Chapter- 05

Laws of Motion

Very Short Answer Type Questions

01. From which Newton's law of motion the definition of force comes?

02. A bus weighing 900kg is at rest on the bus stand. What is the linear momentum of the bus?

03. What are S.I units and C.G.S units of force? Define Kg wt.

04. 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?

05. What is the principle of rocket propulsion?

06. Why an athlete runs some steps before taking jumps?

07. 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?

08. State Newton's 2nd Law of motion
a) when mass is constant b) when velocity is constant.

09. What is the difference between absolute and gravitational units of force?

10. Two bodies of different mass have the same linear momentum. Which one will move faster?

11. 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?

12. 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.

13. Can a rocket operate in free space?

14. What do you mean by concurrent force?

15. Does a bomb explode in mid-air into two fragments what is the direction of motion of the two fragments?

16. What is the magnitude and direction of the net force acting on kite skillfully held stationary in the sky?

17. State the law of conservation of linear momentum.

18. 1kgf is how much newton?

19. What do you mean by a coefficient of kinetic friction?

20. Mention the unit of coefficient of friction.

21. Name the factors on which the coefficient of friction between two surfaces depends.

22. Why are rockets given a conical shape?

23. 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.

24. 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?

25. A body of mass 1 kg lies on a rough horizontal plane. A horizontal force of 15N produces an acceleration of $1 m/s^2$ in the body. Find the coefficient of friction between the body and the table?

26. Is frictional force conservative?

27. A body is sliding on a level road, what is the direction of the force of friction?

28. Why does a cricketer move his hands backwards when holding a catch?

Short Answer Type Questions (2 marks each):

29. Why do we beat carpet with a stick to remove dust particles?

30. Two bodies of unequal masses move with the same velocity. Which body has large momentum? Explain.

31. When the electric current is switch off the blade of the fan keep on moving for some time. Explain.

32. 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.

33. 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?

34. It is difficult to start a cycle than riding. Justify.

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

36. Why a gun recoils back when it is being fired?

37. It is more difficult to catch a cricket ball than to catch a tennis ball moving with the same velocity. Explain why?

38. 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?

39. Which is greater, the attraction of 1kg of load on the earth or attraction of the earth on 1kg of load?

40. 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

41. 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 $m_1 > m_2$

42. No force is required to move a body with constant velocity. Explain.

43. A cubical block rests on an inclined plane of μ= determine the angle of friction.

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

45. 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 =9.87

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

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

   Short Answer Type Questions (3 marks each):

48. Define impulse and derive impulse-momentum relation.

49. A ship mass 3×10^7 kg and initially at rest can be pulled through a distance of 3m employing a force of 5×10^4 N. The water resistance is negligible. Find the speed attained by the ship.

50. A block of mass 4kg is suspended as shown in fig. Find the tension in the string AO and OB.
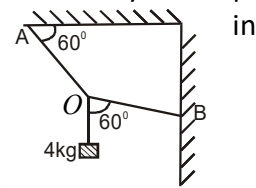
51. Find the acceleration of blocks A and B connected by an inextensible string as shown in fig. Pulley is assumed to be frictionless. Given m_1=1kg, m_2=2kg.
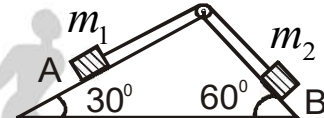
52. This figure shows the position ~ time graph of a particle of mass 4 kg. What is the (a) Force on the particle for t<0, t>4s, 0<t<4 sec? (b) Impulse at t = 0 and t = 4 sec for one dimensional motion.
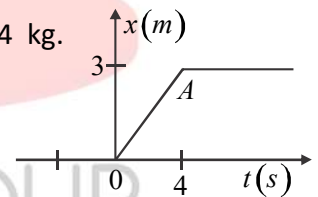
53. A 20g bullet moving at 300 m/s stops after penetrating 3cm of bone. Calculate the average force exerted by the bullet.

54. 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.

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

56. 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):

57. What is a force? What are the absolute and gravitational units of force in CGS system and S.I? system? How are the three different units related to each other?

58. State Newton's second law motion. Prove that Newton's second law is the real law of motion.

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

60. What is the limiting friction? State the laws of limiting friction.
61. Define the angle of friction and angle of repose and hence show that both are numerically equal.
62. 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.
63. 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.
64. Obtain an expression for the speed with which a vehicle can negotiate a flat curved road.