EXERCISE-I

CALCULATION OF CENTRE OF MASS

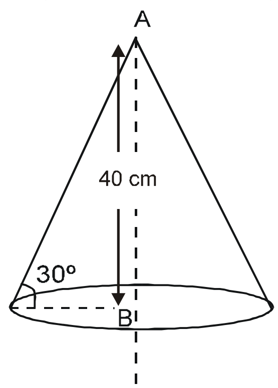
1. All the particles of a body are situated at a distance R from the origin. The distance of the centre of mass of the body from the origin is

(A) = R (B) ≤ R
(C) > R (D) ≥ R

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

(A) towards m (B) towards M
(C) between m and M (D) anywhere

3. A uniform solid cone of height 40 cm is shown in figure. The distance of centre of mass of the cone from point B (centre of the base) is :



(A) 20 cm (B) 10/3 cm
(C) 20/3 cm (D) 10 cm

4. In the HCl molecule, the separation between the nuclei of the two atoms is about 1.27 Å (A Å = 10^{-10} m). The approximate location of the centre of mass of the molecule, distance from hydrogen atom assuming the chlorine atom to be about 35.5 times massive as hydrogen is

(A) 1Å (B) 2.5 Å
(C) 1.24 Å (D) 1.5 Å

5. Two spherical bodies of mass M and 5M and radii R and 2R respectively are released in free space with initial separation between their centres equal to 12R. If they attract each other due to gravitational force only, then the distance covered by the smaller body just before collision is

(A) 1.5 R (B) 2.5 R
(C) 4.5 R (D) 7.5 R

6. The distance between the carbon atom and the oxygen atom in a carbon monoxide molecule is 1.1 Å. Given, mass of carbon atom is 12 a.m.u. and mass of oxygen atom is 16 a.m.u., calculate the position of the centre of mass of the carbon monoxide molecule

(A) 6.3 Å from the carbon atom
(B) 1 Å from the oxygen atom
(C) 0.63 Å from the carbon atom
(D) 0.12 Å from the oxygen atom

7. Three identical metal balls each of radius r are placed touching each other on a horizontal surface such that an equilateral triangle is formed, when centres of three balls are joined. The centre of the mass of system is located at

(A) Horizontal surface
(B) Centre of one of the balls
(C) Line joining centres of any two balls
(D) Point of intersection of the medians

8. 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

9. Choose the correct statement about the centre of mass (CM) of a system of two particles

(A) The CM lies on the line joining the two particles midway between them
(B) The CM lies on the line joining them at a point whose distance form each particle is inversely proportional to the mass of that particle
(C) The CM lies on the line joining them at a point whose distance from each particle is proportional to the square of the mass of that particle
(D) The CM is on the line joining them at a point whose distance from each particle is proportional to the mass of that particle

10. The centre of mass of a system of two particles divides the distance between them

(A) In inverse ratio of square of masses of particles

(B) In direct ratio of square of masses of particles

(C) In inverse ratio of masses of particles

(D) In direct ratio of masses of particles

11. A cricket bat is cut at the location of its centre of mass as shown. Them

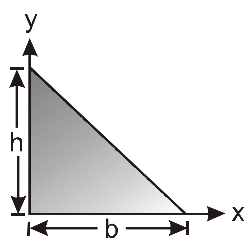
(A) The two pieces will have the same mass

(B) The bottom piece will have larger mass

(C) The handle piece will have larger mass

(D) Mass of handle piece is double the mass of bottom piece

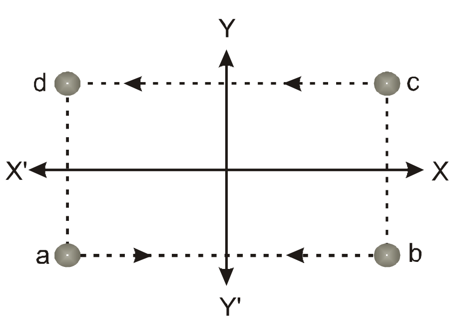
12. The centre of mass of triangle shown in figure has coordinates



