	INDIAN SCHOOL AL WADI AL KABIR	
Class: IX	**Department: SCIENCE 2024 – 25** **SUBJECT: PHYSICS**	**Date of submission:** **30-08-2024**
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) Cricket player does not get hurt while catching the fast moving ball because:
   a) The acceleration of the ball is decreased by holding and pulling his hand back
   b) The fielder increases the time during which the high velocity of the ball decreases to 0.
   c) Both a and b.
   d) Weight of the ball is very less.

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

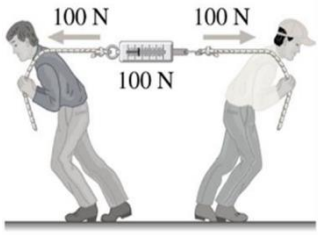
3) If the mass of an object remains constant and the force acting on it doubles, its acceleration will:
   a) Double
   b) Halve
   c) Remain the same
   d) Become zero

4) A vehicle of mass 120 kg is moving with a uniform velocity of 108 km/h . The force required to stop the vehicle in 10 s is
   a) 90 N
   b)180 N
   c) 360 N
   d) 720 N

5) The greater the mass of an object,
   a) The easier the object starts moving.
   b) The more balanced it is.
   c) The more space it takes up.
   d) The greater is its inertia.

6) Consider the mass of one block to be 100 grams. How much force will be required to pick 10 such blocks individually?
   a) 0.98 N
   b) 9.8 N
   c) 980 N
   d) 98 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) Man sitting in a train in a motion is facing the engine. He tosses a coin up, the coin falls behind him. The train is moving:
   a) Forward with uniform speed
   b) Backward with uniform speed
   c) Forward with acceleration
   d) Forward with retardation

10) A goalkeeper in a football game pulls his hands backwards after holding the ball shot at the goal. This enables the goalkeeper to:
   a) Increase the rate of change of momentum
   b) Decrease the rate of change of momentum
   c) Reduce the force exerted by the ball on the hands
   d) Exert larger force on the ball

11) Select the equivalent of unit newton (N)
   a) ms
   b) kg m/s
   c) kg m/s^2
   d) m/s^2

12) A force of 50 N moves a body,
   a) Friction force exerted on the body is less than 50 N
   b) Friction force exerted on the body is more than 50 N
   c) None of these
   d) Both of I and II

13) When a body is stationary
   a) There is no force acting on it
   b) The force acting on it are not in contact with it
   c) The combination of forces acting on it balance each other
   d) All the above

14) When we are not pedaling the bicycle it stops because
   a) The earth's gravitational force acts on it
   b) It is not accelerated
   c) No unbalanced force acts on it
   d) Frictional force acts on it

15) Momentum of a body occupies the direction of
   a) Force
   b) velocity
   c) acceleration
   d) none of these

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

16) **Assertion:** The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass.
   Reason: This statement describes Newton's Second Law of Motion.

17) **Assertion:** The momentum of an object is the product of its mass and velocity.
   Reason: An object with a greater mass will have a smaller momentum for the same velocity

18) **Assertion:** Both A and R are true, and R is not the correct explanation of A.
   Reason: Both A and R are true, and R is not the correct explanation of A.

19) **Assertion:** A stationary object remains at rest unless acted upon by an external force.
   Reason: This is due to Newton's Third Law of Motion.

VERY SHORT ANSWER TYPE OF QUESTIONS: (2 MARK)

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

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

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

23) If two masses in the ratio 3: 5 are accelerated by forces in the ratio 5 : 3 . Find the ratio of acceleration produced.

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

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

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

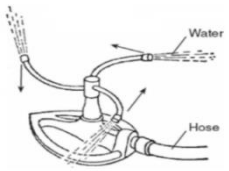
27) How does wearing a seatbelt in a moving car relate to Newton's First Law of Motion and the concept of inertia?

28) A 4 kg object is moving along a frictionless surface with a constant velocity of 2 m/s. Determine the amount of force required to maintain its state of motion.

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

30) Give reason
   a) The mangoes are detached from the branch if it is shaken well
   b) If we Jerk out a piece of paper from under a heavy book, the book will not move

31) 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.

