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| **Karan Arora**  **R.L. Institute M: 9416974837**  **Class : IX**  **“FORCES & LAWS OF MOTION”** |

**Worksheet**

Multiple Choice Questions :

1. Which forces can change the state of a body?

|  |  |
| --- | --- |
| a) Balanced forces | b) Unbalanced forces |
| c) Both (a) and (b) | d) Neither (a) nor (b) |

1. What is a measure of inertia of the body in linear motion?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Mass | b) Velocity | c) Force | d) None |

1. A heavy object is at rest. Its linear momentum is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Zero | b) large | c) small | d) no one |

1. Which one of the following is not a vector quantity?

|  |  |  |  |
| --- | --- | --- | --- |
| a) Mass | b) velocity | c) momentum | d) force |

1. The total linear momentum of a bullet and gun on firing is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Positive | b) Negative | c) zero | d) no one |

1. When mass of a body and its velocity, both are doubled, the percentage change in its linear momentum is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 100 | b) 200 | c) 300 | d) 400 |

1. Mass of a body is quadrupled. When happens to its acceleration under a given force?

|  |  |  |  |
| --- | --- | --- | --- |
| a) a | b) a/2 | c) a/4 | d) a/8 |

1. What is linear momentum of a toy car of mass 300 g, moving with a speed of 18 km/h.

|  |  |  |  |
| --- | --- | --- | --- |
| a) 1.5 kg m/s | b) 3 kg m/s | c) 5.4 kg m/s | d) None |

1. A body of mass 2 kg is moving over a perfectly smooth surface with a uniform velocity of 5 m/s. The external force acting on the body is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 10 N | b) 10 dyne | c) zero | d) no one |

1. A body of mass 2 kg is moving over a perfectly smooth surface with a uniform velocity of 5 m/s. Find the linear momentum of the body.

|  |  |  |  |
| --- | --- | --- | --- |
| a) zero | b) 10 kg m/s | c) 2.5 kg m/s | d) none |

1. Why does a person in a bus tend to fall forward, when the bus stops suddenly? This is due to :
2. Inertia of motion of upper part of his body.
3. Inertia of motion of lower part of his body.
4. Inertia of rest of the person.
5. None of the above.
6. From a rifle of mass 5 kg, a bullet of mass 50 g is fired with an initial velocity of 30 m/s. The initial velocity of recoil of the rifle is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 0.3 m/s | b) 0.6 m/s | c) 0.9 m/s | d) 1 m/s |

1. When a branch of a tree is shaken, some of the fruits may fall down. This happens due to :

|  |  |
| --- | --- |
| a) Inertia of rest | b) Inertia of motion |
| c) Inertia of direction | d) None of the above |

1. The S.I. unit of linear momentum is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Newton | b) Dyne | c) kg m/s | d) g m/s |

1. In collision, between a heavier body and a lighter body
2. Both experience the same force.
3. Both undergo same change in momentum.
4. Lighter body is likely to be damaged more than the heavier body.
5. All of the above.
6. According to the third law of motion, action and reaction :
7. Always act on the same body.
8. Always act on different bodies in opposite directions.
9. Have same magnitude and directions.
10. Act on either body at normal to each other.
11. A goalkeeper in a game of football pulls his hands backwards while holding the ball shot at the goal. This enables the goalkeeper to :
12. Exert larger force on the ball.
13. Reduce the force exerted by the ball on hands.
14. Increase the rate of change of momentum.
15. Decrease the rate of change of momentum.
16. The inertia of an object tend to cause the object :
17. To increase its speed.
18. To decrease its speed.
19. To resist any change in its state of rest or motion.
20. To decelerate due to friction.
21. A passenger in a moving train tosses a coin which falls behind him. It means that motion of the train is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) Accelerated | b) along circular track | c) retarded | d) uniform |

1. An object of mass 2 kg is sliding with a constant velocity of 4 m/s on a frictionless horizontal table. The force required to keep the object moving with the same velocity is :

|  |  |  |  |
| --- | --- | --- | --- |
| a) 32 N | b) 0 N | c) 2 N | d) 8 N |

1. Rocket works on the principle of conservation of :

|  |  |  |  |
| --- | --- | --- | --- |
| a) momentum | b) energy | c) velocity | d) mass |

**Answers**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 1. b | 1. a | 1. a | 1. a | 1. c | 1. c | 1. c |
| 1. a | 1. c | 1. b | 1. a | 1. a | 1. a | 1. c |
| 1. d | 1. b | 1. b,d | 1. c | 1. a | 1. b | 1. a |

Fill in the Blanks :

1. Newton’s \_\_\_\_\_\_\_ law is called the real law of motion.
2. Magnitude of force is the \_\_\_\_\_\_\_\_ of \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_.
3. Linear momentum of a particle is the product of \_\_\_\_\_\_\_\_ of the particle and its \_\_\_\_\_\_\_\_\_\_.
4. Mass of a body is a measure of \_\_\_\_\_\_\_\_\_ of the body.
5. The S.I. unit of force is \_\_\_\_\_\_\_.
6. If net force acting on a particle is zero, the particle is \_\_\_\_\_\_\_\_\_ or in uniform \_\_\_\_\_\_\_\_\_\_ along a straight line.
7. Force acting on a body is measured by rate of \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the body.
8. Force is a \_\_\_\_\_\_\_\_\_\_ quantity.
9. To every action, there is always an \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_ reaction.
10. Impulse is the product of \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_.

