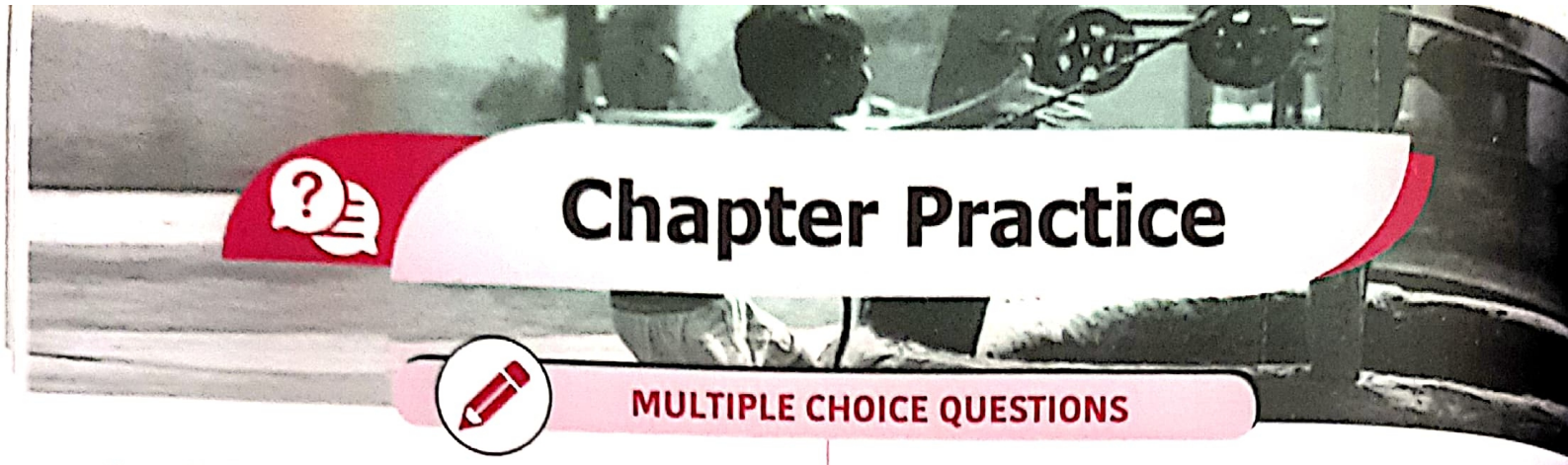


Chapter Practice

MULTIPLE CHOICE QUESTIONS

1. The inertia of an object tends to cause the object
   (a) To increase its speed
   (b) To decrease its speed
   (c) To resist any change in its state of motion
   (d) To decelerate due to friction

2. A passenger in a moving train tosses a coin which falls behind him. It means that motion of the train is
   (a) Accelerated (b) Uniform
   (c) Retarded (d) Circular Motion

3. The resultant force acting on a body is zero, then the
   (a) body is in equilibrium
   (b) body is not in equilibrium
   (c) body is moving with constant acceleration
   (d) body is stationary

4. Two objects of masses 1 kg and 2 kg are moving with velocities 2 m/s and 4 m/s, respectively. They collide and after collision the first object moves at a velocity of 1.67 m/s, the velocity of the second object is
   (a) 3.5 m/s (b) 4.2 m/s
   (c) 2.5 m/s (d) 0 m/s

5. If velocity of an object decreases with time, then it is called
   (a) retardation (b) deceleration
   (c) negative acceleration (d) all of the above

6. Jet plane works on the principle of conservation of
   (a) Energy (b) Momentum
   (c) Heat (d) Mass

7. A bullet of mass 10 g moving with a velocity of 400 m/s gets embedded in a freely suspended wooden block of mass 900 g. What is the velocity acquired by the block?
   (a) 4.4 m/s (b) 5.4 m/s
   (c) 6.4 m/s (d) 3.4 m/s

8. During a football match the ball shot towards the goal struck the defender's foot at the speed of 10 m/s and it bounces back at 20 m/s. If the time of impact was 0.2 s and mass of the ball is 0.5 kg then the average force exerted by defender on the ball will be
   (a) 65 N (b) 75 N
   (c) 70 N (d) 80 N

9. A car is moving with uniform velocity on a rough horizontal road. Therefore, according to Newton's first law of motion:
   (a) No force is being applied by its engine
   (b) A force is surely being applied by its engine
   (c) An acceleration is being produced in the car
   (d) The kinetic energy of the car is increasing

10. A ship of mass 3×10^7 kg initially at rest is pulled by a force 5×10^4 N through a distance of 3 m. Assume that the resistance due to water is negligible, the speed of the ship is
    (a) 1.5 m/s (b) 60 m/s
    (c) 0.1 m/s (d) 5 m/s

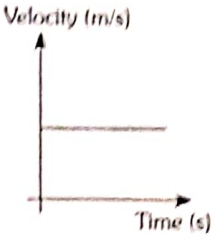
1 MARK QUESTIONS

1. Two similar vehicles are moving with the same velocity on the road such that one of them is loaded and the other one is empty. Which of the two vehicles will require larger force to stop it? Give reasons.
2. Name two effects a force can bring about other than moving or stopping a body.
3. If Newton's first law of motion holds good, why does a rolling football come to rest on its own?
4. State two factors which determine the momentum of a body.

