NEET : CHAPTER WISE TEST-7

SUBJECT :- PHYSICS — **DATE**..
CLASS :- 11th — **NAME**..
CHAPTER :- CENTRE OF MASS — **SECTION**..

(SECTION-A)

1. The centre of mass of a body :

(A) Lies always at the geometrical centre
(B) Lies always inside the body
(C) Lies always outside the body
(D) Lies within or outside the body

2. Where will be the centre of mass on combining two masses m and M(M > m) :

(A) towards m
(B) towards M
(C) at middle of m and M
(D) anywhere

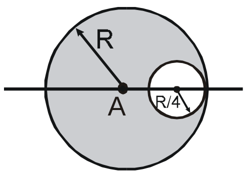
3. Two homogenous spheres A and B of masses m and 2m having radii 2a and a respectively are placed in touch. The distance of centre of mass from first sphere is :

(A) a (B) 2a
(C) 3a (D) none of these

4. Centre of mass is a point

(A) Which is geometric centre of a body
(B) From which distance of particles are same
(C) Where the whole mass of the body is supposed to concentrated
(D) Which is the origin of reference frame

5. The centre of mass of the shaded portion of the disc is : (The mass is uniformly distributed in the shaded portion) :



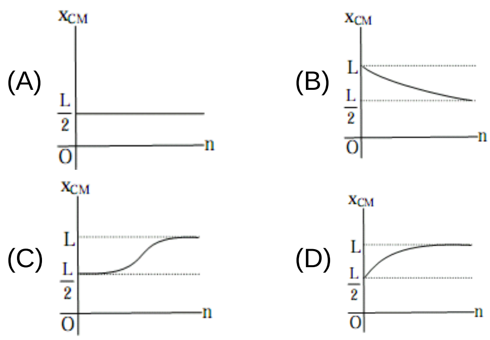
(A) $\frac{R}{20}$ to the left of A

(B) $\frac{R}{12}$ to the left of A

(C) $\frac{R}{20}$ to the right of A

(D) $\frac{R}{12}$ to the right of A

6. A thin rod of length 'L' is lying along the x-axis with its ends at x = 0 and x = L. Its linear density (mass/length) varies with x as $k\left(\frac{x}{L}\right)^n$, where K is a constant & n can be zero or any positive number. If the position X_{CM} of the centre of mass of the rod is plotted against 'n', which of the following graphs best approximates the dependence of X_{CM} on n ?



7. If a ball is thrown upwards from the surface of earth and during upward motion :

(A) The earth remains stationary while the ball moves upwards
(B) The ball remains stationary while the earth moves downwards
(C) The ball and earth both moves towards each other
(D) The ball and earth both move away from each other

8. Two objects of masses 200 gm and 500 gm posses velocities $10\hat{i}$ m/s and $3\hat{i}+5\hat{j}$ m/s respectively. The velocity of their centre of mass in m/s is :

(A) $5\hat{i}-25\hat{j}$ (B) $\frac{5}{7}\hat{i}-25\hat{j}$

(C) $5\hat{i}+\frac{25}{7}\hat{j}$ (D) $25\hat{i}-\frac{5}{7}\hat{j}$

9. 2 bodies of different masses of 2kg and 4kg are moving with velocities 20m/s and 10m/s towards each other due to mutual gravitational attraction. What is the velocity of their centre of mass ?

(A) 5 m/s (B) 6 m/s
(C) 8 m/s (D) zero

10. Two particles having mass ratio n : 1 are interconnected by a light inextensible string that passes over a smooth pulley. If the system is released, then the acceleration of the centre of mass of the system is :

(A) $(n-1)^2 g$ (B) $\left(\frac{n+1}{n-1}\right)^2 g$

(C) $\left(\frac{n-1}{n+1}\right)^2 g$ (D) $\left(\frac{n+1}{n-1}\right) g$

11. A uniform thin rod of mass M and Length L is standing vertically along the y-axis on a smooth horizontal surface, with its lower end at the origin (0,0). A slight disturbance at t = 0 causes the lower end to slip on the smooth surface along the positive x-axis, and the rod starts falling. The acceleration vector of centre of mass of the rod during its fall is :

[$\vec{R}$ is reaction from surface]

(A) $\vec{a}_{CM}=\frac{M\vec{g}+\vec{R}}{M}$ (B) $\vec{a}_{CM}=\frac{M\vec{g}-\vec{R}}{M}$

