QUESTION BANK

EXERCISE - 1

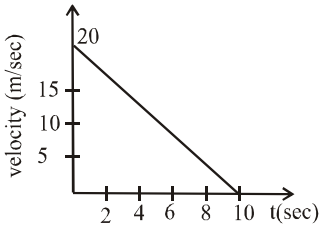
Q.1 What determines the inertia of the body.
Q.2 Give one example of inertia of motion.
Q.3 State Newton's third law.
Q.4 What do you understand by a resultant force ? Explain with an example.
Q.5 Define impulses and prove that it is equal to change in momentum.
Q.6 Explain Newton first law with the help of Newton's second law of motion.
Q.7 Give any two examples of Newton's third law of motions?
Q.8 A ship of mass 3×10^7 kg initially at rest is pulled through a distance of 3m by a force of 5×10^4 N. If the friction due to water is negligible, calculate the speed of the ship ?
Q.9 The momentum of a student riding a bicycle (including bicycle) is 400 kg m/sec. The bicycle moves with a velocity of 5 m/sec. Calculate the combined mass of the student and the bicycle.
Q.10 Some force produces an acceleration of 2 m/s² when is applied to a body of mass 5 kg. What will be the acceleration of a body when it is subjected to the same force ? Determine the magnitude of force, also.
Q.11 A young boy drives his motor-cycle with a velocity of 72km/hr. and it takes 4s to come to a stop after the brakes are applied. What is the force exerted by brakes on the motorcycle if the mass of the motor cycle alongwith the rider is 200 kg.
Q.12 A javelin throw is marked foul if the athlete crosses over the line marked for the throw. Explain why athletes often fail to stop themselves before that line ?
Q.13 If action is always equal to the reaction, explain why a cart pulled by a horse can be moved.
Q.14 Why is it difficult to balance our body when we accidentally step on a peel of banana ?
Q.15 In oil tankers some space is left at the top while filling them. Explain, why ?
Q.16 Why it is advised to tie the luggage with a rope on the roof of buses ?
Q.17 Explain, why a glass pan of a window is shattered when a flying pebble hits it ?
Q.18 A cricket player while catching a ball pulls his hands backwards with the ball, why ?
Q.19 Why does a player run some distance before making a jump in some event of long/high jump ?
Q.20 When a moving bus stops suddenly, a passenger standing in the bus falls forward, why ?
Q.21 A person is standing on ice at the centre of a frozen lake. What should be do to reach the shore ?
Q.22 Explain on the basis of the third law of motion that how are we able to walk on ground ?
Q.23 Name and state the action and reaction in the following cases ; (a) firing of a bullet from a gun, (b) hammering a nail, (c) a book lying on a table, (d) moving rocket, (e) a person moving on the floor, and (f) a moving train colliding with a stationary train.
Q.24 Show that the rate of change of momentum = mass × acceleration.
Q.25 Explain the following :
(a) When a train suddenly moves forward, the passenger standing in the compartment tends to fall backwards.
(b) People often shake a tree for getting down the fruits.
(c) After alighting from a moving bus, one has one has to run for some distance in the direction of bus in order to avoid falling. **(d)** Dust particles are removed from a carpet by beating it.
Q.26 When you step ashore from a rowing boat, it tends to leave the shore.

EXERCISE - 2

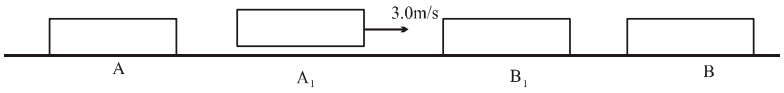
Q.1 A bullet of mass 10g is fired with a rifle. The bullet takes 0.003s to move through its barrel and leaves it with a velocity of 300 m/s. What is the force exerted on the bullet by the rifle ?
Q.2 A girl of mass 40 kg jumps with a horizontal velocity of 5m/s onto a stationary cart with frictionless wheels. The mass of the cart is 3 kg. What is her velocity as the cart starts moving ? Assume that there is no external unbalanced force working in the horizontal direction.

Q.3 A motor car 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 4s by an unbalanced external force. Calculate the acceleration and change in momentum. Also calculate the magnitude of the force required.

Q.4 The velocity time graph of a toy rolling over marble floor in a straight line, of the mass of the car is 20g. How much force does marble exert on the car to bring it to rest.



Q.5 Two small magnets are placed at a point A and B on a frictionless horizontal table there masses are 20g respectively. The magnets are released and move on the table due to mutual attraction when the first magnet reaches point A_1 its speed is found 3.0 m/sec. Find the velocity of the other magnet at this instant.