2 MARKS QUESTIONS

1. What examples can you find around you to illustrate Newton's second law of motion?
2. "Road accidents occurring due to high speeds are much worse than accidents due to low speeds of vehicles. "
   Do you agree with this statement? Justify your answer.
3. Based on what you have learnt in this chapter, explain why glasswares are wrapped in straw during their transportation.
4. A bullet of mass 4 g when fired with a velocity of 50m/s can enter a wall up to a depth of 10 cm. How much will be the average resistance offered by the wall?
5. For how much time should a force of 200 N act on an object having mass 5 kg, so as to increase its velocity from 50 m/s to 100 m/s ?

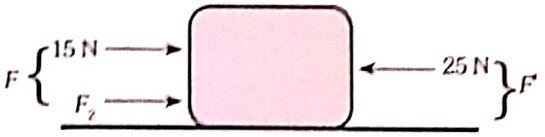
6. Velocity - time graph of a moving particle of mass 1 kg is shown in figure.



Is any force acting on the body? Justify your answer.

7. Name the physical quantity which corresponds to the rate of change of momentum.

8. If F and F' are balanced forces, then what will be the magnitude of F_2?

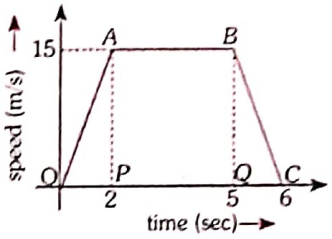


9. A water tanker filled upto $(2/3)^{rd}$ of its height is moving with a uniform speed. On sudden application of the brake, in which direction will the water in the tanker flow?

10. What would happen if a fielder stops the fast moving ball suddenly? Justify your answer.

3 MARKS QUESTIONS

1. The speed-time graph of a car is given. The car weighs 1000 kg.



(i) What is the distance travelled by the car in the first 2 s?

(ii) What is the braking force applied at the end of 5 s to bring the car to stop within one second?

2. A constant force of friction of 50 N is acting on a body of mass 200 kg moving initially with a speed of 15 m/s. How long does the body take to stop? What distance will it cover before coming to rest?

3. Give reasons for the following statements based on your knowledge of Newton's laws of motion.

(i) Water sprinkler used for grass lawns begins to rotate as soon as water is supplied.

(ii) Water drops are removed from wet clothes by giving a tight jerk to the cloth.

4. A rifle of mass 3 kg fires a bullet of mass 0.03 kg. The bullet leaves the barrel of the rifle at a velocity of 100 m/s. If the bullet takes 0.003 s to move through its barrel, then calculate the force experienced by the rifle due to its recoil.

5. How would you show your understanding of Newton's third law of motion? Give an example that you encounter in everyday life.

6. Two hockey players of opposite teams, while trying to hit a hockey ball on the ground, collide and immediately get entangled. One has a mass of 60 kg and was moving with a velocity of 5 m/s. The other has a mass of 55 kg and was moving with a velocity of 6 m/s towards the first player.

In which direction and with what velocity will they move after they become entangled? Assume that the frictional force acting between the feet of two players and ground is negligible.

7. An iron sphere of mass 1 kg is dropped from a height of 10 m. If the acceleration of the sphere is 9.8 m/s^2, then calculate the momentum transferred to the ground by the ball.

8. Two balls of the same size but of different materials, rubber and iron, are on the smooth floor of a moving train. The brakes are applied suddenly to stop the train, will the balls start rolling? If so, in which direction? Will they move with the same speed? Justify your answer.

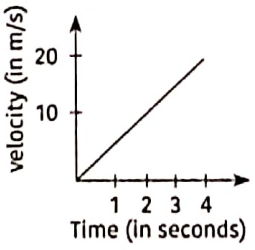
9. Look at the diagram below and answer the following questions:

(i) When a force is applied through the free end of the spring balance A, then the reading on the spring balance A is 15 g wt. What will be the measure of the reading shown by spring balance B?

(ii) Write the reason for your answer.

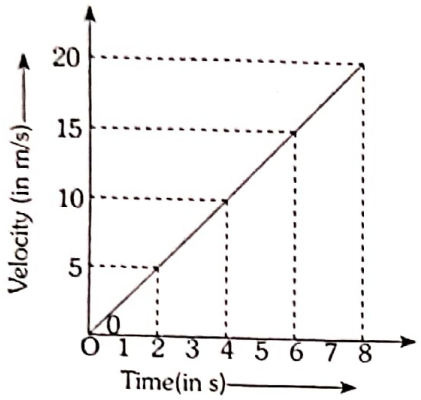
(iii) Name the force which balance A exerts on balance B and the force of balance B on balance A.

10. The velocity-time graph of a ball moving on a smooth surface is shown in the figure.



Calculate the force acting on the ball, if the mass of the ball is 100 g. What inference can you make about the motion of the ball from the graph?

11. The motion of a body of mass 5 kg is known in the velocity-time graph.



From the graph, find:

(i) Its acceleration.

(ii) The force acting on the body.

