INDIAN SCHOOL AL WADI AL KABIR

Class: IX	Department: SCIENCE 2021 - 22 SUBJECT-PHYSICS		Date of submission: 07.10.2021
Worksheet +Answers-No:2	Topic: FORCE AND LAWS OF MOTION		Note: A4 FILE FORMAT [PORTFOLIO]
NAME OF THE STUDENT		CLASS & SEC:	ROLL NO.

1. Which of the following statements is not correct for an object moving along a straight path in an accelerated motion?
   (a) Its speed keeps changing
   (b) Its velocity always changes
   (c) It always goes away from the Earth
   (d) A force is always acting on it

2. According to the third law of motion, action and reaction
   (a) always act on the same body
   (b) always act on different bodies in opposite directions
   (c) have same magnitude and directions
   (d) act on either body at normal to each other

3. A goalkeeper in a game of football pulls his hands backwards after holding the ball shot at the goal. This enables the goalkeeper to
   (a) exert larger force on the ball
   (b) reduce the force exerted by the balls on the hands
   (c) increase the rate of change of momentum
   (d) decrease the rate of change of momentum

4. 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

5. A water tanker filled up to 2/3 of its height is moving with a uniform speed. On a sudden application of brakes, the water in the tank would

   (a) move backward
   (b) move forward

(c) be unaffected
(d) rise upwards

6. Rocket works on the principal of conservation of :
   (a) Mass (b) Energy (c) Momentum (d) Velocity

7. The masses of two bodies are in ratio 5 : 6 and their velocities are in ratio 1 : 2. Then their linear momentum will be in the ratio------------
   (a) 5:12 (b) 12:5 (c) 1:2 (d) 2:1

8. 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

Very short answer questions

9. Define 1 newton force.
10. Describe our walking in terms of Newton's third law of motion.
11. Name the factors on which the momentum of a body depends.
12. An object is thrown vertically upwards. What is its momentum at the highest point?
13. A car of mass 1000 kg is moving with velocity 5 m/s. Calculate the momentum of the car.
14. Find the acceleration produced by a force of 2000 N acting on a car of mass 800 kg.

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.

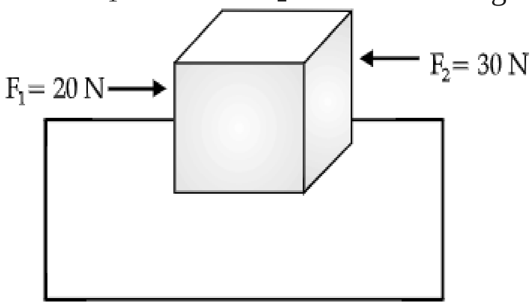
(c) Assertion is true but reason is false.

(d) Both Assertion and Reason are false.

15. **Assertion:** If the net external force on the body is zero, then its acceleration is zero.
    Reason: Acceleration does not depend on force.
16. **Assertion:** A quick collision between two bodies is more violent than a slow collision, even when the initial and the final velocities are identical.
    Reason: Because the rate of change of momentum which determines the force is greater in the first case.
17. **Assertion:** Five rupee coin has more inertia than one rupee coin.
    Reason: Inertia does not depend upon mass of the object.

CASE STUDY BASED QUESTIONS:

18. Observe the diagram and answer any four questions below :
    Two forces F_1 =20N and F_2 = 30 N are acting on an object as shown in figure:



(i) Find the net force acting on the object
(a) Zero (b) 30N (c) 20N (d) 10N

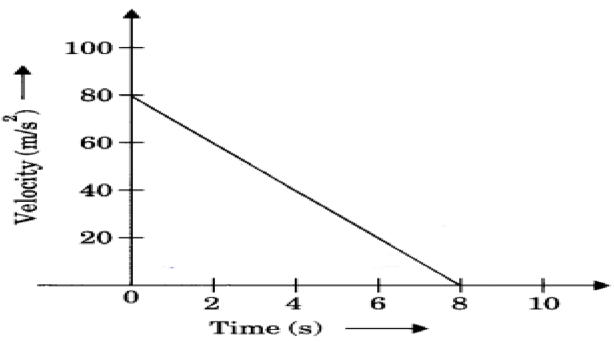
(ii) State the direction of the net force acting on the object
(a) Net force acts in the direction of force F_2
(b) Net force act in the direction of force F_1
(c) No net force is acting on the object
(d) Downward direction

(iii) If a body still does not move under the application of these forces, what can be the possible reason for this
(a) Forces are acting parallel to each other
(b) Forces are acting perpendicular to each other
(c) All forces are balanced
(d) Forces are not balanced.