(A) $x = \frac{h}{2}, y = \frac{b}{2}$ (B) $x = \frac{b}{2}, y = \frac{h}{2}$

(C) $x = \frac{b}{3}, y = \frac{h}{3}$ (D) $x = \frac{h}{3}, y = \frac{b}{3}$

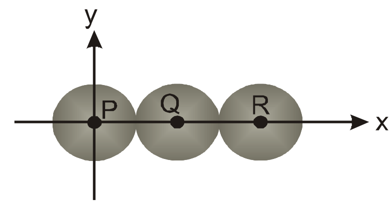
13. Four bodies of equal mass start moving with same speed as shown in the figure. In which of the following combination the centre of mass will remain at origin



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

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

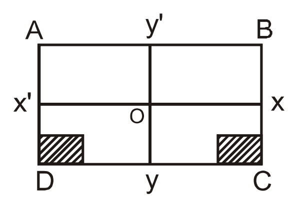
14. Three identical spheres, each of mass 1 kg are kept as shown in figure, touching each other, with their centres on a straight line. If their centres are marked P, Q, R respectively, the distance of centre of mass of the system from P (origin) is



(A) $\frac{PQ + PR + QR}{3}$ (B) $\frac{PQ + PR}{3}$

(C) $\frac{PQ + QR}{3}$ (D) $\frac{PR + QR}{3}$

15. A uniform square plate ABCD has a mass of 10 kg. If two point masses of 3 kg each are placed at the corners C and D as shown in the adjoining figure, then the centre of mass shifts to the point which is lie on -



(A) OC (B) OD

(C) OY (D) OX

MOTION OF CENTRE OF MASS

16. 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

17. Internal forces can change :

(A) the linear momentum but not the kinetic energy of the system.

(B) the kinetic energy but not the linear momentum of the system.

(C) linear momentum as well as kinetic energy of the system.

(D) neither the linear momentum nor the kinetic energy of the system.

18. If the external forces acting on a system have zero resultant, the centre of mass

(A) must not move (B) must accelerate

(C) may move (D) may accelerate

19. Two balls are thrown in air. The acceleration of the centre of mass of the two balls while in air (neglect air resistance)

(A) depends on the direction of the motion of the balls

(B) depends on the masses of the two balls

(C) depends on the speeds of the two balls

(D) is equal to g

20. 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

21. 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.

22. 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) $25\hat{i}-\frac{5}{7}\hat{j}$

23. 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 'kwU;

24. A 2 kg body and a 3 kg body are moving along the x-axis. At a particular instant the 2 kg body has a velocity of 3 ms^{-1} and the 3 kg body has the velocity of 2 ms^{-1}. The velocity of the centre of mass at that instant is

(A) 5 ms^{-1} (B) 1 ms^{-1}

(C) zero (D) None of these

25. Two bodies of masses 2 kg and 4 kg are moving with velocities 2 m/s and 10m/s respectively along same direction. Then the velocity of their centre of mass will be

(A) 8.1 m/s (B) 7.3 m/s

(C) 6.4 m/s (D) 5.3 m/s

26. Two particle of masses m_1 and m_2 initially at rest start moving towards each other under their mutual force of attraction. The speed of the centre of mass at any time t, when they are at a distance r apart, is

(A) Zero (B) $\left(G\frac{m_1m_2}{r^2}.\frac{1}{m_1}\right)t$

(C) $\left(G\frac{m_1m_2}{r^2}.\frac{1}{m_2}\right)t$ (D) $\left(G\frac{m_1m_2}{r^2}.\frac{1}{m_1+m_2}\right)t$

27. Two spheres of masses 2M and M are initially at rest at a distance R apart. Due to mutual force of attraction, they approach each other. When they are at separation R/2, the acceleration of the centre of mass of spheres would be