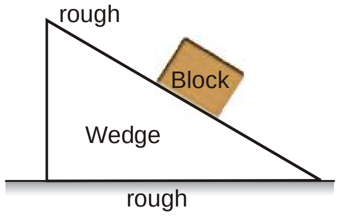
(C) $\vec{a}_{CM}=M\vec{g}-\vec{R}$ (D) None of these

12. Three particles of masses 1 kg, 2 kg and 3 kg are subjected to forces $(3\hat{i}-2\hat{j}+2\hat{k})N$, $(-\hat{i}+2\hat{j}-\hat{k})N$, and $(\hat{i}+\hat{j}+\hat{k})N$ respectively. The magnitude of the acceleration of the CM of the system is :

(A) $\frac{\sqrt{11}}{6}ms^{-2}$ (B) $\frac{\sqrt{14}}{6}ms^{-2}$

(C) $\frac{11}{6}ms^{-2}$ (D) $\frac{22}{6}ms^{-2}$

13. When a block is placed on a wedge as shown in figure, the block starts sliding down and the wedge also start sliding on ground. All surfaces are rough. The centre of mass of (wedge + block) system will move



(A) leftward and downward.
(B) right ward and downward.
(C) leftward and upwards.
(D) only downward.

14. A moving body of mass m and velocity 3 km/hr collides with a body at rest and of mass 2m and then sticks to it. Now the combined mass starts to move, then the combined velocity will be :

(A) 4 km/hr (B) 3 km/hr
(C) 2 km/hr (D) 1 km/hr

15. A stationary body explodes into two fragments of masses m_1 and m_2. If momentum of one fragment is p, the minimum energy of explosion is

(A) $\frac{p^2}{2(m_1+m_2)}$ (B) $\frac{p^2}{2\sqrt{m_1m_2}}$

(C) $\frac{p^2(m_1+m_2)}{2m_1m_2}$ (D) $\frac{p^2}{2(m_1-m_2)}$

16. Two bodies of masses m and 4m are moving with equal linear momentum. The ratio of their kinetic energies is :

(A) 1 : 4 (B) 4 : 1

(C) 1 : 1 (D) 1 : 2

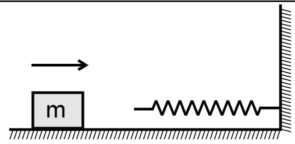
17. A man is in a moving train, then wrt train :
(A) his momentum must not be zero
(B) his kinetic energy is zero
(C) his kinetic energy is not zero
(D) his kinetic energy may be zero

18. Two blocks of masses m_1 and m_2 are connected by a massless spring and placed on smooth surface. The spring initially stretched and released. Then :
(a) the momentum of each particle remains constant separately
(b) the momentums of each body are equal
(c) the magnitude of momentums of each body are equal to each other
(d) the mechanical energy of system remains constant
(A) a and b are correct
(B) a, b and c are correct
(C) c and d are correct
(D) only c is correct

19. Which of the following is incorrect ?
(A) If centre of mass of three particles is at rest, and it is known that two of them are moving along different non parallel lines then the third particle must also be moving.
(B) If centre of mass remains at rest, then net work done by the forces acting on the system must be zero.
(C) If centre of mass remains at rest then net external force must be zero
(D) None of these statement is incorrect

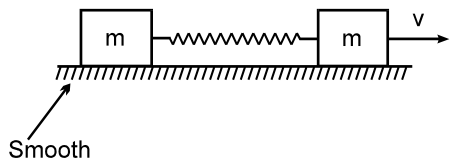
20. A body of mass 'M' collides against a wall with a velocity υ and retraces its path the same speed. The change in momentum is (take initial direction of velocity as positive) :
(A) zero (B) $2M\upsilon$
(C) $M\upsilon$ (D) $-2M\upsilon$

21. In the figure shown the magnitude of change in momentum of the block when it comes to its initial position if the maximum compression of the spring is x_0 will be :



(A) $2\sqrt{km}\,x_0$ (B) $\sqrt{km}\,x_0$
(C) zero (D) none of these

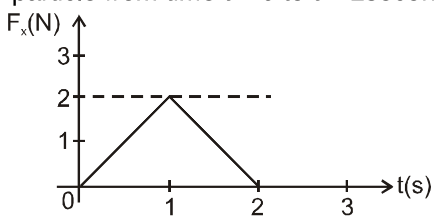
22. Two masses are connected by a spring as shown in the figure. One of the masses was given velocity v = 2 k, as shown in figure where 'k' is the spring constant. Then maximum extension in the spring will be



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

23. The area of F-t curve is A, where 'F' is the force on one mass due to the other. If one of the colliding bodies of mass M is at rest initially, its speed just after the collision is :
(A) A/M (B) M/A
(C) AM (D) $\sqrt{\frac{2A}{M}}$

24. The given figure shows a plot of the time dependent force F_x acting on a particle in motion along the x-axis. What is the total impulse delivered by this force to the particle from time t = 0 to t = 2second?