Q.6 A student pulls a box of books on a smooth horizontal floor with a force of 100 N in a direction of 37° above the horizontal surface. If the mass of the box and the books is 40.0 kg, what is the acceleration of the box and the normal force on the box by the floor ?

Q.7 In physics, the concept force is used to describe how the acceleration of a particle is affected by its interactions with other objects. According to its definition, the force $\vec{F}$ exerted on a particle, by one or more other objects is a quantity which depends on the properties of all the interacting objects. It is related to the acceleration $\vec{a}$ of the particle so that $\vec{F} = m\vec{a}$.

Force is a very important concept in physics and has a meaning somewhat different from that associated with that word in everyday life.

Every particle near the surface of the earth interacts with the earth. If this is the only interaction affecting the particle, the resultant acceleration of any such particle is directed downward and has a magnitude g (approximately equal to 9.80 m/s^2)

(a) Does the earth exert a force on every particle near its surface ?

(b) Is this a long-range force or contact force ?

(c) What is the magnitude of this force on a particle of mass m ? What is the direction of this force ?

(d) Two objects A and B, having respective masses of 2 kg and 10 kg, are both dropped from a tower and fall while interacting solely with the earth (since air resistance is negligible).

(1) What then is the gravitational force on A by the earth ? What is the gravitational force on B by the earth?

(2) What is the acceleration of the falling object A ? What is the acceleration of the falling object B ?

Q.8 To propel a rocket, some mass of fuel in the rocket is burned. The resultant gas is then expelled from the rear of the rocket at some high speed (much larger than that of the rocket). Hence the rocket itself is accelerated with an acceleration of magnitude a_0.

(a) How is the direction of the rocket's acceleration related to the direction along which the gas is expelled?

(b) Does the expelled gas exert a force on the rocket ? If so, in which direction is this force ?

(c) Suppose that the same mass of gas is expelled with larger speed so that its acceleration is twice as large. What then would be the magnitude of the rocket's acceleration ?

(d) Suppose that more fuel is burned per second so that twice as large a mass of gas is expelled with the original acceleration. What then would be the magnitude of the rocket's acceleration ?

(e) Suppose that twice as large a mass of gas is expelled with an acceleration twice as large as the original one. What then would be the magnitude of the rocket's acceleration ? How much larger would be the force exerted on the rocket by the gas (compared to the force exerted on it in the original situation)?

EXERCISE - 3

FILL IN THE BLANKS

Q.1 The SI unit of force is the .....

Q.2 It takes about 4.45 newtons to equal a .....

Q.3 If a force of 200 newtons is required to move a wagon up a frictionless hill at constant speed, the force needed to left the wagon roll downhill at constant speed is .....

Q.4 In any interaction between two or more isolated objects, the total ..... does not change.

Q.5 An object will move in a circular path at constant speed if a force is applied to it in a direction that is kept ..... to its velocity.

Q.6 The change in the velocity of an object is proportional to the .....applied to it.

Q.7 The ratio of net force applied to an object to the acceleration it produces is the ..... of the object.

Q.8 If there are several forces on an object, its acceleration depends on its mass and the ..... force.

TRUE & FALSE STATEMENT

Q.9 When we push our foot against the ground backwards (action), the ground exerts on equal and opposite force (reaction) on our foot which causes us to more forward.

Q.10 It is easier to start motion in a lighter body than a heavier body.

Q.11 A rocket can propel itself in a vacuum.

Q.12 Action and reaction force an on the same object.

Q.13 Particle of different masses falls with different acceleration on earth.

Q.14 Particle is at rest, it force is zero.

Q.15 Particle moves in the direction of force.

Q.16 If particle is initially at rest then it moves in direction of net force.

EXERCISE - 4 (MCQ LEVEL 1)

ONLY ONE OPTION IS CORRECT

Q.1 A force F_1 acting on a body of 2 kg produces an acceleration of 2.5 m/sec^2. An other force F_2 acting on the another body of mass 5 kg produces an acceleration of 2 m/sec^2. Find the ratio of F_2/F_1.

(1) 2 (2) 4 (3) 6 (4) 8

Q.2 A field gun of mass 1.5t fires a shell of mass 15 kg with a velocity of 150 m/s. Calculate the velocity of the recoil of the gun.

(1) 1 m/sec (2) 1.5 m/sec (2) 3 m/sec (4) 5 m/sec

Q.3 A feather of 20 grams is dropped from a height. It is found to fail down arts a constant velocity. The net force acting on it is –

(1) 200 N (2) 0.2 N (3) 0.02 N (4) zero

Q.4 A body of mass 1 kg is kept at rest. A constant force of 6.0N acting on it, the time taken by the body to move through a distance of 12m –

(1) 2 sec. (2) 3 sec. (3) 4 sec. (4) 5 sec.