(A) 0 m/s^2 (B) g m/s^2

(C) 3g m/s^2 (D) 12g m/s^2

28. A body of mass 20 kg is moving with a velocity of 2ν and another body of mass 10 kg is moving with velocity V along same direction . The velocity of their centre of mass is

(A) 5ν/3 (B) 2ν/3
(C) ν (D) Zero

29. The two particles X and Y, initially at rest, start moving towards each other under mutual attraction. If at any instant the velocity of X is V and that of Y is 2V, the velocity of their centre of mass will be

(A) Zero (B) V
(C) 2V (D) V/2

30. Two bodies A and B have masses M and m respectively, where M > m and they are at a distance d apart. Equal force is applied to them so that they approach each other. The position where they hit each other is

(A) Nearer to B
(B) Nearer to A
(C) At equal distance from A and B
(D) Cannot be decided

31. Two particles whose masses are 10 kg and 30 kg and their position vectors are $\hat{i}+\hat{j}+\hat{k}$ and $-\hat{i}-\hat{j}-\hat{k}$ respectively would have the centre of mass at -

(A) $-\frac{(\hat{i}+\hat{j}+\hat{k})}{2}$ (B) $\frac{(\hat{i}+\hat{j}+\hat{k})}{2}$
(C) $-\frac{(\hat{i}+\hat{j}+\hat{k})}{4}$ (D) $\frac{(\hat{i}+\hat{j}+\hat{k})}{4}$

32. Two balls A and B of masses 100 gm and 250 gm respectively are connected by a stretched spring of negligible mass and placed on a smooth table. When the balls are released simultaneously the initial acceleration of B is 10 cm/sec^2 west ward. What is the magnitude and direction of initial acceleration of the ball A -

(A) 25 cm/sec^2 East ward
(B) 25 cm/sec^2 North ward
(C) 25 cm/sec^2 West ward
(D) 25 cm/sec^2 South ward

33. 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

34 A stone is projected with an initial velocity at some angle to the horizontal. A small piece separates from the stone before the stone reaches its maximum height. Then the piece will :

(A) fall to the ground
(B) fly horizontally initially and will then describe a parabolic path
(C) fly side by side with the parent stone along a parabolic path
(D) lag behind the parent stone increasing the distance from it.

35. Three particles with masses 10, 20 and 40gm are moving with velocities $10\hat{i}, 10\hat{j}$ and $10\hat{k}$ m/sec respectively. If due to some interaction the first particle comes to rest and the velocity of second becomes $(3\hat{i}+4\hat{j})$ m/sec. then the velocity of third particle after the interaction is-

(A) $\hat{i}+\hat{j}+5\hat{k}$ (B) $\hat{j}+10\hat{k}$
(C) $\hat{i}+\hat{j}+10\hat{k}$ (D) $\hat{i}+3\hat{j}+10\hat{k}$

CONSERVATION OF LINEAR MOMENTUM

36. If the KE of a body becomes four times its initial value, then the new momentum will be more than its initial momentum by;

(A) 50% (B) 100%
(C) 125% (D) 150%

37. A particle of mass 4m which is at rest explodes into three fragments. Two of the fragments, each of mass m are found to move with speed v each, in mutually perpendicular directions. The total energy released in the process of explosion is-

(A) 3mv^2/2 (B) mv^2
(C) 4mv^2 (D) 2mv^2

38. A bullet of mass m is being fired from a stationary gun of mass M. If the velocity of the bullet is v, the velocity of the gun is-

(A) $\frac{Mv}{m+M}$ (B) $\frac{mv}{M}$

(C) $\frac{(M+m)v}{M}$ (D) $\frac{M+m}{Mv}$

39. A bomb explodes in air in two equal fragments. If one of the fragments is moving vertically upwards with velocity v_0, then the other fragment is moving-

(A) Vertically up with velocity v_0

(B) Vertically downwards with velocity v_0

(C) In any arbitrary direction

(D) None of these

40. Two particles with equal kinetic energies are having masses in the ratio of 1 : 2. Then linear momenta will be in the ratio-