(A) 0 (B) 1 kg-m/s
(C) 2 kg-m/s (D) 3 kg-m/s

25. Two particles of masses m_1 and m_2 in projectile motion have velocities $\vec{u}_1$ and

$\vec{u}_2$ respectively at time t = 0. They collide at time t_0. Their velocities become $\vec{v}_1$ and $\vec{v}_2$ at time $2t_0$ while still moving in air. The value of $[(m_1\vec{v}_1 + m_2\vec{v}_2) - (m_1\vec{u}_1 + m_2\vec{u}_2)]$ is

(A) Zero
(B) $(m_1 + m_2)gt_0$
(C) $2(m_1 + m_2)gt_0$
(D) $\frac{1}{2}(m_1 + m_2)gt_0$

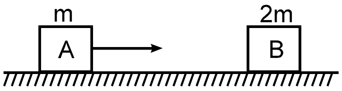
26. A super-ball is to bounce elastically back and forth between two rigid walls at a distance d from each other. Neglecting gravity and assuming the velocity of super-ball to be v_0 horizontally, the average force being exerted by the super-ball on one wall is :

(A) $\frac{1}{2}\frac{mv_0^2}{d}$ (B) $\frac{mv_0^2}{d}$
(C) $\frac{2mv_0^2}{d}$ (D) $\frac{4mv_0^2}{d}$

27. A body is moving towards a finite body which is initially at rest collides with it. In the absence of any external impulsive force, it is not possible that
(A) both the bodies come to rest
(B) both the bodies move after collision
(C) the moving body comes to rest and the stationary body starts moving
(D) the stationary body remains stationary, the moving body is changed its velocity.

28. In head on elastic collision of two bodies of equal masses, it is not possible :
(A) the velocities are interchanged
(B) the speeds are interchanged
(C) the momenta are interchanged
(D) the faster body speeds up and the slower body slows down

29. In the figure shown the block A collides head on with another block B at rest. Mass of B is twice the mass of A. The block A stops after collision. The co-efficient of restitution is :



(A) 0.5
(B) 1
(C) 0.25
(D) it is not possible

30. A completely inelastic collision is one in which the two colliding particles-
(A) Are separated after the collision.
(B) Remain together after the collision.
(C) Split into small fragments flying in all directions.
(D) None of the above.

31. Which of the following statements is true for collisions-
(A) Momentum is conserved in elastic collisions but not in inelastic collisions
(B) Total kinetic energy is conserved in elastic collisions but momentum is not conserved
(C) Total kinetic energy is not conserved in inelastic collisions but momentum is conserved
(D) Total kinetic energy and momentum both are conserved in all types of collisions

32. A bullet of mass m = 50 gm strikes a sand bag of mass M = 5 kg hanging from a fixed point, with a horizontal velocity $\vec{v}_p$. If bullet sticks to the sand bag then the ratio of final & initial kinetic energy of the bullet is (approximately) :
(A) 10^{-2} (B) 10^{-3}
(C) 10^{-6} (D) 10^{-4}

33. In an elastic collision of two particles the following is conserved :
(A) Momentum of each particle
(B) Speed of each particle
(C) Kinetic energy of each particle
(D) Total kinetic energy of both the particles

34. The coefficient of resitution e for a perfectly elastic collision is :
(A) 1 (B) 0 (C) ∞ (D) –1

35. For inelastic collision between two spherical rigid bodies :
(A) The total kinetic energy is conserved
(B) The linear momentum is not conserved
(C) The total mechanical energy is not conserved
(D) The linear momentum is conserved

(SECTION-B)

36. **STATEMENT-1 :** In an elastic collision between two bodies, the relative speed of the bodies after collision is equal to the relative speed before the collision.
because
STATEMENT-2 : In an elastic collision, the linear momentum of the system is conserved
(A) Statement-1 is True, Statement-2 is True; Statement-2 **is** a correct explanation for Statement-1
(B) Statement-1 is True,Statement-2 is True;Statement-2 **is NOT** a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True.

