frac{gt}{u\cos\theta}$ (2) $\frac{t}{u\cos\theta}$

(3) $\tan\theta - \frac{gt}{u\cos\theta}$ (4) $\tan\theta + \frac{gt}{u\cos\theta}$

59. The ceiling of a large hall is 20 m high. What is the maximum horizontal distance covered by the ball, thrown at a speed of 40 ms^{-1}, without hitting the ceiling of the hall ? ($g = 10\ ms^{-2}$)

(1) $80\sqrt{3}$ m (2) $100\sqrt{3}$ m

(3) $60\sqrt{3}$ m (4) $40\sqrt{3}$ m

60. A frame of reference F_2 moves with velocity $\vec{v}$ with respect to another frame of reference F_1. When an object is observed from both frames of reference, its velocity is found to be $\vec{v}_1$ in F_1 and $\vec{v}_2$ in F_2. Then, $\vec{v}_2$ is equal to

(1) $\vec{v}_1+\vec{v}$ (2) $\vec{v}-\vec{v}_1$

(3) $\vec{v}_1-\vec{v}$ (4) none of these

61. A small body of mass *m*, attached to a thin string of negligible mass, is whirled in a vertical circular path. The other end of the string is held at fixed point. The rotation of the body is such that at the highest position of its motion, its speed is minimum. When the positions of body are *P*, *Q* and *R*, the string makes angles of 60°, 120° and 180°, respectively, with the vertical. The ratio of velocities of the body at positions *P*, *Q* and *R* is

(1) $\sqrt{2} : 2 : \sqrt{5}$ (2) $\sqrt{2} : \sqrt{3} : \sqrt{5}$

(3) $1 : \sqrt{3} : \sqrt{5}$ (4) $\sqrt{3} : 2 : \sqrt{5}$

62. A small spherical ball of mass 100 g, attached to a light string of length 100 cm, is revolving in a vertical circular path with a fixed speed of 10 ms^{-1}. When the tension in the string is 10.5 N ($g = 10\ ms^{-2}$)

(1) the spherical ball is at the highest position
(2) the spherical ball is at the lowest position
(3) the string is in the horizontal position
(4) the string makes an angle of 120° with the vertical

63. What should be the minimum safe speed of a car while moving over a speed breaker of radius of curvature 5 m, so that wheels do not lose contact with the road ?
(1) $9.8\ ms^{-1}$ (2) $7\ ms^{-1}$
(3) $5\ ms^{-1}$ (4) $10\ ms^{-1}$

64. A large number of bullets are fired, in all possible directions, with the same speed of $10\ ms^{-1}$. The maximum area of the ground on which these bullets can fall is ($g = 10\ ms^{-2}$)
(1) $10\pi\ m^2$ (2) $100\pi\ m^2$
(3) $1000\pi\ m^2$ (4) none of these

65. What should be the height through which outer side of the road of radius of curvature 300 m be banked for a safe speed of 54 km/hr for the vehicles ? The width of road is 4 m. Take $g = 10\ ms^{-2}$.
(1) 20 cm (2) 25 cm
(3) 30 cm (4) 40 cm

66. Two paper screens *A* and *B* are separated by a distance of 100 m. A bullet pierces *A* and then *B*. The hole in *B* is 10 cm below the hole in *A*. If the bullet is travelling horizontally at the time of hitting the screen, its velocity when it strikes the screen *A* is (neglect resistance and take $g = 9.8\ ms^{-2}$)
(1) $980\ ms^{-1}$ (2) $700\ ms^{-1}$
(3) $490\ ms^{-1}$ (4) $350\ ms^{-1}$

67. A boy aims his gun at a bird 100 m away. If the velocity of the bullet is $200\ ms^{-1}$, to hit the bird, the boy should aim
(1) directly towards the bird
(2) approximately 20 cm above the bird
(3) approximately 63 cm above the bird
(4) approximately 1.25 m above the bird

68. Two stones are projected with same magnitude of velocity but making different angles with the horizontal. Their ranges are equal. If the angle of projection of one is $2\pi/6$ and its maximum height is y_1, then the maximum height of the other stone will be
(1) $3y_1$ (2) $\sqrt{3}\ y_1/2$
(3) $y_1/2$ (4) $y_1/3$

69. An object is thrown initially along a direction inclined at an angle of $\tan^{-1}(2)$ with the horizontal direction. The horizontal range of the particle is equal to
(1) vertical height
(2) twice the vertical height
(3) half the vertical height
(4) four-times the vertical height

70. A projectile thrown from the ground, making an angle of 45° with the horizontal, crosses the wall of a building 6 m high and at a distance of 10 m from the place of projection of the projectile. The horizontal range of the projectile is
(1) 18 m (2) 20 m
(3) 25 m (4) 30 m

71. A projectile is thrown from the ground into the air. Its range is 200 m and it remains above the ground for 5 seconds. Neglecting air resistance, the angle of projection of the projectile is ($g = 10\ ms^{-2}$)
(1) $\tan^{-1}(5/8)$ (2) $\tan^{-1}(5/4)$
(3) $\tan^{-1}(7/8)$ (4) $\tan^{-1}(5/6)$

72. A projectile is projected, at an angle of 60° with the horizontal, with initial velocity v_0. What would be the velocity of the projectile when the direction of velocity of the projectile makes an angle of 45° with the horizontal
(1) $0.75\ v_0$ (2) $v_0/2$
(3) $v_0/\sqrt{2}$ (4) $\sqrt{3}\ v/2$

73. A mass of 100 g is attached to one end of a string of length 1 m, which can withstand a maximum tension of 100 N. Taking $\pi^2 = 10$, with what minimum time period can this mass be rotated in a horizontal circular path with the given string ?
(1) 0.5 *s* (2) 0.25 *s*
(3) 0.1 *s* (4) 0.2 *s*

74. The roof of a building is connected to the ground with stairs, each of width 40 cm and height 20 cm. A ball leaves the roof with a speed of $3.5\ ms^{-1}$ and hits the *n*th stair from the top. Value of *n* is
(1) 4 (2) 3
(3) 6 (4) 7

75. A particle moves in a circle of radius 25 cm with a time period of 0.5 second. The acceleration of the particle in ms^{-2} is
(1) π^2 (2) $2\pi^2$
(3) $4\pi^2$ (4) $8\pi^2$

76. A projectile, thrown from ground and making an angle of 45° with the horizontal, crosses two poles each of height 0.9 m. If velocity of projection of the projectile is $7\sqrt{2}\ ms^{-1}$, then the separation between the two poles is
(1) $7\sqrt{2}$ m (2) 9 m
(3) 8 m (4) 9.8 m

77. The horizontal muzzle velocity of a bullet, fired from a height, is $120\ ms^{-1}$. It is fired to hit a target 5 seconds later. If $g = 10\ ms^{-2}$, the bullet will hit the target with a velocity of (ignore resistance and other dissipative forces)

(1) 120 ms^{-1} (2) 120 $\sqrt{2}$ ms^{-1}
(3) 130 ms^{-1} (4) 132 ms^{-1}

78. A shell is fired from a boat gun to hit a ship 2.0 km away. If the shell rises to a maximum height of 0.5 km, the muzzle velocity of the shell should be
(1) 140 ms^{-1} (2) $100\sqrt{7}$ ms^{-1}
(3) $50\sqrt{14}$ ms^{-1} (4) $70\sqrt{3}$ ms^{-1}

79. The nozzle of a water pipe, fixed at the ground makes an angle of 60º with the horizontal. At a distance of 4 m from the nozzle there is a vertical wall. If water gushes out of the nozzle with a speed of 7 ms^{-1}, at what height from the ground will the water hit the wall ?
(1) 18.5 cm (2) 25.8 cm
(3) 58.2 cm (4) 52.8 cm

80. A car whose wheels are 1.5 m apart has its C.G. 0.75 m above the ground. The maximum safe speed at which it can move around an unbanked road of radius of curvature 20 m, is
(1) 10.5 ms^{-1} (2) 21 ms^{-1}
(3) 14 ms^{-1} (4) 9.8 ms^{-1}

81. An aeroplane is at a height of 490 m. What should be the effective velocity of rocket fired horizontally from the aeroplane so that it can hit a target at a horizontal distance of 2 km on the ground ?
(1) 200 ms^{-1} (2) 196 ms^{-1}
(3) 245 ms^{-1} (4) 150 ms^{-1}

82. A bob of mass *m* is attached to one end of the string of length *l*. This is raised to the horizontal position and then released from rest. At what angle with the vertical, the tension in the string will be equal to the magnitude of weight of the bob ?
(1) $\cos^{-1}(1/2)$ (2) $\cos^{-1}(1/3)$
(3) $\cos^{-1}(1/\sqrt{2})$ (4) $\cos^{-1}(1/\sqrt{3})$

83. The range of a projectile, fired at an angle of 15º with the horizontal, is 1.5 km. If the projectile is thrown with same velocity at 60º with the horizontal, then the range will be about
(1) 6.0 km (2) 3.0 km
(3) 1.8 km (4) 2.6 km

84. A stone is projected at an angle θ with the horizontal and with velocity *u*. If it executes a nearly circular motion near its maximum height for a short time, then the radius of this circular part will be
(1) u^2/g (2) $u^2\cos^2\theta/g$
(3) $u^2\sin^2\theta/g$ (4) $u^2\cos^2\theta/2g$

85. The range of a projectile is twice the maximum height it attains. Its horizontal range is
(1) $\frac{2}{5}\cdot\frac{v_0^2}{g}$ (2) $\frac{3}{5}\cdot\frac{v_0^2}{g}$
(3) $\frac{4}{5}\cdot\frac{v_0^2}{g}$ (4) $\frac{8}{5}\cdot\frac{v_0^2}{g}$

86. Two projectiles are thrown from same position to it a target, lying in the horizontal plane with the target. If h_1 and h_2 are the maximum heights, attained by the two projectiles, then $\sqrt{h_1 h_2}$ is equal to
(1) R (2) *R*/2
(3) *R*/4 (4) 2 *R*

87. A body is projected with a speed of 1 ms^{-1} and at an angle of 60º with the vertical. The maximum height to which the body will rise is
(1) $\frac{1}{8g}$ (2) $\frac{3}{8g}$
(3) $\frac{3}{4g}$ (4) $\frac{1}{2g}$

88. A stone, thrown at an angle θ with the horizontal, reaches a maximum height *h*. The time of flight of the stone is
(1) $\frac{\sqrt{2h\sin\theta}}{g}$ (2) $\frac{2\sqrt{2h\sin\theta}}{g}$
(3) $2\sqrt{\frac{2h}{g}}$ (4) $\sqrt{\frac{2h}{g}}$

89. A body of mass *m*, thrown horizontally with velocity *v* from the top of a tower of height *h*, touches the level of ground at a distance of 250 m from the foot of the tower. Now, if a body of mass 2*m* is thrown horizontally with velocity *v*/2 from the top of the second tower of height 2 *h*, then it touches the ground at distance *x* from the foot of this tower. The value of *x* is
(1) 250 m (2) $250\sqrt{2}$ m
(3) $250/\sqrt{2}$ m (4) 500 m

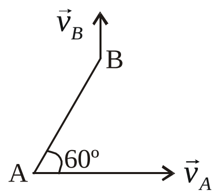
90. A projectile can hit a target along same horizontal line in two ways. If t_1 and t_2 are the times of flight in the two cases and *R* is the horizontal range, then t_1t_2 =
(1) 4*R*/*g* (2) *R*/2g
(3) *R*/g (4) 2*R*/g

91. A balloon starts rising from the surface of earth. The ascent rate is constant and equal to v_0. Due to wind the balloon gathers the horizontal velocity component $v_x = Ay$ while *A* is constant and if *y* is the height of ascent, the horizontal drift of the balloon is

(1) $\frac{A\,y^2}{2\,v_0}$ (2) $\frac{A\,y}{v_0^2}$

(3) $\frac{A}{v_0}$ (4) $\frac{2\,A\,y^2}{v_0}$

92. A link *AB* is moving in a vertical plane. At a certain instant when the link is inclined 60º to the horizontal the point *A* is moving horizontally at 3 m/s while *B* is moving in the vertical direction. What is the velocity of *B* ?



(1) $1/\sqrt{3}$ m/s (2) $\sqrt{3}$ m/s

(3) $2\sqrt{3}$ m/s (4) $\sqrt{3}/2$ m/s

93. Two particles at position vectors $\vec{r}_1 = (3\hat{i} + 5\hat{j})$ m and $\vec{r}_2 = (-5\hat{i} - 3\hat{j})$ m have velocities $\vec{v}_1 = (4\hat{i} + 3\hat{j})$ ms^{-1} and $\vec{v}_2 = (a\hat{i} + 7\hat{j})$ ms^{-1}, respectively. If these collide after 2 seconds, the value of *a* is

(1) 2 (2) 4

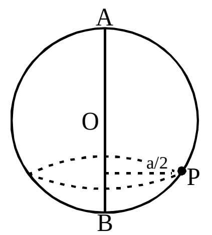
(3) 6 (4) 8

94. A cracker is thrown into air with a velocity of 10 ms^{-1} at an angle of 45º with the vertical. When it is at a height of 0.5 m from the ground, it explodes into a number of pieces which follow different parabolic paths. What is the velocity of centre of mass, when it is at a height of 1 m from the ground? (g = 10 ms^{-2})

(1) $4\sqrt{5}$ ms^{-1} (2) $2\sqrt{5}$ ms^{-1}

(3) $5\sqrt{4}$ ms^{-1} (4) 10 ms^{-1}

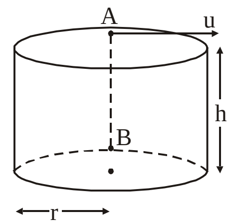
95. A smooth wire is bent into a vertical circle of radius *a*. A bead *P* can slide smoothly on the wire. The circle is rotated about its vertical diameter *AB* as axis, with angular speed ω, as shown. If *P* is at rest at position shown, then $\omega^2 =$



(1) $\frac{\sqrt{3}\,g}{2a}$ (2) $\frac{\sqrt{2}\,g}{3a}$

(3) $\frac{2g}{3a}$ (4) $\frac{2g}{\sqrt{3}\,a}$

96. A hollow vertical cylinder of radius *r* and height *h* has a smooth internal surface. A small particle is placed in contact with the inner side of the upper rim, at a point *A*, and given a horizontal speed *u*, tangential to the rim. It leaves the lower rim at point *B*, vertically below *A* before making *n* rotations. If *n* is an integer then it is equal to



(1) $\frac{u}{2\pi r}\sqrt{2h/g}$ (2) $\frac{h}{2\pi r}$

(3) $\frac{2\pi r}{h}$ (4) $\frac{u}{\sqrt{2gh}}$

97. The horizontal range and maximum height attained by a projectile are *R* and *H* respectively. If a constant horizontal acceleration $a = g/4$ is imparted to the projectile due to wind, then its horizontal range and maximum height will be

(1) $(R+H), \frac{H}{2}$ (2) $\left(R+\frac{H}{2}\right), 2H$

(3) $(R + 2H), H$ (4) $(R + H), H$

98. A stone of mass 1 kg is tied to a light inextensible string of length L = 10/3 m and is whirled in a vertical circular path of radius *L*. If the ratio of the maximum tension and minimum tension in the string is 4, then speed of stone at the highest position is

(1) $10\sqrt{2}$ ms^{-1} (2) $10\sqrt{3}$ ms^{-1}

(3) 10 ms^{-1} (4) 20 ms^{-1}

99. A boy throws a ball upwards with velocity v_0 = 20 ms^{-1}. The wind imparts a horizontal acceleration of 4 m/s^2 to the left. The angle θ with the vertical at which the ball must be thrown, so that the ball returns to the boy's hand, is (g = 10 m/s^2)

(1) $\tan^{-1}(1.2)$ (2) $\tan^{-1}(0.2)$

(3) $\tan^{-1}(2)$ (4) $\tan^{-1}(0.4)$

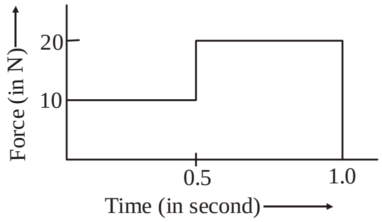
100. The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where a and b are constants, and x and y are respectively horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projection from the horizontal are

(1) $\frac{b^2}{2a}, \tan^{-1}(b)$ (2) $\frac{a^2}{b}, \tan^{-1}(2a)$

(3) $\frac{a^2}{4b}, \tan^{-1}(a)$ (4) $\frac{2a^2}{b}, \tan^{-1}(a)$

Choose the correct answers :

1. Force is applied on an object of mass 2 kg at rest on a frictionless horizontal surface as indicated on the graph (figure below). After 1 second, the speed of the object in ms^{-1} is



(1) 7.5 (2) 12.5
(3) 30 (4) 25

2. A ship of mass 4×10^7 kg, initially at rest, is pulled by a force of 5×10^4 N through a distance of 4 m. Ignoring resistance of water, the ship will gain a velocity of
(1) 0.2 ms^{-1} (2) 0.25 ms^{-1}
(3) 0.1 ms^{-1} (4) 1.5 ms^{-1}

3. When a 3 kg rifle is fired, the 10 g bullet receives an acceleration of 3×10^6 cm s^{-2}. The magnitude of the force acting on the rifle is
(1) 300 N (2) 100 N
(3) 30,000 N (4) zero

4. A rifle of mass 3 kg fires a bullet of mass 0.03 kg. The bullet leaves the barrel of the rifle at a velocity of 100 ms^{-1}. If the bullet takes 0.003 sec. to move through the barrel, the force of recoil experienced by the rifle is
(1) 100 N (2) 300 N
(3) 1000 N (4) 3000 N

5. An object of mass 10 kg is moving at a constant speed of 10 m/s. A constant force acts on it for 4 seconds and gives it a speed of 2 m/s in the opposite direction. The impulse acting on the object is
(1) – 100 Ns (2) – 360 Ns
(3) – 120 Ns (4) – 80 Ns

6. If $F_1 + F_2 + F_3 = 0$, then which one of the following statements is correct ?
(1) $F_1 > F_2$ (2) $F_2 > F_3$
(3) $F_3 > F_1$ (4) None of these

7. A disc of mass 10 g is kept floating horizontally by throwing 10 marbles/sec against it from below. If the mass of each marble is 5 g and after striking against the disc it rebounds downward with the same speed, then the velocity of each marble striking the disc is
(1) 0.98 ms^{-1} (2) 1.96 ms^{-1}
(3) 0.49 ms^{-1} (4) none of these

8. The air from a hole in a balloon escapes with uniform rate of 4 ms^{-1}. If the balloon contains 10 g of air and if it shrinks completely in 2.5 seconds, then the mean force acting on the balloon is
(1) 0.016 N (2) 0.16 N
(3) 0.032 N (4) 0.10 N

9. A wrestler pushes a heavy box on a rough floor with an initial speed of 4 ms^{-1}. The box stops moving after 10 seconds. If the average force of friction on the box through its motion is 10 N, the mass of the box is
(1) 50 kg (2) 40 kg
(3) 25 kg (4) 20 kg

10. A force of 6 N acts on a body of mass 1 kg for some time during which the body attains a kinetic energy of 450 J, starting from rest. The time for which the force acts on the body is
(1) 5 s (2) 6 s
(3) 9 s (4) 10 s

11. A force produces an acceleration of 4 ms^{-2} in a body of mass m_1 kg and the same force produces an acceleration of 6 ms^{-2} in another body of mass m_2 kg. If the same force is applied to the mass $(m_1 + m_2)$ kg, the acceleration will be
(1) 2.7 ms^{-2} (2) 2.1 ms^{-1}
(3) 2.4 ms^{-1} (4) 3.2 ms^{-1}

12. A force produces an acceleration of 16 ms^{-2} in a body of mass 0.5 kg and an acceleration of 4 ms^{-2} in another body. If both the bodies are fastened together then the acceleration produced by the same force would be
(1) 5.0 ms^{-2} (2) 3.2 ms^{-2}
(3) 6.4 ms^{-2} (4) 2.5 ms^{-2}

13. A force of 15 N is applied on a body of mass M. If the body moves in a straight line with its speed increasing by 10 ms^{-1} every 2 seconds, then the mass of the body is
(1) 5 kg (2) 4.5 kg
(3) 6 kg (4) 3 kg

14. A block of mass 10 kg is kept on a rough inclined surface making an angle of 30º with the horizontal. If the block starts from rest and covers a distance of 12 m in first three seconds, then the coefficient of kinetic friction is (g = 10 ms^{-2})
(1) 0.19 (2) 0.27
(3) 0.21 (4) 0.31

15. The tension in the string of an oscillating simple pendulum is

(1) constant
(2) maximum in the extreme positions
(3) zero in the mean position
(4) none of these

16. Which of the following needs correction ?
(1) Frictional forces appear in pair, as Newton's III law of action and reaction
(2) Frictional forces act only when two surfaces in contact have relative motion
(3) Static frictional forces develop upto a limiting value only
(4) Frictional forces between two surfaces are independent of area of contact.

