	INDIAN SCHOOL AL WADI AL KABIR	
Class: IX	**Department: Science 2022 – 23** **Subject: Science**	**Date of submission:** **08.09.2022**
Worksheet No:02 **With Answers**	**Topic: Force and Laws of Motion**	**Note:** **A4 FILE FORMAT**
CLASS/SEC.:	**NAME OF THE STUDENT:**	**ROLL NO.:**

OBJECTIVE TYPE 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) When a carpet is beaten with a stick, dust particle comes out. This phenomenon is an example of …….. law of motion.

   a) First law
   b) Second law
   c) Third law
   d) None of these

3) An object of mass 2 kg is sliding with a constant velocity of 4 ms^{-1} 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

4) Newton's third law of motion explains the two forces namely 'action' and 'reaction' coming into action when the two bodies are in contact with each other. These two forces:

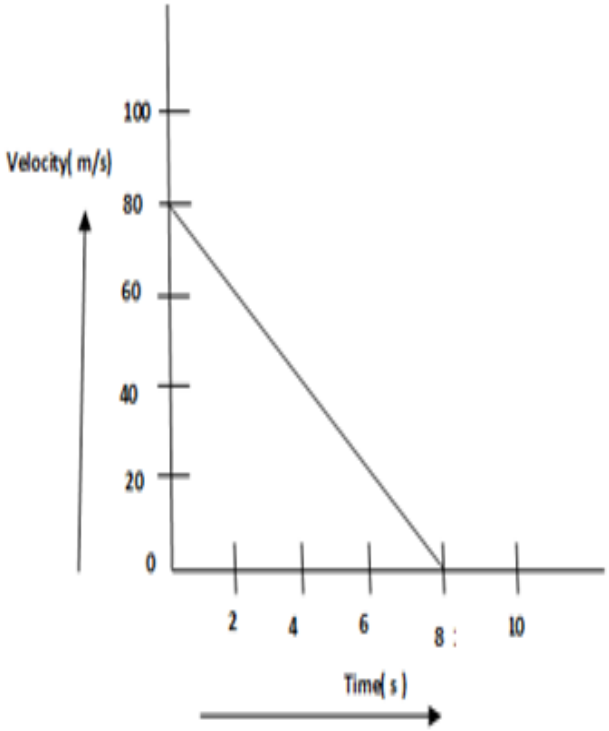
   a) Always act on the same body
   b) Always act on the different bodies in opposite directions
   c) Have same magnitude and direction
   d) Acts on either body at normal to each other

5) A water tank filled upto 2/3 of its height is moving with a uniform speed. On sudden application of the brake, the water in the tank would

   a) Move backward
   b) Move forward
   c) Come to the rest
   d) Be unaffected

6) Velocity versus time graph of a ball of mass 50 g rolling on a concrete floor is shown in the figure below. What will be the frictional force of the floor on the ball?

   a) 0.5 N
   b) 50 N
   c) 5 N
   d) 0.05 N



7) When a balloon held between the hands is pressed, its shape changes. This happens because:

   a) Balanced forces act on the balloon
   b) Unbalanced forces act on the balloon
   c) Frictional forces act on the balloon
   d) Gravitational force acts on the balloon

8) Among the equal-sized stone and a football, the inertia will be higher of:

   a) Football
   b) Stone
   c) Both
   d) none of them

9) If two balls of same masses are dropped on sand, the depths of penetration is same if

   a) Heavier ball is dropped faster than lighter ball
   b) Lighter ball is dropped faster than heavier ball
   c) The product ‘mv’ is same for both bodies
   d) None of these

10) An object will continue to accelerate until

a) The resultant force on it is zero
b) The velocity changes the direction
c) Resultant force on it is increased continuously
d) Resultant force begins to decrease

VERY SHORT ANSWER QUESTIONS (1MARK)

11) Name the factors on which the momentum of a body depends.

12) No force is required to move an object with constant velocity. Why?