(iii) The change in momentum of the body 2 s after the start.

12. An isolated system consists of n particles. For this system:

(i) The momentum of each of the particles is conserved.

(ii) The individual momenta of the particles cannot increase or decrease.

(iii) The momentum of the whole system is conserved.

State whether each of the options are true or false. Justify your answers.

5 MARKS QUESTIONS

1. What is momentum? Write its SI unit. Interpret force in terms of momentum. Represent the following graphically:

(i) Momentum versus velocity when mass is fixed.

(ii) Momentum versus mass when velocity is constant.

2. Derive the unit of force using the second law of motion. A force of 5 N produces an acceleration of 8 m/s^2 on a mass m_1, and an acceleration of 24 m/s^2 on a mass m_2. What acceleration would the same force provide, if both the masses are tied together?

3. Based on what you know about Newton's laws of motion, explain the following:

(i) It is difficult to balance our body when we accidentally step on the peel of a banana.

(ii) Pieces of bursting crackers fall in all possible directions.

(iii) A glass pane of a window is shattered when a flying pebble hits it.

(iv) It is easier to stop a tennis ball than a cricket ball moving at the same speed.

(v) A javelin thrower is marked foul, if an athlete crosses over the line marked for the throw. Athletes often fail to stop themselves before the line.

4. (i) Explain why it is difficult to walk on sand.

(ii) Why is the recoil of a heavy gun, on firing, not so strong as that of a light gun using the same cartridge?

(iii) A constant force acts on an object of 5 kg for a period of 2 s. It increases the velocity of the object from 3 m/s to 7 m/s. Find the magnitude of the applied force.

Now, if the force was applied for a period of 5 s, then what would be the final velocity of the object?

5. A large truck and a car, both moving with a velocity of magnitude u, have a head on collision and both of them come to a halt after that. If the collision lasts for 1 s,

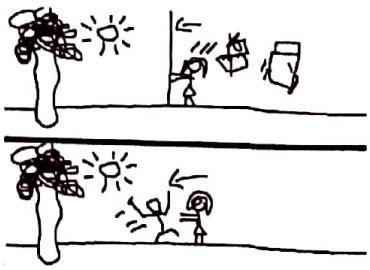
(i) Which vehicle experiences a greater force of impact?

(ii) Which vehicle experiences a greater change in momentum?

(iii) Which vehicle has a greater acceleration?

(iv) Why is the car likely to suffer more damage than the truck?

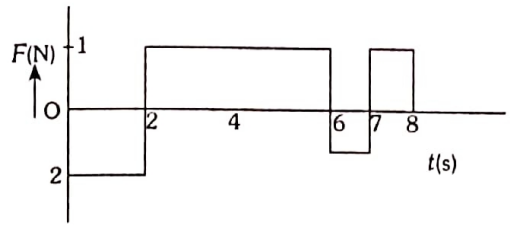
6. Consider the two scenarios shown below:



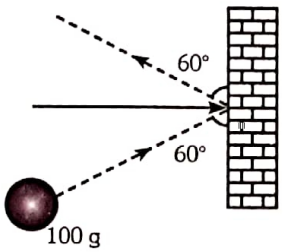
In the first case, the wall does not move even though we are applying an external force on it. In the second case, the person moves when pushed. Explain the two cases and mention if they obey or violate Newton's laws of motion.

HOTS QUESTIONS

1. A force-time graph for a linear motion of a body is shown in the figure. Find the change in linear momentum between 0 and 7 s.



2. A mass of 100 g strikes the wall with a speed of 5 m/s at an angle of 60° as shown in figure. It rebounds with the same speed. If the contact time is 2×10^{-3}s, then find the force applied by the wall on the mass.



3. Two particles A and B of masses 20 g and 30 g, respectively, rest at a certain time. Because of the force exerted by them on each other, the particles start moving. At a given instant, particle A is found to move towards the East with a velocity of 6 cm/s. What is the velocity of particles B at this instant?

4. An athlete always runs some distance before taking a jump. Why? Explain in detail.

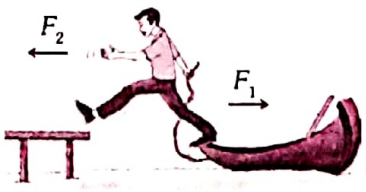
5. What would happen if there was no friction on the surface of the Earth?

6. Give three examples of phenomenons around you that illustrate each of Newton's laws of motion. (One example for each law)

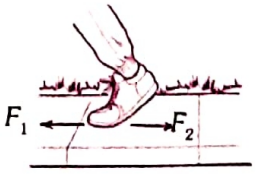
CASE BASED QUESTIONS

Read the following and answer the below questions from I (1 - 4)

Case I : The sailor and boat when a sailor is getting off a boat towards the shore he kicks the boat backwards and he moves in the forward direction. This is shown in the image below:



This is similar to the case when you push the ground with your feet and this allows you to move in the forward direction.