Q.5 If a constant force acts on a body initially kept at rest the distance moved by the body in time t is proportional

(1) t (2) t^2 (3) t^3 (4) t^4

Q.6 By applying a force of one Newton, one can hold a body of mass –

(1) 102 grams (2) 102 kg (3) 102 mg (4) None of these

Q.7 The speed of a falling body increases continuously, this is because –

(1) No force acts on it (2) It is very light

(3) The air exert the frictional force (4) The earth attract it

Q.8 A gun of mass 4.5 kg fires a bullet of mass 20g. with a velocity of 108 km/hr. the recoil velocity of the gun is –

(1) 1.33 m/sec (2) 0.133 m/sec (3) 13.3 m/s (4) 133 m/sec

Q.9 If an object is in a state of equilibrium –
(1) it is at rest (2) it is in motion at constant velocity
(3) it is in free fall (4) may be more than one of the above

Q.10 A fish is swimming upward at an angle of 30° with the horizontal. The direction of the force of gravity acting is–
(1) upward (2) downward (3) horizontal (4) at an angle upward

Q.11 If a boat is moving along at constant speed, it may be assumed that –
(1) a net force is pushing it forward (2) the sum of only vertical forces is zero
(3) the buoyant force is greater than gravity (4) the sum of all forces is zero

Q.12 An astronaut with all her equipment has a mass of 95 kilograms. How much will she weigh on the moon, where the acceleration due to gravity is 1.67 meters per second squared ?
(1) 159 N (2) 169 N (3) 149 N (4) 100 N

Q.13 How much is the viscous drag acting on a rocket-driven sled that is going at constant speed against a frictional force of 22000 newtons when the thrust of the engine is 31000 newtons–
(1) 8500 N (2) 9000 N (3) 9500 N (4) 7500 N

Q.14 To slow down a car, a braking force of 1200 newtons is applied for 10 seconds. How much force would be needed to produce the same change in velocity in 6 seconds –
(1) 2000 N (2) 3000 N (3) 2500 N (4) 1500 N

Q.15 A frictionless wagon is pushed, from rest, with a force of 60 newtons for 14 seconds. If it then strikes a wall and comes to rest in 0.15 second, how much average force does the wall exert on it ?
(1) 6000 N (2) 5600 N (3) 4500 N (4) 4000 N

Q.16 What force is needed to a accelerate a 60-kilogram wagon from rest to 5.0 meters per second in 2.0 seconds
(1) 100 N (2) 120 N (3) 150 N (4) 130 N

Q.17 A frictionless wagon going at 2.5 meters per second is pushed with a force of 380 N, and its speed increases to 6.2 meters per second in 4.0 seconds. What is its mass –
(1) 410 kg (2) 420 kg (3) 480 kg (4) 310 kg

Q.18 A 2.0 kilogram weather balloon is released and begins to rise against 6.5 newtons of viscous drag. If its buoyancy is 32 newtons, what is its acceleration –
(1) 1.0 m/s^2 (2) 3.0 m/s^2 (3) 2.0 m/s^2 (4) 4.0 m/s^2

Q.19 What braking force is needed to bring a 2200 kilogram car going 18 meters per second to rest in 6.0 seconds
(1) 6600 N (2) 6500 N (3) 6000 N (4) 6200 N

Q.20 The 35 kilogram girl is standing on a 20 kilogram wagon and jumps off, giving the wagon a kick that sends it off at 3.8 meters per second. How fast is the girl moving –
(1) 1.2 m/s (2) 3 m/s (3) 4 m/s (4) 2.2 m/s

Q.21 A 500 kg rocket is fired straight up from the earth, the engines providing 7500 N of thrust. Its acceleration is –
(1) 4.5 m/s squared (2) 5.2 m/s squared (3) 9.8 m/s squared (4) 15 m/s squared

Q.22 In outer space, a 250 kg rocket is to be speeded up from 60 meters per second to 75 meters per second in 5.0seconds. The thrust needed is –
(1) 17 newtons (2) 750 newtons (3) 3000 newtons (4) 3200 newtons

Q.23 Two stars of masses m and 5m are 3000 parsecs apart. If the force on the large one is F, the force on the small star is–
(1) F/25 (2) F/5 (3) F (4) 5F

Q.24 A moving object can come to rest only if it –
(1) has a frictional force acting on it (2) has no net force acting on it
(3) is completely isolated (4) applies an impulse to something else

Q.25 If a jet engine provides a thrust of 45000 newtons, how long must it fire to produce 1 million newton-seconds of impulse ?
(1) 22s (2) 18s (3) 25s (4) 15s