13) What happens when you begin to shake a wet piece of cloth? Explain your observation.

14) What force would be needed to produce an acceleration of 4 m/s^2 on a ball of mass 6 kg?

15) Define 1 newton force.

16) What is the acceleration of a body when it is under the action of balanced force? (CBSE 2019 - 20)

ASSERTION-REASON TYPE QUESTIONS

Directions: In each of the following questions, a statement of Assertion is given and a corresponding statement of Reason is given just below it. Of the statements, given below, mark the correct answer as:
(a) Both assertion and reason are true and reason is the correct explanation of assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both Assertion and Reason are false.

17) **Assertion :** When a firefly hits a bus, each of them exerts the same force.
Reason : Firefly has more mass as compared to the windshield.

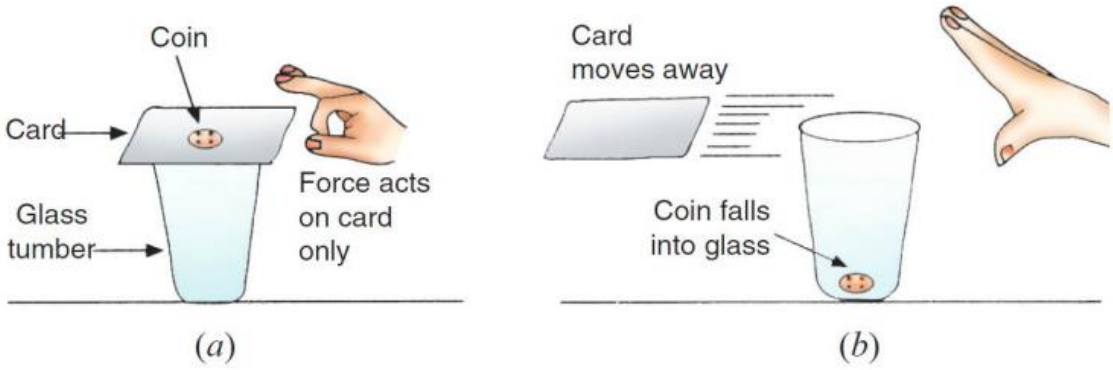
18) **Assertion :** When a bullet is fired from a gun, there is a forward force on the bullet and recoil of gun.
Reason : Every action has an equal and opposite reaction.

19) **Assertion :** When we sit on a chair, our body exerts a force downward and that chair needs to exert an equal force upward or the chair will collapse.
Reason : The third law says that for every action there is an equal and opposite reaction.

20) **Assertion :** A table cloth cannot be pulled from a table without dislodging the dishes.
Reason : Newton's second law of motion gives definition of inertia.

CASE STUDY-BASED QUESTIONS:

21) We take a glass tumbler and place a thick square card on its mouth as shown in Figure (a). A coin is then placed above this card in the middle. Let us flick the card hard with our fingers. On flicking, the card moves away but the coin drops into the glass tumbler as shown in figure (b).



(i) Give reason for the above observation.
(a) The coin possesses inertia of rest, it resists the change and hence falls in the glass.
(b) The coin possesses inertia of motion, it resists the change and hence falls in the glass.
(c) The coin possesses inertia of rest, it accepts the change and hence falls in the glass.
(d) The coin possesses inertia of motion, it accepts the change and hence falls in the glass.

(ii) Name the law involved in this case.
(a) Newton's second law of motion.
(b) Newton's first law of motion.
(c) Newton's third law of motion.
(d) Law of conservation of energy

(iii) If the above coin is replaced by a heavy five-rupee coin, what will be your observation. Give reason.
(a) Heavy coin will possess more inertia so it will not fall in tumbler.
(b) Heavy coin will possess less inertia so it will fall in tumbler.
(c) Heavy coin will possess more inertia so it will fall in tumbler.
(d) Heavy coin will possess less inertia so it will not fall in tumbler.

(iv) Name the law which provides the definition of force.
(a) Law of conservation of mass
(b) Newton's third law.
(c) Newton's first law
(d) Newton's second law.