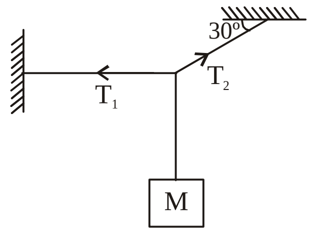
17. In nature, the basic forces are (i) gravitational, (ii) electrical and (iii) nuclear (nuclear forces are strong as well as weak). Out of these, the more dominating and more pervasive force in nature is / are
(1) electrical force (2) gravitational force
(3) nuclear force (4) all the four, equally

18. All the forces in nature are grouped into 3 basic forces which are : electrical forces, nuclear forces and gravitational forces. Which one of the following statements is *wrong* about these forces ?
(1) Gravitation force and nuclear force are mass-dependent
(2) Only nuclear force is short-ranged
(3) Gravitation force < Electrical force < Nuclear force
(4) All the forces are attractive as well as repulsive in nature

19. Which one of the following statements is *wrong* about friction ?
(1) Coefficient of friction may be less than or even greater than 1
(2) Increase in temperature decreases frictional force between two bodies in contact
(3) Frictional force is necessary evil
(4) Frictional force is more on inclined roads as in hilly areas than on level roads as in the plains

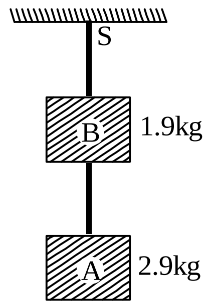
20. A parachutist of weight W strikes the ground with his legs and comes to rest with an upward acceleration of magnitude 3 g. Force exerted on him by the ground during landing is
(1) W (2) $2\,W$
(3) $3\,W$ (4) $4\,W$

21. In the system shown below, tention T_1 in the horizontal string is



(1) 0 (2) $\sqrt{3}\,Mg/2$
(3) $\sqrt{3}\,Mg$ (4) $\sqrt{2}\,Mg$

22. Two blocks of masses 2.9 kg and 1.9 kg are suspended from a rigid-support S by two inextensible wires each of length 1 m. The upper wire has negligible mass and the lower wire has uniform mass of 0.2 kg/m. The whole system of blocks, wires and support have an upward acceleration of 0.2 m/s^2. Acceleration due to gravity is 9.8 m/s^2. The tension at, (a) the mid point of lower wire, and (b) mid point of upper wire are, respectively



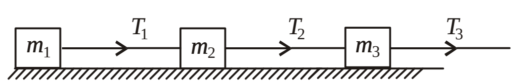
(1) 40 N, 40 N (2) 40 N, 50 N
(3) 30 N, 50 N (4) 30 N, 60 N

23. Two weights W_1 and W_2 are attached to the ends of a string which passes over a frictionless pulley. If the pulley is placed in a rocket accelerating upward at 19.6 ms^{-2}, the tension in the string would be

(1) $\frac{4\,W_1 W_2}{W_1+W_2}$ (2) $\frac{2\,W_1 W_2}{W_1+W_2}$

(3) $\frac{W_1 W_2}{W_1+W_2}$ (4) $\frac{6 W_1 W_2}{W_1+W_2}$

24. Three blocks of masses m_1, m_2 and m_3 are connected by massless strings, as shown, on a frictionless table. These are pulled with a force T_3 = 40 N. If m_1 = 10 kg, m_2 = 6 kg and m_3 = 4 kg, then the tension T_2 will be



(1) 20 N (2) 40 N
(3) 36 N (4) 32 N

25. Two weights are suspended from a light but strong string passing over a fixed frictionless and light pulley. Mass of one weight 200 g and that of other is M kg (where M is very large). If g = 10 ms^{-2}, then tension in the string is nearly

(1) zero (2) 4 N
(3) (0.2 + M) 10 N (4) 6 N

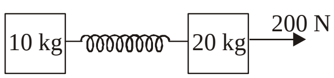
26. A tractor of mass 1000 kg is pulling a roller of mass 500 kg through a strong but light chain. Coefficient of friction between tractor and ground is 0.1 and that between roller and ground is 0.2. If the system has an acceleration of 2 ms^{-1}, tension in the chain is (g = 10 ms^{-2})

(1) 5000 N (2) 4000 N
(3) 3000 N (4) 2000 N

27. In the above question, the total force of the engine of the tractor is

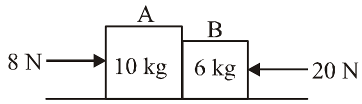
(1) 5000 N (2) 10,000 N
(3) 15,000 N (4) 4000 N

28. Two masses of 10 kg and 20 kg, respectively, are connected by a spring of negligible mass, as shown. A force of 200 N acts on the 20 kg mass. At the instant shown, the 10 kg mass has acceleration of 8 ms^{-2}. At this instant acceleration of 20 kg mass is



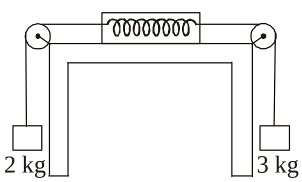
(1) 4 ms^{-2} (2) 6 ms^{-2}
(3) 8 ms^{-2} (4) 10 ms^{-2}

29. Blocks A and B, joined together, are placed on a horizontal smooth surface. Forces of 20 N and 8 N are applied along horizontal direction as shown. The force acting on the common wall of blocks A and B is



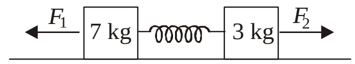
(1) 12 N (2) 15.5 N
(3) 13.5 N (4) 17.5 N

30. Two weights of 2 kg and 3 kg are attached to a spring scale as shown. The reading in the spring balance would be



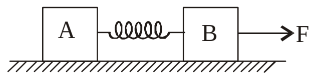
(1) 2.5 kg (2) 2.4 kg
(3) 2.7 kg (4) 3 kg

31. Two blocks of masses 3 kg and 7 kg are connected by a spring of force constant 1000 Nm^{-1} and placed on a smooth horizontal surface. These are acted upon by horizontal force F_1 = 72 N and F_2 = 32 N as shown. When both the blocks move with same acceleration, the tension in the spring is



(1) 40 N (2) 44 N
(3) 104 N (4) 36 N

32. Two bodies A and B each of mass M are fixed together by a massless spring. A force F acts on the mass B as shown in figue. At the instant shown, the mass A has acceleration a. The acceleration of mass B is



(1) $(F/M) - a$ (2) a
(3) $-a$ (4) (F/M)

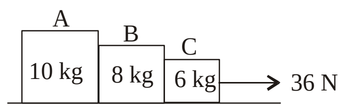
33. A uniform rope of length l lies on a table. If the coefficient of friction is μ, then the maximum length l_0 of the part of this rope, which can lie on the surface of the table without sliding down, is

(1) $\frac{\mu}{\mu+1}l$ (2) $\frac{\mu}{\mu-1}l$
(3) $\frac{l}{\mu+1}$ (4) $\frac{l}{\mu-1}$

34. A spring is compressed between two toy carts of masses m_1 and m_2. When the toy carts are released, then the spring exerts on each, equal and opposite average force for the same time t. If there is no friction between the toy carts and the ground, then the speeds of toy carts are

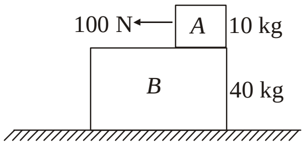
(1) in the opposite directions but in the direct ratio of masses
(2) in the opposite directions but in the inverse ratio of masses
(3) in the opposite directions and equal in magnitude
(4) in the opposite directions but non-equal in magnitude

35. In the following system of blocks, joined together, and placed on a smooth surface, the force acting on the interface of B and C is



(1) 30 N (2) 27 N
(3) zero (4) 24 N

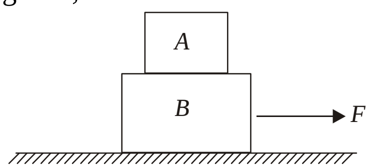
36. A slab *B* of mass 40 kg rests on a frictionless floor. A 10 kg block *A* rests on the top of the slab. The static coefficient of friction between the block and the slab is 0.60, while coefficient of kinetic friction is 0.40. The 10 kg block is acted upon by a horizontal force of 100 N. If $g = 10\ ms^{-2}$, the resulting acceleration of the slab will be



(1) 1.5 ms^{-2} (2) 1.2 ms^{-2}
(3) 3.0 ms^{-2} (4) 1.0 ms^{-2}

37. In the above question, the acceleration of block *A* is
(1) 1.0 ms^{-2} (2) 3.0 ms^{-2}
(3) 6.0 ms^{-2} (4) 4.5 ms^{-2}

38. A 4 kg block *A* is placed on the top of a 8 kg block *B* which rests on a smooth table. Block *A* just slips on *B* when a force of 12 N is applied on *A*. The maximum horizontal force *F*, required to make both *A* and *B* move together, is



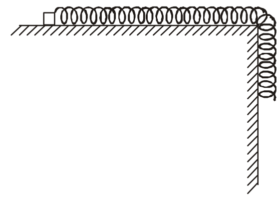
(1) 18 N (2) 24 N
(3) 36 N (4) 48 N

39. A cubical block rests on a plane, with its four edges horizontal and coefficient of friction between surface of plane and surface of block is $1/\sqrt{3}$. Now, the angle of plane with the horizontal is increased slowly till the block just starts sliding down. At this instant, the angle of plane with the horizontal would be
(1) 30º (2) 45º
(3) 60º (4) above 60º

40. A body of mass 10 kg is lying on a plane inclined at an angle of 30º to the horizontal and the co-efficient of static force of friction between the surfaces in contact is 0.866. The minimum forces required to make the body move down the plane and up the plane are, respectively, ($g = 10\ ms^{-2}$)
(1) zero and 75 N (2) 25 N and 75 N
(3) 25 N and 125 N (4) 50 N and 125 N

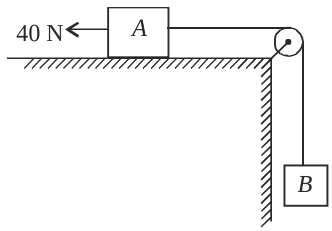
41. An inclined surface is making an angle of 30º with the horizontal. Upper one-third of it is smooth while lower two-thirds of it is rough. A small body is just released from the upper end, and when it reaches the bottom, the velocity of the body is found to be zero. Coefficient of friction of the lower part of the incline is
(1) $1/\sqrt{3}$ (2) 0.5
(3) 0.433 (4) 0.866

42. A chain is lying on the surface of a rough table, with a portion of it hanging downwards. If coefficient of friction of table is 0.15, what is the maximum part of the chain that can hang without moving the chain downward ?



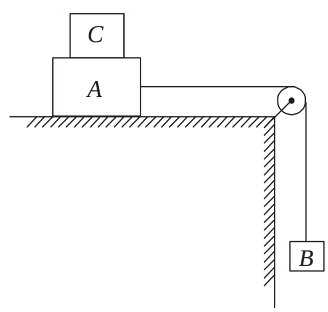
(1) 3/20 (2) 3/13
(3) 3/23 (4) 3/19

43. Two blocks, each of mass 8 kg are connected to a light but strong string passing over a smooth pulley. Surface of table is also smooth. Acceleration of mass *A* is ($g = 10\ ms^{-2}$)



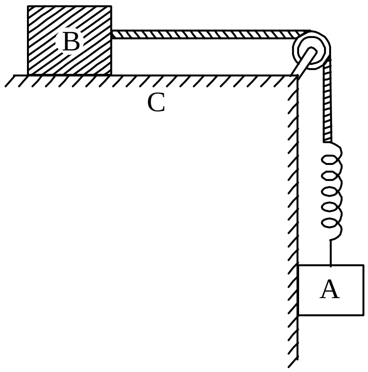
(1) 0 (2) 3.5 ms^{-2}
(3) 2.5 ms^{-2} (4) 5.0 ms^{-2}

44. Two masses *A* and *B* of 10 kg and 5 kg, respectively, are connected with a string, passing over a frictionless pulley fixed at corner of the table, shown in the figure. The coefficient of friction between mass *A* and the table is 0.1. If the system moves with an acceleration of 1.0 ms^{-2} and $g = 10\ ms^{-2}$, then mass of *C* is



(1) 12.5 kg (2) 15 kg
(3) 7.5 kg (4) 10 kg

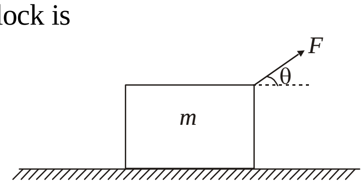
45. Two blocks A and B are connected to each other by a string and a spring. The string passes over a frictionless pulley as shown in figure. Block B slides over the horizontal surface of a stationary block C and the block A slides along the vertical side of C, both with same uniform speed. The coefficient of friction between the surface of the blocks is 0.2. If mass of block A is 2 kg; then mass of the block B is



(1) 2 kg (2) 5 kg
(3) 8 kg (4) 10 kg

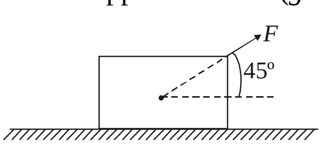
46. In the above problem, energy stored in the springs, if its force constant is 1960 N/m, is
(1) 98 mJ (2) 196 mJ
(3) 9.8 J (4) 19.6 J

47. A wooden block of mass m resting on a rough horizontal table (coefficient of friction = μ), is pulled by a force F as shown in the figure. The acceleration of the block is



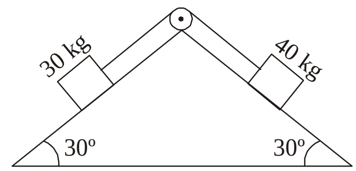
(1) $\frac{F\cos\theta}{m}$ (2) $\frac{F}{m}(\cos\theta+\mu\sin\theta)-\mu g$
(3) $\frac{\mu\times F\cos\theta}{m}$ (4) $\frac{F}{m}(\cos\theta-\mu\sin\theta)$

48. A block of mass 40 kg is pulled with uniform speed on a horizontal surface. If force acts at an angle of 45° with the horizontal and the coefficient of friction is $1/\sqrt{2}$, then the applied force is (g = 9.8 ms^{-2})



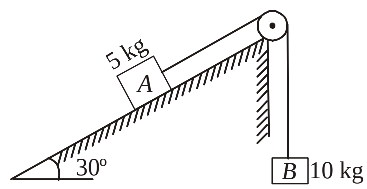
(1) 180 N (2) 270 N
(3) 130 N (4) 230 N

49. Two masses of 40 kg and 30 kg are connected by a string of negligible mass, passing over a frictionless pulley, and placed on smooth inclined surfaces as shown. The tension in the string is



(1) 208 N (2) 128 N
(3) 188 N (4) 168 N

50. Two masses A and B of 5 kg and 10 kg are connected to a string, passing over a smooth pulley. Mass A is placed on a rough incline ($\mu = 1/\sqrt{3}$), making an angle of 30° with the horizontal. Acceleration of A is (g = 10 ms^{-2})

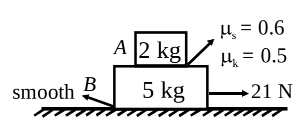


(1) 3.33 ms^{-2} (2) 2.75 ms^{-2}
(3) 4.9 ms^{-2} (4) $2\sqrt{3}$ ms^{-2}.