(A) 1 (B) 4

(C) 0.707 (D) 2

41. If a shell fired from a canon is exploded in air then-

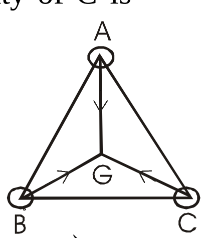
(A) Momentum decreases

(B) Momentum increases

(C) Kinetic energy increases

(D) K.E. decreases

42. Three particles A, B and C of equal mass move with equal speeds v along the medians of an equilateral triangle as shown in the figure. They collide at the centroid G of the triangle. After collision A comes to rest, B retraces its path with speed v. The velocity of C is-



(A) $\vec{v}$, direction $\vec{GA}$ (B) $2\vec{v}$ & direction GA

(C) 2v, direction $\vec{GB}$ (D) $\vec{v}$, & direction $\vec{BG}$

43. Under the effect of mutual internal attractions-

(A) The linear momentum of a system increases

(B) The linear momentum of a system decrease

(C) The linear momentum of the system is conserved

(D) The angular momentum increases

44. A ball of mass 3 kg collides with a wall with velocity 10 m/sec at an angle of 30° and after collision reflects at the same angle with the same speed. The change in momentum of ball in MKS unit is-

(A) 20 (B) 30

(C) 15 (D) 45

45. A particle is moving in X–Y plane under the action of a force $\vec{F}$ such that at some instant 't' the components of its linear momentum $\vec{p}$ are $p_x = 2\cos t$ and $p_y = 2\sin t$. At this instant the angle between and $\vec{F}$ and $\vec{p}$ is-

(A) 90° (B) 0°

(C) 180° (D) 30°

46. The kinetic energies of a lighter body and a heavier body are same. Then the value of momentum is-

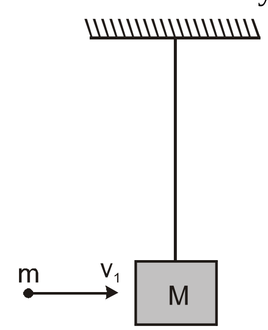
(A) Higher for lighter body

(B) Higher for heavier body

(C) Same for both

(D) Additional information is needed for replying this question

47. A bullet of mass m moving with a velocity v_1 strikes a suspended wooden block of mass M as shown in the figure and sticks to it. If the block rises to a height h the initial velocity of the bullet is



(A) $\frac{m+M}{m}\sqrt{2gh}$ (B) $\sqrt{2gh}$

(C) $\frac{M+m}{M}\sqrt{2gh}$ (D) $\frac{m}{M+m}\sqrt{2gh}$

48. If the mass and kinetic energy of a particle are m and E respectively, then the value of its momentum is-

(A) $\sqrt{mE}$ (B) $\sqrt{2mE}$

(C) $\sqrt{2E/m}$ (D) $\sqrt{2m/E}$

49. If a lighter body (mass M_1 and velocity V_1) and a heavier body (mass M_2 and velocity V_2) have the same kinetic energy, then-

(A) $M_2V_2 < M_1V_1$ (B) $M_2V_2 = M_1V_1$
(C) $M_2V_1 = M_1V_2$ (D) $M_2V_2 > M_1V_1$

50. A bomb of mass 12kg at rest explodes into two fragments of masses in the ratio 1 : 3. The K.E. of the smaller fragment is 216 J. The momentum of heavier fragment is (in kg-m/sec)-

(A) 36 (B) 72
(C) 108 (D) Insufficient data

51. A bomb is projected with 200m/s at an angle 60° with horizontal. At the highest point, it explodes into three particles of equal masses. One goes vertically upward with velocity 100m/sec, second particle goes vertically downward with the same velocity as the first. Then what is the velocity of the third one-

