INDUS RANGERS INSTITUTE PVT. LTD

Centre of Mass, Collision & Impulse

1.A bomb of mass 10 kg, initially at rest explodes into two pieces of masses 4 kg and 8 kg .The speed of the 8 kg masses is 6 m/s. The Kinetic energy of the 4 Kg mass is

(a)32 J (b)48 J (c)114 J (d)288 J

2.A bomb of mass 1 kg at rest ,explodes into three fragments of masses in the ratio 1:1:3 .The two pieces of equal mass fly off perpendicular to each other with a speed of 30 m/s .What is the velocity of the heavier fragments?

(a) $10\sqrt{2}$ m/s at 45° with each of the other two fragments

(b) $10\sqrt{2}$ m/s at 135° with each other two fragments

(c)20 m/s at 45°with each other of the two fragments

(d)20 m/s at 135° with each of the other two fragments

3.In a elastic collision

(a)momentum is conserved but energy is not

(b)energy is conserved but momentum is not

(c)both momentum and energy are conserved

(d)neither momentum nor energy is conserved

4.A bullet hits and gets embedded in a solid block resting on a horizontal frictionless table. What is conserved?

(a)momentum and Kinetic energy

(b)momentum alone

(c)Kinetic energy

(d)neither momentum nor Kinetic energy

5.A shell is fired from a canon with a velocity v at an angle θ weigh the horizontal. At the highest point it explodes into two pieces of equal masses. One of the pieces retraces it path to the canon .The speed of the other piece immediately after the explosion is

(a)3v cosθ (b)2v cos θ (c)$\frac{3}{2}$ v cosθ

(d)v cosθ

6.A sphere has perfectly elastic oplique collision with another identical sphere which is initially at rest .The angel between their velocity after the collision

(a)30° (b)45° (c)60° (d)90°

7. In an inelastic collision :

(a)Kinetic energy is more after the collision

(b)Kinetic energy is less after the collision

(c)momentum is more after the collision

(d)momentum is less after the collision

8.Two particles ,each of mass m, moving in opposite direction with the equals speeds along the same straight line strike elastically .If the velocities of the first and the second particle before collision are denoted by +v and –v ,respectively ,then if there is no change in the line of motion of the two particles ,their velocities after collision are, respectively,

(a)-v and +v (b)+v and –v

(c)0 and 2v (d)2v and 0

9. A rocket works on the principle of conservation of

(a)mass (b)Linear momentum

(c)energy (d)angular momentum

10.A particle of mass m moving with a velocity $\vec{v}$ makes a head –on elastic collision with another identical particle which initially at rest. The velocity of the first after the collision is

(a)$-\vec{v}$ (b)$\vec{v}$ (c)$\frac{\vec{v}}{2}$ (d)zero

11. When a ball collides head –on and elastically with an identical ball on a horizontal frictionless surface, the first one comes to rest while the second one moves with the same velocity as that of the first ball before collision .The rest .

(a)Can be derived by using momentum conservation alone

(b)can be derived by using energy conservation alone

(c)cannot be derived by using any of the two conservation principles

(d)can be derived by using both conservation of energy and momentum

12. Two particles a and B ,initially at rest, move towards each other under a mutual force of attraction .At the instant when the speed of A is v and that of B is 2v,the speed of the centre of mass of the system is

(a)zero (b)v (c)1.5v (d)2 v

13.A ball is dropped from a height of 1m.If the coefficient of restitution between the surface and the ball is 0.6 ,the ball rebounds to a height of

(a)0.6m (b)0.4m (c)0.16m (d)0.36m

14.A bomb of mass M at rest explodes into three pieces two of which of mass M/4 each are thrown off in perpendicular directions with speeds of n3 m/s and 4 m/s. The third piece is thrown off with a speed