Q.26 A rocket-driven sled speeds up from 40 meters per second to 55 meters per second in 5.0 seconds, using an engine that produces 3500 newtons of thrust. How much thrust would be needed to get the same increase in speed in 2.0 seconds –
(1) 8550 (2) 8750 (3) 8700 (4) 8500

Q.27 What force is needed to speed up a frictionless 60 kg cart from 4.0 meters per second to 6.5 meters per second in 3.0 seconds ?
(1) 50 N (2) 100 N (3) 5N (4) 20 N

Q.28 What force must the brakes and tires apply to a 2800 kg truck going 30 meters per second to bring it to rest in 8.0 seconds –
(1) 12000 N (2) 13000 N (3) 11000 N (4) 12500 N

Q.29 A 680 kg rocket is to be lifted off the surface of the moon, where g = 1.67 meters per second squared. What force is needed to give it an upward acceleration of 2.0 meters per second squared
(1) 2000 N (2) 2100 N (3) 3000 N (4) 2500 N

Q.30 A 35 kg girl on roller skates, standing still, throws a 6 kg medicine ball forward at 3.5 metes per second. How much is her recoil velocity (the backward speed she acquires as a result of the throw) –
(1) – 0.6 m/s (2) – 1.6 m/s (3) – 2.6 m/s (4) – 5.6 m/s

Q.31 The recoil velocity of a 7.5 kg rifle if it fires an 8.0g bullet with a muzzle velocity of 640 meters per second is–
(1) 0.12 m/s (2) 0.68 m/s (3) 2.68 m/s (4) 6.8 m/s

Q.32 A 750 kg. rocket, at rest in outer space, propels itself forward by ejecting 45 kg. of hot gas, which leaves the nozzle at 85 meters per second. The change in the momentum of the fuel is –
(1) 3825 kg m/s (2) 3025 kg m/s (3) 3725 kg m/s (4) 3125 kg m/s

Q.33 When a body is stationary-
(1) There is no force acting on it
(2) The force acting on it not in contact with it
(3) The combination of forces acting on it balances each other
(4) The body is in vacuum

Q.34 A rider on horse falls back when horse starts running, all of a sudden because-
(1) rider is taken back
(2) rider is suddenly afraid of falling
(3) inertia of rest keeps the upper part of body at rest while lower part of the body moves forward with the horse
(4) none of the above

Q.35 A man getting down a running bus, falls forward because-
(1) due to inertia of rest, road is left behind and man reaches forward
(2) 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
(3) he leans forward as a matter of habit
(4) of the combined effect of all the three factors stated in (1), (2) and (3)

Q.36 The heart is pumping blood at x kg per unit time, with constant velocity v. The force needed is-
(1) x v (2) $v\frac{dx}{dt}$ (3) $x\frac{dv}{dt}$ (4) Zero

Q.37 A force of 50 dynes is acted on a body of mass 5 g which is at rest for an interval of 3 sec., then impulse is-
(1) 0.15×10^{-13} Ns (2) 0.98×10^{-3} Ns (3) 1.5×10^{-3} Ns (4) 2.5×10^{-3} Ns

Q.38 A force 10 N acts on a body of mass 20 kg for 10 sec. Change in its momentum is-
(1) 5 kg m/s (2) 100 kg m/s (3) 200 kg m/s (4) 1000 kg m/s

Q.39 Swimming is possible on account of-
(1) First law of motion (2) Second law of motion (3) Third law of motion (4) Newton's law of gravitation

Q.40 The distance x covered in time t by a body having velocity v_0 and having a constant acceleration a is given by $x = v_0 t + \frac{1}{2}at^2$. This result follows from-

(1) Newton's first law (2) Newton's second law (3) Newton's third law (4) none of these

Q.41 Gravels are dropped on a conveyor belt at the rate of 0.5 kg/sec. The extra force required in newtons to keep the belt moving at 2 m/sec. is-

(1) 1 (2) 2 (3) 4 (4) 0.5

Q.42 a cricket ball of mass 150 gm is moving with a velocity of 12 m/sec. and is hit by a bat so that the ball is turned back with a velocity of 20 m/sec. The force of bat acts for 0.01 s on the ball then the average force exerted by the bat on the ball.

(1) 840 N (2) 48 N (3) 84 N (4) 480 N

Q.43 The average force necessary to stop a hammer having momentum 25 N-s in 0.05 second is-

(1) 25 N (2) 50 N (3) 1.25 N (4) 500 N

Q.44 A force of 100 dynes acts on mass of 5gm for 10 sec. The velocity produced is-

(1) 2 cm/sec. (2) 20 cm/sec. (3) 200 cm/sec. (4) 2000 cm/sec.