51. When a body slides from rest from the top of an incline, making an angle of 30° with the horizontal, the time taken by the body to reach its bottom is t. But, when the same incline is made rough uniformly, the time taken by the same body to reach its bottom is $2t$. The coefficient of friction of the rough incline is
(1) $\sqrt{3}/2$ (2) $1/\sqrt{3}$
(3) 0.707 (4) 0.433

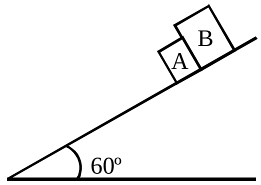
52. A block slides down an inclined surface of inclination 30° with the horizontal. Starting from rest, it covers 6 m in the first two seconds. Coefficient of kinetic force of friction is (g = 10 ms^{-2})
(1) 0.11 (2) 0.23
(3) 0.29 (4) 0.16

53. When a force of 21 N starts acting on the block B, the frictional force on the block A, as shown in figure, would be



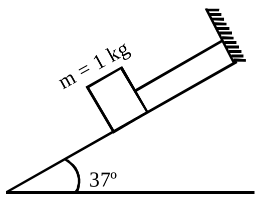
(1) 6 N (2) 12 N
(3) 10 N (4) zero

54. The blocks A and B are just touching each other and their masses are 2 kg and 4 kg, respectively. If inclined plane is smooth, then the contact force between A and B is



(1) 10 N (2) 15 N
(3) zero (4) 5 N

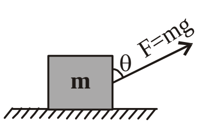
55. Coefficient of friction between the block and the inclined plane is 0.75 and $\tan^{-1}(0.75) = 37^\circ$. The tension in the string would be



(1) $g \sin 37^\circ$ (2) $g \cos 37^\circ - \sin 37^\circ$
(3) zero (4) $g \cos 37^\circ + \sin 37^\circ$

56. On the horizontal surface of a truck, a block of mass 1 kg is placed ($\mu_S = 0.7$, $\mu_k = 0.6$). The relative acceleration of block w.r.t. truck when truck starts accelerating with an acceleration of 8 m/s^2 is
(1) zero (2) 6 m/s^2
(3) 8 m/s^2 (4) 2 m/s^2

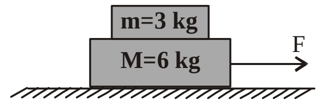
57. A block of mass *m* rests on a rough horizontal surface as shown in the figure. Coefficient of friction between the block and the surface is μ. A force $F = mg$ acting at angle θ with the vertical side of the block pulls it. In which of the following cases can the block be pulled along the surface ?



(1) $\tan\theta \geq \mu$ (2) $\cot\theta \geq \mu$
(3) $\tan\frac{\theta}{2} \geq \mu$ (4) $\cot\frac{\theta}{2} \geq \mu$

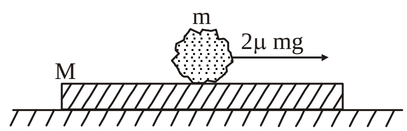
58. A man walks over a rough surface; the angle between the force of friction and the instantaneous velocity of the person is
(1) π (2) $\pi/2$
(3) 2π (4) zero

59. Two blocks of mass $M = 6$ kg and $m = 3$ kg are placed as shown below. Coefficient of friction between M and m is 0.5. Coefficient of friction between M and the surface is 0.4. The maximum horizontal force that can be applied to the mass M so that they move without separation is ($g = 10$ ms^{-2})



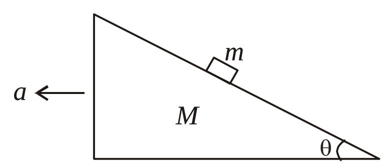
(1) 41 N (2) 61 N
(3) 81 N (4) 101 N

60. A plate of mass *M* is placed on a horizontal frictionless surface (see figure), and a body of mass *m* is placed on this plate. The coefficient of dynamic friction between this body and the plate is μ. If a force $2\mu mg$ is applied to the body of mass *m* along the horizontal, the acceleration of the plate will be



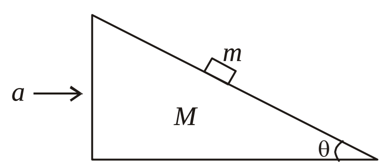
(1) $\frac{\mu m}{M} g$ (2) $\frac{\mu m}{(M+m)} g$
(3) $\frac{2\mu m}{M} g$ (4) $\frac{2\mu m}{(M+m)} g$

61. A body of mass *m* is resting on a wedge of angle θ, as shown in the figure. The wedge is given an acceleration *a* as shown. What should be the value of *a* so that the mass *m* just falls freely ?



(1) $g \cos\theta$ (2) $g \sin\theta$
(3) $g \tan\theta$ (4) $g \cot\theta$

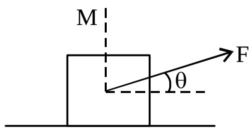
62. A body of mass *m* is resting on a wedge of angle θ, as shown in the figure. The wedge is given an acceleration *a* as shown. What should be the value of *a* so that the body does not move downward?



(1) $g \cos \theta$ (2) $g \sin \theta$
(3) $g \tan \theta$ (4) $g \cot \theta$

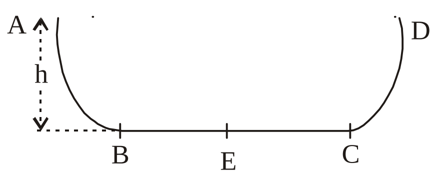
63. A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerating horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block has a magnitude
(1) mg (2) mg cos θ
(3) mg tan θ (4) mg/ cos θ

64. A body of mass M is dragged along a horizontal rough surface, as shown. If λ is angle of friction, then minimum force required to drag the body is



(1) $Mg \tan \lambda$ (2) $Mg \tan \theta$
(3) $Mg \cos \lambda$ (4) $Mg \sin \lambda$

65. A particle slides along a track with elevated ends and a flat central part (between B and C); see figure. The flat part has length of 3 m. The curved portions of the track are frictionless, whereas the coefficient of kinetic friction of the flat central part is 0.2. If the particle is released from A, which is at height, h = 1.5 m above the flat part of the track, then the particle will come to rest (E is mid-point of BC)



(1) either at B or at C
(2) at any point between B and E
(3) at any point between E and C
(4) at mid-point E

66. When a truck moving with a speed of 36 km/hr reaches the foot of an upward inclined road of angle 30°, its engine is switched off. The coefficient of friction involved is 0.1 and assume g = 10 ms^{-2}. The maximum distance the truck can move along this straight incline before coming to rest is
(1) 6.82 m (2) 5.85 m
(3) 8.52 m (4) 10.32 m

67. If a rope can withstand a tension of 300 N, then the least acceleration with which a man of 50 kg can slide along it is
(1) 3.8 ms^{-2} (2) 2.8 ms^{-2}
(3) 3.2 ms^{-2} (4) 4.2 ms^{-2}

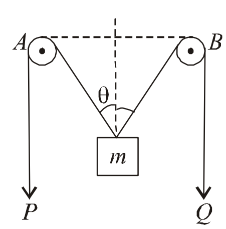
68. A child weighing 25 kg slides down a rope hanging from the branch of a tree. If the force of friction against the child is 220 N, then the acceleration, with which he moves down along the rope, is
(1) 0.98 ms^{-2} (2) 1.0 ms^{-2}
(3) 1.96 ms^{-2} (4) 1.5 ms^{-2}

69. A 15 kg mass is accelerated from rest with a force of 100 N. As it moves faster, friction and air resistance create an oppositely directed retarding force given by $F_R = A + Bv$, where $A = 25\ N$ and $B = 0.5\ \dfrac{N}{m/s}$. At what velocity does the acceleration equal to one half of the initial acceleratioin ?
(1) 25 m/s (2) 50 m/s
(3) 75 m/s (4) 100 m/s

70. A balloon of gross weight W is falling vertically downward with constant acceleration a. The amount of ballast Q that must be thrown out in order to give the balloon an equal upward acceleration a is such that
(1) $Q = \dfrac{W}{2}$ (2) $Q = 2W\dfrac{a}{a+g}$
(3) $Q = \dfrac{W(a-g)}{a}$ (4) $Q = \dfrac{W(a-g)}{g}$

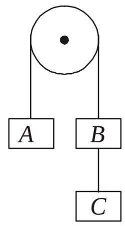
71. A body of mass 10 kg is being acted upon by a force 3 t^2 and an opposing constant force of 32 newton. The initial speed is 10 m/s. The velocity of the body after 5 second is
(1) 6.5 m/s (2) 4.5 m/s
(3) 3.5 m/s (4) 2.5 m/s

72. In the arrangement shown, the ends P and Q of an unstretchable string move downward with uniform speed U. Pulleys A and B are fixed. Mass M moves upward with a speed of



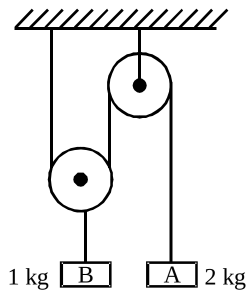
(1) 2 U cosθ (2) U cosθ
(3) 2U/cosθ (4) U/cosθ

73. Three equal weights of 2.4 kg each are attached to a string passing over a frictionless pulley, as shown in figure. The tension in the string connecting weights B and C is (take g = 10 ms^{-2})



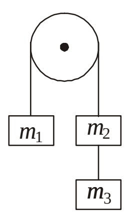
(1) 13 N (2) 16 N
(3) 20 N (4) 18 N

74. In the following diagram, when bodies are just released, the acceleration, with which the body A will fall down, is



(1) 10/3 ms^{-2} (2) 20/3 ms^{-2}
(3) 5/3 ms^{-2} (4) 15/3 ms^{-2}

75. In the arrangement shown in the figure, tension in the string between masses m_2 and m_3 is



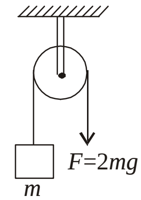
(1) $\dfrac{2\, m_1 m_3}{m_1 + m_2 + m_3} g$ (2) $\dfrac{3\, m_1 m_3}{m_1 + m_2 + m_3} g$

(3) $\dfrac{2\, m_2 m_3}{m_1 + m_2 + m_3} g$ (4) $\dfrac{3\, m_2 m_3}{m_1 + m_2 + m_3} g$

76. In a circus, a man of mass 50 kg starts climbing up along a rope with an acceleration of 3.2 ms^{-2}. The minimum tension which the rope should withstand is
(1) 300 N (2) 650 N
(3) 600 N (4) 710 N

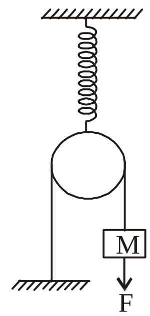
77. In gravity-free space, a man of mass M, standing at a height h above the floor, throws a ball of mass m straight down with a speed u. When the ball reaches the floor, the distance of the man above the floor is
(1) $h(M + m)/M$ (2) $h(M + m)/m$
(3) $h(2M - m)/M$ (4) $2\,h$

78. In the following case, the acceleration with which m rises up is



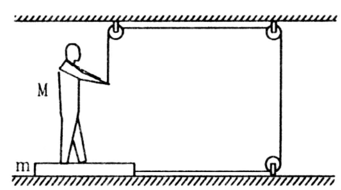
(1) $g/2$ (2) $g/3$
(3) $3\,g/4$ (4) g

79. If an applied force F displaces mass M vertically down by y from equilibrium position, then find the force F in terms of force-constant k of the spring and displacement y.



(1) $ky/2$ (2) $ky/4$
(3) ky (4) $4\,ky$

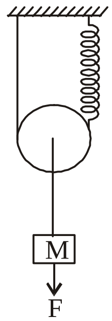
80. The friction coefficient between the board and the floor shown is μ. The maximum force, that the man can exert on the rope so that the board does not slip, would be



(1) $\dfrac{\mu[M + m]g}{\mu + 1}$ (2) $\dfrac{\mu[M + m]g}{\mu - 1}$

(3) $\dfrac{\mu[M - m]g}{\mu + 1}$ (4) $\dfrac{\mu[M - m]g}{\mu - 1}$

81. If an applied force F displaces mass M vertically down by y from equilibrium position, then find the force F in terms of force-constant k of the spring and displacement y.



(1) $ky/2$ (2) $ky/4$
(3) ky (4) $4\ ky$

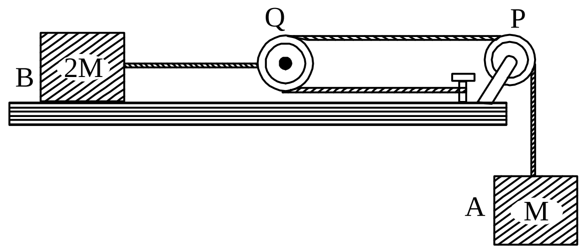
82. A particle inside a hollow sphere of radius r, having coefficient of friction $\frac{1}{\sqrt{3}}$ can rest upto a height of
(1) $0.25\,r$ (2) $0.125\,r$
(3) $0.134\,r$ (4) $0.375\,r$

83. A weight Mg is suspended from the middle of a rope whose ends are at the same level. Due to the suspended weight, the rope is no longer horizontal. The minimum tension in the rope to completely straighten it is
(1) $Mg / 2$ (2) $2Mg\cos\theta$
(3) $2Mg$ (4) infinitely large

84. A smooth inclined plane of length L, having inclination θ with the horizontal, is inside a lift which is moving down with retardation 'a'. The time taken by a body to slide down the inclined plane, from the position of rest, is
(1) $\sqrt{2L/(g-a)\sin\theta}$ (2) $\sqrt{2L/(g+a)\sin\theta}$
(3) $\sqrt{2L/g\sin\theta}$ (4) $\sqrt{2L/(g+a\sin\theta)}$

85. An open knife edge of mass M is dropped from a height h on a wooden floor. If the blade penetrates distance S into the wood, the average resistance offered by the wood to the blade is
(1) Mg (2) $Mg\left(1+\frac{h}{S}\right)$
(3) $Mg\left(1-\frac{h}{S}\right)$ (4) $Mg\left(1+\frac{h}{S}\right)^2$

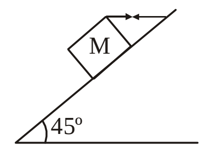
86. Consider the situation shown in figure. Both the pulleys and the strings are light and all the surfaces are frictionless. The acceleration of mass M is



(1) $g/2$ (2) $g/3$
(3) $2g/3$ (4) $3g/4$

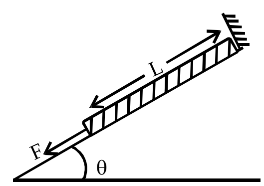
87. In the above problem, force exerted by the clamp on the pulley is
(1) zero (2) $Mg/3$
(3) $\sqrt{2}.Mg/3$ (4) $2\,Mg/3$

88. A block of mass 15 kg is resting on a rough inclined plane as shown in figure. The block is tied up by a horizontal string which has a tension of 50 N. The coefficient of friction between the surfaces of contact is (g = 10 m/s^2)



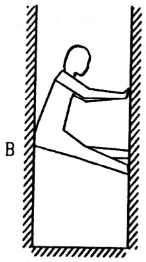
(1) 1/2 (2) 2/3
(3) 3/4 (4) 1/4

89. A uniform rope of mass m and length L is pulled along a frictionless inclined plane of angle θ by applying a force F parallel to the incline, as shown. The tension in the rope at a distance x from the end at which force is applied is



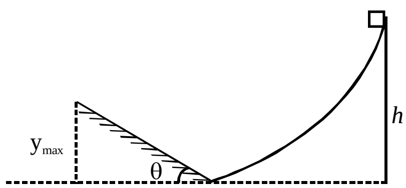
(1) $F\frac{x}{L}+\frac{x}{L}\,mg\sin\theta$
(2) $F\left(1-\frac{x}{L}\right)+\frac{x}{L}\,mg\sin\theta$
(3) $\frac{x}{L}\,mg\sin\theta+F$
(4) none of these

90. A person weighing 40 kg manages to be at rest between two vertical walls by pressing one wall B by his back and the other wall A by his hands and feet. If the coefficient of friction between his body and wall is 0.8, then the normal force exerted by either wall on the person is



(1) 250 N (2) 200 N
(3) 500 N (4) 400 N

91. A block slides down a smooth curved track of vertical height h and then rises up a rough inclined surface, making an anlge θ with the horizontal. If coefficient of kinetic friction between the block and the inclined surface is μ_k, then the maximum vertical height upto which the block can rise the inclined surface is

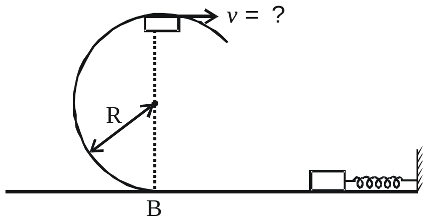


(1) $\dfrac{h}{1+\mu_k \tan\theta}$ (2) $\dfrac{h}{1+\mu_k \sin\theta}$

(3) $\dfrac{h}{1+\mu_k \cos\theta}$ (4) $\dfrac{h}{1+\mu_k \cot\theta}$

92. The length of an elastic string is x when the tension is 5 N. Its length is y when the tension is 7 N. What will be its length, when the tension is 9 N ?
(1) $2x + y$ (2) $2y – x$
(3) $7y – 5x$ (4) $7y + 5x$

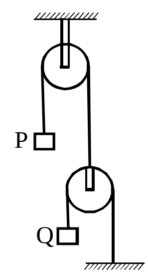
93. A block of mass 0.5 kg is pushed against a horizontal spring of negligible mass and of spring constant 450 Nm^{-1}, until the spring is compressed by 0.4 m. When released, the block travels along a fricitionless horizontal surface to a point B, at the bottom of the vertical circular track of radius 1.0 m and continues to move up this circular track. If the average frictional force of the circular track is 7 N, then the velocity of the block, when it reaches the top of the track would be (g = 10 ms^{-2}, π = 22/7)



(1) zero (2) 4.0 ms^{-1}
(3) 5.0 ms^{-1} (4) 3.5 ms^{-1}

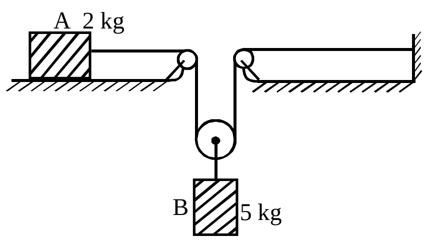
94. An aeroplane requires for take-off a speed of 90 km /hr on a ground having 125 m runway. The mass of the aeroplane is 10^4 kg and the coefficint of friction of ground is 0.2. The minimum force developed by the engine of the aeroplane for the take-off, is (g = 10 ms^{-2})
(1) 2.5×10^4 N (2) 5.0×10^4 N
(3) 4.5×10^4 N (4) 4.0×10^4 N

95. Refer to figure and neglecting friction and mass of pulleys, find the acceleration of the mass Q assuming that $P = Q$.



