Chapter- 05

Laws of Motion

Very Short Answer Type Questions

01. A bus weighing 900kg is at rest on the bus stand. What is the linear momentum of the bus?
02. What are S.I units and C.G.S units of force? Define Kg wt.
03. If the force is acting on a moving body perpendicular to the direction of motion, then what will be its effect on speed and direction of the body?
04. Why an athlete runs some steps before taking jumps?
05. A ball of mass 1 kg with a speed of 10 m/s rebounds after striking normally on a perfect elastic wall. What is the change in momentum of the ball?
06. State Newton's 2^{nd} Law of motion
a) when mass is constant b) when velocity is constant.
07. Two bodies of different mass have the same linear momentum. Which one will move faster?
08. A batsman hits back a ball straight in the direction of bowler without changing its initial speed of 12 m/sec. If the mass of the ball is 0.15kg, find the impulse imparted to the ball for its linear motion?
09. What is magnitude and direction of the net force acting on (a) A car moving with cost vel. of 30 km/h on a rough rod. (b) A cork of mass 10 gm floating on water.
10. What do you mean by concurrent force?
11. Does a bomb explode in mid-air into two fragments what is the direction of motion of the two fragments?
12. What is the magnitude and direction of the net force acting on kite skillfully held stationary in the sky?
13. A force of 98 N as just able to move a body of weight 4.5 kg f on the rough horizontal surface. Find the coefficient of friction and angle of friction.
14. A hunter has a machine gun that can fire 50g bullets with a velocity of 150 m/s. A 60 kg trigger springs at him with a velocity of 10 m/s. How many bullets must the hunter fire into the trigger to stop him?
15. A body of mass 1 kg lies on a rough horizontal plane. A horizontal force of 15N produces an acceleration of $1m/s^2$ in the body. Find the coefficient of friction between the body and the table?

Short Answer Type Questions (2 marks each):

16. Show that Avg. force on bullets by a gun and vice versa when bullets are fired continuously is $F_{av} = mnv$
Where m $\rightarrow$ mass of each bullet,
n $\rightarrow$ no of bullets fired per sec.,
v $\rightarrow$ velocity of bullet w.r.t gun.

17. A batsman deflects a ball of 0.15 kg by an angle of 45^0 without changing its initial velocity 54 km/h. What is the impulse imparted to the ball?

18. Action and reaction are equal and opposite. Why cannot they cancel each other?

19. A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a speed of 15 ms^{-1}. How long does the body take to stop?

20. A woman stands on a spring scale on an elevator. In which case, will the scale record the minimum reading and the maximum reading?
(i) Elevator stationery
(ii) Elevator cable breaks free fall.
(ii) Elevator accelerating upwards
(iv) Elevator accelerating downwards

21. Two bodies of different masses m_1 and m_2 are falling from the same height. If resistance offered by the air be the same for both the bodies, when will they reach the earth simultaneously? Assume $m_1 > m_2$

22. A cubical block rests on an inclined plane of the coefficient of friction μ. Determine the angle of friction.

23. What is the angular velocity in radian/sec of a flywheel making 300 rpm?

24. A ball of 3cm diameter and 300g in weight is attached to the end of a string of 46cm length. If it is rotated uniformly in a horizontal circle at the rate of 15 reps, what is tension in the string? Take g =9.8m/s^2

25. What provides the centripetal force to a car taking a turn on a level road?

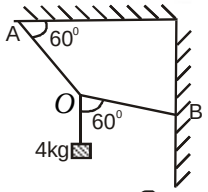
26. If both the speed of a body and radius of the circular path are doubled, what happens to centripetal force?

Short Answer Type Questions (3 marks each):

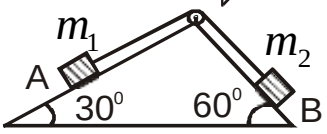
27. Define impulse and derive impulse-momentum relation.

28. A ship mass $3x10^7$kg and initially at rest can be pulled through a distance of 3m employing a force of $5x10^4$N. The water resistance is negligible. Find the speed attained by the ship.

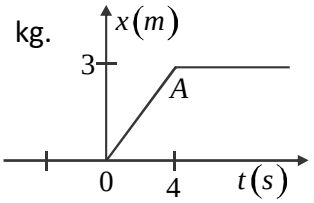
29. A block of mass 4kg is suspended as shown in fig. Find the tension in the string AO and OB.



30. Find the acceleration of blocks A and B connected by an inextensible string as shown in fig. Pulley is assumed to be frictionless. Given m_1=1kg, m_2=2kg.



31. This figure shows the position ~ time graph of a particle of mass 4 kg. What is the (a) Force on the particle for t<0, t>4s, 0<t<4 sec?
(b) Impulse at t = 0 and t = 4 sec for one dimensional motion.



32. A 20g bullet moving at 300 m/s stops after penetrating 3cm of bone.

Calculate the average force exerted by the bullet.

33. A string passes over a light smooth pulley with masses 4kg and 5kg attached to the ends of the string and hanging vertically. Find the acceleration either mass or the tension in the string.

34. A bob of a pendulum of mass 50g is suspended by a string with the roof of an elevator. If the lift is falling with a uniform accelerator of $5m/s^2$, find the tension in the string. Take $g=10m/s^2$.

35. A bomb at rest explodes into three fragments of equal masses. Two fragments fly off at a right angle to each other with velocities 9m/s and 12m/s respectively. Calculate the speed of the third.

Long Answer Type Questions (5 marks each):

36. State Newton's second law motion. Prove that Newton's 1^{st} law is contained in Newton's second law.

37. State and prove a law of conservation of linear momentum. Derive law of conservation of linear momentum from Newton's third law motion.

38. Derive an expression for the maximum velocity required for a car on a banked road by taking into account the force of friction for a safe turn.

39. What is the need for banking a road? Obtain an expression for the maximum speed with a vehicle can safely negotiate a curved road banked at an angle.

40. Obtain an expression for the speed with which a vehicle can negotiate a flat curved road.