Q.45 The newton's laws of motion are valid in-

(1) inertial frames (2) non-inertial frames (3) rotating frames (4) accelerated frames

Q.46 Newton's third law is equivalent to the-

(1) law of conservation of linear momentum (2) law of conservation of angular momentum

(3) law of conservation of energy (4) law of conservation of energy and mass

Q.47 When we jump out a boat standing in water it moves-

(1) forward (2) backward (3) side ways (4) none of the above

Q.48 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

(1) first law (2) second law (3) third law (4) all the laws

Q.49 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-

(1) unchanged (2) reduced (3) increased (4) Nothing can be said

Q.50 A cannon after firing recoils due to-

(1) Conservation of energy (2) Backward thrust of gases produced

(3) Newton's third law of motion (4) Newton's first law of motion

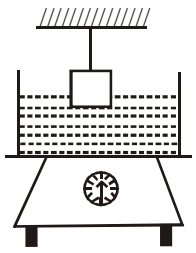
Q.51 Newton's third law of motion leads to the law of conservation of-

(1) Angular momentum (2) Energy (3) Mass (4) Momentum

EXERCISE - 5 (MCQ LEVEL 2)

ONE OR MORE THAN ONE CHOICE MAY BE CORRECT

Q.1 The mass of block is m_1 and that of liquid with the vessel is m_2.
The block is suspended by a string (tension T) partially in the liquid.
The reading of the weighing machine placed below the vessel.



(1) can be $(m_1 + m_2)g$
(2) can be greater than $(m_1 + m_2)g$
(3) is equal to $(m_1g + m_2g - T)$
(4) can be less than $(m_1 + m_2)g$

Q.2 A mass of 10 kg is hung to a spring balance in lift. If the lift is moving with an acceleration g/3 in upward & downward directions. Choose the correct options related to the reading of the spring balance.

(1) 13.3 kg (2) 6.67 kg (3) 32.6 kg (4) 0

Q.3 Choose the correct options –

(1) A reference frame in which Newton's first law is valid is called an inertial reference frame.

(2) Frame moving at constant velocity relative to a known inertial frame is also an inertial frame.

(3) Idealy, no inertial frame exists in the universe for practical purpose, a frame of reference may be considered as Inertial if its acceleration is negligible with respect to the acceleration of the object to be observed.

(4) To measure the acceleration of a falling apple, earth cannot be considered as an inertial frame.

Q.4 Mark the correct statements about the friction between two bodies -

(1) static friction is always greater than the kinetic friction

(2) coefficient of static friction is always greater than the coefficient of kinetic friction

(3) limiting friction is always greater than the kinetic friction

(4) limiting friction is never less than static friction

Q.5 A block is placed on a rough floor and a horizontal force F is applied on it. The force of friction f by the floor on the block is measured for different values of F and a graph is plotted between them –

(1) The graph is a straight line of slope 45°

(2) The graph is straight line parallel to the F axis

(3) The graph is a straight line of slope 45° for small F and a straight line parallel to the F-axis for large F.

(4) There is small kink on the graph

Q.6 Choose the correct options –

(1) Inertia $\propto$ mass

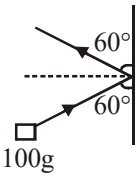
(2) 1 Newton = 10^5 dyne

(3) Thrust on rocket $\vec{F} = \frac{\Delta M}{\Delta t}\vec{v} - M\vec{g}$

(4) Apparent weight of a body in the accelerated lift is W = m (g + a).

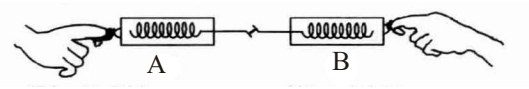
INTEGER TYPE QUESTIONS

Q.7 A mass of 100 g strikes the wall with speed 5 m/s at an angle as shown in figure and it rebounds with the same speed. If the contact time is 2×10^{-3} s, The force applied by the wall is $250\sqrt{x}$ N to left



Find the value of x.

Q.8 Consider two spring balances hooked as shown in the figure. We pull them in opposite directions. If the reading shown by A is 1.5 N, the reading shown by B will be X Newton. Find the value of 2X.



Q.9 Water drops fall at regular intervals from a roof. At an instant when a drop is about leave the roof, the separations between 3 successive drops below the roof are in the ratio X : Y : Z. Find the minimum value of X + Y + Z.

PASSAGE BASED QUESTIONS

Read the passage and answer Q. nos. 10 and 11

An object of mass 1.5 kg travelling in a straight line with a velocity of 5 ms^{-1} collides with a wooden block of mass 5 kg resting on the floor. This object sticks with wooden block after collision and both move together in a straight line.