(A) 120 m/sec with 60° angle
(B) 200 m/sec with 30° angle
(C) 50 m/sec, in horizontal direction
(D) 300 m/sec, in horizontal direction

52. The law of conservation of energy implies that the-

(A) Total mechanical energy is conserved
(B) Total kinetic energy is conserved
(C) Total potential energy is conserved
(D) Sum of all kinds of energies is conserved

53. If the kinetic energy of a body becomes four times of its initial value, then new momentum will-

(A) Become twice its initial value
(B) Become three times, its initial value
(C) Become four times, its initial value
(D) Remains constant

54. A space craft of mass M is travelling in space with velocity v. It then breaks up into two parts such that the smaller part m comes to the rest, then the velocity of the remaining part is-

(A) $\frac{Mv}{M-m}$ (B) $\frac{Mv}{M+m}$
(C) $\frac{mv}{M-m}$ (D) $\frac{Mv}{m}$

55. A bomb at rest has mass 60 kg. It explodes and a fragment of 40 kg has kinetic energy 96 joule. Then kinetic energy of other fragment is-

(A) 180 J (B) 190 J
(C) 182 J (D) 192 J

56. On doubling the speed of an object its-

(A) K.E. is doubled
(B) P.E. is doubled
(C) Momentum is doubled
(D) Acceleration is doubled

57. Consider the following two statements-

(a) Linear momentum of a system of particle is zero
(b) kinetic energy of a system of particles is zero. Then

(A) a does not imply b but b implies a
(B) a implies b and b implies a
(C) a does not imply b & b does not imply a
(D) a implies b but b does not imply a

58. When a U^{238} nucleus originally at rest, decays emitting an alpha particle having a speed 'u', the recoil speed of the residual nucleus is-

(A) $\frac{4u}{234}$ (B) $-\frac{4u}{238}$
(C) $\frac{4u}{238}$ (D) $-\frac{4u}{234}$

59. 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-

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

60. A radioactive nucleus initially at rest decays by emitting an electron and neutrino at right angles to one another. The momentum of the electron is 3.2×10^{-23} kg-m/sec. and that of the neutrino is 6.4×10^{-23} kg-m/sec. The direction of the recoiling nucleus with that of the electron motion is-

(A) $\tan^{-1}$ (0.5) (B) $\tan^{-1}$ (B)
(C) $\pi - \tan^{-1}$ (B) (D) $\frac{\pi}{2} + \tan^{-1}$ (B)

SPRING - MASS SYSTEM

61. After falling from a height h a mass m compresses a spring of force constant k. The compression produced in the spring is :

(A) $(mgh/k)^{1/2}$ (B) $(Bmgh/k)^{1/2}$
(C) $(k/mgh)^{1/2}$ (D) $(Bk/mgh)^{1/2}$

62. With how much velocity a block of mass 2 kg should move on a frictionless surface so as to compress a spring with force constant 2 newton/meter by 4 meter:

(A) 4 m/s (B) 16 m/s
(C) 2 m/s (D) 8 m/s

63. A body of mass 8kg moving with a velocity of 2 m/sec comes to the rest, after compressing a spring placed on a frictionless table. If the spring constant is 5000N/m then compression produced in the spring shall be :

(A) 4 cm (B) 8 cm
(C) 16 cm (D) 32 cm

64. A mass of 2 kg falls from a height 0.4 m on a spring of force constant k = 1960 N/m. The maximum distance upto which the string can be compressed is:

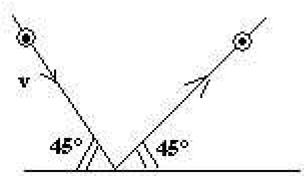
(A) 9 cm (B) 4.5 cm
(C) 12.6 cm (D) 6.3 cm

65. An object is attached to a vertical spring and slowly lowered to its equilibrium position. This stretches the spring by 10 cm. If the same object is attached to the same vertical spring but permitted to fall instead, the maximum distance upto which the spring can be stretched is :