(1) g (2) $2g/5$
(3) $g/5$ (4) $g/2$

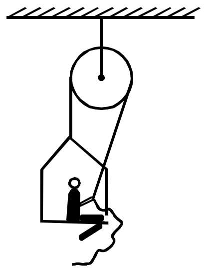
96. The accelerations (in ms^{-2}) of the blocks A and B, shown in figure, are (g = 10 ms^{-2})



(1) $\dfrac{80}{13}, \dfrac{40}{13}$ (2) $\dfrac{100}{13}, \dfrac{100}{13}$

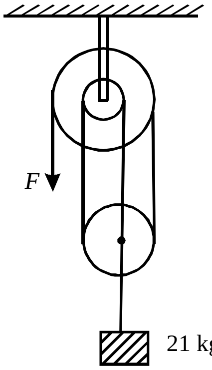
(3) $\dfrac{100}{13}, \dfrac{50}{13}$ (4) $\dfrac{50}{13}, \dfrac{50}{13}$

97. A painter sits on Bosun's chair supported by a rope passing over a pulley, as shown. The painter who weighs 1000 N exerts a force of 450 N on the chair downwards while pulling on the rope. If the chair weighs 250 N and g = 10 ms^{-2}, then the upward acceleration of the system is



(1) 4.5 ms^{-2} (2) zero
(3) 2.5 m/s^2 (4) 2.0 ms^{-2}

98. In the figure, at free end of a light string, a force F is applied to keep the suspended mass at rest. Then the force exerted by the system on the ceiling, assuming the string segments are vertical and the pulleys are light and frictionless, is (g = 10 ms^{-2})



(1) 70 N (2) 140 N
(3) 210 N (4) 280 N

Choose the correct answers :

1. Which one of the following statements is *incorrect* ?
   (1) Work depends on the frame of reference
   (2) In a conservative field, work done is independent of path
   (3) Work done by a resultant force acting on it is always equal to the change in its kinetic energy
   (4) The work done depends on duration of time

2. In which of the following cases the work done increases the potential energy ?
   (1) Both conservative and non-conservative forces
   (2) Conservative forces only
   (3) Non-conservative forces only
   (4) Neither conservative or non-conservative forces

3. Which of the following statements is false ?
   (1) Momentum is conserved in all types of collisions
   (2) Energy is conserved in all types of collisions
   (3) During elastic collisions conservative forces are involved
   (4) Work-energy theorem is not applicable to inelastic collisions

4. Which one of the following gives *positive* work ?
   (1) Work done by the gravitational force when a man is lifting a bucket full of water out of a well by means of a rope
   (2) Work done by friction on a body sliding down an inclined plane
   (3) Work done by the resistive force of air on a vibrating pendulum, in bringing it to rest.
   (4) Work done by an applied force on a body moving on a rough horizontal with a uniform velocity

5. Which of the following statements is *incorrect* ?
   (1) If K.E. = 0 and P.E. = 0 of a body, then its mechanical energy is zero
   (2) If mechanical energy of a body is zero, then its, K.E. as well as its P.E. must be zero
   (3) If mechanical energy of a body is zero, then its K.E. and P.E. may not be zero
   (4) Mechanical energy of a body may also be negative

6. The potential energy of a system is given by the relation : $U = -U_0 \cos\theta$, where θ is the angle made by the system with a fixed reference line. The body is in stable equilibrium when
   (1) $\theta = 0^\circ$ (2) $\theta = \pi/2$
   (3) $\theta = \pi/4$ (4) $\theta = \pi$

7. The potential energy of a conservative force is given by $U = ax^2 - bx$ where a and b are constants. The position of equilibrium is
   (1) $x = b/2a$ (2) $x = b/a$
   (3) $x = 2a/b$ (4) $x = a/b$

8. If K.E. of body decreases to 16%, then velocity of the body decreases by nearly
   (1) 32% (2) 48%
   (3) 60% (4) 64%

9. If the momentum of body increases by 40%, then its K.E. increases by
   (1) 160% (2) 112%
   (3) 96% (4) 84%

10. 1 kilowatt-hour equals all *except*
   (1) 2.25×10^{19} MeV (2) 3.6×10^{6} J
   (3) 2.25×10^{15} GeV (4) 2.25×10^{25} eV

11. An object of mass m is thrown vertically upwards. At what rate will its momentum change ?
   (1) zero (2) mg/h
   (3) $2\ mg$ (4) mg

12. When velocity of a body is increased by 4 ms^{-1}, its kinetic energy becomes nine times. The original velocity of the body is
   (1) 4 ms^{-1} (2) 3 ms^{-1}
   (3) 2 ms^{-1} (4) 5 ms^{-1}

13. A body of mass 10 kg accelerates uniformly from rest to a speed of 2 ms^{-1} in 30 seconds. The work done on the body during first 10 seconds is (neglect friction)
   (1) 20/3 J (2) 20/9 J
   (3) 40/9 J (4) 40/3 J

14. If clouds are one kilometre above the earth and rain falls, sufficient to cover one square kilometre at sea level 1 cm deep. The work done in raising this water back to the level of clouds is ($g = 10\ ms^{-2}$).
   (1) 10^8 J (2) 10^9 J
   (3) 10^{11} J (4) 10^{12} J

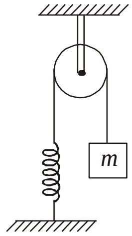
15. The velocity of a body of mass 800 g changes from $(3\hat{i} - 4\hat{j})\ ms^{-1}$ to $(-6\hat{i} + 2\hat{k})\ ms^{-1}$. The change in K.E. of the body is
   (1) 12 J (2) 6 J
   (3) 8 J (4) 16 J

16. When a mass of one-hundredth microgram is converted fullyinto energy, the energy produced is
   (1) 9×10^5 J (2) 9×10^8 J
   (3) 9×10^6 J (4) 9×10^9 J

17. Work done to increase the speed of a body from 5 ms^{-1} to 10 ms^{-1} is 1.5 E. The work done to increase the speed of same body from 15 ms^{-1} to 20 ms^{-1} should be
(1) 1.5 E (2) 6.0 E
(3) 4.5 E (4) 3.5 E

18. The electrical energy is supplied from a nuclear power plant. Assuming efficiency to be 80%, how much mass is annihilated per day to supply an electrical energy of 40 GWh ?
(1) 2.0 g (2) 1.28 g
(3) 3.2 g (4) 4.0 g

19. In the given figure, the position of mass m is such that the spring is initially unstretched. From this position, mass is gently released. Assuming pulley to be frictionless, the maximum elongation of the spring of force constant k, is



(1) $\frac{mg}{k}$ (2) $\frac{2mg}{k}$
(3) $\frac{mg}{2k}$ (4) $\frac{mg}{4k}$

20. A block of mass 2.0 kg is dropped from a height of 50 cm on a spring of force constant 1960 Nm^{-1}; when the spring is held vertical with its lower part rigidly held on the ground. The maximum compression produced in the spring would be :
(1) 7.5 cm (2) 10 cm
(3) 12.5 cm (4) 11 cm

21. A car of mass m is driven with acceleration a along a straight level road against a constant external resistive force R. When the velocity of the car is v, the rate at which the engine of the car is doing work will be
(1) Rv (2) mav
(3) $(R + ma)v$ (4) $(ma – R)v$

22. A satellite in force-free space sweeps stationary interplanetary dust at a rate of (dM/dt) = αv. The acceleration of the satellite is
(1) $-2\alpha v^2/M$ (2) $-\alpha v^2/M$
(3) $-\alpha v^2/2M$ (4) αv^2

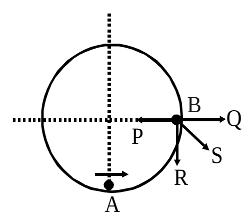
23. A space-craft of mass M, moving with velocity v in free-space, explodes and breaks into two. After the explosion, the smaller part of mass m starts moving with the same speed but in opposite direction. The speed of the other part would be
(1) $\frac{M+m}{M-m}v$ (2) $\frac{M-m}{M+m}v$
(3) $\frac{M+m}{M}v$ (4) $\frac{M}{M-m}v$

24. Three particles, each of mass m, are located at the vertices of an equilateral triangle ABC. These start moving with equal speed v, each along the medians of the triangle and collide at its centroid G. If after the collision, A comes to rest and B retraces its path along GB with speed v, then C
(1) moves with speed v along GB
(2) moves with speed v along GC
(3) moves with speed v along BG
(4) will also come to rest

25. A bomb at rest explodes into 3 equal parts. The momenta of two parts are $-2p\hat{i}$ Ns and $p\hat{j}$ Ns, respectively. The magnitude of the momentum of the third part is
(1) p Ns (2) $p\sqrt{3}$ Ns
(3) $p\sqrt{5}$ Ns (4) zero

26. A rope is uncoiled by pulling the end of the rope horizontally along a frictionless surface, at a steady speed of 2 ms^{-1}. If mass of 1 m of rope is 0.25 kg, then work done is uncoiling 12 m of rope would be
(1) zero (2) 3 J
(3) 6 J (4) 12 J

27. A ball of mass m moves inside a smooth spherical shell of radius R with velocity $\sqrt{2gR}$ at A. What is the direction of force acting on the ball, when it reaches B ?



(1) Along BP (2) Along BQ
(3) Along BR (4) Along BS

28. The kinetic energy K of a particle moving in a straight line depends upon the distance s as : $K = as^2$. The tangential force acting on the particle is
(1) $2as$ (2) $2mas$
(3) $2a$ (4) $\sqrt{as^2}$

29. A particle of mass m is moving in a horizontal circle of radius r under a centripetal force equal to $-K/r^2$ where K is a constant. The total energy of the particle is

(1) $\frac{K}{2r}$ (2) $\frac{-K}{2r}$

(3) $\frac{-K}{r}$ (4) $\frac{+K}{r}$

30. A particle of mass m moves on a straight line with its velocity varying with the distance travelled, according to the equation $v = a\sqrt{x}$, where a is a constant. The total work done by all the forces during a displacement from $x = 0$ to $x = d$, is

(1) $ma^2d^2/2$ (2) $mad^2/2$

(3) $ma^2d/4$ (4) $ma^2d/2$

31. A cyclist comes to a skidding stop in 10 m. If the force of friction of road on the cyclist is 200 N, then work done by the road on the cyclist and by the cyclist on the road are, respectively,

(1) –200 J, +200 J (2) –200 J, zero

(3) +200 J, zero (4) +200 J, –200 J

32. A mass m is lowered vertically down, by a chord attached to a fixed block, through a distance d, at a constant downward acceleration g/4. The work done by the chord is

(1) $mgd / 4$ (2) $- mgd / 4$

(3) $3\, mgd / 4$ (4) $- 3\, mgd / 4$

33. A man who is running has half the kinetic energy of a boy of half his mass. If the man speeds up by 1 ms^{-1}, then his K.E. becomes same as that of the boy. The original speed of man is

(1) $\sqrt{2}$ ms^{-1} (2) $(\sqrt{2}-1)$ ms^{-1}

(3) 2 ms^{-1} (4) $(\sqrt{2}+1)$ ms^{-1}

34. A chain is layed on a frictionless table with $(1/n)$th of its length hanging over the edge. If the length of chain is L and its mass is M, then the minimum work done, to pull the hanging part back on the table, should be

(1) $\frac{MgL}{2n^2}$ (2) $\frac{MgL}{2n}$

(3) $\frac{MgL}{n^2}$ (4) $\frac{2MgL}{n^2}$

35. A metre stick of mass $(200 + 100\sqrt{3})$ g is pivoted at one end and is hanging vertically down. When it is displaced through an angle of 30º with the vertical, the increase in its potential energy is (g = 10 ms^{-2})

(1) 0.25 J (2) 0.35 J

(3) 0.50 J (4) 0.20 J

36. A cubical tank of each side of 6 m is completely filled with water. A 90% efficient pump is used for emptying the tank in one hour. The minimum power of the engine should be (g = 10 ms^{-2})

(1) 2 kW (2) 4 kW

(3) 4.5 kW (4) 1.8 kW

37. A man, in a circus show, jumps from a height of 10 m and is caught by a net spread below him. The net sags down 2 m due to this impact. Find out the average force exerted by the net on the man to stop his fall. Mass of the man is 60 kg and g = 10 ms^{-2}.

(1) 3,000 N (2) 3,600 N

(3) 7,200 N (4) None of these

38. An open knife edge of mass 0.5 kg is dropped from a height 10 m. If blade penetrates 0.1 m into the wood, the average resistance offered by the wood to the blade is (g = 10 m/s^2)

(1) 510 N (2) 505 N

(3) 500 N (4) 495 N

39. A 5000 kg rocket is set for vertical launching with an upward acceleration of 20 ms^{-2}. If the exhaust speed of gases is to be kept at 800 ms^{-1}, then the amount of gases ejected per second to supply the required thrust should be [Take g = 10 ms^{-2}]

(1) 187.5 kg s^{-1} (2) 62.5 kg s^{-1}

(3) 125 kg s^{-1} (4) 1 kg s^{-1}

40. Two bodies of masses m_1 and m_2, respectively, but having the same momenta are thrown vertically upwards. Then the ratio of maximum heights attained by the first to that by the second body is

(1) $m_2 : m_1$ (2) $m_2^2 : m_1^2$

(3) $m_1^2 : m_2^2$ (4) $m_1 : m_2$

41. How much work is done in raising a stone of mass 5 kg and relative density 3, lying at the bed of lake, through a height of 5 m (g = 10 ms^{-1}) ?

(1) 83.3 J (2) 133.3 J

(3) 250 J (4) 166.7 J

42. The mass of a pendulum bob is 100 g and the string is 1 metre long. The bob is held so that the string is horizontal and it is then allowed to fall along the path of its swing. When the string makes an angle of 30º with the vertical, the K.E. possessed by the pendilum would be about

(1) 1.47 J (2) 0.98 J

(3) 1.7 J (4) 0.85 J

43. A machine is 80% efficient. It uses 2500 J of energy in lifting a body of mass 10 kg vertically up. If g = 10 ms^{-2} and the body is made to have free to fall down, it will fall on the ground with a velocity of
(1) $10\sqrt{5}$ ms^{-1} (2) 20 ms^{-1}
(3) 22.5 ms^{-1} (4) 17.5 ms^{-1}

44. A bullet moving with a velocity of 100 ms^{-1} is just able to pierce a block of wood 3 cm thick. If the bullet is required to pierce a block of wood 12 cm thick, then the velocity of the bullet should be
(1) 400 ms^{-1} (2) 600 ms^{-1}
(3) 200 ms^{-1} (4) 300 ms^{-1}

45. A bullet loses 1/8 of its velocity in passing through a plank. The least number of such planks required to be placed side by side, to stop the bullet, is
(1) 4 (2) 5
(3) 8 (4) 11

46. The bob of a pendulum of length 1.25 m is raised so that the string becomes horizontal. From this position it is released so that it falls down along the circular path. If 2% of energy is used against friction of air, the velocity of the bob at the lowest position is about
(1) 4.9 ms^{-1} (2) 5.2 ms^{-1}
(3) 4.5 ms^{-1} (4) 5.9 ms^{-1}

47. The power of a water jet, flowing through an orifice of radius 10 cm, with a velocity of 5 ms^{-1}, is nearly
(1) 1,960 W (2) 19,600 W
(3) 196 W (4) none of these

48. A steam shovel driven by a 4 HP engine (1 HP = 746 W) lifts 300 tons of gravel in an hour to a height of 3 metres. How much work is lost per second ? (g = 10 ms^{-2})
(1) 746 J s^{-1} (2) 674 J s^{-1}
(3) 584 J s^{-1} (4) 484 J s^{-1}

49. An electric motor creates a tension of 4500 N in a hoisting cable and reels it in at the rate of 2 ms^{-1}. The power of the electric motor is
(1) 4.5 kW (2) 9 kW
(3) 90 kW (4) 22.5 kW

50. A spring is held in compressed state on a smooth horizontal surface such that energy stored in it is 2.4 J. Its one end is rigidly fixed and the other end is in contact with an elastic body of mass 300 g. When the spring is released, the maximum velocity gained by the body would be
(1) 4 ms^{-1} (2) 2.4 ms^{-1}
(3) 4.8 ms^{-1} (4) 6 ms^{-1}

51. A quarter horse power motor runs at a speed of 600 r.p.m. Assuming 40% efficiency, the work done by the motor in one rotation will be (1 H.P. = 746 W)
(1) 74.6 J (2) 7.46 J
(3) 18.65 J (4) 37.3 J

52. A heart discharges 75 cc of blood in each beat against an average pressure of 10 cm of mercury. Assuming that the pulse frequency is 72 per minute, density of mercury is 13.6 g cm^{-3} and g = 9.8 ms^{-2}, rate of working of heart is
(1) 1.2 W (2) 2.4 W
(3) 0.98 W (4) 1.47 W

53. A ball is thrown vertically downward from a height of 10 m with initial velocity u. It strikes the ground, loses 50% of its K.E. and rebounds to the same height. The velocity u is
(1) 9.8 ms^{-1} (2) 14.7 ms^{-1}
(3) 15 ms^{-1} (4) 14 ms^{-1}

54. A body P of mass 50 g moving with a velocity of 20 ms^{-1} collides against a body Q of mass 100 g moving with the velocity of 8 ms^{-1} but in opposite direction. If coefficient of restitution is 0.8, the velocity of P after the collision will be
(1) 5.6 ms^{-1} (2) –9.6 ms^{-1}
(3) –7.6 ms^{-1} (4) –13.6 ms^{-1}

55. A particle moves in x-y plane under the action of a force $\vec{F}$ such that the value of its linear momentum $\vec{p}$ at any time t is $\vec{p}_x = 2\cos t$ and $\vec{p}_y = 2\sin t$. Then, the angle between $\vec{F}$ and $\vec{p}$ at any given time t is
(1) 0º (2) 90º
(3) 180º (4) 45º

56. If a spring of force constant k is cut into 4 parts such that their lengths are in the ratio 1 : 2 : 3 : 4, then the ratio of force constants of these parts will be
(1) 4 : 3 : 2 : 1 (2) 12 : 6 : 4 : 3
(3) 12 : 8 : 6 : 3 (4) 12 : 9 : 4 : 3

57. Two equal masses are attached to the two ends of a spring of spring constant k. The masses are pulled out symmetrically to stretch the spring by a length x over its natural length. The work done by the spring on each mass is
(1) $\frac{1}{2}kx^2$ (2) $-\frac{1}{2}kx^2$
(3) $\frac{1}{4}kx^2$ (4) $-\frac{1}{4}kx^2$