(a)1.5m/s (b)2.0m/s

(c)2.5m/s (d)3.0m/s

15.A block of mass 1 kg ,moving with a speed of 4m/s, collides with another block of mass 2 kg which is at rest .The lighter block comes to rest after collision .The loss in the Kinetic energy of the system is

(a)8 J (b)4 x10^{-7}J (c)4J (d)none of these

16.A ball ,moving with a speed towards north ,collides with an identical ball, moving with a speed v towards east .After collision the two balls stick together and move towards north-east. The speed of the combination is

(a)v (b)v$\sqrt{2}$ (c)v/$\sqrt{2}$ (d)v/2

17.A radiation nucleus of mass number A, initially at rest ,emits an a particle with speed v. The recoil speed of the daughter nucleus is

(a)$\frac{4v}{A-4}$ (b)$\frac{4v}{A}$

(c)$\frac{(A-4)v}{A}$ (d) $\frac{(A-4)v}{4}$

18.Two spheres of a masses M and 2M are initially at rest at a distance R apart .Due to mutual force of attraction thy approach each other .when they are at separate r/2 ,the acceleration of their centre of mass would be

(a)0 (b) gm /s²

(c)3gm/s² (d)12gm/s²

19.A bullet of mass m and velocity is fired into a large block of wood of mass M. The final velocity of the system is

(a)$\frac{M}{m+M}$ a (b)$\frac{m+M}{m}$ a

(c)$\frac{m+M}{M}$ a (d)$\frac{m}{m+M}$a

20.A 50 g bullet moving with velocity of 10 m/s strikes a block of mass 950 g at rest and gets embedded in it .The losses in Kinetic energy is

(a)100% (b)95%

(c)5% (d)50%

21. 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 particle

22.The coefficient of restitution for a perfectly elastic collision is

(a)1 (b)0 (c)∞ (d)-1

23.A railway truck of mass 2 X10^4 kg travelling at 0.5 m/s, collides with another truck of half its mass, moving in the opposite direction at 0.4 m/s. If the trucks couple automatically on collision ,their common velocity after collision is

(a)0.2m/s (b)0.47 m/s

(c)0.1 m/s (d)0.3m/s

24.In carbon monoxide molecules ,the carbon and the oxygen atoms are separated by a distance of 1.2 X 10^{-10}m. The distance of the centre of mass, from the carbon atom is

(a)0.48 X 10^{-10}m (b)0.51 X 10^{-10}m

(c)0.69 X 10^{-10}m (d)0.56 X 10^{-10}m

25.A metal ball of mass 2 kg ,moving with speed of 36 km/h, has a head –on collision with a stationary ball of mass 3 kg .If after the collision ,the two balls

move together ,the loss in K.E due to collision is

(a)40 J (b)60J (c)100J (d)140 J

26. Which of the following works on the conservation of linear momentum ?

(a)jet (b)aeroplane

(c)rocket (d)all of these

27.A ball of mass 100g falls from a height of 5m on a massive floor .At each bounce the speed of the ball is halved .Total momentum imparted by the ball to the floor, in Kg m/s ,is (g=10 m/s²)

(a)3 (b)2 (c)1 (d)0

28.A neutron ,moving with a velocity v, collides head-on with a stationary a-particle ,After collision the neutron moves with a velocity

(a)v/5 (b)v/4

(c)3v/4 (d)3v/5

29. An isolated particle of mass m is moving in a horizontal plane (x-y),along the x-axis ,at a certain height above the ground .It suddenly explodes into two fragments of masses m/4 and 3m/4.An instant later, the smaller fragments is at y=+15 cm. The larger fragments at this instant is at

(a)v=-5cm (b)v=+20cm (c)y=+5cm

(d)v=-20cm

30.Two equals masses m_1 and m_2 moving along the same straight line with velocities +3m/s and -5 m/s respectively collide elastically .Their velocities after the collision will be respectively

(a)+4 m/s for both (b)-4m/s and +4m/s

(c)-3m/s and +4 m/s (d)-5 m/s and +3 m/s