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

IMPULSE

66. A body of mass M moving with a speed V collides on a surface at an angle 45 degree without changing its speed the change in momentum of the body will be-



(A) $MV(\hat{j}-\hat{i})$ (B) $MV(\hat{i}+\hat{j})$
(C) $2MV\hat{j}$ (D) $\sqrt{2}MV\hat{j}$

67. 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) $\sqrt{\frac{2A}{M}}$

68. A body of mass 0.5 kg is projected under gravity with a speed of 98 m/s at an angle of 60° with the vertical. The change in momentum [in magnitude] of the body when it returns on ground is-

(A) 24.5 N-s (B) 49.0 N-s
(C) 98.0 N-s (D) $49\sqrt{3}$ N-s

69. 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) $-2M\upsilon$

70. If two balls, each of mass 0.06 kg, moving in opposite directions with speed of 4m/s, collide and rebound with the same speed, then the impulse imparted to each ball due to other (in kg-m/s) is :

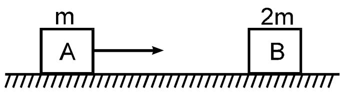
(A) 0.48 (B) 0.53
(C) 0.81 (D) 0.92

COLLISION

71. In a collision between two solid spheres, velocity of separation along the line of impact (assume no external forces act on the system of two spheres during impact) :

(A) cannot be greater than velocity of approach
(B) cannot be less than velocity of approach
(C) cannot be equal to velocity of approach
(D) none of these

72. 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

73. A sphere of mass m moving with a constant velocity hits another stationary sphere of the same mass. If e is the coefficient of restitution, then ratio of speed of the first sphere to the speed of the second sphere after collision will be :

(A) $\left(\frac{1-e}{1+e}\right)$ (B) $\left(\frac{1+e}{1-e}\right)$
(C) $\left(\frac{e+1}{e-1}\right)$ (D) $\left(\frac{e-1}{e+1}\right)$

74. A ball rebounds after colliding with the floor, then in case of inelastic collision-

(A) The momentum of the ball before and after collision is same
(B) The mechanical energy of the ball is conserved
(C) The total momentum of the earth-ball system is conserved
(D) The total kinetic energy of earth and ball is conserved

75. A ball is allowed to fall from a height of 8cm, if the ball is perfectly elastic, how much it rise after rebound-

(A) 8 cm (B) 1 cm
(C) 0.5 cm (D) 0

76. A particle of mass m_1 moving with a velocity of 5m/s collides head on with a stationary particle of mass m_2. After collision both the particle move with a common velocity of 4m/s, then the value of m_1/m_2 is-

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

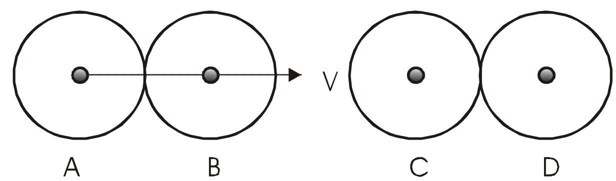
77. A body of mass m_1 collides head on elastically with a stationary body of mass m_2. If velocities of m_1 before and after the collision are v and –v/3 respectively then the value of m_1/m_2 is-

(A) 1 (B) 2
(C) 0.5 (D) 4

78. A sphere of mass 0.1 kg is attached to a cord of 1m length. Starting from the height of its point of suspension this sphere hits a block of same mass at rest on a frictionless table. If the impact is elastic, then the kinetic energy of the block after the collision is-

(A) 1 J (B) 10 J
(C) 0.1 J (D) 0.5 J

79. Two identical smooth spheres A and B are moving with same velocity and collides with similar spheres C and D, then after collision- (Consider one dimensional collision)



(A) D will move with greater speed
(B) C and D will move with same velocity v
(C) C will stop and D will move with velocity v
(D) All spheres A, B, C & D will move with velocity v/2

80. A ball is allowed of fall from a height 1.0 m. If the value of the coefficient of restitution is 0.6, then after the impact ball will go up to-