1. Choose the option which correctly mentions the action and reaction forces for the two cases.
   (a) Case 1: Action: F_1, Reaction: F_2
   Case 2: Action: F_1, Reaction: F_2
   (b) Case 1: Action: F_2, Reaction: F_1
   Case 2: Action: F_1, Reaction: F_2
   (c) Case 1: Action: F_1, Reaction: F_2
   Case 2: Action: F_2, Reaction: F_1
   (d) Case 1: Action: F_2, Reaction: F_1
   Case 2: Action: F_2, Reaction: F_1

2. If a man pushes the ground with a force of 110 N, what is the force exerted by the ground on the man?
   (a) 110 N (b) – 110 N
   (c) 55 N (d) – 55 N

3. Which equation correctly represents Newton's third law of motion?
   (a) $F_1 = -F_2$ (b) $F_1 = F_2$
   (c) $F_1 = F_2 = 0$ N (d) None of the above

4. Choose the correct statement.
   (a) Action and reaction always produce accelerations of equal magnitudes.
   (b) Action always produces an acceleration greater in magnitude than that produced by the reaction.
   (c) Reaction always produces an acceleration greater in magnitude than that produced by the action.
   (d) Action and reaction can produce accelerations of different magnitudes.

Read the following and answer any four questions from II (5 - 9)

Case II: Newton farther studied Galileo's ideas on force and motion and presented three fundamental laws that govern the motion of objects. These three laws are known as Newton's laws of motion. The first law of motion is stated as:

An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force.

In other words, all objects resist a change in their state of motion. In a qualitative way, the tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia. This is why, the first law of motion is also known as the law of inertia.

5. A football and a stone has same mass, then both will have
   (a) same inertia (b) same momentum
   (c) different inertia (d) different momentum

6. The inertia of a moving object depends on
   (a) mass of object (b) momentum of object
   (c) shape of object (d) speed of object

7. When a rubber ball held between hands is pressed, its shape changes. This happens because
   (a) balanced forces act on ball
   (b) unbalanced forces act on ball
   (c) frictional forces act on ball
   (d) gravitational force acts on ball

8. There are two statements
   A. Newton's first law is valid for the pilot in an aircraft which is taking off.
   B. Newton's first law is valid for the observer in a train moving with constant velocity.

   Which of the following is correct?
   (a) *A* only (b) *B* only
   (c) Both *A* and *B* (d) None of the above

9. A water tanker filled upto $(1/3)^{rd}$ of its height is moving with a uniform speed. On a sudden application of brakes, the water in the tank would
   (a) move backward (b) move forward
   (c) be unaffected (d) rise upwards

Read the following and answer any four questions from III (10 - 14)

Case IV: While catching a fast moving cricket ball, a fielder in the ground gradually pulls his hands backwards with the moving ball. In doing so, the fielder increases the time during which the high velocity of the moving ball decreases to zero.

Thus, the acceleration of the ball is decreased and therefore the impact of a catching the fast moving ball (see figure) is also reduced.

If the ball is stopped suddenly then its high velocity decreases to zero in a very short interval of time.

Thus, the rate of change of momentum of the ball will be large. Therefore, a large force would have to be applied for holding the catch that may hurt the palm of the fielder.

A fielder pulls his hands gradually with the moving ball while holding a catch

10. Why a fast moving cricket ball can cause more injuries to a cricketer than a moving tennis ball?
   (a) Due to large force (b) Due to large velocity
   (c) Both (a) and (b) (d) None of the above

11. Momentum of a bullet of mass 0.2 kg moving at 400 m/s will be
   (a) 4 kg m/s (b) 80 kg m/s
   (c) 8 kg m/s (d) 40 kg m/s

12. The unit of measuring momentum of moving body is
   (a) ms^{-1} (b) $kgms^{-1}$
   (c) $kgms^{-2}$ (d) Nm^2kg^{-2}

13. If the mass of a body and the force acting on it are both doubled, what happens to the acceleration?
   (a) doubled (b) halved
   (c) remains same (d) becomes zero

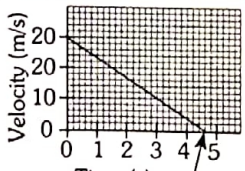
14. If the force acting on the body is zero, its momentum will be
   (a) zero (b) constant
   (c) infinite (d) variable

Read the following and answer any four questions from IV (15 - 19)

Case V: A car was travelling at 30 m/s. The driver applies brakes suddenly by seeing a running dog. The velocity-time (v-t) graph and its corresponding table during the time of applying brakes is shown below.

Velocity-time graph shows how the velocity of a body changes with passage of time. To draw velocity-time graph, velocity of the body is plotted along V-axis and the time taken by the body is plotted along X-axis. The area under velocity-time graph gives displacement.

Time	Velocity
0 (s)	30 m/s
1 (s)	23.5 m/s
2 (s)	17 m/s
3 (s)	11 m/s
4 (s)	5 m/s
4.8 (s)	0



Velocity-time (v-t) graph

15. The rate at which the velocity of a car decreases (deceleration) is

(a) 2.25 ms^{-2} (b) 6.25 ms^{-2}

(c) 7 ms^{-2} (d) 7.85 ms^{-2}

16. What is the magnitude of braking force, if the mass of the car is 900 kg?

(a) 5625 N (b) 6625 N

(c) 7025 N (d) 7625 N

17. Calculate the braking distance travelled by the car.

(a) 36 m (b) 60 m

(c) 72 m (d) 86 m

18. A constant force (F) is applied on a stationary particle of mass (m). The velocity attained by the particle after a certain displacement will be proportional to

(a) $\frac{1}{\sqrt{m}}$ (b) m

(c) $\frac{1}{m}$ (d) $\sqrt{m}$

19. The same net force is applied to object A and B. The observed accelerations of the two objects are not the same; object A has an acceleration three times that of object B. Which of the following is correct?