(v) State Newton's first law of motion.
(a) Energy can neither be created nor be destroyed, it can be converted from one form to another, total amount of energy always remains constant.
(b) A body at rest remains at rest or, if in motion, remains in motion at constant velocity unless it is acted upon by an external unbalanced force.
(c) For every action in nature there is an equal and opposite reaction.
(d) The acceleration in an object is directly related to the net force and inversely related to its mass.

SHORT ANSWER QUESTIONS

22) An object of mass 100 kg is accelerated uniformly from a velocity of 5 m/s to 8 m/s in 6 s. Find the magnitude of force exerted on the object.

23) Explain (a) why it is difficult for a fireman to hold a hose, which ejects a large amount of water at high velocity (b) It is difficult to walk on sand or ice.

24) A cricket ball of mass 100 g moving with a speed of 30 m/s is brought to rest by a player. Then find the change in momentum of ball.

25) Two bodies have masses in the ratio 3:4. When a force is applied on first body, it moves with an acceleration of 6 m/s2. How much acceleration will the same force produce in the other body?

26) A stone of 1 kg is thrown with a velocity of $20\ m\ s^{-1}$ across the frozen 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?

27) A body of mass 25 kg has a momentum of 125 kg m/s. calculate the velocity of the body. Out of the four physical quantities associated with the motion of an object viz force, velocity, acceleration and momentum which one remains constant for all bodies large or small, undergoing a free fall?

LONG ANSWER TYPE QUESTIONS

28) Explain the following giving reasons
i. Cars and scooters are fitted with shockers
ii. Velocity is a vector quantity
iii. Action and reaction forces never cancel each other
iv. Athlete run a certain distance before taking a leap. (CBSE 2019 - 20)

29) State Newton's first law of motion. Show that Newton's first law of motion is a special case of Newton's second law. Determine the acceleration of a car of mass 800 kg, on application of force 200N on it. (CBSE 2012)

30) Give statement for Newton's second law of motion. Deduce a mathematical formulation for it. Using above derived expression, calculate the force exerted by a nail on the hammer of mass 500g moving at 5.0 m/s striking on it. consider that the nail stops the hammer in a short time of 0.01 s. (CBSE 2014)

ANSWERS

1	To resist any change in its state of motion
2	First law
3	0 N
4	Always act on the different bodies in opposite directions
5	Move forward
6	0.5 N
7	Balanced forces act on the balloon
8	Stone
9	The product 'mv' is same for both bodies
10	The resultant force on it is zero
11	Mass and velocity of the body.
12	When velocity does not change, acceleration is zero. Hence, no force is required to move an object with constant velocity.
13	When we shake a wet cloth, water droplets come off from it, because of inertia of rest. Water drops in the wet cloth were in a position of rest. When shaken, the cloth moves suddenly, but the droplets have a tendency to remain at rest owing to the property of inertia and they are detached from the cloth.
14	F= ma = 24 N
15	1 Newton is the magnitude of force which produces an acceleration of 1 m/s2 in a body of mass 1 kg.
16	zero
17	(c) Assertion is true but reason is false.
18	(a) Both assertion and reason are true and reason is the correct explanation of assertion.
19	(a) Both assertion and reason are true and reason is the correct explanation of assertion.
20	(d) Both Assertion and Reason are false.
21	(i) (a) The coin possesses inertia of rest, it resists the change and hence falls in the glass. (ii) (b) Newton's first law of motion. (iii) (c) Heavy coin will possess more inertia so it will fall in tumbler.