58. A stationary bomb explodes into two parts of masses 3 kg and 1 kg. The total K.E. of the two parts after the explosion is 2400 J. The K.E. of the smaller part is
(1) 600 J (2) 800 J
(3) 1800 J (4) 1600 J

59. Under the action of a force, a 2 kg body moves such that its position x, as a function of time t, is given by the relation : $x = t^3/3$, where x is in metre and t is in second. The work done by the force in first two seconds is
(1) 16 J (2) 32 J
(3) 24 J (4) none of these

60. Force, $F_x = (5x - 4)$ N acts on a body. The increase in K.E. of the body, when it moves from $x = 1$ m to $x = 3$ m, is
(1) 15 J (2) 18 J
(3) 24 J (4) 12 J

61. A particle moves along a straight line with a retardation, proportional to square root of its displacements x. The loss of its K.E. is proportional to
(1) x^2 (2) $x^{.05}$
(3) $x^{1.5}$ (4) x^{-2}

62. A body is displaced from $x = x_1$ to $x = x_2$ by a force $2x$. The work done is
(1) $2x_1 (x_2 - x_1)$ (2) $2x_2 (x_2 - x_1)$
(3) $x_2^2 - x_1^2$ (4) $(x_2 - x_1)^2$

63. A bullet of mass a and velocity b is fired into a large block of wood of mass c. The final velocity of the system is
(1) $\frac{b}{a+b}a$ (2) $\frac{a+b}{c}a$
(3) $\frac{a}{a+c}b$ (4) $\frac{a+c}{a}b$

64. A gun fires 50 g bullets with a velocity of 1000 ms^{-1} each. The person, holding the gun, can exert an average force of 180 N against the gun. The maximum number of bullets, the person can fire per minute is
(1) 36 (2) 180
(3) 144 (4) 216

65. A body of mass m_1 moving with initial velocity v collides against a stationary body of mass m_2. If after the collision, the two bodies stick together, then loss in K.E. of the system is
(1) $\frac{1}{2}.\frac{m_1+m_2}{2}v^2$ (2) $\frac{1}{2}.\frac{m_1 m_2}{m_1+m_2}v^2$
(3) $\frac{1}{2}.\sqrt{\frac{m_1+m_2}{2}}v^2$ (4) $\frac{1}{4}.\frac{m_1+m_2}{2}v^2$

66. A stationary U^{238} nucleus emits an α-particle with a velocity of 1.4×10^7 ms^{-1} and kinetic energy 4.1 MeV. The velocity of recoil of the residual nucleus is
(1) 3.4×10^5 ms^{-1} (2) 2.7×10^5 ms^{-1}
(3) 4.2×10^5 ms^{-1} (4) 2.4×10^5 ms^{-1}

67. A body of mass 500 g moving with velocity of 10 ms^{-1} collides elastically against another body of mass 1.0 kg moving with a velocity of 8 ms^{-1}, both moving along same line and in same direction. Velocity of heavier body after the collision is
(1) 7.6 ms^{-1} (2) 10 ms^{-1}
(3) 8.8 ms^{-1} (4) 9.3 ms^{-1}

68. A body P of mass 600 g moving with a velocity of 12 ms^{-1} collides elastically against a stationary body Q of equal mass. The energy lost by body P during the elastic collision is
(1) zero (2) 43.2 J
(3) 86.4 J (4) 36 J

69. The power of a water jet flowing through an orifice of radius r with velocity v is
(1) zero (2) $500\ \pi r^2 v^2$
(3) $500\ \pi r^2 v^3$ (4) $\pi r^4 v$

70. A sphere P of mass m, moving with a constant velocity u, hits another stationary sphere Q of the same mass. If e is the coeffcient of restitution of the collision, the ratio of velocities of Q and P, after the collision is
(1) $\frac{1-e}{1+e}$ (2) $\frac{1+e}{1-e}$
(3) $\frac{e}{1+e}$ (4) $\frac{e}{1-e}$

71. A body A of mass m moving with a velocity of 20 ms^{-1} collides against a stationary body B of same mass. If coefficient of restitution is 0.7, velocity of A after the collision is
(1) 0 (2) 2.5 ms^{-1}
(3) 3.0 ms^{-1} (4) 3.5 ms^{-1}

72. A body is released from a height of 40 m on a hard surface. If coefficient of restitution during impact is 0.75, the velocity with which the body rises after first bounce is
(1) 21 ms^{-1} (2) 30 ms^{-1}
(3) 12.66 ms^{-1} (4) 16.875 ms^{-1}

73. A particle falls from a height h upon a fixed horizontal surface. If e be the coefficient of restitution, then the height upto which it rises after nth rebound, is
(1) $h\ e^{2n}$ (2) $h\ e^n$
(3) $h\ e^{-2n}$ (4) $h\ e^{-n}$

74. In a nuclear reactor, carbon rods are used as moderator. The percentage loss in K.E. of fast moving neutrons, when these collide elastically against the nucleus of carbon-atom, is
(1) 24.6% (2) 42.5%
(3) 18.6% (4) 28.4%

75. A body falls from a height of 1 kilometre when released from rest. If the coefficient of restitution during its collision with ground surface is 0.8, the height upto which it rises after the first rebound, is nearly
(1) 640 m (2) 512 m
(3) 410 m (4) 28 m

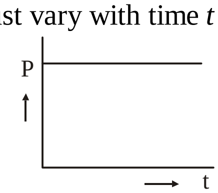
76. A neutron travelling with velocity v and K.E. E collides perfectly elastically head-on with the nucleus of an atom of mass number A, initially at rest. The fraction of energy lost by neutron after the collision would be
(1) $\frac{A}{(A+1)^2}$ (2) $\frac{4A}{(A+1)^2}$
(3) $\left[\frac{A-1}{A}\right]^2$ (4) $\left[\frac{A-1}{A+1}\right]^2$

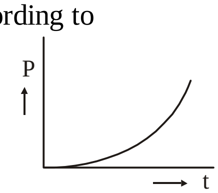
77. A particle falls from a height h upon a fixed horizontal surface. If e be the coefficient of restitution, then the velocity with which it rises vertically up, is
(1) $\sqrt{2g/h}\,.e$ (2) $\sqrt{2gh}\,.e$
(3) $\sqrt{2gh}\,.e^2$ (4) $\sqrt{2ghe}$

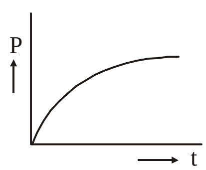
78. A sphere moving with velocity v strikes a wall, moving towards the sphere with a velocity u. If mass of the wall is infinitely large, the velocity with which the ball moves, after the collision, is
(1) $-v + 2u$ (2) $-2u + v$
(3) $-v - 2u$ (4) $-v - u$

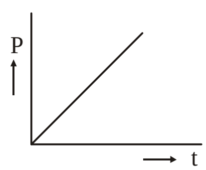
79. A body of mass 0.5 kg moving with a speed of 7 ms^{-1} collides elastically head-on against a stationary body of mass M. If the body comes back with a speed of 2 ms^{-1}, then M is equal to
(1) 0.9 kg (2) 0.7 kg
(3) 1.2 kg (4) 1.4 kg

80. A motor drives a body along a straight line with a constant force. The power P developed by the motor must vary with time t according to

(1) 

(2) 

(3) 

(4) 

81. A constant power is delivered by a source to a body. The velocity v attained by the body is time t is proportional to
(1) $t^{1/2}$ (2) $t^{3/2}$
(3) t^3 (4) $t^{-1/2}$

82. In the above question, distance s travelled by the body in time t is proportional to
(1) $t^{1/2}$ (2) $t^{3/2}$
(3) $t^{2/3}$ (4) $t^{-1/2}$

83. In the question 47, the acceleration produced in the body is proportional to
(1) $t^{1/2}$ (2) $t^{3/2}$
(3) $t^{2/3}$ (4) $t^{-1/2}$

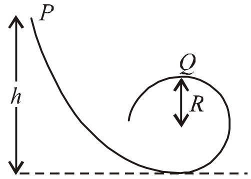
84. The kinetic energy K of a particle moving along a circle of radius R depends on the distance S as : $K = aS^2$, where a is a constant. The force acting on the particle is :
(1) $2a\frac{S^2}{R}$ (2) $2aS\left[1+\frac{S^2}{R^2}\right]^{½}$
(3) $2\,a\,S$ (4) $½\,a\,S$

85. A body of weight W is thrown up with v_1. If F is the constant force of resistance acing on the body, throughout its motion and it hits the ground with velocity v_2, then
(1) $\frac{v_1}{v_2}=\frac{W-F}{W+F}$ (2) $\frac{v_1}{v_2}=\frac{W+F}{W-F}$
(3) $\frac{v_1}{v_2}=\left[\frac{W-F}{W+F}\right]^{1/2}$ (4) $\frac{v_1}{v_2}=\left[\frac{W+F}{W-F}\right]^{1/2}$

86. Two boats, set on parallel course, move under their own momentum through stagnant water of a lake, towards each other and with the same velocity of 6 ms^{-1}. As soon as these come abreast, a load is shifted from the first boat to the second. After that, the second boat continues to move in the original direction but with a velocity of 4 ms^{-1}. If the mass of first boat is 500 kg and weight of the load shifted is 60 kg, then mass of the second boat is
(1) 500 kg (2) 400 kg
(3) 300 kg (4) 600 kg

87. Upper one-third of inclined plane, making an angle of 45° with the horizontal, is smooth while the lower two-thirds is rough. When a body is released from the top of incline, it reaches the bottom with zero velocity. Coefficient of friciton of rough portion is
(1) 1.5 (2) $\sqrt{3}$
(3) $\sqrt{2}/3$ (4) 1.414

88. A body slides down a frictionless track which ends in a circular loop of radius R as shown. If it reaches point Q with a velocity twice the minimum velocity to loop the circular loop, then the height h, in terms of R is



(1) 2.5 R (2) 3.5 R
(3) 4 R (4) 6 R

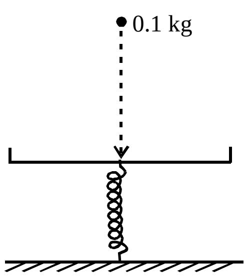
89. A constant power P is developed by the engine of a car of mass m to move it. Starting from rest, the speed v of the car, when it has travelled distance x, would be
(1) $[2x\ P/m]^{1/2}$ (2) $[3x\ P/m]^{1/3}$
(3) $[3x\ P/m]^{1/2}$ (4) $[2x\ P/m]^{1/3}$

90. A pump motor is used to deliver water at a certain rate from a given pipe.To increase the rate of water to n times, power of motor should be increased to
(1) n times (2) n^2 times
(3) n^3 times (4) n^4 times

91. A pump motor is used to deliver water at a certain rate from a given pipe. To increase the rate of water n times, the force of the motor should be increased to
(1) n times (2) n^2 times
(3) n^3 times (4) n^4 times

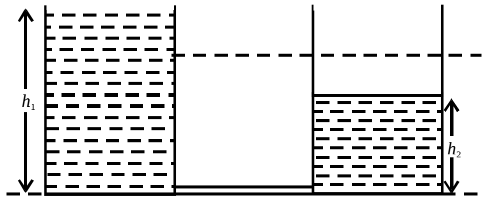
92. Water coming out of a horizontal tube at a speed of v strikes normally against a vertical wall, close to the tube, and falls down vertically after the impact. If the speed of water is increased to $2v$, then thrust exerted by the water on the wall would be
(1) 2 times (2) 4 times
(3) 8 times (4) unaffected

93. A platform of negligible mass is fixed on a light elastic spring, as shown. When a dense particle of mass 0.1 kg is dropped on the platform from a height of 0.24 m, the particle strikes the pan and the spring is compressed by 0.01 m. To compress the string by 0.02 m, the particle should be dropped from a height of



(1) 0.96 m (2) 0.98 m
(3) 0.48 m (4) 1.0 m

94. Two identical cylindrical vessels, with their bases at the same level, contain same liquid of density ρ. Area of base of the cylinders is A but heights of liquids in the cylinders are h_1, and h_2. If a thin pipe of very small internal volume connects the cylinders to equalise the level of liquid in both the cylinders, then work done by the gravity for the purpose is



(1) $\frac{1}{2}A\rho g\ [h_1-h_2]$ (2) $\frac{1}{4}A\rho g\ [h_1-h_2]$

(3) $\frac{1}{2}A\rho g\ [h_1-h_2]^2$ (4) $\frac{1}{4}A\rho g\ [h_1-h_2]^2$

95. A small block of mass m is kept on a rough inclined surface of inclination θ fixed in an elevator. The elevator goes up with a uniform velocity v and the block does not slide on the wedge. The work done by the force of friction on the block in time t will be
(1) zero (2) $mgvt\cos^2\theta$
(3) $mgvt\sin^2\theta$ (4) $mgvt\sin\theta\cos\theta$

96. Work done in time t on a body of mass m, which is accelerated from rest to a speed v in time t_1, as a function of time t is given by

(1) $\frac{1}{2}m\frac{v}{t_1^2}t^2$ (2) $\frac{1}{2}m\frac{v^2}{t_1^2}t^2$

(3) $\frac{1}{2}m\frac{v^2}{t^2}t_1^2$ (4) $\frac{1}{2}m\frac{v}{t^2}t_1^2$

97. A pendulum consists of wooden bob of mass M and length l. A bullet of mass m is fired towards the pendulum with speed v. The bullet emerges out of the bob with a speed of $v/3$, and the bob just completes the motion along the vertical circle of radius l. The velocity of the bullet is

(1) $\frac{m}{M}\sqrt{5gl}$ (2) $\frac{3M}{2m}\sqrt{5gl}$

(3) $\frac{2m}{3M}\sqrt{gl}$ (4) $\frac{M}{m}\sqrt{gl}$

98. A spring is compressed between two toy-carts of masses m_1 and m_2. When the toy-carts are released, the spring exerts on each toy-cart equal and opposite forces for the same time. If the coefficients of friction 'μ' between the ground and the toy-carts are equal, then the displacements of the two toy-carts are given by the relation

(1) $\frac{s_1}{s_2} = -\frac{m_2}{m_1}$ (2) $\frac{s_1}{s_2} = -\frac{m_1}{m_2}$

(3) $\frac{s_1}{s_2} = -\left[\frac{m_2}{m_1}\right]^2$ (4) $\frac{s_1}{s_2} = -\left[\frac{m_1}{m_2}\right]^2$

99. A body falls from a height h on the ground and the coefficient of restitution of collision on the ground is e. The total distance travelled by the body before coming to rest would be

(1) $h\frac{1+e^2}{1-e^2}$ (2) $h\frac{1+e}{1-e}$

(3) $2h\frac{1-e^2}{1+e^2}$ (4) $2h\frac{1-e}{1+e}$

100. A body falls from a height h on the ground and the coefficient of restitution of collision on the ground is e. The total time elapsed, before it comes to rest, would be

(1) $\sqrt{\frac{2h}{g}}\frac{1+e^2}{1-e^2}$ (2) $2\sqrt{\frac{h}{g}}\frac{1+e^2}{1-e^2}$

(3) $\sqrt{\frac{2h}{g}}\frac{1+e}{1-e}$ (4) $2\sqrt{\frac{h}{g}}\frac{1+e}{1-e}$

Assertion-Reason Type Questions (For AIIMS)

Each of the questions given below consists of two statements, an assertion (*A*) and reason (*R*). Darken the number corresponding to the appropriate alternative on the answer sheet as follows :

(1) If both ***A*** and ***R*** are true and ***R*** is the correct explanation of ***A***, then mark **1**

(2) If both ***A*** and ***R*** are true but ***R*** is not the correct explanation of ***A***, then mark **2**

(3) If ***A*** is true but ***R*** is false, then mark **3**

(4) If both ***A*** and ***R*** are false, then mark **4**

1. *A.* In all types of collisions (elastic or inelastic), total enregy is always conserved.
   R. Momentum and K.E. are related by the relation $p^2 = 2mE$.
2. *A.* Coefficient of friction is always less than 1.
   R. There is a limit for the roughness between two surfaces in contact.
3. *A.* The force of friction on a person, walking on the ground, acts on him in the backward direction.
   R. In this case, force of friction opposes his motion in the forward direction.
4. *A.* The direction of force acting on a body and the direction of velocity of the body are always same.
   R. Velocity is due to acceleration, produced by a force, and the direction of velocity is always same as that of acceleration.
5. *A.* A body moving in a circular path with fixed speed is not in equilibrium.
   R. No torque acts on it, but resultant force acting on it is not-zero.
6. *A.* A system is in stable equilibrium when its kinetic energy is minimum.
   R. In stable equilibrium position, the body should have minimum energy or minimum kinetic energy.
7. *A.* A system is in stable equilibrium if its potential energy is minimum.
   R. For stable equilibrium, centre of gravity of the system should be lowest or its potential energy should be minimum.
8. *A.* Work done by an external force is always equal to gain in its K. E.
   R. This statement is always true.
9. *A.* When a small body of mass *m* collides elastically head-on against a stationary heavy body of mass *M* such that the small body comes back, then the velocity of centre of mass of the system will also change the direction, after the collision.
   R. Motion of a body in a system means motion of its centre of mass.
10. *A.* When a body is raised from the surface of earth, through any heigt *h*, the increase in its potential energy is *mgh*.
    R. Work done = $\vec{F} \cdot \vec{s}$, always.
11. *A.* No work is done by the centripetal force, howsoever large force may act on the body to make it moving in a circular path.
    R. The force acting on the body is always perpendicular to the direction of its velocity, at any instant.
12. *A.* When a 'spirit level', tied to a string is whirled rapidly in a horizontal plane, then air bubble in it will lie at its inner edge.
    R. More centripetal force is required to act on the air bubble.
13. *A.* Torque acting on a body due to centripetal force, responsible for rotating the body in a circular path, is zero
    R. When two parallel forces, equal in magnitude but opposite in directions, act on a body, then these produce a torque.

14. *A.* When a heavy body and a light body are released from same position, at a height above the surface of the earth, the forces acting on them are different but both fall down with same acceleration.

    R. Force of attraction on body (by the earth) is directly proportional to the mass of the body.

15. *A.* When a spring is cut into three exactly equal parts, then force constant of each smaller part is three times the force constant of the original spring.

    R. Force constant of a spring is inversely proportional to the length.

16. *A.* Frictional forces are conservative forces.