(a) Object A has three times the mass of object B.

(b) Object A has one-third mass of object B.

(c) Object A has a different, less streamlined shape than object B.

(d) Object A has more friction than object B.

❑❑❑

EXAM PRACTICE

NCERT QUESTIONS

1. Which of the following has more inertia?
   (i) A rubber ball and a stone of some size
   (ii) A bicycle and a train
   (iii) A five-rupees coin and a one -rupees coin
   Given reasons for your answer.

2. In the following example, try to identify the number of times the velocity of the ball changes.
   (i) A football player kicks a football to another player of his team
   (ii) who kicks the football towards the goal.
   (iii) The goalkeeper of opposite team collects the ball and kicks it towards a player of his own team.
   (iv) Also, identify the agent supplying the force in each case.

3. Explain, why some of the leaves may get detached from a tree, if we vigorously shake its branch?

4. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backwards when it accelerates from rest?

5. If action is always equal to the reaction then explain how a horse can pull a cart?

6. Explain, why is it difficult for a fireman to hold a hose-pipe, which ejects large amount of water with a high a velocity?

7. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35 m/s Calculate the initial recoil velocity of the rifle.

8. Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2 m/s, and 1 m/s, respectively . They collide and after collision, the first object moves at a velocity of 1.67 m/s. Determine the velocity of the second object.

9. An object experiences a net zero external unbalanced force. Is it possible for the object to be travelling with a non-zero velocity? If yes, state the conditions that must be placed on the magnitude and direction of the velocity. If no, provide a reason.

10. When a carpet is beaten with a stick, dust comes out of it. Explain.

11. Why is it advised to tie any luggage kept on the roof of a bus with a rope?

12. A batsman hits a cricket ball which then, rolls on a level ground. After covering a short distance, the ball comes to rest. Why does the ball slows down to stop?
   (a) The batsman did not hit the ball hard enough
   (b) Velocity is proportional to the force exerted on the ball
   (c) There is a force on the ball opposing the motion
   (d) There is no unbalanced force on the ball, so the ball would want to come to rest.

13. A truck starts from rest and down a hill with a constant acceleration. It travels a distance of 400 m in 20 s. Find its acceleration and the force acting on it, if its mass is 7 tonne.
   (**Hint:** 1 tonne = 1000kg)

14. A stone of size 1 kg is thrown with a velocity of 20 m/s across the frozen the surface of a lake and comes to rest after travelling a distance of 50 m. What is the force of friction between the stone and the ice?

15. A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction of 5000 N, then calculate
   (i) The net accelerating force.
   (ii) The acceleration of the train.
   (iii) The force of wagon 1 on wagon 2.

16. An automobile vehicle has a mass of 1500 kg. What must be the force between the vehicle and road, if the vehicle is to be stopped with a negative acceleration of 1.7 m/s^2?

17. What is the momentum of an object of mass m moving with a velocity v?
   (a) m^2v^2 (b) mv^2
   (c) $(1/2)\,mv$ (d) mv

18. Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor at a constant velocity. What is the friction force that will be exerted on the cabinet?

19. Two objects each of mass. 1.5 kg are moving in the same straight line but in opposite directions. The velocity of each object is 2.5 m/s before the collision during which they stick together. What will be the velocity of the combined object after collision?

20. According to the third law of motion when we push an object, the object pushes back on us with an equal and opposite force. If the object is a massive truck parked along the roadside, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other. Comment on this logic and explain why the truck does not move.

21. A hockey ball of mass 200 g travelling at 10 m/s is struck by a hockey stick, so as to return it along its original path with velocity at 5 m/s .Calculate the change of momentum occurred in the motion of the hockey ball by the force applied by the hockey stick.

22. A bullet of mass 10 g travelling horizontally with a velocity of 150 m/s strikes a stationary wooden block and comes to rest in 0 .03 s. Calculate the distance of penetration of the bullet into the block. Also, calculate the magnitude of the force exerted by the wooden block on the bullet.

23. An object of mass 1 kg travelling in a straight line with a velocity of 10 m/s collide with, and sticks to a stationary wooden block of mass 5 kg. Then they both move off together in the same straight line. Calculate the total momentum just before the impact and just after the impact. Also, calculate the velocity of the combined object.

24. An object of mass 100 kg is accelerated uniformly from a velocity of 5 m/s to 8 m/s in 6 s .Calculate the initial and final momentum of the object .Also, find the magnitude of the force exerted on the object.

