	INDIAN SCHOOL AL WADI AL KABIR	
Class: IX	**Department: SCIENCE 2023 – 24** **SUBJECT: PHYSICS**	**Date of submission:** **30-08-2023**
Worksheet No: 03 **WITH ANSWERS**	**CHAPTER / UNIT:** **FORCE AND LAWS OF MOTION**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.:**

OBJECTIVE TYPE OF QUESTIONS (1 MARK):

1) Which law of motion explains why passengers inside a moving bus tend to fall backward when the bus suddenly stops?
   a) Newton's First Law
   b) Newton's Second Law
   c) Newton's Third Law
   d) None of the above

2) An object is moving with a constant velocity. Which of the following statements is true?
   a) There are no forces acting on the object.
   b) The net force acting on the object is zero.
   c) The object is not accelerating.
   d) All of the above

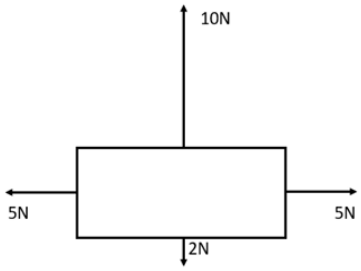
3) If the mass of an object remains constant and the force acting on it doubles, its acceleration will:
   a) Double
   b) Halve
   c) Remain the same
   d) Become zero

4) A block is sliding on a frictionless surface. If a constant force is applied, the block will:
   a) Moves with constant speed
   b) Slows down and eventually stop
   c) Accelerates with a constant acceleration
   d) None of the above

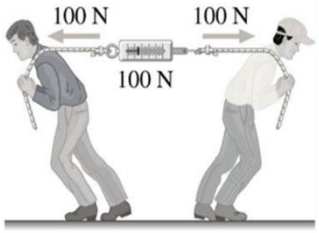
5) Which of the following quantities is directly proportional to an object's momentum?
   i. Mass
   ii. Acceleration
   iii. Force
   iv. Velocity

a) i
b) i and ii
c) i and iv
d) iv

6) What is the resultant force?
   a) 8 N upwards
   b) 12 N downwards
   c) 12 N upwards
   d) 22 N



7) Why is the reading in the force – meter constant 100 N?



   a) Equal forces are acting
   b) Unequal forces are acting
   c) Equal and opposite forces are acting
   d) Unequal and opposite forces are acting

8) Momentum of a body increases from 20kgm/s to 40kgm/s in 5 seconds, then the force applied is
   a) -4 N
   b) 4 N
   c) 20 N
   d) -20 N

9) Which law of motion gives the measure of force?
   a) Newton's first law of motion
   b) Newton's second law of motion
   c) Newton's third law of motion
   d) Galileo's law

10) 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?
   a) 200 N
   b) 100 N
   c) 50 N
   d) 0 N

ASSERTION AND REASONING TYPE OF QUESTIONS (1 MARK):

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

a) Both A and R are true, and R is the correct explanation of A.
b) Both A and R are true, and R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true

11) **Assertion:** An object can have a non-zero velocity even if the net force acting on it is zero.
Reason: If the object is moving with a constant velocity, the net force acting on it must be zero.

12) **Assertion:** When an object is thrown vertically upwards, its velocity becomes zero at the highest point
Reason: The object experiences a net force of zero at the highest point.

13) **Assertion:** While walking on ice, one should take small steps to avoid slipping.
Reason: This is because smaller steps ensure smaller friction.

14) **Assertion:** Newton's third law applies to all types of forces. e.g. gravitational, electric or magnetic forces etc.
Reason: Newton's third law of motion is applicable only when bodies are in motion.

VERY SHORT ANSWER TYPE OF QUESTIONS: (2 MARK)

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

16) Explain how the acceleration of an object is affected by its mass and the applied force, using the second law equation.

17) If two objects of different masses are subjected to the same force, which one will experience a greater acceleration? Justify your answer.

18) 'A boatman pushes the river bank with a bamboo pole to take his boat into the river.' Explain his action with reason.

19) In a high jump athletic event, the athletes are made to fall on a cushion bed. Give reason.

20) Why is it incorrect to say that the action-reaction forces cancel each other out? Explain with a suitable scenario.

21) Why do fielders pull their hand gradually with the moving ball while holding a catch?

22) How does wearing a seatbelt in a moving car relate to Newton's First Law of Motion and the concept of inertia?