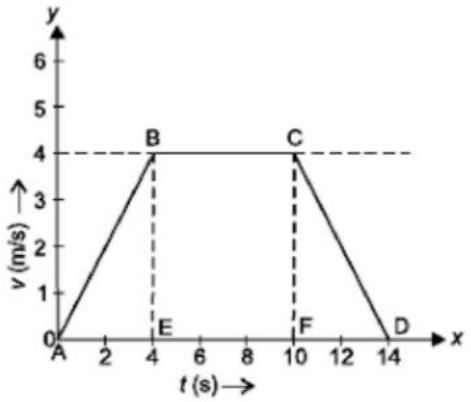


SHORT ANSWER TYPE OF QUESTIONS (3 MARK):

32) 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.

33) 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.

34) From the given v—t graph of a body of mass 4 kg
   a) Calculate the force on the object in the time interval 0—4s
   b) Identify the time interval in which there is no net force acting on the body



35) 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?

36) 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.

37) Which would require more force: accelerating a 10 g mass at 5 m/s or a 20 g mass at 2 m/s^2 ?

38) A constant retarding force of 50 N is supplied to a body of 20 kg moving initially with a speed of 15 m/s. How long does the body take to stop?

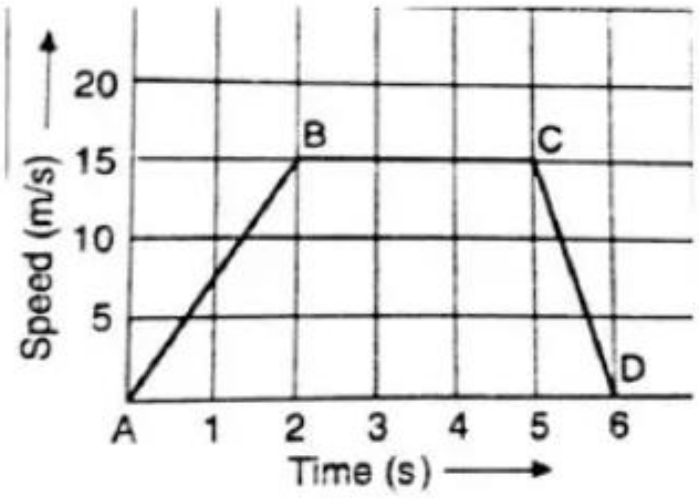
LONG ANSWER TYPE OF QUESTIONS (5 MARK):

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

40) State Newton's three laws of motion. Calculate the magnitude of force required to produce an acceleration of 2 m/s^2 in a body of mass 12.5 kg.

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

42) 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) Find the acceleration of the car during the first interval of two second?

CASE STUDY TYPE OF QUESTIONS (4 MARK):

43) The force acting on a body is capable of bringing changes in its motion. Newton's three laws of motion are the consequences of this effect of force. While Newton's first law is called the law of inertia, the second law is called the real law of motion. But it is the third law of motion which enables our movement on the earth. During our movement, the total momentum of any system of which we are a part, remains constant, as obtained from the third law of motion. Despite that, action and reaction forces cannot create an equilibrium.

(i) Newton's first law states that no net force acts on a body moving with uniform velocity. Then why do we have to spend fuel in keeping our car in constant speed?

(ii) A block is at rest on a table. A girl applies a force towards the right. The applied force is equal to the frictional force between block and the surface. What will happen to the block?

(iii) Differentiate between balanced and unbalanced force

OR

A dumb bell of 10 kg mass falls from a height of 0.8 m. What is the momentum transferred by the dumb bell while hitting the ground?

ANSWER KEY	
1	b)The fielder increases the time during which the high velocity of the ball decreases to 0
2	b) The net force acting on the object is zero.
3	a)Double
4	c) 360 N
5	d)The greater is its inertia
6	a) 0.98 N
7	c)Equal and opposite forces are acting
8	b)4 N
9	c)Forward with acceleration
10	b)Decrease the rate of change of momentum
11	c)kg m/s^2
12	a)Friction force exerted on the body is less than 50 N
13	c)The combination of forces acting on it balance each other
14	d)Frictional force acts on it
15	b)velocity
16	a)Both A and R are true, and R is the correct explanation of A.
17	c)A is true but R is false.
18	b)Both A and R are true, and R is not the correct explanation of A.
19	c)A is true but R is false.
20	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.
21	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.
22	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
23	Given : $\frac{m_1}{m_2} = \frac{3}{5}\frac{F_1}{F_2} = \frac{5}{3}$ Acceleration $a = \frac{F}{m}$ $\Rightarrow \frac{a_1}{a_2} = \frac{F_1}{F_2}.\frac{m_2}{m_1} = \frac{5}{3} \times \frac{5}{3} = \frac{25}{9}$
24	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.