25. Akhtar, Kiran and Rahul were riding on a motorcar that was moving with a high velocity on an expressway when an insect hit the windscreen. Akhtar and Kiran started pondering over the situation. Kiran suggested that the insect suffered a greater change in momentum as compared to the change in momentum of motorcar. Akhtar said that, since the motorcar was moving with largest velocity , it exerted a larger force on the insect and as a result insect died. Rahul while putting an entirely new explanation said that both motorcar and the insect experienced the same force and change in their momentum. Comment on these suggestions.

26. How much momentum will a dumb-bell of mass 10 kg transfer to the floor, if it falls from a height of 80 cm? Take, its downward acceleration to be 10 m/s^2.

27. The following is the distance-time table of an object in motion:

Time (in second)	Distance (in metre)
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343

(i) What conclusion can you draw about the acceleration? Is it constant, increasing and decreasing or zero?

(ii) What do you infer about the force acting on the object?

28. Two persons manage to push a motorcar of mass 1200 kg at an uniform velocity along a level road. The same motorcar can be pushed by three persons to produce an acceleration of 0.2 m/s^2 with what force does each person push the motorcar?(Assume that all person push the motorcar with the same muscular effort.)

29. A hammer of mass 500 g moving at 50 m/s strikes a nail. The nail stops the hammer in a very short time of 0.01 s. What is the force of the nail on the hammer?

30. A motorcar of mass 1200 kg is moving along a straight line with a uniform velocity of 90 km/h. Its velocity is slowed down to 18 km/h in 4 s by an unbalanced external force. Calculate the acceleration and change in momentum Also, calculate the magnitude of the force required.

COMPETENCY QUESTIONS
(FOR FOUNDATION, NTSE, OLYMPIAD QUESTIONS)

SECTION A MULTIPLE CHOICE QUESTIONS

DIRECTIONS: This section contains multiple choice questions. Each question has 4 choices (a), (b), (c) and (d) out of which only one is correct.

1. Friction forces act
   (a) in the direction of force applied
   (b) in the direction of the motion
   (c) in the direction opposite to the direction of motion
   (d) None of these

2. By applying a force of one Newton, one can hold a body of mass
   (a) 102 grams (b) 102 kg
   (c) 102 milligrams (d) None of these

3. The effect of frictional force may be minimized by
   (a) using a smooth object
   (b) using a smooth plane
   (c) providing a lubricant at the surface of contact
   (d) All of these

4 If a boat is moving along at constant speed, it may be assumed that
   (a) a net force is pushing it forward
   (b) the sum of only vertical forces is zero
   (c) the buoyant force is greater than gravity
   (d) the sum of all forces is zero

5. If A and B are two objects with masses 6 kg and 34 kg respectively, then
   (a) A has more inertia than B
   (b) B has more inertia than A
   (c) A and B have same inertia
   (d) None of the two has inertia

6. When a motorcar makes a sharp turn at a high speed, we tend to get thrown to one side because
   (a) we tend to continue in our straight line motion
   (b) an unbalanced force is applied by the engine of the motorcar changes the direction of motion of the motorcar
   (c) we slip to one side of the seat due to the inertia of our body
   (d) All of these

7. When a bus suddenly starts, the standing passengers lean backwards in the bus. It is an example of
   (a) Newton's first law (b) Newton's second law
   (c) Newton's third law (d) None of Newton's laws

8. Momentum has the same units as that of
   (a) couple (b) torque
   (c) impulse (c) force

9. When a force of Newton acts on a mass of 1 kg that is free to move, the object moves with a
   (a) speed of 1 m/s (b) speed of 1 km/s
   (c) acceleration of 10 m/s² (d) acceleration of 1m/s²

10. If an object experience a net zero unbalanced force, then the body
   (a) can be accelerated
   (b) moves with constant velocity
   (c) cannot remain at rest
   (d) None of these

11. Rate of change of momentum of an object is proportional to the
   (a) balanced force applied
   (b) applied unbalanced force in the direction of the force
   (c) time during which the force is applied
   (d) All of these

12. A book of weight 10 N is placed on a table. The force exerted by the surface of the table on the book will be
   (a) Zero (b) 10 N
   (c) 20 N (d) None of these

13. A moving object can come to rest only if it
   (a) has a frictional force acting on it
   (b) has no net force acting on it
   (c) is completely isolated
   (d) applies an impulse to something else

14. When a body is stationary -
   (a) There is no force acting on it
   (b) The force acting on it not in contact with it
   (c) The combination of forces acting on it balances each other
   (d) The body is in vacuum

15. Which of the following mathematical formulations are not correct?
   (a) $F = kma$ (b) $p = mv$
   (c) $Ft = mv - mu$ (d) $F / t = m(v - u)$

16. A rider on horse falls back when horse starts running, all of a sudden because
   (a) rider is taken back
   (b) rider is suddenly afraid of falling
   (c) inertia of rest keeps the upper part of body at rest while lower part of the body moves forward with the horse
   (d) None of the above

17. A man getting down a running bus, falls forward because
   (a) due to inertia of rest, road is left behind and man reaches forward
   (b) due to inertia of motion upper part of body continues to be in motion in forward direction while feet come to rest as soon as they touch the road
   (c) he leans forward as a matter of habit
   (d) of the combined effect of all the three factors stated in (i), (ii) and (iii)