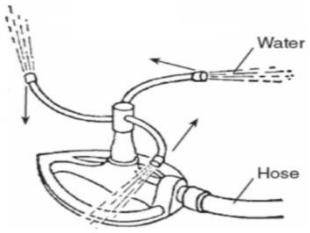
23) If a body is not at rest, the net external force acting on it cannot be zero. Is it true or false? Justify.

24) A body of mass 2 kg is acted upon by a force of 1 N, what would be its acceleration?

25) What is the momentum of a man of mass 70 kg, when he walks with a uniform velocity of 2 ms^{-1}?

26) How does a swimmer use Newton's Third Law to push against the water and move forward?

27) Water sprinkler, used for grass lawns, begins to rotate as soon as the water is supplied. Which law of motion is the cause of rotation of the water sprinkler? Explain.



SHORT ANSWER TYPE OF QUESTIONS (3 MARK):

28) Give reason:
   (i) A javelin thrower is marked foul if he crosses over the line marked for throw. Athletes often fail to stop themselves before the line.
   (ii) It is difficult to stop our body, when we accidently step on a peel of banana.
   (iii) A stone tied to a string is whirling in a horizontal circle. If the string breaks, the stone flies away tangentially.

29) A ball of mass 100 g moving with a velocity 10 ms^{-1} is stopped by a boy in 0.2 s. calculate the force applied by the boy to stop the ball.

30) When you kick a football it flies away but when you kick a stone you get hurt why?

31) A cart of mass 500 kg is initially at rest. It experiences a constant force for 10 seconds and accelerates uniformly. Given that the final velocity of the cart is 20 m/s, calculate the magnitude of the force applied.

32) A ball is suspended by a cord from the ceiling of a car. What will be the effect on the position of the ball if (i) The car is moving with constant velocity? (ii) The car is in accelerated motion? (iii) The car is turning towards right?

33) Define inertia. How does it depend on mass of the object? Explain (a)Dusting of a carpet by beating it with a stick. (b)Removal of water from wet cloth.

34) Give reason and give the law related to these statements (a) some of the leaves may get detached from a tree if we vigorously shake its branch. (b) It is difficult for a fireman to hold a hose which ejects large amount of water with high velocity.

35) A scooter is moving with a velocity of 20m/s when brakes are applied. The mass of the scooter and the rider is 180Kg. The constant force applied by the brakes is 500N. a) How long should the brakes be applied to make the scooter come to a halt? b) How far does the scooter travel before it comes to rest?

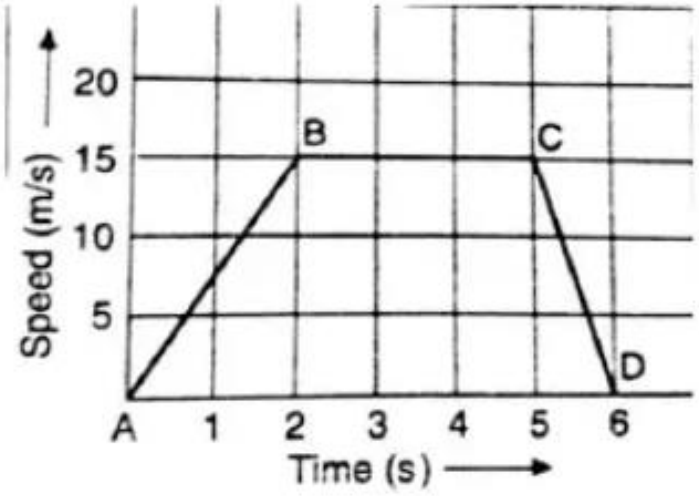
LONG ANSWER TYPE OF QUESTIONS (5 MARK):

36) State the second law of motion and Derive its mathematical expression?

37) Deduce Newton's first law from the second law.

38) A bullet of mass 4 g when fired with a velocity of 50 ms^{-1}, can enter a wall up to a depth of 10 cm. How much will be the average resistances offered by the wall?