    R. Potential energy can be associated with frictional forces.

ANSWERS TO ASSIGNMENT

Motion in Two & Three Dimensions

1.	(2)	2.	(2)	3.	(2)	4.	(2)	5.	(3)
6.	(4)	7.	(2)	8.	(3)	9.	(2)	10.	(3)
11.	(1)	12.	(3)	13.	(2)	14.	(2)	15.	(2)
16.	(2)	17.	(1)	18.	(2)	19.	(3)	20.	(3)
21.	(3)	22.	(2)	23.	(1)	24.	(4)	25.	(4)
26.	(2)	27.	(1)	28.	(2)	29.	(2)	30.	(1)
31.	(3)	32.	(4)	33.	(4)	34.	(4)	35.	(3)
36.	(3)	37.	(2)	38.	(2)	39.	(4)	40.	(3)
41.	(2)	42.	(2)	43.	(2)	44.	(1)	45.	(4)
46.	(2)	47.	(4)	48.	(3)	49.	(4)	50.	(4)
51.	(1)	52.	(1)	53.	(1)	54.	(1)	55.	(3)
56.	(1)	57.	(1)	58.	(3)	59.	(1)	60.	(3)
61.	(1)	62.	(4)	63.	(2)	64.	(2)	65.	(3)
66.	(2)	67.	(4)	68.	(4)	69.	(2)	70.	(3)
71.	(1)	72.	(3)	73.	(4)	74.	(1)	75.	(3)
76.	(3)	77.	(3)	78.	(1)	79.	(4)	80.	(3)
81.	(1)	82.	(2)	83.	(4)	84.	(2)	85.	(3)
86.	(3)	87.	(1)	88.	(3)	89.	(3)	90.	(4)
91.	(1)	92.	(2)	93.	(4)	94.	(1)	95.	(4)
96.	(1)	97.	(4)	98.	(3)	99.	(4)	100.	(3)

Laws of Motion & Friction

1.	(1)	2.	(3)	3.	(1)	4.	(3)	5.	(3)
6.	(4)	7.	(1)	8.	(1)	9.	(3)	10.	(1)
11.	(3)	12.	(2)	13.	(4)	14.	(2)	15.	(4)
16.	(2)	17.	(2)	18.	(4)	19.	(4)	20.	(4)
21.	(3)	22.	(3)	23.	(4)	24.	(4)	25.	(2)
26.	(4)	27.	(1)	28.	(2)	29.	(2)	30.	(2)
31.	(2)	32.	(1)	33.	(3)	34.	(2)	35.	(2)
36.	(4)	37.	(3)	38.	(3)	39.	(1)	40.	(3)
41.	(4)	42.	(3)	43.	(3)	44.	(1)	45.	(4)
46.	(1)	47.	(2)	48.	(4)	49.	(4)	50.	(1)
51.	(4)	52.	(2)	53.	(1)	54.	(3)	55.	(3)
56.	(4)	57.	(4)	58.	(4)	59.	(3)	60.	(1)
61.	(4)	62.	(3)	63.	(4)	64.	(4)	65.	(4)
66.	(3)	67.	(1)	68.	(2)	69.	(3)	70.	(2)
71.	(1)	72.	(4)	73.	(2)	74.	(2)	75.	(1)
76.	(2)	77.	(1)	78.	(4)	79.	(2)	80.	(1)
81.	(4)	82.	(3)	83.	(4)	84.	(2)	85.	(2)
86.	(3)	87.	(3)	88.	(2)	89.	(2)	90.	(1)
91.	(4)	92.	(2)	93.	(2)	94.	(3)	95.	(2)
96.	(3)	97.	(4)	98.	(4)				

1.	(4)	2.	(2)	3	(4)	4.	(4)	5.	(2)
6.	(1)	7.	(1)	8	(3)	9.	(3)	10.	(3)
11.	(4)	12.	(3)	13	(2)	14.	(3)	15.	(2)
16.	(1)	17.	(4)	18	(1)	19.	(2)	20.	(4)
21.	(3)	22.	(1)	23	(1)	24.	(3)	25.	(3)
26.	(3)	27.	(3)	28	(1)	29.	(2)	30.	(4)
31.	(2)	32.	(4)	33	(4)	34.	(1)	35.	(1)
36.	(1)	37.	(2)	38	(2)	39.	(1)	40.	(2)
41.	(4)	42.	(4)	43	(2)	44.	(3)	45.	(2)
46.	(1)	47.	(1)	48	(4)	49.	(2)	50.	(1)
51.	(2)	52.	(1)	53	(4)	54.	(4)	55.	(2)
56.	(2)	57.	(4)	58	(3)	59.	(1)	60.	(4)
61.	(3)	62.	(3)	63	(3)	64.	(4)	65.	(2)
66.	(4)	67.	(4)	68	(2)	69.	(3)	70.	(2)
71.	(3)	72.	(1)	73	(1)	74.	(4)	75.	(1)
76.	(2)	77.	(2)	78	(3)	79.	(1)	80.	(4)
81.	(1)	82.	(2)	83	(4)	84.	(2)	85.	(4)
86.	(3)	87.	(1)	88	(3)	89.	(2)	90.	(3)
91.	(2)	92.	(2)	93	(2)	94.	(4)	95.	(3)
96.	(2)	97.	(2)	98	(3)	99.	(1)	100.	(3)

ASSERTION-REASON TYPE QUESTIONS (FOR AIIMS)

1.	(2)	2.	(4)	3.	(4)	4.	(4)	5.	(1)
6.	(4)	7.	(1)	8.	(1)	9.	(4)	10.	(4)
11.	(1)	12.	(3)	13.	(2)	14.	(1)	15.	(1)
16.	(4)								

CBSE - PMT

1. The mass of a lift is 2000 kg. When the tension in the supporting cable is 28000 N, then its acceleration is

   (1) 14 ms^{-2} upwards
   (2) 30 ms^{-2} downwards
   (3) 4 ms^{-2} upwards
   (4) 4 ms^{-2} downwards

2. An explosion blows a rock into three parts. Two parts go off at right angles to each other. These two are, 1 kg first part moving with a velocity of 12 ms^{-1} and 2 kg second part moving with a velocity of 8 ms^{-1} and 2 kg second part moving with a velocity of 8 ms^{-1}. If the third part flies off with a velocity of 4 ms^{-1}, its mass would be

   (1) 3 kg (2) 5 kg
   (3) 7 kg (4) 17 kg

3. A block of mass M is attached to the lower end of a vertical spring. The spring is hung from a ceiling and has force constant value *k*. The mass is released from rest with the spring initially unstretched. The maximum extension produced in the length of the spring will be

   (1) $Mg/2k$ (2) Mg/k
   (3) $2Mg/k$ (4) $4Mg/k$

4. A body, under the action of a force $\vec{F} = 6\hat{i} - 8\hat{j} + 10\hat{k}$, acquires an acceleration of 1 m/s^2. The mass of this body must b

   (1) $10\sqrt{2}$ kg (2) $2\sqrt{10}$ kg
   (3) 10 kg (4) 20 kg

5. An engine pumps water continuously through a hose. Water leaves the hose with a velocity *v* and *m* is the mass per unit length of the water jet. What is the rate at which kinetic energy is imparted to water?

   (1) $\frac{1}{2}m^2v^2$ (2) $\frac{1}{2}mv^3$
   (3) mv^3 (4) $\frac{1}{2}mv^2$

6. A body of mass 1 kg is thrown upwards with a velocity 20 m/s. It momentarily comes to rest after attaining a height of 18 m. How much energy is lost due to air friction? (g = 10 m/s^2)

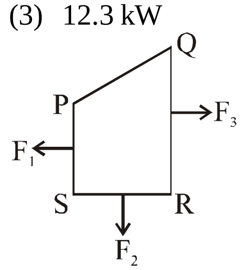
   (1) 10 J (2) 20 J
   (3) 30 J (4) 40 J

7. A roller coaster is designed such that riders experience "weightlessness" as they go round the top of a hill whose radius of curvature is 20 m. The speed of the car at the top of the hill is between

   (1) 14 m/s and 15 m/s (2) 15 m/s and 16 m/s
   (3) 16 m/s and 17 m/s (4) 13 m/s and 14 m/s

8. Water falls from a height of 60 m at the rate of 15 kg/s to operate a turbine. The losses due to frictional forces are 10% of energy. How much power is generated by the turbine ? (g = 10 m/s^2)]

   (1) 8.1 kW (2) 10.2 kW
   (3) 12.3 kW (4) 7.0 kW

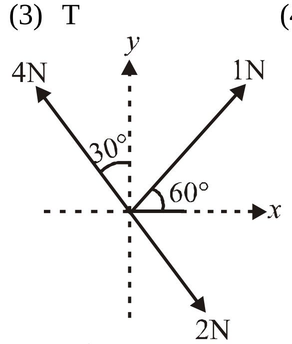
9. 

   A closed loop *PQRS* carrying current is placed in a uniform magnetic field. If the magnetic forces on segments *PS*, *SR* and *RQ* are F_1, F_2 and F_3 respectively and are in the plane of the paper and along the directions shown, the force on the segment *QP* is

   (1) $F_3 - F_1 - F_2$ (2) $\sqrt{(F_3 - F_1)^2 + F_2^2}$
   (3) $\sqrt{(F_3 - F_1)^2 - F_2^2}$ (4) $F_3 - F_1 + F_2$

10. A particle of mass *m*, charge *Q* and kinetic energy *T* enters a transverse uniform magnetic field of induction $\vec{B}$. After 3 seconds the kinetic energy of the particle will be

    (1) 3 T (2) 2 T
    (3) T (4) 4 T

11. 

    Three forces acting on a body are shown in the figure. To have the resultant force only along the *y*-direction, the magnitude of the minimum additional force needed is

    (1) 0.5 N (2) 1.5 N

(3) $\frac{\sqrt{3}}{4}$N (4) $\sqrt{3}$ N

12. A shell of mass 200 gm is ejected from a gun of mass 4 kg by an explosion that generates 1.05 kJ of energy. The initial velocity of the shell is

(1) 100 ms^{-1} (2) 80 ms^{-1}
(3) 40 ms^{-1} (4) 120 ms^{-1}

13. A particle of mass *m* is projected with velocity *v* making an angle of 45° with the horizontal. When the particle lands on the level ground the magnitude of the change in its momentum will be

(1) 2 *mv* (2) $mv/\sqrt{2}$
(3) $mv\sqrt{2}$ (4) zero

14. Sand is being dropped on a conveyor belt at the rate of M Kg/s. The force necessary to keep the belt moving with a constant velocity of *v* m/s will be

(1) M*v* newton (2) 2M*v* newton
(3) $\frac{Mv}{2}$ newton (4) zero

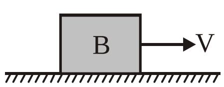
15. The position *x* of a particle with respect to time *t* along *x*-axis is given by $x = 9t^2 - t^3$ where *x* is in metres and *t* in second. What will be the position of this particle when it achieves maximum speed along the +*x* direction ?

(1) 54 m (2) 81 m
(3) 24 m (4) 32 m

16. A particle starting from the origin (0, 0) moves in a straight line in the (*x*, *y*) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the *x*-axis an angle of

(1) 45° (2) 60°
(3) 0° (4) 30°

17. A block B is pushed momentarily along a horizontal surface with an initial velocity V. If μ is the coefficient of sliding friction between B and the surface, block B will come to rest after a time



(1) *g*μ/V (2) *g*/V
(3) V/*g* (4) V/*g*μ

18. A particle moving along *x*-axis has acceleration *f*, at time *t*, given by $f = f_0\left(1 - \frac{t}{T}\right)$, where f_0 and T are constants. The particle at *t* = 0 has zero velocity. In the time interval between *t* = 0 and the instant when *f* = 0, the particle's velocity (v_x) is

(1) $(1/2)f_0 T^2$ (2) $f_0 T^2$
(3) $(1/2)f_0 T$ (4) $f_0 T$

19. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them, if $|\vec{A} \times \vec{B}| = \sqrt{3}(\vec{A} \cdot \vec{B})$ the value of θ is

(1) 45° (2) 30°
(3) 90° (4) 60°

20. 300 J of work is done in sliding a 2 kg block up an inclined plane of height 10 m. Taking $g = 10$ m/s^2, work done against friction is

(1) zero (2) 1000 J
(3) 200 J (4) 100 J

21. A 0.5 kg ball moving with a speed of 12 m/s strikes a hard wall at an angle of 30° with the wall. It is reflected with the same speed and at the same angle. If the ball is in contact with the wall for 0.25 seconds, the average force acting on the wall is

(1) 12 N (2) 96 N
(3) 48 N (4) 24 N

22. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is 6 ms^{-1}. The kinetic energy of the other mass is

(1) 524 J (2) 256 J
(3) 486 J (4) 324 J

23. A drum of radius *R* and mass *M*, rolls down without slipping along an inclined plane of angle θ. The frictional force

(1) decrease the rotational and translational motion
(2) dissipates energy as heat
(3) decreases the rotational motion
(4) converts translational energy to rotational energy

24. A stone tied to the end of a string of 1 m long is whirled in a horizontal circle with a constant speed. If the stone makes 22 revolution in 44 seconds, what is the magnitude and direction of acceleration of the stone ?

(1) π^2 ms^{-2} and direction along the tangent to the circle
(2) π^2 ms^{-2} and direction along the radius towards the centre
(3) $\frac{\pi^2}{4}$ ms^{-2} and direction along the radius towards the centre
(4) $\pi^2 ms^{-2}$ and direction along the radius away from the centre

25. The circular motion of a particle with constant speed

is
(1) periodic and simple harmonic
(2) simple harmonic but not periodic
(3) neither periodic nor simple harmonic
(4) periodic but not simple harmonic

26. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{j} - 4\hat{i} + \alpha\,\hat{k}$, then the value of α is

(1) -1 (2) $-\frac{1}{2}$
(3) $\frac{1}{2}$ (4) 1

27. If the angle between the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $(\vec{B} \times \vec{A}) \cdot \vec{A}$ is equal to

(1) zero (2) $BA^2 \sin\theta \cos\theta$
(3) $BA^2 \cos\theta$ (4) $BA^2 \sin\theta$

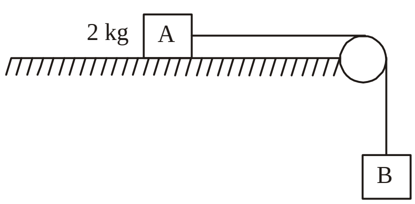
28. The displacement x of a particle varies with time t as $x = ae^{-\alpha t} + be^{\beta t}$, where a, b, α and β are positive constants. The velocity of the particle will

(1) be independent of α and β
(2) go on increasing with time
(3) drop to zero when $\alpha = \beta$
(4) go on decreasing with time

29. A mass of 0.5 kg moving with a speed of 1.5 m/s on a horizontal smooth surface, collides with a nearly weightless spring of force constant k = 50 N/m. The maximum compression of the spring would be

(1) 0.5 m (2) 0.15 m
(3) 0.12 m (4) 1.5 m

30. The coefficient of static friction, μ_s, between block A of mass 2 kg and the table as shown in the figure is 0.2. What would be the maximum mass value of block B so that the two blocks do not move ? The string and the pulley are assumed to be smooth and massless. (g = 10 m/s^2)



(1) 0.4 kg (2) 2.0 kg
(3) 4.0 kg (4) 0.2 kg

31. If $|\vec{A} \times \vec{B}| = \sqrt{3}\vec{A} \cdot \vec{B}$, then the value of $|\vec{A} + \vec{B}|$ is

(1) $\left(A^2 + B^2 + \sqrt{3}\,AB\right)^{1/2}$
(2) $(A^2 + B^2 + AB)^{1/2}$
(3) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$
(4) $A + B$

32. Two springs of spring constant k_1 and k_2 are joined in series. The effective spring constant of the combination is given by

(1) $k_1 k_2/(k_1 + k_2)$ (2) $\sqrt{k_1 k_2}$
(3) $(k_1 + k_2)/2$ (4) $k_1 + k_2$

33. A stone is tied to a string of length 'l' and is whirled in a vertical circle with the other end of the string as the centre. At a certain instant of time, the stone is at its lowest position and has speed 'u'. The magnitude of the change in velocity as it reaches a position where the string is horizontal (g being acceleration due to gravity) is

(1) $\sqrt{2gl}$ (2) $\sqrt{2(u^2 - gl)}$
(3) $\sqrt{u^2 - gl}$ (4) $u - \sqrt{u^2 - 2gl}$

34. A particle of mass m_1 is moving with a velocity v_1 and another particle of mass m_2 is moving with a velocity v_2. Both of them have the same momentum but their different kinetic energies are E_1 and E_2 respectively. If $m_1 > m_2$ then

(1) $E_1 = E_2$ (2) $E_1 < E_2$
(3) $\frac{E_1}{E_2} = \frac{m_1}{m_2}$ (4) $E_1 > E_2$

35. A ball of mass 2 kg and another of mass 4 kg are dropped together from a 60 feet tall building. After a fall of 30 feet each towards earth, their respective kinetic energies will be in the ratio of [CBSE 2004]

(1) $1 : \sqrt{2}$ (2) $\sqrt{2} : 1$
(3) 1 : 4 (4) 1 : 2

36. A block of mass m is placed on a smooth wedge of inclination θ. The whole system is accelerated horizontally so that the block does not slip on the wedge. The force exerted by the wedge on the block (g is acceleration due to gravity) will be

(1) $mg/\cos\theta$ (2) $mg\cos\theta$
(3) $mg\sin\theta$ (4) mg

37. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces

(1) are equal to each other in magnitude
(2) are not equal to each other in magnitude
(3) cannot be predicted
(4) are equal to each other

38. A stationary particle explodes into two parts of masses m_1 and m_2 which move in opposite directions with velocities v_1 and v_2. The ratio of their kinetic energies E_1, E_2 is

(1) m_1/m_2 (2) 1
(3) m_1v_2/m_2v_1 (4) m_2/m_1

39. A man weighs 80 kg. He stands on the scale in a lift which is moving upward with a uniform acceleratin of 5 m/s^2. What will be the reading on the scale? (g = 10 ms^2)

(1) 400 N (2) 800 N
(3) 1200 N (4) Zero

40. A monkey of mass 20 kg is holding a rope. The rope will not break when a mass of 25 kg is suspended from it but will break if the mass exceeds 25 kg. What is the maximum acceleration with which the monkey can climb up along the rope? (g = 10 m/s^2)

(1) 10 m/s^2 (2) 25 m/s^2
(3) 2.5 m/s^2 (4) 5 m/s^2

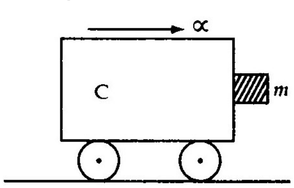
41. A particle moves along a circle of radius $\left(\frac{20}{\pi}\right)m$ with constant tangential accelertion. If the velociyt of the particle is 80 m/s at the end of the second revolution after motion has begun, the tangential acceleration is

(1) 640 π m/s^2 (2) 160 π m/s^2
(3) 40 π m/s^2 (4) 40 m/s^2

42. A particle has initial velocity $(3\hat{i}+4\hat{j})$ and has acceleration $(0.4\hat{i}+0.3\hat{j})$. Its speed after 10s is

(1) 10 units (2) 7 units
(3) $7\sqrt{2}$ units (4) 8.5 units

43. A block of mass m is in contact with the cart C as shown in the figure



The coefficient of static friction between the block and the cart is μ. The acceleration α of the cart that will prevent the block from falling satisfies

(1) $\alpha < \frac{g}{\mu}$ (2) $\alpha > \frac{mg}{\mu}$
(3) $\alpha > \frac{g}{\mu m}$ (4) $\alpha \geq \frac{g}{\mu}$

44 An engine pumps water through a hose pipe. Water passes through the pipe and leaves it with a velocity of 2 m/s. The mass per unit length of water in the pipe is 100 kg/m. What is the power of the engine?]