18. A force 10 N acts on a body of mass 20 kg for 10 sec. Change in its momentum is
   (a) 5 kg m/s (b) 100 kg m/s
   (c) 200 kg m/s (c) 1000 kg m/s

19. Force required in accelerating a 2 kg mass at 5 m s^{-2} will be
   (a) Lesser than the force required in accelerating a 4 kg mass at 2 ms^{-2}
   (b) Greater than the force required in accelerating a 4 kg mass at 2 ms^{-2}
   (c) Same as the force required in accelerating a 4 kg mass at 2 ms^{-2}
   (d) None of these

20. Swimming is possible on account of
   (a) Newton's 1st law of motion
   (b) Newton's 2nd law of motion
   (c) Newton's 3rd law of motion
   (d) Newton's law of gravitation

21. A man is at rest in the middle of a pond on perfectly smooth ice. He can get himself to the shore by making use of Newton's
   (a) First law (b) Second law
   (c) Third law (d) all the laws

22. A parrot is sitting on the floor of a closed glass cage which is in a boy's hand. If the parrot starts flying with a constant speed, the boy will feel the weight of the cage as

(a) unchanged (b) reduced
(c) increased (d) nothing can be said

23. A force of 10 N gives a mass m_1 an acceleration of 5 ms^{-2} and a mass m_2 an acceleration of 15 ms^{-2}. If the two masses are tied together, the acceleration will become

(a) 20 ms^{-2} (b) 10 ms^{-2}
(c) 3.75 ms^{-2} (d) 2 ms^{-2}

24. A cannon after firing recoils due to -

(a) conservation of energy
(b) backward thrust of gases produced
(c) Newton's third law of motion
(d) Newton's first law of motion

25. Newton's third law of motion leads to the law of conservation of-

(a) angular momentum (b) energy
(c) mass (d) momentum

26. The force of friction acting on a car on different roads in the increasing order of magnitude will be

(a) mud, tar, concrete and gravel roads
(b) tar, concrete, gravel and mud roads
(c) concrete, tar, gravel and mud roads
(d) gravel, mud, tar and concrete roads

27. A force acts for 10 s on a body of mass 10 g, after which the force ceases to act. The body travels a distance of 50 cm in the next 5 seconds. The magnitude of the applied force is

(a) 10^{-4} N (b) 100 N
(c) 10 N (d) None of these

28. A fish is swimming upward at an angle of 30° with the horizontal. The direction of the force of gravity acting on it is–

(a) upward (b) downward
(c) horizontal (d) at an angle upward

29. A certain force exerted for 1.4 seconds on a moving body increases its speed from 2.8 m/s to 5.6 m/s. If the same force is later applied for 3 seconds, the speed of the body changes by

(a) 11.2 m/s (b) 8.2 m/s
(c) 6 m/s (d) 11.6 m/s

30. Two blocks of mass 4 kg and 6 kg are placed in contact with each other on a frictionless horizontal surface. A push of 5 N is applied on a heavier mass. The force on the lighter mass will be

(a) 3 N (b) 2 N
(c) 5 N (d) 50 N

31. Rockets work on the principle of conservation of

(a) energy (b) mass
(c) momentum (d) All of these

32. A person is standing in an elevator. In which situation he finds his weight less than actual when –

(a) The elevator moves upward with constant acceleration.
(b) The elevator moves downward with constant acceleration
(c) The elevator moves upward with uniform velocity
(d) The elevator moves downward with uniform velocity

33. In which of the following examples is a net force of zero acting on the object in question?

I. A car drives around a circular racetrack at a constant speed
II. A person pushes on a door to hold it shut
III. A ball, rolling across a grassy field, slowly comes to a stop

(a) I only
(b) II only
(c) III only
(d) I and II only

34. When a bus suddenly takes a turn, the passengers are thrown outwards because of -

(a) inertia of motion
(b) acceleration of motion
(c) speed of motion
(d) Both (ii) and (iii)

SECTION B MATCHING BASED MCQ

DIRECTIONS (Qs.36 to 37): Match Column-I with Column-II and select the correct answer using the codes given below the columns.

35.

Column-I		Column-II	
(A)	Force	(p)	kg ms^{-1}
(B)	Momentum	(q)	newton
(C)	Impulse	(r)	kg
(D)	Mass	(s)	ms^{-2}
(E)	Acceleration	(t)	Force × time

(a) (A) - (q); (B) - (p); (C) - (t); (D) - (r); (E) - (s)
(b) (A) - (p); (B) - (q); (C) - (t); (D) - (r); (E) - (s)
(c) (A) - (q); (B) - (t); (C) - (p); (D) - (r); (E) - (s)
(d) (A) - (q); (B) - (t);(C) - (p); (D) - (s); (E) - (r)

36.

Column-I		Column-II	
(A)	Newton first law	(p)	Qualitative definition of force
(B)	Newton second law	(q)	Qualitative definition of force
(C)	Newton third law	(r)	Oppose relative linear motion
(D)	Friction force	(s)	Define nature of force

(a) (A) - (q); (B) - (p); (C) - (s); (D) - (r)
(b) (A) - (p); (B) - (q); (C) - (s); (D) - (r)
(c) (A) - (q); (B) - (s); (C) - (p); (D) - (r)
(d) (A) - (q); (B) - (p); (C) - (r); (D) - (s)

SECTION C STATEMENT BASED MCQ

37. Consider the following statements:

(i) Particle of different masses falls with different acceleration on earth.
(ii) Particle is at rest, it force is zero.
(iii) Particle moves in the direction of force.
(iv) If particle is initially at rest then it moves in direction of net force.