Q.10 The total momentum after collision is –

(1) 3.5 kg m s^{-1} (2) 1.5 kg m s^{-1} (3) 7.5 kg m s^{-1} (4) 2 kg m s^{-1}

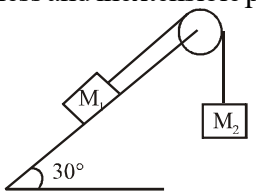
Q.11 The velocity of the combination of these objects after collision is

(1) 8.5 ms^{-1} (2) 9.5 ms^{-1} (3) 1.15 ms^{-1} (4) 1.5 ms^{-1}

MATCH THE COLUMN TYPE QUESTIONS

Each question contains statements given in two columns which have to be matched. Statements (A, B, C, D) in **column I** have to be matched with statements (p, q, r, s) in **column II**.

Q.12 For the system shown in the figure, the incline is frictionless and the string is massless and inextensible pulley is light and frictionless. As the system is released from rest.



Column I	**Column II**
(A) $M_1 > M_2$	(p) M_2 accelerates down
(B) $M_2 > M_1$	(q) M_2 accelerates up
(C) $M_1 = M_2$	(r) M_1, M_2 in equilibrium
(D) $M_1 >> M_2$	(s) Tension in string equals the weight of either block

Q.13 **Match the column–**

Column I	**Column II**
(A) Newton first law	(p) Quantitative 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

ASSERTION & REASON TYPE

Each question contains STATEMENT-1 (Assertion) and STATEMENT-2 (Reason). Each question has 5 choices (1), (2), (3), (4) and (5) out of which ONLY ONE is correct.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(2) Statement-1 is True, Statement-2 is True; Statement-2 is not a correct explanation for Statement-1.
(3) Statement -1 is True, Statement-2 is False.
(4) Statement -1 is False, Statement-2 is True.
(5) Statement -1 is False, Statement-2 is False.

Q.14 **Statement 1 :** Force exerted by the ground on the man moves him forward.
Statement 2 : It is a reactional force.

Q.15 **Statement 1 :** A quick collision between two bodies is more violent than a slow collision, even when the initial and the final velocities are identical.
Statement 2 : Because the rate of change of momentum which determines the force is greater in the first case.

Q.16 **Statement 1:** Thrust on a rocket depends only on the velocity of exhaust gases and. not on the reduction in mass.
Statement 2 : Larger the velocity, greater will be the thrust.

Q.17 **Statement 1 :** Change in momentum is impulse.
Statement 2 : Impulse is the area between (F – t) graph and time axis.

Q.18 **Statement 1 :** A body is momentarily at rest when it reverses the direction.
Statement 2 : A body cannot have acceleration if its velocity is zero at a given instant of time.

Q.19 **Statement 1 :** For stable equilibrium force has to be zero and potential energy should be minimum.
Statement 2 : For equilibrium, it is not necessary that the force is not zero.

Q.20 **Statement 1 :** While walking on ice, one should take small steps to avoid slipping.
Statement 2 : This is because smaller steps ensure smaller friction.

Q.21 **Statement 1 :** Change in momentum associated with a ball thrown normally on a smooth wall is zero.
Statement 2 : The speed of rebound may differ with momentum remaining same.

Q.22 **Statement 1 :** Force required to accelerate a mass in two perpendicular directions is never same.
Statement 2 : The presence of g will not influence the acceleration.

Q.23 **Statement 1 :** An air tight cage in which a bird is sitting is suspended from a spring balance. If the bird start flying, then the reading of the balance will decrease.
Statement 2 : A set of three equal magnitude forces cannot have resultant force equal to zero.

Q.24 **Statement 1 :** A bomb explodes while being 'at rest. The momentum just after explosion is zero.
Statement 2 : In the absence of an external force, momentum remains conserved.

EXERCISE - 6 (PREVIOUS YEARS COMPETITION MCQ)

IIT JEE/AIEEE/AIPMT/OLYMPIADS QUESTIONS

Q.1 When a bus suddenly takes a turn, the passengers are thrown outwards because of –
(1) inertia of motion (2) Acceleration of motion (3) Speed of motion (4) Both (2) and (3)

Q.2 A person is standing in an elevator. In which situation he finds his weight less than actual when –
(1) The elevator moves upward with constant acceleration.
(2) The elevator moves downward with constant acceleration
(3) The elevator moves upward with uniform velocity
(4) The elevator moves downward with uniform velocity

Q.3 A player caught a cricket ball of mass 150gm. moving at a rate of 20 m/s. If the catching process be completed in 0.1s, then the force of the blow exerted by the ball on the hands of the player is –
(1) 0.3 N (2) 30 N (3) 300 N (4) 3000 N

