Solution of Questions For Short Answer

Chapter 9: Centre of Mass Linear Momentum Collision

Ans. 1.
Yes center of mass of a body may be outside the body for example in case of uniform ring center of mass of the ring is at the center of ring but not at the at the ring .

Ans. 2.
Yes in the case when all of particles are on same axis the center of mass would also lie on the same axis.

Ans. 3.
Yes in case cube is uniform in that case center of mass should be inside cube.

Ans. 4.
a) Center of charge can lie away from line segment joining two charges in case both charges are unequal and are of same charge. but eventually would lie on the axis joining two charges.
b) Yes in case all charge particles are in same plane the center of charge would lie on same plane.
c) Yes in case all charges are in cube in that case center of charge would lie on the same cube.

Ans. 6.
When car accelerates the ob lean backward to retain its rest position. But the tension in the string pulls the bob forward in direction of the motion of car. thus motion of the bob as seen from the ground is increasing in momentum. no its not violation of linear momentum law as there is an external force applied on the bob.

Ans. 7.
As the mass of iron trunk containing luggage would eventually be more than nearly equal to mass of 3 year old kid.
So when kid jumps on the platform the force required to move trunk backward (recoil) is not enough. so the trunk doesn't recoil.

Ans. 8.
It is not necessary that in a head on collision the particles would acquire same initial velocity it is possible in elastic collision but it is not necessary.

Ans. 9.
Velocity and mass are only two components that affect collision between two bodies so in this change in acceleration due to gravity will not affect the collision between two bodies. (if kept horizontally)

Ans. 10.
In case car is accelerated it would affect velocity of both bodies,
a) In this case the change in velocity would affect velocity of both bodies. (body moving in direction of car would slow down and other one moving in opposite direction would speed up in case car is accelerated)
b) Velocity of separation would be equal to velocity of approach. as only change would be in velocity but everything would remain same.
c) Yes final momentum would be still equal to initial momentum as with increase in velocity of one body the velocity of other body does decrease.

Ans. 12.
As linear momentum is known we can find its kinetic energy, as momentum is P =mv
and K.E. is 1/2 *mv^2 so K.E.=(P^2)/2m
and vice verse.

Ans. 13.
It would be less than r/2
as more of the mass is concentrated near center of the sphere so center of mass should be less than r/2

Ans. 14.
In case the cage is made of rods to let air pass the air displaced by bird to fly would pass and the weight of cage will be reduced in case of closed cage the air displaced by bird would remain inside the cage so cage would weigh same as it was before.

Ans. 15.
As the fat person moves on the plank he applies a force on plank to move forward as friction is more between feet of man and plank but lesser than plank and water, so as newton's third law as man moves the plank moves back as the plank is not feeling any friction from water the plank moves instead.

so actually the man is not moving forward he is pushing the plank backward and remains nealry at his own position.

Ans. 16.
The the man jumps over bar the shape of the body is like semicircle so the center of mass lies near about the center of the semicircle of the body of high jumper. if jumper just clears the bar it is possible that his center of mass may lie below bar.

Ans. 17.
The person sitting on right side of the figure is likely to fall
Because of moment of inertia of the body of person his upper body is still in rest but lower body that is in contact with seat due to friction may move forward (right) as center of mass may be at the center of body the man may fall towards left.

Ans. 18.
As in case linear momentum= mass* speed
As velocity is speed in linear motion (only difference between speed and velocity is that in velocity we consider displacement in linear motion displacement is equal to distance so here speed= velocity)
hence if no external force is applied linear momentum will be conserved. as linear momentum is conserved.

Ans. 19.
Yes in case of single particle the principle of conservation of linear momentum is justify.

Ans. 20.
Yes the force generated by engine accelerate the car.
The engine rotates the wheel of car and due to friction with road the car moves ahead.

Ans. 21.
Friction is responsible for reducing the speed of the ball so the ball slows down and finally stops after some distance.

Ans. 22.
In this case as friction is internal force,
The force applied by table offered to the ball is reason of decrease in momentum of the ball. (as Newton's third law as ball moves forward the table exerts some force on the ball that is in opposite direction)

Ans. 23.
Principle of conservation of momentum is applicable only for macro particles but not for atoms or molecules so principle of conservation of momentum may not be applicable in this case.

Ans. 24.
As it is explained in Q15 as the car is on friction-less part of road so the road would not offer any friction but the person inside the car have some friction w.r.t. car so if the person would move in backward direction due to Newton's third law of motion the car will move forward as recoil of motion of person and the engine will start.

Ans. 25.
No, it’s not possible as total momentum is to be constant thus if heavy body is at rest and light body is moving the light body will move back with same speed in opposite direction.
If a heavy body strikes a lighter body at rest the light body would start moving with double as velocity of heavy body but the heavy body would retain its velocity.