Which of these statement(s) is/are correct?

(a) (i), (ii) and (iv) (b) (iii) and (iv)
(c) Only (iv) (d) Only (iii)

38. Consider the following statements:

(i) It is easier to start motion in a lighter body than a heavier body.
(ii) The product of the mass of a body and its velocity is called inertia.

Which of these statement(s) is/are correct?

(a) (i) only (b) (ii) only
(b) Both (i) and (ii) (d) Neither (i) nor (ii)

39. Consider the following statements:

(i) A rocket can propel itself in a vacuum.
(ii) Momentum is never created nor destroyed

Which of these statement(s) is/are correct?

(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

40. Consider the following statements:

(i) Action and reaction act on the same body.
(ii) Volume is a measure of the inertia of a body.

Which of these statement(s) is/are correct?

(a) (i) only (b) (ii) only
(c) Both (i) and (ii) (d) Neither (i) nor (ii)

SECTION D PASSAGE BASED MCQ

DIRECTIONS (Qs. 42 to 44): Read the passage(s) given below and answer the questions that follow.

Passage-1

A physicist is investigating the effect that different conditions have on the force of friction. The material used is an ordinary brick, with a mass of 1.8 kg. It is pulled across the surface of a wooden table. Friction is measured by pulling the brick with a string attached to a spring scale, calibrated in newtons (N). When the brick is pulled at constant speed, the reading on the scale is equal to the force of friction between the brick and the table top.

Experiment 1: The brick is placed on the table in three different positions. First, it is allowed to rest on its broad face (area=180cm²), then on its side (area=130cm²), and finally on its end (area = 56 cm²).

Table 1

Area (cm²)	180	130	25
Friction (N)	7.1	7.3	7.2

Experiment 2: A wooden block of mass 0.6 kg is made to the same dimensions as the brick, and the experiment is repeated.

Table 2

Area (cm²)	180	130	56
Friction (N)	1.2	1.1	1.2

Experiment 3: This time, the wooden block is loaded by adding 1.2 kg of extra mass on top of it, to give it the same weight as the brick.

Table 3

Area (cm²)	180	130	56
Friction (N)	3.5	3.6	3.7

41. From Experiment 1, it would be reasonable to hypothesize that:

(a) the surface area of contact does not affect the amount of friction.
(b) friction is large in a brick-to-wood contact.
(c) the amount of friction depends on the way the weight of the object is distributed.
(d) heavy objects have more friction than light ones.

42. Which combination of experiments shows that the amount of friction depends on the weight of the object?

(a) Experiment 1 and Experiment 2
(b) Experiment 1 and Experiment 3
(c) Experiment 2 and Experiment 3
(d) Experiment 1, Experiment 2, and Experiment 3

43. In doing Experiment 3, what was the purpose of adding enough weight to the wooden block to make its weight equal to that of the brick?

(a) To test the hypothesis that adding weight increases friction

(b) To find the relationship between surface area of contact and friction

(c) To find out whether the density of the material influences the amount of friction

(d) To control other factors and test the effect of the nature of the materials in contact

SECTION E ASSERTION REASON BASED MCQ

DIRECTIONS (Qs.45 to 47): Following questions consist of two statements, one labelled as the 'Assertion' and the other as 'Reason'. You are to examine these two statements carefully and select the answer to these items using the code given below.

Codes:

(a) Both A and R are individually true and R is the correct explanation of A:

(b) Both A and R are individually true but R is not the correct explanation of A.

(c) A is true but R is false

(d) A is false but R is true.

44. **Assertion:** A body is momentarily at rest when it reverses the direction.

Reason: A body cannot have acceleration if its velocity is zero at a given instant of time.

45. **Assertion:** Force exerted by the ground on the man moves him forward.

Reason: It is a reaction force.

46. **Assertion:** While walking on ice, one should take small steps to avoid slipping.

Reason: This is because smaller steps ensure smaller friction.

SECTION F CORRECT DEFINITION BASED MCQ

47. Inertia is

(a) natural tendency of an object to resist a change in its state of rest.

(b) natural tendency of an object to resist a change in its state of motion.

(c) measure of mass of an object.

(d) tendency of an object to resist a change in its state of motion.

SECTION G FEATURE BASED MCQ

48. On the basis of following features identify the correct option.

(i) It is measured in units of kg m/s.

(ii) Its direction is same as that of velocity of body.

(a) Momentum (b) Inertia

(c) Both (i) and (ii) (d) Neither (i) nor (ii)

48. On the basis of following features identify the correct option.

(i) A body tends to retain its state of motion when any force is applied.

(ii) Athelete runs fast before making the jump.

(a) Inertia of rest (b) Inertia of direction

(c) Inertia of motion (d) Both (i) and (ii)

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