	(iv) (d) Newton's second law. (v) (b) A body at rest remains at rest or, if in motion, remains in motion at constant velocity unless it is acted upon by an external unbalanced force.
22	F = ma = {m(v-u)}/t = 100 (8-5) / 6 = 50 N
23	(a) When large amount of water is ejected from a hose at a high velocity, according to Newton's Third Law of Motion, water pushes the hose in backward direction with the same force. Hence, it is difficult for a fireman to hold a hose in which ejects large amount of water at a high velocity. (b) It is difficult to walk on sand because we can exert much smaller force in the form of backward action on the ground and the forward reaction of the ground will reduce accordingly while when we walk on the ground, we push the ground with our foot and as a reaction, the ground pushes our foot forward with the same force. It is this forward force of the ground that enables us to walk. This is based on Newton s third law of Motion.
24	Acceleration (a) =(v−u)/ t = - 1000 m/s^2 Force (F) = m×a = 0.1 × (-1000) = -100 N ∴ The average resistive force applied by the player is 100 N.
25	Let us consider the two masses as 3x and 4x respectively. Given acceleration of first body as 6. F=m×a F=3x × 6=18x As we are applying same force for the second body, 18x=4x × a ⇒a=18/4=4.5m/s^2. Hence acceleration is 4.5m/s^2.
26	$v^2 = u^2+2as$ $(0)^2=(20)^2+2a(50)$ 100a=−400 ∴a=$-4ms^{-2}$ Here negative sign shows that there is relation in the motion of stone. Force of friction between stone and ice = Force required to stop the stone.

	=ma =1×−4=−4N or 4N.
27	p = mv 125 = 25 v V = 5 m/s Only acceleration remains same.
28	(i) The vehicle receives a sudden sharp movement when it moves on uneven surfaces. So, the vehicle receives impulsive force. Using the second law of motion to minimize this impact, shock absorbers are used. The shock absorbers increase the time of sudden sharp movement by reducing impulsive force. This minimizes the damage to the vehicle. (ii) Velocity has both magnitude and direction (iii) They are not balanced forces because they act on different objects so they don't cancel each other out. (iv) An athlete run some distance before taking a jump so as to increase his speed and thus his inertia of motion which helps him to jump a longer distance.
29	An object remains in the state of rest or of uniform motion, in a straight line unless compelled to change that state by an applied force. According to second law of motion, F = ma or F = m(v- u)/ t or Ft = mv – mu That is, when F = 0, v = u for whatever time, t is taken. This means that the object will continue moving with uniform velocity, u throughout the time, t. If u is zero, then v will also be zero. That is, the object will remain at rest. m=800kg F=200N a=? Using : F = ma 200=800a 200/800=a 0.25m/s^2=a a=0•25m/s^2
30	The rate of change of momentum of an object is directly proportional to the applied unbalanced force in the direction of the force. Mathematical Formulation of Second Law of Motion: Suppose an object of mass, m is moving along a straight line with an initial velocity, u. It is uniformly accelerated to velocity, v in time, t by the application of a constant force, F throughout the time, t.

The initial and final momentum of the object will be, $p_1 = mu$ and $p_2 = mv$ respectively.

The change in momentum $\propto p_2 - p_1$

$\propto mv - mu$

$\propto m \times (v - u)$.

The rate of change of momentum $\propto m \times (v - u) / t$

Or, the applied force,

$F \propto m \times (v - u) / t$

Or, the applied force, $F = km \times (v - u) / t$ ---------- (2)

$= kma$ ----------(3)

Here $a = (v - u) / t$] is the acceleration, which is the rate of change of velocity. The quantity, k is a constant of proportionality. The SI units of mass and acceleration are kg and m s^{-2} respectively. The unit of force is so chosen that the value of the constant, k becomes one. For this, one unit of force is defined as the amount that produces an acceleration of 1 ms^{-2} in an object of 1 kg mass. That is,

1 unit of force = $k \times (1 \text{ kg}) \times (1 \text{ m } s^{-2})$

Thus, the value of k becomes 1. From Eq. (3) , therefore, F = ma ---------(4)

From Newton's second law of motion

$F = m (v - u) / t$

Where f = force

$F = 0.5 \times (0 - 50) / 0.01$

F = -2500 N

-ve sign indicates the force of the nail on the hammer moving in the opposite direction to that of hammer movement.

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