37. If the force on a rocket which is ejecting gases with a relative velocity of 300 m/s, is 210 N. Then the rate of combustion of the fuel will be :
(A) 10.7 kg/sec (B) 0.07 kg/sec
(C) 1.4 kg/sec (D) 0.7 kg/sec

38. A rocket with a lift-off mass 3.5×10^4 kg is blasted upwards with an intial acceleration of 10 m/s^2. Then the initial thrust of the blast is :
(A) 3.5×10^5 N (B) 7.0×10^5 N
(C) 14.0×10^5 N (D) 1.75×10^5 N

39. Two particles which are initially at rest, move towards each other under the action of their internal attraction. If their speeds are v and 2v at any instant, then the speed of centre of mass of the system will be
(A) 2v (B) zero
(C) 1.5 v (D) v

40. A mass m moving horizontally (along the x-axis) with velocity v collides and sticks to mass of 3m moving vertically upward (along the y-axis) with velocity 2v. The final velocity of the combination is :
(A) $\frac{1}{4}v\hat{i}+\frac{3}{2}v\hat{j}$ (B) $\frac{1}{3}v\hat{i}+\frac{2}{3}v\hat{j}$
(C) $\frac{2}{3}v\hat{i}+\frac{1}{3}v\hat{j}$ (D) $\frac{3}{2}v\hat{i}+\frac{1}{4}v\hat{j}$

41. A moving block having mass m, collides with another stationary block having mass 4m. The lighter block comes to rest after collision. When the initial velocity of the lighter block is v, then the value of coefficient of restitution (e) will be
(A) 0.5 (B) 0.4
(C) 0.8 (D) 0.25

42. **Assertion :** A sphere of mass m moving with speed u undergoes a perfectly elastic head on collision with another sphere of heavier mass M at rest (M > m), then direction of velocity of sphere of mass m is reversed due to collision [no external force acts on system of two spheres]
Reason : During a collision of spheres of unequal masses, the heavier mass exerts more force on lighter mass in comparison to the force which lighter mass exerts on heavier mass.
(A) If both assertion and reason are true and reason is the correct explanation of assertion.
(B) If both assertion and reason are true but reason is not the correct explanation of assertion.
(C) If Assertion is true but reason is false.

(D) If both assertion and reason are false.

43. Two persons of masses 55 kg and 65 kg respectively, are at the opposite ends of a boat. The length of the boat is 3.0 m and weighs 100 kg. The 55 kg man walks up to the 65 kg man and sits with him. If the boat is in still water the centre of mass of the system shifts by :
(A) 3.0 m (B) 2.3 m
(C) zero (D) 0.75 m

44. Two particles of mass 1 kg and 0.5 kg are moving in the same direction with speed of 2m/s and 6m/s respectively on a smooth horizontal surface. The speed of centre of mass of the system is :
(A) $\frac{10}{3}$ m/s (B) $\frac{10}{7}$ m/s
(C) $\frac{11}{2}$ m/s (D) $\frac{12}{3}$ m/s

45. The motion of the centre of mass of a system of two particles is unaffected by their internal forces :
(A) irrespective of the actual directions of the internal forces
(B) only if they are along the line joining the particles
(C) only if they are at right angles to the line joining the particles
(D) only if they are obliquely inclined to the line joining the particles.

46. The centre of mass of a solid cone along the line from the centre of the base to the vertex is at
(A) one-fourth of the height
(B) one-third of the height
(C) one-fifth of the height
(D) None of the above

47. A shell of mass m moving with velocity u suddenly breaks into 2 pieces. The part having mass m/4 remains stationary. The velocity of the other shell will be :
(A) u (B) 2u
(C) $\frac{3}{4}$u (D) $\frac{4}{3}$u

48. If two balls each of mass 0.06 kg moving in opposite directions with speed 4 m/s collide and rebound with the same speed, then the impulse imparted to each ball due to other is
(A) 0.48 kg-m/s (B) 0.24 kg-m/s
(C) 0.81 kg-m/s (D) Zero

49. A body of mass 5kg moving with velocity 10m/s collides with another body of the mass 20kg at rest and comes to rest. The velocity of the second body due to collision is
(A) 2.5 m/s (B) 5 m/s
(C) 7.5 m/s (D) 10 m/s

50. A gun fires a bullet of mass 50g with a velocity of 30msec–1. Because of this the gun is pushed back with a velocity 1m sec^{-1}. The mass of the gun is
(A) 15kg (B) 30kg
(C) 1.5kg (D) 20kg