(A) 0.16 m (B) 0.36 m
(C) 0.40 m (D) 0.60 m

81. A ball of mass m moving with velocity v collides elastically with another ball of identical mass coming from the opposite direction with velocity 2v. Their velocities after collisions are-

(A) – v, 2v (B) – 2v, v
(C) v, – 2v (D) 2v, – v

82. A sphere of mass M moving with velocity u collides head on elastically with a sphere of mass m at rest. After collision their respective velocities are V and v. The value of v is-

(A) $2u\frac{M}{m}$ (B) $2u\frac{m}{M}$
(C) $\frac{2u}{1+m/M}$ (D) $\frac{2u}{1+M/m}$

83. A scooter of 40 kg mass moving with velocity 4 m/s collides with another scooter of 60 kg mass and moving with velocity 2 m/s. After collision the two scooters stic to each other the loss in kinetic energy-

(A) 392 J (B) 440 J
(C) 48 J (D) 110 J

84. Two spheres approaching each other collides elastically. Before collision the speed of A is 5m/s and that of B is 10m/s. Their masses are 1kg and 0.5kg. After collision velocities of A and B are respectively-

(A) 5 m/s –10 m/s (B) 10 m/s, –5 m/s
(C) –10 m/s, –5 m/s (D) –5 m/s, 10 m/s

85. After falling from a height h and striking the ground twice, a ball rise up to the height [e = coefficient of restitution]

(A) he (B) he^2
(C) he^3 (D) he^4

86. A metal ball of mass 2.0kg moving at 36km/hr collides with a stationary ball of mass 3.0kg. If after the collision both balls move together, the loss in kinetic energy will be-

(A) 40 J (B) 60 J
(C) 100 J (D) 140 J

87. A rubber ball is dropped from a height of 5m on a plane. On bouncing it rises to 1.8m. The ball loses its velocity on bouncing by a factor of-

(A) 16/25 (B) 2/5
(C) 3/5 (D) 9/25

88. One sphere collides with another sphere of same mass at rest inelastically. If the value of coefficient of restitution is 1/2, the ratio of their speeds after collision shall be-

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

89. A steel ball of radius 2cm is initially at rest on a horizontal frictionless surface. It is struck head on by another steel ball of 4 cm radius travelling with a velocity of 81 cm/s. The velocities of two balls after collision are-

(A) 72 cm/s and 56 cm/s
(B) 144 cm/s and 56 cm/s
(C) 144 cm/s and 63 cm/s
(D) 63 cm/s and 72 cm/s

90. 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

91. For a two particle collision, the following quantities are conserved in general-

(A) Kinetic energy
(B) Momentum
(C) Both kinetic energy and momentum
(D) Neither kinetic energy nor momentum

92. 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.

93. In a perfectly inelastic direct collision maximum transfer of energy takes place if-

(A) $m_1 >> m_2$ (B) $m_1 << m_2$
(C) $m_1 = m_2$ (D) $m_2 = 0$

94. Which of the following statement is true for collisions-

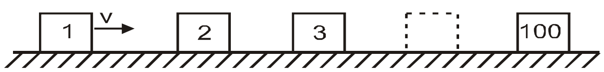
(A) Momentum is conserved in elastic collisions but not in inelastic collisions.
(B) Total K.E. is conserved in elastic collisions but momentum is not conserved.
(C) Total K.E. is not conserved in inelastic collisions but momentum is conserved.
(D) Total K.E. and momentum both are conserved in all types of collisions.