(1) 800 W (2) 400 W
(3) 200 W (4) 100 W

45. A gramophone record is revolving with an angular velocity ω. A coin is placed at a distance r from the centre of the record. The static coefficient of friction is μ. The coin will revolve with the record if

(1) $r \geq \frac{\mu g}{\omega^2}$ (2) $r = \mu g \omega^2$
(3) $r < \frac{\omega^2}{\mu g}$ (4) $r \leq \frac{\mu g}{\omega^2}$

46. A particle moves in a circle of radius 5 cm with constant speed and time period 0.2 πs. The acceleration of the particle is

(1) 15 m/s^2 (2) 25 m/s^2
(3) 35 m/s^2 (4) 5 m/s^2

47. A missile is fired for maximum range with an initial velocity of 20 m/s. If g = 10 m/s^2, the range of the missile is

(1) 40 m (2) 50 m
(3) 60 m (4) 20 m

48. A boy standing at the top of a tower of 20 m height drops a stone. Assuming g = 10 ms^{-2}, the velocity with which it hits the ground is [

(1) 10.0 m/s (2) 20.0 m/s
(3) 40.0 m/s (4) 5.0 m/s

49. A body is moving with velocity 30 m/s towards east. After 10 seconds its velocity becomes 40 m/s towards north. The average acceleration of the body is

(1) 1 m/s^2 (2) 7 m/s^2
(3) $\sqrt{7}$ m/s^2 (4) 5 m/s^2

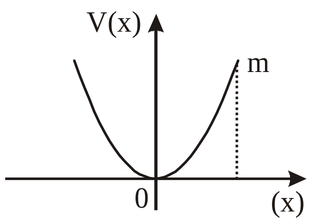
50. A body projected vertically from the earth reaches a height equal to earth's radius before returning to the earth. The power exerted by the gravitational force is greatest

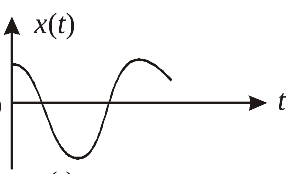
(1) at the highest position of the body
(2) at the instant just before the body hits the earth
(3) it remains constant all through
(4) at the instant just after the body is projected

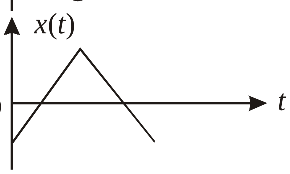
51. A person of mass 60 kg is inside a lift of mass 940 kg and presses the bottom on control panel. The lift starts moving upwards with an acceleration 1.0 m/s^2. If $g = 10\ ms^{-2}$, the tension in the supporting cable is

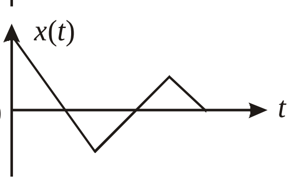
(1) 8600 N (2) 9680 N
(3) 11000 N (4) 1200 N

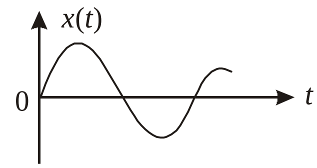
52. A particle of mass m is released from rest and follows a parabolic path as shown. Assuming that the displacement of the mass from the origin is small, which graph correctly depicts the position of the particle as a function of time?



(1) 

(2) 

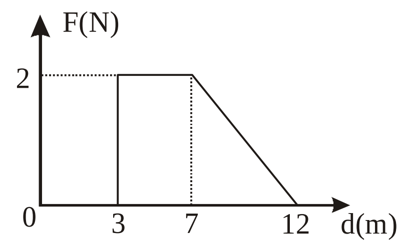
(3) 

(4) 

53. A body of mass M hits normally a rigid wall with velocity V and bounces back with the same velocity. The impulse experienced by the body is

(1) MV (2) 1.5 MV
(3) 2 MV (4) zero

54. Force F on a particle moving in a straight line varies with distance *d* as shown in the figure. The work done on the particle during its displacement of 12 m is



(1) 18 J (2) 21 J
(3) 26 J (4) 13 J

CBSE-PMT Mains

1. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is

(1) 60° (2) 15°
(3) 30° (4) 45°

2. A particle of mass M starting from rest undergoes uniform acceleration. If the speed acquired in time T is V, the power delivered to the particle is

(1) $\frac{MV^2}{T}$ (2) $\frac{1}{2}\frac{MV^2}{T^2}$

(3) $\frac{MV^2}{T^2}$ (4) $\frac{1}{2}\frac{MV^2}{T}$

3. A mass *m* moving horizontally (along the x-axis) with velocity *v* collides and sticks to a mass of 3m moving vertically upward (along the y-axis) with velocity 2*v*. The final velocity of the combination is [

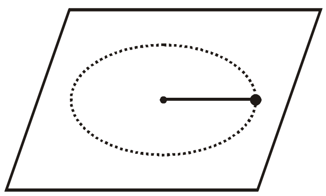
(1) $\frac{3}{2}v\hat{i}+\frac{1}{4}v\hat{j}$ (2) $\frac{1}{4}v\hat{i}+\frac{3}{2}v\hat{j}$

(3) $\frac{1}{3}v\hat{i}+\frac{2}{3}v\hat{j}$ (4) $\frac{2}{3}v\hat{i}+\frac{1}{3}v\hat{j}$

4. A conveyor belt is moving at a constant speed of 2 m/s. A box is gently dropped on it . The coefficient of friction between them is $\mu = 0.5$. The distance that the box will move relative to belt before coming to rest on it, taking $g = 10\ ms^{-2}$, is

(1) 0.4 m (2) 1.2 m
(3) 0.6 m (4) zero

5. A small mass attached to a string rotates on a frictionless table top as shown. If the tension in the string is increased by pulling the string causing the radius of the circular motion to decrease by a factor of 2, the kinetic energy of the mass will



(1) decrease by a factor of 2
(2) remain constant
(3) increase by a factor of 2
(4) increase by a factor of 4

6. A projectile is fired at an angle of 45° with the horizontal. Elevation angle of the projectile at its highest point as seen form the point of projection, is

(1) 45° (2) 60°
(3) $\tan^{-1}½$ (4) $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

NEET

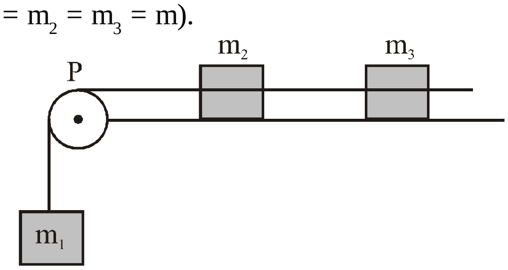
1. A particle is moving such that its position coordinates (x, y) are ($2m$, $3m$) at time $t = 0$, ($6m$, $7m$) at time $t = 2$s and ($13m$, $14m$) at time $t = 5$s. Average velocity vector $(\vec{V}_{av})$ from $t = 0$ to $t = 5s$ is

(1) $2(\hat{i}+\hat{j})$ (2) $\frac{11}{5}(\hat{i}+\hat{j})$
(3) $\frac{1}{5}(13\hat{i}+14\hat{j})$ (4) $\frac{7}{3}(\hat{i}+\hat{j})$

2. A balloon with mass 'm' is descending down with an acceleration a (where a < g). How much mass should be removed from it so that it starts moving up with an acceleration a?

(1) $\frac{ma}{g+a}$ (2) $\frac{ma}{g-a}$
(3) $\frac{2ma}{g+a}$ (4) $\frac{2ma}{g-a}$

3. A system consists of three masses m_1, m_2 and m_3 connected by a string passing over a pulley P. The mass m_1 hangs freely and m_2 and m_3 are on a rough horizontal table (the coefficient of friction = μ). The pulley is frictionless and of negligible mass. The downward acceleration of mass m_1 is (Assume $m_1 = m_2 = m_3 = m$).



(1) $\frac{g(1-2\mu)}{3}$ (2) $\frac{g(1-2\mu)}{2}$
(3) $\frac{g(1-g\mu)}{9}$ (4) $\frac{2g\mu}{3}$

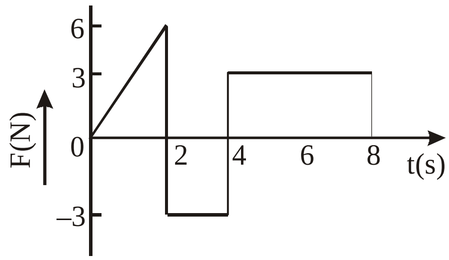
4. A projectile is fired from the surface of the earth with a velocity of 5 ms^{-1} and angle θ with the horizontal. Another projectile fired from a another planet with a velocity of 3 ms^{-1} at the same angle follows a trajectory which is identical with the trajectory of the projectile fired from the earth. The value of the acceleration due to gravity on the planet is (in ms^{-2}) is (given $g = 9.8\ ms^{-2}$)

(1) 16.3 (2) 110.8
(3) 3.5 (4) 5.9

5. A body of mass (4m) is lying in x-y plane at rest. It suddenly explodes into three pieces. Two pieces, each of mass (m) move perpendicular to each other with equal speeds (v). The total kinetic energy generated due to explosion is

(1) 2 mv^2 (2) 4 mv^2
(3) mv^2 (4) $\frac{3}{2}mv^2$

6. The force F acting on a particle of mass m is indicated by the force time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is



(1) 12 Ns (2) 6 Ns
(3) 24 Ns (4) 20 Ns

DPMT

1. A rope of mass 0.1 kg is connected at the same height of two opposite walls. It is allowed to hang under its own weight. At the contact point between the rope and the wall, the rope makes an angle $\theta = 10°$ with respect to horizontal. The tension in the rope at its midpoint between the walls is

(1) 2.78 N (2) 2.56 N
(3) 2.82 N (4) 2.71 N

2. A boat crosses a river from port A to port B, which are just on the opposite side. The speed of the water is V_W and that of boat is V_B relative to water. Assume $V_B = 2V_W$. What is the time taken by the boat, if it has to cross the river directly on the AB line?

(1) $\frac{2D}{V_B\sqrt{3}}$ (2) $\frac{\sqrt{3}D}{2V_B}$
(3) $\frac{D}{V_B\sqrt{2}}$ (4) $\frac{D\sqrt{2}}{V_B}$

3. A uniform rod of length L and mass 18 kg is made to rest on two measuring scale at its two ends. A uniform block of mass 2.7 kg is placed on the rod at a distance L/4 from the left end. The force experienced by the measuring scale on the right end is

(1) 18 N (2) 27 N
(3) 29 N (4) 45 N

4. Two iron blocks of equal mass but with double surface area slide down an inclined plane with friction coefficient μ. If the first block with surface area A experience a frictional force *f*, then the second block with surface area 2A will experience a frictional force

(1) *f* /2 (2) *f*
(3) 2*f* (4) 4*f*

5. On the centre of a frictionless table a small hole is made, through which a weightless string of length 2*l* is inserted. On the two ends of the string two balls of the same mass *m* are attached. Arrangement is made in such a way that half of the string is on the table top and half is hanging below. The ball on the table top is made to move in a circular path with a constant speed V. What is the centripetal acceleration of the moving ball?

(1) mV*l* (2) *g*
(3) zero (4) 2mV*l*

6. A ball moves in a frictionless inclined table without slipping. The work done by the table surface on the ball is

(1) positive (2) negative
(3) zero (4) none of these

7. The three initial and final position of a man on the x-axis are given as

(i) (–8 m, 7 m)
(ii) (7 m, –3 m) and
(iii) (–7 m, 3 m)

Which pair gives the negative displacement?

(1) (i) (2) (ii)
(3) (iii) (4) (i) & (iii)

8. A bird flies from (–3 m, 4 m, –3 m) to (7 m, – 2 m, – 3 m) in *xyz* coordinates. The birds's displacement in unit vectors is given by

(1) $(4i + 2j - 6k)$ (2) $(10i + 6j)$
(3) $(4i - 2j)$ (4) $(10i + 6j - 6k)$

9. A coastguard ship locates a pirate ship at a distance 560 m. It fires a cannon ball with an initial speed 82 m/s. At what angle from horizontal the ball must be fired so that it hits the pirate ship?

(1) 54° (2) 125°
(3) 27° (4) 18°

10. An object moves at a constant speed along a circular path in horizontal XY plane, with the centre at the origin. When the object is at x = –2 m, its velocity is

$-(4\ m/s)\ \hat{j}$. What is the object's acceleration when it is y = 2 m?

(1) $-(8\ m/s^2)\ \hat{j}$ (2) $(8\ m/s^2)\ \hat{i}$

(3) $(-4\ m/s^2)\ \hat{j}$ (4) $(4\ m/s^2)\ \hat{i}$

11. A block is lying static on the floor. The maximum value of static frictional force on the block is 10 N. If a horizontal force of 8 N is applied to the block, what will be the frictional force on the block?

]

(1) 2 N (2) 18 N
(3) 8 N (4) 10 N

12. A car of mass 400 kg is pulling a coach of mass 300 kg. If friction force is 1N/100 kg, what is tension?
(1) 2100 N (2) 2126 N
(3) 1926 N (4) 2750 N

13. A body is projected horizontally with velocity 196 m/sec from height 400 m. What is time to reach the ground.
(1) 5 (2) 10
(3) 15 (4) 20

14. A rod of length *l* and mass *m* is kept vertically on the ground. Its potential energy is

(1) mgL (2) $mg\dfrac{L}{2}$

(3) $mg\dfrac{L}{3}$ (4) $mg\dfrac{L}{4}$

15. A body of mass 10 kg is initially at rest aquires velocity 10 m/sec. What is work done.

]

(1) –500 J (2) 500 J
(3) 50 J (4) –50 J

16. A stone is whirled in path of radius 1 m and its speed decreases from 4 m/sec. to 2 m/sec. in 2 sec. What is angular acceleration ?
(1) 1 rad/sec^2 (2) 2 rad/sec^2
(3) 4 rad/sec^2 (4) none of these

17. A ball is dropped from height *h* on the ground where coefficient of restitution is *e*. After one bounce the maximum height is

(1) e^2h (2) $e\sqrt{h}$

(3) eh (4) $\sqrt{eh}$

18. If μ_s is coefficient static friction and μ_k is coefficient of kinetic friction then
(1) no relation between μ_s and μ_k
(2) generally $\mu_s > \mu_k$
(3) generally $\mu_s = \mu_k$
(4) generally $\mu_s < \mu_k$

19. No force is required for
(1) an object moving is straight line with constant velocity
(2) an object moving in circular motion
(3) an object moving with constant acceleration
(4) an object moving in elliptical path

20. Kinetic energy of particles of mass 10 g and 40 gm is same, the ratio of their linear momentum

(1) 1/4 (2) 1/2

(3) $1/\sqrt{2}$ (4) $\sqrt{2}/1$

21. A lift accelerates upward then deaccelerates and stops at higher floor. The apparent weight of the body in the later parts of its motion is

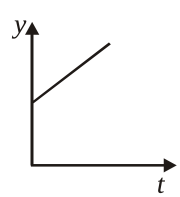
(1) more than actual weight
(2) less than actual weight
(3) no change
(4) equal to actual weight

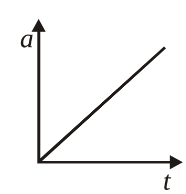
22. When two springs of spring force constant K and 2K are connected in series then force constant becomes K_S, if they are connected in parallel then force constant becomes K_p. Ratio K_s/K_p is

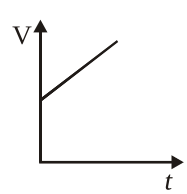
[

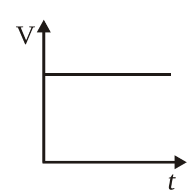
(1) 2/9 (2) 1/2
(3) 2/1 (4) 1/3

23. A particle is moving with constant acceleration then the correct graph is (V velocity, *y* displacement and *t* time)

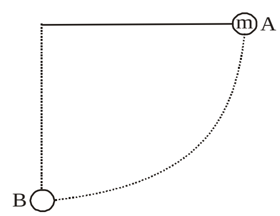
(1)


(2)


(3)


(4)


24. For a car not to turn safely on a curved road
    (1) speed is slow
    (2) distance between tyres is large
    (3) centre of gravity for car is low
    (4) high friction force
25. Which of the following is true regarding projectile motion ?
    (1) horizontal velocity of projectile is constant
    (2) vertical velocity of projectile is constant
    (3) acceleration is not constant
    (4) momentum is constant
26. Two masses of 2 kg and 4 kg are tied to a string passing over frictionless and massless pulley. A force of 50 N is applied on pulley in upward direction. The acceleration of masses are (initially masses are resting on ground)
    (1) 0, 0
    (2) 0, 5 m/sec^2
    (3) 0, 2.5 m/sec^2
    (4) +5 m/sec^2, –5 m/sec^2
27. A bullet of mass 20 gm and moving with 600 m/sec collides with a block of mass 4 kg hanging with the string. What is velocity of bullet when it comes out of block, if block rises to height 0.2 m after collision
    (1) 200 m/sec (2) 150 m/sec
    (3) 400 m/sec (4) 300 m/sec
28. A ball of mass 2 kg is moving with velocity 3 m/sec, collides with spring of natural length 2 m and force constant 144 N/m. What will be length of compressed spring
    (1) 2m (2) 1.5 m
    (3) 1 m (4) 0.5 m
29. A particle accelerating uniformly has velocity V at time t_1. What is work done in time t
    (1) $\frac{1}{2}\frac{m V^2}{t_1^2}t^2$ (2) $\frac{1}{2}\left(\frac{m V}{t_1}\right)t^2$
    (3) $\frac{m V^2}{t_1^2}t^2$ (4) $\frac{2m V^2}{t_1^2}t^2$
30. A body of mass m is moving towards east and another body of equal mass is moving towards north. If after collision both stick together, their speed after collision would be
    (1) v (2) $v/2$
    (3) $\sqrt{2}\,v$ (4) $v/\sqrt{2}$
31. A body of mass 1 kg is moving in a vertical circular path of radius 1 m. The difference between the kinetic energies at its heighest and lowest positions is
    (1) 20 J (2) 10 J
    (3) $4\sqrt{5}$ J (4) $10(\sqrt{5}-1)$J
32. Two bodies are thrown up at angles of 45º and 60º, respectively, with the horizontal. If these attain same vertical height, then the ratio of velocities with which these are thrown is
    (1) $\sqrt{2/3}$ (2) $2/\sqrt{3}$
    (3) $\sqrt{3/2}$ (4) $\sqrt{3}/2$
33. A body takes time t to reach the bottom of an inclined plane of angle θ with the horizontal. If the plane is made rough, time taken now is $2t$. The coefficient of friction of the rough surface is
    (1) $^3/_4$ tan θ (2) $^2/_3$ tan θ
    (3) $^1/_4$ tan θ (4) $^1/_2$ tan θ
34. A body m of mass 1 kg is dropped from position A. If 10% of its energy is lost as heat, what will be its velocity at B ?