Q.4 A body, whose momentum is constant, must have constant –
(1) Force (2) Velocity (3) Acceleration (4) All of these

Q.5 Two masses of 1 gm and 4 gm. are moving with equal kinetic energies. The ratio of the magnitudes of their linear momenta is–
(1) 4 : 1 (2) $\sqrt{2}:1$ (3) 1 : 2 (4) 1 : 16

Q.6 If the kinetic energy of a body becomes four times of its initial value, then new momentum will –
(1) Becomes twice its initial value (2) Becomes three times its initial value
(3) Become four times its initial value (4) Remains constant

Q.7 A particle of mass 0.3 kg. is subjected to a force $F = -kx$ with $k = 15$ N/m. What will be its initial acceleration if it is released from a point 20 cm. away from the origin –
(1) 5 m/s^2 (2) 10 m/s^2 (3) 3 m/s^2 (4) 15 m/s^2

Q.8 A rocket with a lift off mass 3.5×10^4 kg is blasted upwards with an initial acceleration of 10 m/s^2. The nthe initial thrust of the blast is –
(1) 1.75×10^5 N (2) 3.5×10^5 N (3) 7.0×10^5 N (4) 14.0×10^5 N

Q.9 An automobile travelling with a speed of 60 km/h, can brake to stop within a distance of 20m. If the car is going twice as fast, i.e., 120 km/h, the stopping distance will be –
(1) 20m (2) 40m (3) 60m (4) 80m

Q.10 A ship of mass 3×10^7 kg initially at rest is pulled by a force of 5×10^4 N through a distance of 3m. Assume that the resistance due to water is negligible, the speed of the ship is –
(1) 1.5 m/s (2) 60 m/s (3) 0.1 m/s (4) 5 m/s

Q.11 Consider the following two statements : 1. Linear momentum of a system of particles is zero
2. Kinetic energy of a system of particles is zero. Then –
(1) 1 implies 2 and 2 implies 1 (2) 1 does not imply 2 and 2 does not imply 1
(3) 1 implies 2 but 2 does not imply 1 (4) 1 does not imply 2 but 2 implies 1

EXERCISE - 7

PREVIOUS YEARS SA (SUMMATIVE ASSESSMENT) QUESTIONS

Q.1 State an example, how force can change velocity of a body ?

Q.2 State two effects, a force can produce in a non-rigid body fixed at a position.

Q.3 State any three changes that a force brings about on a body. Give one example of each.

Q.4 Define the term balanced force.

Q.5 Name the force which is responsible for change in position or state of an object.

Q.6 Name the unbalanced force which slows down a moving bicycle when we stop pedalling it.

Q.7 Tabulate two differences between balanced and unbalanced forces. Write one example of each.

Q.8 (i) Write an activity to distinguish between a balanced and an unbalanced force.
(ii) Explain whether the force is balanced or unbalanced in the following situations:
(a) A suitcase is dropped from a certain height.
(b) A bicycle is moving in a straight line with constant velocity.
(c) In the game of tug of war, the two teams apply force but the rope doesn't move.
(d) A ball rolling on the ground stops after sometime.

Q.9 State the law of inertia.

Q.10 Name the property of an object to resist a change in its state of rest or of uniform motion in a straight line.

Q.11 When the driver of a bus applies sudden brakes, the passengers fall forward. Why ?

Q.12 When a carpet is beaten with a stick it releases dust. Explain why.

Q.13 Leaves of a tree may get detached if we vigorously shake its branch. Explain.

Q.14 Fastening of seat belts is advised for the safety of persons sitting in a moving car. Give reason.

Q.15 A passenger in a moving car slips to one side of the seat when the car takes a sharp turn. Give reason for it.

Q.16 Define 'inertia of motion' and 'inertia of direction' by giving one example of each.

Q.17 Name the physical quantity that measures inertia. State its SI unit.

Q.18 Raju is having three solid blocks of same size and shape made up of steel, wood and plastic. Which one of these will have highest inertia ? Give reason for your choice.

Q.19 Define momentum and state its SI unit.

Q.20 Name the physical quantity which is determined by the rate of change of linear momentum.

Q.21 A ball is thrown vertically upwards. What is its momentum at the highest point ?

Q.22 Find the momentum of a man of mass 75 kg when he walks with a velocity of 2m/s.

Q.23 How the first law of motion can be mathematically stated from the mathematical expression for the second law of motion ?

Q.24 Derive the relation between force and acceleration using Newton's second law of motion.

Q.25 State Newton's third law of motion.

Q.26 State the meaning of recoil velocity of a gun.