(iv) What is the unit of force ?
(a) Pascal
(b) Metre
(c) Kilogram
(d) Newton

Short answer questions

19. Two balls of the same size but of different materials, rubber and iron are kept on the smooth floor of a moving train. The brakes are applied suddenly to stop the train. Will the balls start rolling? If so, in which direction? Will they move with the same speed? Give reasons for your answer
20. Velocity versus time graph of a ball of mass 50 g rolling on a concrete floor is shown in the figure. Calculate the acceleration and frictional force of the floor on the ball.



21. Explain
    (a) How do we swim?
    (b) It is difficult to walk on sand or ice.

22. A car weighing 1600 kg moving with a velocity of 30 m/s retards uniformly coming to rest in 20 seconds. Calculate the
    1. Initial and final momentum of the car.
    2. Rate of change of linear momentum of the car.
    3. Acceleration of the car.

23. Two spheres of masses 20 g and 40 g moving in a straight line in the same direction with velocities of 3 m/s and 2 m/s respectively. They collide with each other and after the collision, the sphere of mass 20 g moves with a velocity of 2.5 miles. Find the velocity of the second ball after collision.

24. A bullet of mass 200 g is fired from a gun of mass 10 kg with a velocity of 100 m/s. Calculate the velocity of recoil. (CBSE 2012)

25. A body of mass 100g is at rest on a smooth surface. A force of 0.1-newton act on it for 5 seconds. Calculate the distance travelled by the body.

Long answer type questions

26. A boy of mass 40 kg jumps with a horizontal velocity of 5 ms^{-1} onto a stationary cart with frictionless wheels. The mass of the cart is 3 kg. What is his velocity as the cart starts moving? Assume that there is no external unbalanced force working in horizontal direction.
27. 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?
28. State Newton's first law of motion .Show that Newton's first law of motion is a special case of Newtons second law. Determine the acceleration of a car of mass 800 kg , on application of force 200N on it. (CBSE 2012)
29. 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)

Q. No	Answers
1	(d) A force is always acting on it
2	(b) always act on different bodies in opposite directions
3	(d) decrease the rate of change of momentum
4	(d) 8 N
5	(b) move forward
6	(c) Momentum
7	(a) 5 : 12
8	(a) First law
9	1 Newton is the magnitude of force which produces an acceleration of 1 m/s^2 in a body of mass 1 kg.
10	When we walk on the ground or road, our foot pushes the ground backward (action) and the ground pushes our foot forward (reaction). Thus, the forward reaction exerted by the ground on our foot makes us walk forward.
11	Mass and velocity of the body.
12	Since the velocity at the highest point is zero, so the momentum of the object is zero at the highest point.
13	mass, m = 1000 kg Velocity, u = 5 m/s Momentum, P = mυ P= 1000 x 5 = 5000kg m/s P= 5000 kg m/s
14	Mass, m =800kg Force, F = 2000 N F = ma a = F/m a = 2000800 = 2.5 m/s^2
15	Answer: (c) Assertion is true but reason is false. According to Newton's second law,