25	By Newton's First law of motion, a body remains in the state of rest or uniform motion unless an external force is applied on it. So, if the body has some initial velocity and net force applied is zero, it will continue to move with the same initial velocity.
26	It reduces the impact of catching the fast moving ball. Increasing the time decreases the force.
27	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.
28	the object moves with a constant velocity of 2 m/s. Hence, its velocity does not change with respect to time and hence the force experienced by the body is zero. No force is required to maintain this state of motion for the body.
29	Mass, m=70 kg Velocity, v=2 ms^{-1} Let the momentum be 'p'. p=mv=70×2=140 kg ms^{-1}
30	a) When we shake a mango tree, the mangoes fall down. It is because when we shake the tree, the mangoes tend to be at rest due to inertia whereas the branches are in motion. That is why the mangoes get detached from the branches. b) Both book and piece of paper are initially at rest. When sudden jerk is given to a piece of paper which is under book, the motion of piece of paper in not imported to the book. Hence, due to inertia of rest the book does not move.
31	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.
32	(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
33	F = ma = m(v-u)/t = 0.1(0-10)/ 0.2 = -5 N, -ve sign indicates that the force applied by the boy is in the direction opposite to the ball's initial direction of motion.
34	a) F=ma a=slope=4-0/4-0 = 1 m/s^2 F=4(1) =4 N b)BC = 4 s to 10 s
35	(i)The ball will remain suspended vertically. (ii) The ball will move in backward direction. (iii) The ball will move towards left.

36	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.
37	$m_1 = 10\,\text{g} = 0.01\,\text{kg}$ $a_1 = 5\,\text{m/s}^2$ $F_1 = m_1 \times a_1 = 0.01\,\text{kg} \times 5\,\text{m/s}^2 = 0.05\,\text{N}$ $m_2 = 20\,\text{g} = 0.02\,\text{kg}$ $a_2 = 2\,\text{m/s}^2$ $F_2 = m_2 \times a_2 = 0.02\,\text{kg} \times 2\,\text{m/s}^2 = 0.04\,\text{N}$ accelerating a 10 g mass at 5 m/s², requires more force (0.05 N) compared to Scenario 2 (0.04 N).
38	F = ma − 50 = 20 × a ∴ a = $\frac{-50}{20}$ = −2.5 m/s² Using the first equation of motion, the time (t) taken by the body to come to rest can be calculated as: v = u + at ∴ t = $\frac{-u}{a} = \frac{-15}{-2.5}$ = 6 s
39	As given in the notebook
40	As given in the notebook F=ma F = 12.5(2)=25 N
41	$\Delta P = mv - mu$ $\Delta P = 1200 \times 5 - 1200 \times 25$ $\Delta P = -24000\ \text{kg m/s}$ $V = u + at$ $5 = 25 + a \times 4$ $a = -5\ \text{m/s}^2$ $\lvert F \rvert = m\lvert a \rvert$ $\lvert F \rvert = 1200 \times 5$ $\lvert F \rvert = 6000\ \text{N}$ Thus, the acceleration, change in momentum and the magnitude of the force is $a = -5\ \text{m/s}^2, \Delta P = -24000\ \text{kg m/s}, \lvert F \rvert = 6000\ \text{N}.$

<table>
<tr><td>42</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) a = (15-0)/ 2-0 = 7.5 ms^{-2}</td></tr>
<tr><td>43</td><td>(i) We have to spend fuel to maintain a zero net force acting on the car by balancing the applied force with the frictional force acting in the opposite direction of motion.
(ii) it does not move
<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></table>OR
$v^2 = u^2 + 2gh$
Upon substituting the values we get,
$v^2 = 0 + 2 \times 10 \times 0.8$
$= 16$
$\therefore v = 4\ m/s$
$\Delta p = m\,\Delta v$
Δp is the change in momentum and Δv is the change in velocity
$\Delta v = v - u$
$\Delta v = 4 - 0$
$\Delta v = 4\ m/s$
Upon substituting the values we get,
$p = 10 \times 4$
$= 40\ kg\ m/s$</td></tr>
</table>

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