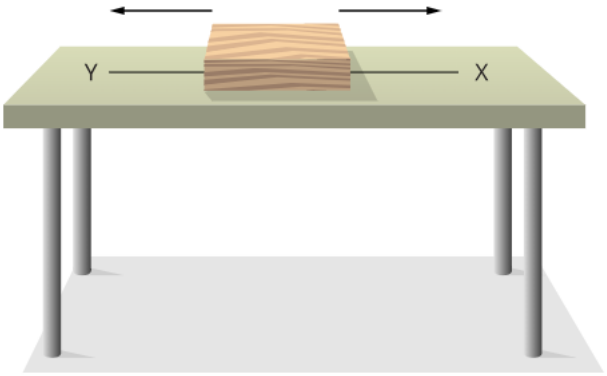
39) The speed – time graph of a car 1000 kg mass is given below. On the basis of this answer the following questions.



a) When is the maximum force acting on the car?
b) What is the retarding force acting on the car?
c) For how long is there no force acting on the car?
d) What is the velocity of the car at 5 second?
e) Find the acceleration of the car during the first interval of two second?

CASE STUDY TYPE OF QUESTIONS (4 MARK):

40) Two strings X and Y are tied to the two opposite faces of the block as shown in figure. If we apply a force by pulling the string X, the block begins to move to the right. Similarly, if we pull the string Y, the block moves to the left. But, if the block is pulled from both the sides with equal forces, the block will not move. Such forces are called balanced forces and do not change the state of rest or of motion of an object. Now, let us consider a situation in which two opposite forces of different magnitudes pull the block. In this case, the block would begin to move in the direction of the greater force. Thus, the two forces are not balanced and the unbalanced force acts in the direction the block moves. This suggests that an unbalanced force acting on an object brings it in motion. Force is push or pull.



(i) What happens when a balanced force is acting on a moving object?

(ii) From above diagram if one person pulls from Y rope with 10N force and another person pull from X rope with 5N force, what is the net force acting on the box?

(iii)Differentiate between balanced and unbalanced force

OR

A speedboat has a mass of 500 kg. It starts from rest and travels 200 m in 12 s. The boat undergoes constant acceleration during 12 s. Find the magnitude of unbalanced force acting on the boat?

ANSWER KEY	
1	a) Newton's First Law
2	b)The net force acting on the object is zero.
3	a)Double
4	c) Accelerates with a constant acceleration
5	c) i and iv
6	a)8 N upwards
7	c)Equal and opposite forces are acting
8	b)4 N
9	b)Newton's second law of motion
10	a)200 N
11	a)Both A and R are true, and R is the correct explanation of A.
12	b)Both A and R are true, and R is not the correct explanation of A.
13	c)A is true but R is false.
14	c)A is true but R is false.
15	When the bus stops suddenly, the luggage on the roof top will fall forward due to inertia of motion. Similarly, when the bus starts the luggage will fall backwards due to inertia of rest. To avoid this, any luggage kept on the roof of a bus is tied with a rope.
16	F=ma a=F/m As force increases acceleration also increases and vice versa as acceleration and force are

	directly proportional As mass increases acceleration decreases and vice versa as acceleration and mass are inversely proportional.
17	If two objects of different masses are subjected to the same force, the object with the smaller mass will experience a greater acceleration. a=F/m Since the force F is the same for both objects and the mass m is smaller for one of the objects, the resulting acceleration will be larger for the object with the smaller mass
18	When the boatman pushes the river with a bamboo pole, it applies a force on the bank of river and river returns the similar magnitude reaction force to the boat by pushing it forward. This is happening by Newton's third law, which states that every action has an equal and opposite reaction.
19	This is to increase the time of the athlete's fall to stop after making the jump. This decreases the rate of change of momentum and hence, the force.
20	Even though action and reactions are two equal forces in the opposite directions they act on different bodies and not on same body, therefore they do not get canceled. Explain with any example(action and reaction)
21	It reduces the impact of catching the fast moving ball. Increasing the time decreases the force.
22	If an accident occurs or brakes are applied to the car suddenly, the body will tend to continue its inertia of motion and move forward. To prevent such accidents, seat belts are used, stopping your body from moving forward in inertia and avoiding danger.
23	The statement is true**.** When a body is not at rest (meaning it's either in motion or changing its velocity), there must be an external force acting on it. This force is responsible for changing the body's state of motion. If there were no net external force acting on the body, it would either remain at rest or continue moving with a constant velocity.
24	$F = ma$ $a = F/m = ½ = 0.5\ ms^{-2}$
25	$p = mv = 70\ (2) = 140\ kg\ ms^{-1}$
26	Newton’s third law states that for every action there is an equal and opposite reaction. When a person swims, he pushes the water backward and the water, in turn, pushes the person with an equal force in the forward direction.
27	On the basis of Newton's third laws of motion, rotation of the sprinkler is explained. As soon as water comes out of the nozzle of the sprinkler, it exerts an equal force on the nozzle in opposite direction and the sprinkler starts rotating.
28	(i) Due to inertia of motion, an object do not stop all of a sudden rather it continues to move over some distance. Hence the athletes stop themselves much before line marked so that they come to rest before crossing that line, otherwise it is said to be a foul (ii) The surface of banana is smooth. Hence less will be the friction. Therefore, it is difficult to balance our body if we accidently step on a peel of banana.