	force = acceleration x mass i.e., if net external force on the body is zero (F = 0), then, the acceleration of a body is also zero.
16	Answer: (a) Both assertion and reason are true and reason is the correct explanation of assertion.
17	(c) Assertion is true but reason is false.
18	(i) (d) 10N (ii) (a) Net force acts in the direction of force F_2 (iii) (c) All forces are balanced (iv) (d) Newton
19	Yes, both the balls will start rolling in the direction opposite to the motion of the train. The speed of two balls will be different as the inertia of the two balls are different.
20	Mass of ball, m = 50 g = 50 x 10^{-3} kg Acceleration can be calculated by υ – t graph, $a = \frac{\text{change in velocity}}{\text{time taken}}$ $= -\frac{80 \text{ m/s}}{8 \text{ s}} = -10 \text{ m/s}^2$ $a = -10 \text{ m/s}^2$ Friction force, F = ma F = 50 x 10^{-3} x 10 F = 0.5 N
21	(a) While swimming, a swimmer pushes the water backward with his hands (i.e., he applies force in the backward direction, which is known as action.) The reaction offered by the water to the swimmer pushes him forward. (b) It is difficult to walk on sand or ice: When our feet press the sandy ground in the backward direction, the sand gets pushed away and as a result, we get only a small reaction (forward) from the sandy ground making it difficult to walk.
22	mass, m = 1600 kg Initial velocity, u = 30 m/s

	Final velocity, υ = 0 m/s Time, t = 20s 1. Initial momentum, P_i = mu = 1600 x 30 P_i = 4800 kg m/s Final momentum, P_f = mυ = 1600 x 0 P_f = 0 kg m/s 2. Rate of change of linear momentum = (P_f−P_i)/t = 0−4800/20 = – 240N 3. a = (v−u)/t = (0–30)/20 a = – 1.5 m/s^2.
23	Given, m_1 = 20 g = 20 x 10^{-3} kg m_1 = 40g = 40g x 10^{-3}kg u_1 = 3 m/s u_2 = 2 m/s $υ_1$ = 2.5 m/s Applying conservation of linear momentum, $m_1u_1 + m_2u_2 = m_1υ_1 + m_2υ_2$ 20 x 10^{-3} x 3 + 40 x 10^{-3} x 2 = 20 x 10^{-3} x 2.5 + 40 x 10^{-3} x $υ^2$ $υ_2$ = 2.25m/s.
24	Mass of bullet, m = 200 g = 0.2 kg Mass of gun, M = 10 kg Velocity of bullet, V = 100 m/.s Recoil velocity of gun, V_G = mv/M V_G = – 0.2×100/10 = 2m/s Recoil velocity of gun, V_G = 2 m/s
25	Mass of body = 100 g = 0.1 kg Force, F = 0.1N

	Time, t = 5s Initial velocity, u = 0 m/s Using formula, F = ma ⇒ a = F/m=0.1/0.1 = 1 m/s^2 Using formula, s = ut + at^2 s = ut + 1/2at^2 ⇒ s = 0 + 1/2 x 1 x (5)^2 ∴ s = 12.5 m
26	The total momenta of the boy and cart before the interaction = 40 kg × 5 ms^{-1} + 3 kg × 0 ms^{-1} = 200 kg ms^{-1} Also, the total momenta after the interaction = (40 + 3) kg × v ms^{-1} = 43v kg ms^{-1} 43 v = 200 or, v = 200/43 = 4.65 ms^{-1} Thus, the boy on cart would move with a velocity of 4.65 ms-1 in the direction in which the boy jumped onto the cart.
27	Mass of the bullet, m = 4 × 10^{-3} kg Initial velocity, Depth, u = 50 ms^{-1} Depth, s = 10cm = 0.1 m Final velocity, v = 0, Force, F = ? We know v^2 = u^2 + 2as v^2 – u^2 = 2as 0 – (50)^2 = 2a × 0.1 or, -2500 = 0.2 a ⇒ a = -12500ms^{-1} Force, F = ma = 4 × 10^{-3} × (-12500) = -50N

	Thus, the average resistance offered = 50 N Negative sign indicates that the force is acting opposite to the motion.
28	An object remains in a state of rest or of uniform motion in a straight line unless compelled to change that state by an applied force. The first law of motion can be mathematically stated from the mathematical expression for the second law of motion F = ma or F = m (v- u)/ t , or Ft = mv – mu That is, when F = 0, v = u . The object will continue to move with uniform velocity. M=800 Kg , F= 200N a =F/ m = 200/800 = ¼ = 0.25m/s^2
29	a = (0-5)/0.01 a= -500 m/s^2 F= ma = 0.5x -500 = -250 N

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