    (1) 6 ms^{-1} (2) 5.5 ms^{-1}
    (3) 6.32 ms^{-1} (4) 5.6 ms^{-1}
35. A ball of mass 25g, moving with a velocity of 2 ms^{-1} is stopped within 5 cm. The average resistance offered to the ball is
    (1) 10 N (2) 5 N
    (3) 2 N (4) 1 N
36. If $\vec{P}+\vec{Q}=\vec{R}$ and $|\vec{P}|=|\vec{Q}|=|\vec{R}|$, then angle between $\vec{P}$ and $\vec{Q}$ is
    (1) 30º (2) 60º
    (3) 90º (4) 120º

37. An ideal spring with spring constant K = 200 N/m is fixed on one end on a wall. If the spring is pulled with a force 10 N at the other end along its length, how much it will be extended?

(1) 5 cm (2) 2 m
(3) 2 cm (4) 5 m

38. An iron block of mass 5 kg is kept on a trolley. If the trolley is being pushed with an acceleration of 5 m/s^2, what will be the force of friction between the block and the trolley surface? (Take the coefficient of static friction between the block and the trolley surface to be 0.8)

(1) zero (2) 5 N
(3) 4 N (4) 25 N

39. A person is measuring his weight by standing on a weighing machine inside a lift. When the lift is at rest, the machine shows his weight to be 55 kg. In between the floor when the lift is moving up with a constant speed of 10 km/hr, he again measures his weight, which is

(1) 55 kg (2) 65 kg
(3) 50 kg (4) 45 kg

40. A child travelling in a train throws a ball outside with a speed V. According to a child who is standing on the ground, the speed of the ball is

(1) same as V (2) greater than V
(3) less than V (4) none of these

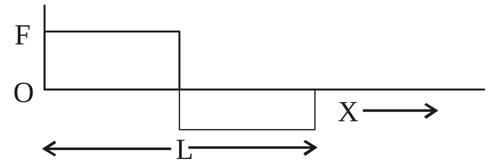
41. Which of the following is correct relation between an arbitrary vector $\overline{A}$ and null vector $\overline{O}$?

(1) $\overline{A}+\overline{O}+\overline{A}\times\overline{O}=\overline{A}$ (2) $\overline{A}+\overline{O}+\overline{A}\times\overline{O}\neq\overline{A}$
(3) $\overline{A}+\overline{O}+\overline{A}\times\overline{O}=\overline{O}$ (4) None of these

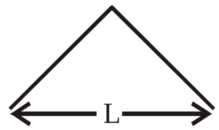
42. An object is being thrown at a speed 20 m/s in a direction 45° above the horizontal. The time taken by the object to return to the same level is

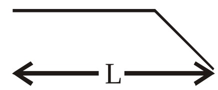
(1) The total kinetic energy is conserved
(2) The total potential energy is conserved
(3) The linear momentum is not conserved
(4) The linear momentum is conserved

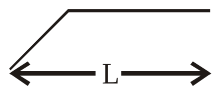
3. A person used force (*F*), shown in figure to move a load with constant velocity on given surface

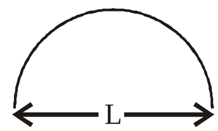


Identify the correct surface profile

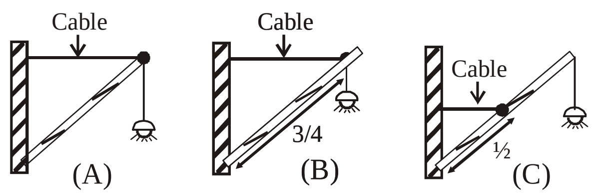
(1) 

(2) 

(3) 

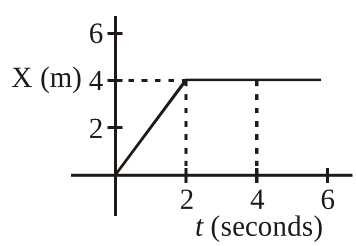
(4) 

4. If a street light of mass *M* is suspended from the end of a uniform rod of length *L* in different possible patterns as shown in figure, then



(1) Pattern *A* is more sturdy
(2) Pattern *B* is more sturdy
(3) Pattern *C* is more sturdy
(4) All will have same sturdiness

5. In the figure given below, the position-time graph of a particle of mass 0.1 Kg is shown. The impulse at *t* = 2 sec is



(1) 0.2 Kg m sec^{-1} (2) –0.2 Kg m sec^{-1}
(3) 0.1 Kg m sec^{-1} (4) –0.4 Kg m sec^{-1}

6. A block of mass 10 Kg is moving in *x*-direction with a constant speed of 10 m/sec. It is subjected to a retarding force F = –0.1 *x* joules/meter during its travel from *x* = 20 meters to *x* = 30 meters. Its final

kinetic energy will be

(1) 475 joules (2) 450 joules

(3) 275 joules (4) 250 joules

7. A person is standing in an elevator. In which situation he finds his weight less

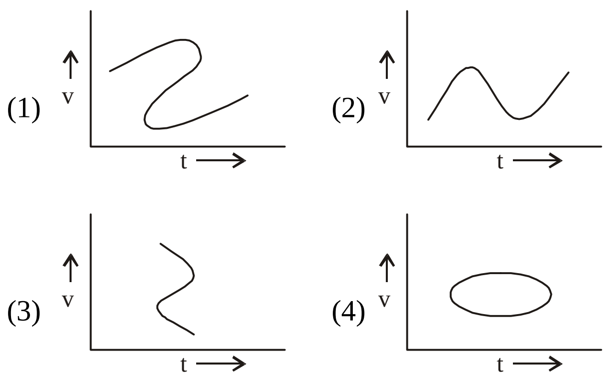
(1) When the elevator moves upwards with constant acceleration

(2) When the elevator moves downward with constant acceleration

(3) When the elevator moves upward with uniform velocity

(4) When the elevator moves upward with uniform velocity

8. Which of the following velocity-time graphs shows a realistic situation for a body in motion ?

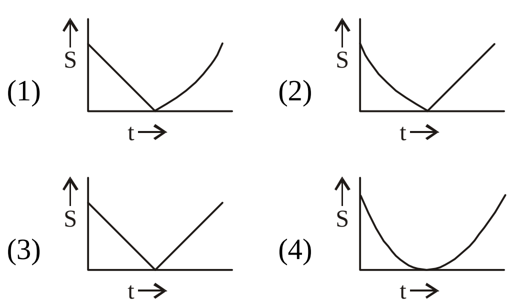


9. A bomb of mass 3.0 kg explodes in air into two pieces of masses 2.0 kg and 1.0 kg. The smaller mass goes at the speed of 80 m/s. The total energy imparted to the two fragments is

(1) 1.07 kJ (2) 2.14 kJ

(3) 2.4 kJ (4) 4.8 kJ

10. A ball is thrown vertically upwards. Which of the following plots represents the speed-time graph of the ball during its flight if the air resistance is not ignored ?



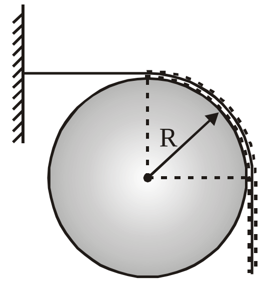
Science Olympiad

1. A sphere of mass 20 kg is placed on a rough horizontal surface where coefficient of static friction is $\mu_s = 0.2$. A horizontal force F = 14 N, passing through its centre. The force of friction on the sphere is

(1) 40 N (2) 14 N

(3) 4 N (4) 10 N

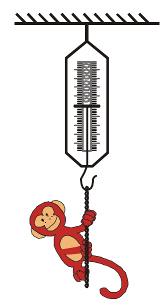
2. A chain of length $l = \pi R$, and mass m, is placed over smooth sphere as shown inthe figure. One end of chain is attached with the horizontal string. If string is being cut, the acceleration of chain just after cutting the chain is (assume $g = 10\ m/s^2$)



(1) $10\ m/s^2$ (2) $5\ m/s^2$

(3) $8\ m/s^2$ (4) zero

3. A monkey of mass 20 kg is hanging on a rope, which is attached with a spring balance as shown in figure. If monkey climbs up the rope, the reading of spring balance



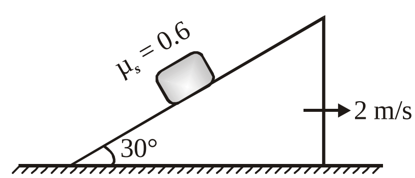
(1) 20 kg. wt.

(2) more than 20 kg. wt.

(3) less than 20 kg. wt.

(4) zero

4. A block of mass $m = \sqrt{3}$ kg is placed on a rough wedge, ($\mu_s = 0.6$), which is moving on horizontal plane with uniform velocity 2 m/s. The work done by friction force on the block in 2 sec is



(1) zero (2) 30 J

(3) $20\sqrt{3}$ J (4) $24\sqrt{3}$ J

5. The potential energy of a system is given by $u(x) = x^2 + 4x + 4$

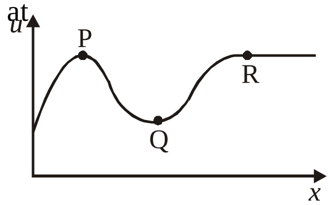
(1) $x = -\frac{4}{3}$, corresponds to stable equilibrium position of system

(2) $x = -2$, corresponds to stable equilibrium position of the system

(3) $x = -2$, correspondes to unstable equilibrium position

(4) $x = 2$, correspondes to neutral equilibrium position

6. A mass can moves along x direction only. Its potential energy (u) varies with its position x as shown in figure, the net force on the mass is zero at



(1) P, Q and R (2) P and R only

(3) Q only (4) none of these

7. A body of 10 kg is moving on a circular path of radius 5 m on horizontal rough surface. Its speed is decreasing at the rate of 2 m/sec^2 due to friction. What is friction force acting on car (assuming there is no sliding), when its speed is 5 m/sec.

(1) 50 N (2) 53.8 N

(3) 48 N (4) 45 N

8. A particle is moving with speed 2 m/sec. on horizontal surface. It rolls off the wall of the well at A. If velocity makes an angle 60° with diameter of the well through A. What should be velocity of particle if it comes out of well after under going elastic collision with the bottom of well. (Depth of well is 20 m and radius is 2 m).

(1) 1.25 m/sec (2) 0.75 m/sec

(3) 0.5 m/sec (4) 1 m/sec

9. A particle can have

(1) $\frac{d\mathbf{V}}{dt} = 0$ but $\frac{d\,|\mathbf{V}|}{dt} \neq 0$

(2) $\frac{d\mathbf{V}}{dt} \neq 0$ but $\frac{d\,|\mathbf{V}|}{dt} = 0$

(3) both $\frac{d\mathbf{V}}{dt}$ and $\frac{d\,|\mathbf{V}|}{dt}$ should be zero simultaneously

(4) none of these

10. If a block rests on the rough floor of a truck and the truck is accelerated then

(1) the block always slips back

(2) the block always slips forward

(3) the block slips back only after a certain value of acceleration of truck

(4) the block slips initially backward then starts moving with the truck without slipping

11. If a person moving due north with a flag in his hand, flattering due east, then it shows that

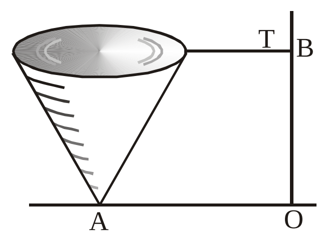
(1) the wind is blowing due east

(2) the wind must be blowing due south

(3) the wind may be due south east

(4) the wind may be due north east

12. For a block of conical shape as shown in figure connected to a vertical wall with the help of a string on a frictionless surface



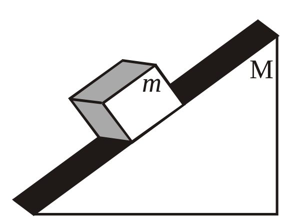
(1) tension T must be equal to mg for equilibrium

(2) tension $T = mg \times \frac{OA}{OB}$

(3) tension T = 0

(4) none of these

13. If a block of mass m is placed on an inclined plane of another block of mass M and the surfaces are smooth then for m at rest on M,



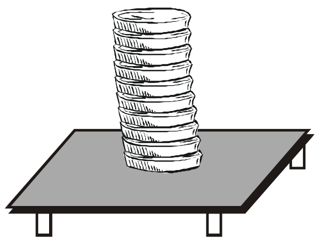
(1) M must have an acceleration to the left

(2) M must have an acceleration to the right

(3) M may have an acceleration in downward direction

(4) M may have an acceleration in upward direction

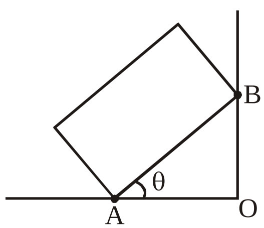
14. Ten coins each of mass m are placed on each other as shown in figure. The net force on 7th coin from the top is



(1) 6 mg (2) 7 mg
(3) mg (4) zero

15. If the coefficient of friction between the coins and with table in μ then the frictional force between 7th and 8th coin is
(1) μ(7 mg)
(2) μ mg
(3) more than that between 4th and 5th coin
(4) equal to that between 6th and 7th coin

16. If all the surfaces are frictionless thus in the adjacent figure the rectangular block



[

(1) can be in equilibrium only in one position
(2) can be in equilibrium only if OA = OB
(3) can be in equilibrium only if vertical line passing through the centre of mass passes through A
(4) can never be in equilibrium for $\pi/2 > \theta > 0$

17. During free fall if a person throws an object horizontally, then after that [Science Olympiad 2006]
(1) acceleration of that object will be horizontal but it moves vertically down
(2) acceleration of that object is vertical but it moves in horizontal direction
(3) acceleration of both object and person will be at an angle θ with vertical such that $0<\theta<\pi/2$
(4) acceleration of both object and person will be vertical but they have velocity an angle θ with each other

ANSWERS :

QUESTIONS FROM COMPETITIVE EXAMS

CBSE PMT

1.	(3)	2.	(2)	3.	(3)	4.	(1)	5.	(2)
6.	(2)	7.	(1)	8.	(1)	9.	(2)	10.	(3)
11.	(1)	12.	(1)	13.	(3)	14.	(1)	15.	(1)
16.	(2)	17.	(4)	18.	(3)	19.	(4)	20.	(4)
21.	(4)	22.	(3)	23.	(4)	24.	(2)	25.	(4)
26.	(2)	27.	(1)	28.	(2)	29.	(2)	30.	(1)
31.	(2)	32.	(1)	33.	(2)	34.	(2)	35.	(4)
36.	(1)	37.	(1)	38.	(4)	39.	(3)	40.	(3)
41.	(4)	42.	(3)	43.	(4)	44.	(2)	45.	(4)
46.	(4)	47.	(1)	48.	(2)	49.	(4)	50.	(2)
51.	(3)	52.	(1)	53.	(3)	54.	(4)		

CBSE PMT MAINS

1.	(1)	2.	(4)	3.	(2)	4.	(1)	5.	(4)
6.	(3)								

NEET

1.	(2)	2.	(3)	3.	(1)	4.	(3)	5.	(4)\
6.	(1)								

DPMT

1.	(1)	2.	(1)	3.	(1)	4.	(2)	5.	(2)
6.	(3)	7.	(2)	8.	(2)	9.	(3)	10.	(1)
11.	(3)	12.	(3)	13.	(2)	14.	(2)	15.	(2)
16.	(1)	17.	(1)	18.	(2)	19.	(1)	20.	(2)
21.	(2)	22.	(1)	23.	(3)	24.	(4)	25.	(1)
26.	(3)	27.	(3)	28.	(2)	29.	(1)	30.	(4)
31.	(1)	32.	(3)	33.	(1)	34.	(1)	35.	(4)
36.	(4)	37.	(1)	38.	(4)	39.	(1)	40.	(1)
41.	(1)	42.	(3)	43.	(2)	44.	(3)	45.	(3)
46.	(1)								

AIIMS

1.	(4)	2.	(4)	3.	(1)	4.	(1)	5.	(2)
6.	(1)	7.	(2)	8.	(2)	9.	(4)	10.	(3)

Science Olympiad

1.	(3)	2.	(3)	3.	(2)	4.	(2)	5.	(2)
6.	(1)	7.	(2)	8.	(3)	9.	(2)	10.	(3)
11.	(4)	12.	(3)	13.	(3)	14.	(4)	15.	(4)
16.	(1)	17.	(4)						