	(iii)Inertia of direction
29	F = ma = m(v-u)/t = 0.1(0-10)/ 0.2 = -5 N
30	This is because stone is heavier than football and heavier objects offer larger inertia. When we kick a football its mass is less and inertia is also less so force applied by our kick acts on it and hence it shows larger displacement but in case of stone, it has larger mass and offers larger inertia.
31	F = ma = m(v-u)/t = 500(20-0)/ 10 = 1000 N
32	(i)The ball will remain suspended vertically. (ii) The ball will move in backward direction. (iii) The ball will move towards left.
33	Inertia is the property of the body to be in the state of rest or in the state of uniform motion unless compelled by an external unbalanced force. More the mass of an object more is the inertia as mass is the measure of inertia. a) When a carpet is beaten with a stick, the dust comes out of it because of inertia. Initially the dust particles are at rest along with the carpet. Beating the carpet with the stick makes the carpet to move but the dust particles remain at rest due to inertia at rest, thus the dust gets detached from the carpet. b) 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.
34	a) When the tree is at rest, the leaves are also at rest. When the tree is vigorously shaken, the tree is in motion while the leaves are at rest, due to inertia. The force acts on the leaves in changing directions and results in the leaves detaching from the trees. It is related to Newton's first law of motion. b) Hose pipes eject a large amount of water at a high velocity. There's a backward reaction force due to the water rushing out. This tends to decrease the stability of the fireman, thus making it difficult for him to hold it. It is related to Newton's third law of motion
35	a) F = ma a = F/m = -500/180 = - 2.78 ms^{-2} a = (v-u)/t -2.78 = (0-20)/ t t = 7.19 s

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b) $S=ut+\frac{1}{2}at^2$

$S=20\times7.2+\frac{1}{2}\times(-2.78)\times(7.2)^2$

$S=144-72.1=71.9m$
</td></tr>
<tr><td>36</td><td>As given in the notebook</td></tr>
<tr><td>37</td><td>As given in the notebook</td></tr>
<tr><td>38</td><td>$v^2 - u^2 = 2as$
$a = -(50)^2 / 2\ (0.1) = -\ 12500\ ms^{-2}$
$F = ma = 0.004(-12500) = -\ 50$ N
The average resistive force is 50 N</td></tr>
<tr><td>39</td><td>a) Slope of the graph gives acceleration
A to B: $a = (15-0)/\ 2-0 = 7.5\ ms^{-2}$
B to C: a=0
C to D: $a=(0-15)/6-5 = -15\ ms^{-2}$
Hence between 5 s to 6 s, maximum force is acting on the car.
b) Retarding force is acting between C to D
F = ma = 1000(-15) = -15000 N
Hence retarding force is 15000 N
c) Since there is no acceleration between B to C, there is no force acting on the car.
For 3 s from 2s to 5s, there is no force acting.
d) 15 m/s
e) $a = (15-0)/\ 2-0 = 7.5\ ms^{-2}$</td></tr>
<tr><td>40</td><td>(i) Object continues to move with same speed
(ii) 5 N in the direction of Y
(iii)
<table>
<tr><td>Balanced force</td><td>Unbalanced force</td></tr>
<tr><td>The forces are equal in magnitude</td><td>The forces are unequal in magnitude</td></tr>
<tr><td>It does not cause any change in the state of motion of the object.</td><td>Causes change in the state of motion of the object.</td></tr>
<tr><td>Balanced force means the sum of all the forces(or net force) acting on a body is zero.</td><td>Unbalanced force means the sum of all the forces acting on a body is non-zero.</td></tr>
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OR</td></tr>
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	$s = ut + ½ a t^2$ $200 = 0 + ½ a 12^2$ $a = 2.78 ms^{-2}$ $F = ma = 500 (2.78) = 1390 N$

Prepared by : **Ms Vivette Shirly Lasrado**	**Checked by:** **HOD SCIENCE & FRENCH**