Q.27 (a) Explain why is it difficult to hold a hose, which ejects a large amount of water at a high velocity.
(b) Why action and reaction do not cancel each other ?

Q.28 (a) If some one jumps to the shore from a boat the boat moves in the opposite direction. Explain.
(b) When air from an inflated balloon is allowed to be released, the balloon moves in a direction opposite to that of air. Explain.

Q.29 A swimmer is able to swim in a forward direction in a swimming pool only when he is pushing the water in the backward direction. Give reason for the above mentioned statement and justify the same.

Q.30 Two objects of masses 100g and 200g are moving along the same line and direction, with velocities of $2ms^{-1}$ and $1ms^{-1}$ respectively. They collide, and after the collision, the first object moves at a velocity of $1.67\ ms^{-1}$. Determine the velocity of the second object.

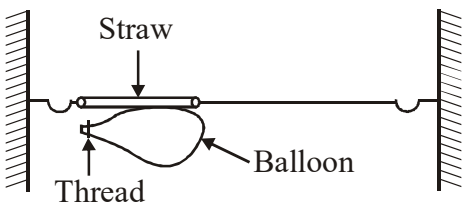
Q.31 State the law of conservation of momentum. Using this law explain why a gun recoils.

VALUE BASED QUESTIONS (Q.32-Q.34)

Q.32 During the game of table tennis, if the ball hits a player it does not hurt him. On the other hand when a fast moving cricket ball hits a spectator it may hurt him. State reason.

Q.33 An auto driver moving with a speed of 36 km/h sees a child standing in the middle of the road. He applies brakes and brings his vehicle to rest in 5 seconds just in time to save the child. If the total mass of the auto and the driver be 450 kg then calculate the force of brakes.

Q.34 Observe the following diagram and answer the questions :
(i) Which direction does the balloon move when the thread tied to its neck is removed and why ?
(ii) State the conclusion drawn from this activity.



ANSWER KEY

EXERCISE - 1

8. 0.1 m/s **9.** 80 kg. **10.** 10 m/s^2, 10N **11.** –1000 N

EXERCISE - 2

1. 1000 N

2. The girl on the cart would move with a velocity of 4.65 m/s in the direction in which the girl jumped.

3. 5 m/s^2, 2400 kg m/s, 6000 N **6.** $2m/sec^2$, N = 332 N

7. (a) Yes (b) Long-range (c) mg downward (d) (1) 20 newton and 98 newton (2) 9.8 m/s^2 for both

8. (a) opposite direction (b) Yes. opposite to acceleration of expelled gas
(c) $2a_0$ (d) $2a_0$ (e) $4a_0$, 4 times larger

EXERCISE - 3

(1) newton **(2)** pound **(3)** 200 newtons **(4)** momentum
(5) perpendicular **(6)** impulse **(7)** mass **(8)** net unbalanced
(9) True **(10)** True **(11)** True **(12)** False
(13) False **(14)** False **(15)** False **(16)** True

EXERCISE - 4

Q	1	2	3	4	5	6	7	8	9	10	11
A	1	2	2	1	2	1	4	1	4	2	4
Q	12	13	14	15	16	17	18	19	20	21	22
A	1	2	1	2	3	1	2	1	4	2	2
Q	23	24	25	26	27	28	29	30	31	32	33
A	3	4	1	2	1	3	4	1	2	1	3
Q	34	35	36	37	38	39	40	41	42	43	44
A	3	2	1	3	2	3	2	1	4	4	3
Q	45	46	47	48	49	50	51				
A	1	1	2	3	1	3	4				

EXERCISE - 5

(1) (1, 3, 4) **(2)** (1, 2) **(3)** (1, 2, 3) **(4)** (2, 3, 4) **(5)** (3, 4) **(6)** (1, 2, 3)
(7) 3 **(8)** 3 **(9)** 9 **(10)** (3) **(11)** (3)
(12) (A) → p, q, r, s (B) → p, s (C) → p (D) → q **(13)** (A) → q (B) → p (C) → s (D) → r
(14) (2) **(15)** (1) **(16)** (5) **(17)** (2) **(18)** (3) **(19)** (3)
(20) (1) **(21)** (5) **(22)** (3) **(23)** (5) **(24)** (1)

EXERCISE - 6

Q	1	2	3	4	5	6	7	8	9	10	11
A	1	2	2	2	3	1	2	3	4	3	4

EXERCISE - 7

(5) Unbalanced force **(6)** Force of friction **(10)** Inertia **(17)** Mass, kg **(20)** Force
(21) Zero **(22)** 150 kg m/s **(30)** 1.165 m/s **(33)** 900 N