True/False :

1. The CGS unit of force is newton.
2. 1 newton = 105 dyne.
3. A rain drop is falling vertically with constant velocity. No net force acting on the drop.
4. Forces of action and reaction act always on the same body.
5. When velocity of a body is doubled, its linear momentum becomes twice.
6. The product of mass of a body and its velocity is called inertia.
7. A particle at rest will always move in the direction of net force applied on it.
8. Force of 10 N acting on a body of mass 5 kg produces in it an acceleration of 2 m/s.

Match The Following Questions :

1. Match column I and column II

|  |  |
| --- | --- |
| Column I | Column II |
| A. Mass | I. Newton |
| B. Velocity | II. Kg |
| C. Momentum | III. m/s |
| D. Force | IV. kg m/s |

1. Match column I and column II

|  |  |
| --- | --- |
| Column I | Column II |
| A. Quantity of motion | I. Acceleration |
| B. Rate of change of velocity | II. Momentum |
| C. Rate of change of linear momentum | III. Force applied |
| D. Force that opposes motion | IV. Force of friction |

1. Match column I and column II

|  |  |
| --- | --- |
| Column I | Column II |
| A. One metric tonnes | I. 103 gram weight |
| B. One newton | II. 103 kg |
| C. One kg m/s | III. 105 dyne |
| D. One kg weight | IV. 105 g cm/s |

1. Match column I and column II

|  |  |
| --- | --- |
| Column I | Column II |
| A. Recoiling of a gun | I. Newton’s 2nd law of motion |
| B. Flight of jet planes or rockets | II. Newton’s 3rd law of motion |
| C. Definition of force | III. Newton’s 1st law of motion |
| D. No force is required to move a body  uniformly along a straight line | IV. Law of conservation of linear  momentum |

**Answers**

1. Second 2. Product , Mass , Acceleration 3. Mass , Velocity 4. Inertia

5. Newton 6. At rest , Motion 7. Change of linear momentum

8. Vector 9. Equal , Opposite 10. Force , Time

11. False 12. True 13. True 14. False 15. True

16. False 17. True 18. True

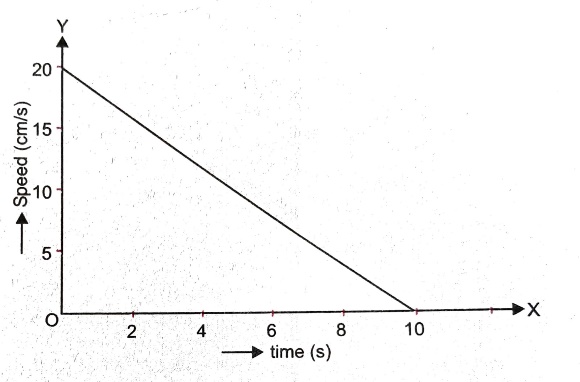
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Problem For Practice :

**Based on Newton’s Second Law Of Motion , Linear Momentum :**

1. What is the acceleration produced by a force of 12 newton exerted on an object of mass 3 kg?
2. A motorcycle is moving with a velocity of 90 Km/h and it takes 5 second to stop after the brakes are applied. Calculate the force exerted by the brakes on the motorcycle if its mass along with the rider is 200 kg.
3. Calculate the force required to impart a car, a velocity of 30 m/s in 10 seconds. The mass of the car is 1500 kg.
4. What would be the force required to produce an acceleration of 2 m/s2 in a body of mass 12 kg? What would be the acceleration if the force were doubled?
5. A certain force exerted for 1.2 s raises the speed of an object from 1.8 m/s to 4.2 m/s. Later, the same force applied for 2 second. How much does the speed change in 2 s?
6. A man pushes a box of mass 50 kg with a force of 80 N. What will be the acceleration of the box? What would be the acceleration if the mass were halved?
7. A constant force acts on an object of mass 5 kg for a duration of 2 s. It increases the object’s velocity from 3 m/s to 7 m/s. find the magnitude of the applied force. Now if the force were applied for a duration of 5 s, what would be the final velocity of the object?
8. Which would required a greater force: accelerating a 2 kg mass at 5 m/s2 or a 4 kg mass at 2 m/s2.
9. A motor car is moving with a velocity of 108 km/h and it takes 4 seconds to stop after the brakes are applied. Calculate the force exerted by the brakes on the motorcar if its mass along with the passengers is 1000 kg.
10. A force of 5 N gives a mass m1, an acceleration of 10 m/s2 and a mass m2 , an acceleration of 20 m/s2. What acceleration would it give if both the masses were tied together?
11. The speed time graph of a ball of mass 20 g moving along a straight line on a long table is given in figure. How much force does the table exert on the ball to bring it to rest?