95. 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}

96. There are hundred identical sliders equally spaced on a frictionless track as shown in the figure. Initially all the sliders are at rest. Slider 1 is pushed with velocity v towards slider 2. In a collision the sliders stick together. The final velocity of the set of hundred stucked sliders will be :



(A) $\frac{v}{99}$ (B) $\frac{v}{100}$

(C) zero (D) v

97. The co-efficient of restitution depends upon-

(A) The masses of the colliding bodies

(B) The direction of motion of the coliding bodies

(C) The inclination between the colliding bodies

(D) The materials of the colliding bodies

98. 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

99. A body of mass M_1 collides elastically with another mass M_2 at rest. There is maximum transfer of energy when :

(A) $M_1 > M_2$

(B) $M_1 < M_2$

(C) $M_1 = M_2$

(D) Same for all values of M_1 and $M_2 M_1$ o M_2ds

100. Two putty balls of equal mass moving with equal velocity in mutually perpendicular directions, stick together after collision. If the balls were initially moving with a velocity of $45\sqrt{2}$ ms^{-1} each, the velocity of their combined mass after collision is :

(A) $45\sqrt{2}$ ms^{-1} (B) 45 ms^{-1}

(C) 90 ms^{-1} (D) $22.5\sqrt{2}$ ms^{-1}

101. The coefficient of resitution e for a perfectly elastic collision is :

(A) 1 (B) 0

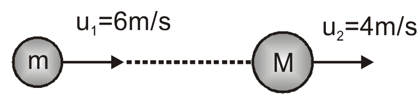
(C) ∞ (D) –1

102. Two perfectly elastic particles P and Q of equal mass travelling along the joining them with velocities 15m/sec. and 10 m/sec. After collision, their velocities respectively (in m/sec.) will be :

(A) 0,25 (B) 5,20

(C) 10, 15 (D) 20, 5

103. A particle of mass m moving with horizontal speed 6 m/sec. as shown in figure. If m << M then for one dimensional elastic collision, the speed of lighter particle after collision will be :



(A) 2 m/sec in original direction

(B) 2 m/sec opposite to the original direction

(C) 4 m/sec opposite to the original direction

(D) 4 m/sec in original direction

104. A body falls on a surface of coefficient of restitution 0.6 from a height of 1m. Then the body rebounds to a height of :

(A) 0.6 m (B) 0.4 m

(C) 1m (D) 0.36 m

105. A particle of mass m moving towards East with a velocity v collides with another particle of same mass moving towards North with the same speed and adheres to it. The velocity of the combined particle is-

(A) $v/\sqrt{2}$ along North-East

(B) $v/\sqrt{2}$ along North-West

(C) $\sqrt{2v}$ along North-East

(D) $\sqrt{2v}$ along North-West

VARIABLE MASS

106. A rocket with a life-off mass 3.5×10^4 kg is blasted upwards with an initial acceleration of 10 m/s^2. The initial thrust of the blast is-

(A) 14.0×10^5 N (B) 1.76×10^5 N

(C) 3.5×10^5 N (D) 7.0×10^5 N

107. Fuel is consumed at the rate of 100 kg/sec. in a rocket. The exhaust gases are ejected as a speed of 4.5×10^4 m/s. What is the thrust experience by the rocket-

(A) 3×10^6 N (B) 4.5×10^6 N

(C) 6×10^6 N (D) 9×10^6 N

108. A rocket of initial mass 6000 kg. ejects mass at a constant rate of 16 kg/sec. with constant relative speed of 11 km/sec. What is acceleration of the rocket, a minute after the blast-(Consider acceleration due to gravity g = 10msec^{-2})

(A) 28.3 m/sec^2 (B) 42 m/sec^2

(C) 34.9 m/sec^2 (D) 24.92 m/sec^2

109. A 6000 kg rocket is set for vertical firing. If the exhaust speed is 1000 m/sec. How much gas must be ejected each second to supply the thrust needed to give the rocket an initial upward acceleration of 20 m/sec^2- (consider g = 9.8 msec^{-2} acceleration due to gravity)

(A) 92.4 kg/sec (B) 178.8 kg/sec

(C) 143.2 kg/sec (D) 47.2 kg/sec

110. The rocket works on the principle of conservation of-

(A) Energy (B) Angular momentum

(C) Momentum (D) Mass