1. A 150 g ball travelling at 30 m/s strikes the palm of a player’s hand and is stopped in 0.06 s. Calculate the force exerted by the ball on the hand.
2. A force of 4 N acts on a body of mass 2 kg for 4 s. Assuming the body to be initially at rest. Find :
3. Its velocity when the force stops acting.
4. The distance covered in 10 s after the force starts acting.
5. A truck starts from rest and rolls down a hill with a constant acceleration. It travels a distance of 400 m in 20 s. Find its acceleration. Find the force acting on it if its mass is 7 metric tonnes.
6. 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 frictional force of 5000 N, then calculate :

(a) The net accelerating force (b) The acceleration of the train (c) The force of wagon 1 on 2.

1. 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. 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 a velocity of 5 m/s. Calculate the change in momentum of the hockey ball by the force applied by the hockey stick.
3. 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.
4. 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.
5. 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/s2.

**Based on**

**Newton’s Third Law Of Motion , Law of Conservation of Linear Momentum :**

1. A 10 g bullet is shot from a 5 kg gun with a velocity of 400 m/s. What is the speed of recoil of the gun?
2. A bullet of mass 50 g is fired from a gun of mass 6 kg with a velocity of 400 m/s. Calculate the recoil velocity of the gun.
3. A girl of mass 50 kg jumps out of a rowing boat of mass 300 kg on to the bank with horizontal velocity of 3 m/s. With what velocity does the boat begin to move backwards?
4. A bullet of mass 20 g is fired horizontally with a velocity of 150 m/s from a pistol of mass 2 kg. What is the recoil velocity of the pistol?
5. 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.
6. The car A of mass 1500 kg, travelling at 25 m/s collides with another car B of mass 1000 kg travelling at 15 m/s in the same direction. After collision, the velocity of car A becomes 20 m/s. Calculate the velocity of car B after collision.
7. Two object of masses 100 g and 200 g are moving along the same line in the same direction with velocities of 2m/s and 1 m/s respectively. They collide and after the collision, the first object moves at a velocity of 1.67 m/s in the same direction. Determine the velocity of the second object.
8. A bullet of mass 20 g moving with a velocity of 300 m/s get embedded in a freely suspended wooden block of mass 880 g. what is the velocity acquired by the block?
9. A truck of mass 2500 kg moving at 15 m/s collides with a car of mass 1000 kg moving at 5 m/s in the opposite direction. With what velocity would the two move together?
10. A boy of mass 60 kg running at 3 m/s jumps on to a trolley of mass 140 kg moving with a velocity of 1.5 m/s in the same direction. What is their common velocity?
11. A girl of mass 40 kg jumps with a horizontal velocity of 5 m/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.
12. Two hockey players of opposite teams, while trying to hit a hockey ball on the ground collide and immediately become entangled. One has a mass of 60 kg , and was moving with a velocity of 5 m/s, while the other has a mass of 55 kg and was moving faster with a velocity of 6 m/s towards the first player. What velocity will they move after they become entangled?
13. Two object, 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?

**Answers**

**1.** 4 m/s2 **2.** – 1000 N **3.** 4500 N **4.** 24 N , 4 m/s2 **5.** 4 m/s

**6.** 1.6 m/s2 , 3.2 m/s2 **7.** 10 N , 13 m/s **8.** 2 kg mass at 5 m/s2 **9.** – 7500 N

**10.** 6.67 m/s2 **11.** – 4 x 10 – 4 N **12.** – 75 N **13.** (a) 8 m/s (b) 64 m

**14.** 14000 N **15.** (a) 35000 N (b) 1.94 m/s2 (c) 15520 N **16.** – 2550 N

**17.** – 3 kg m/s **18.** 2.25 m , 50 N **19.** 50 N **20.** 40 kg m/s

**21.** – 0.8 m/s **22.** – 3.3 m/s **23.** – 0.5 m/s **24.** – 1.5 m/s **25.** – 7/16 m/s

**26.** 22.5 m/s **27.** 1.17 m/s **28.** 6.67 m/s **29.** 9.3 m/s **30.** 1.95 m/s

**31.** 4.65 m/s **32.** – 0.26 m/s **33.** 0

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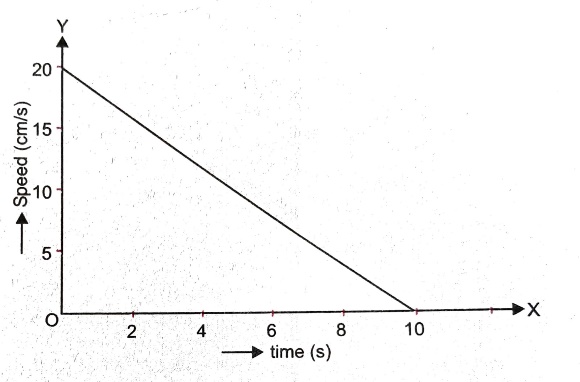
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