

Motion, Force and Laws of Motion

Science · Class 9 · Topic-wise Practice Worksheet

TIME 45 minutes	QUESTIONS 18	TOTAL MARKS 24	MAX. SCORE ___ / 24
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Name: _____ Class/Sec: _____ Date: _____

INSTRUCTIONS

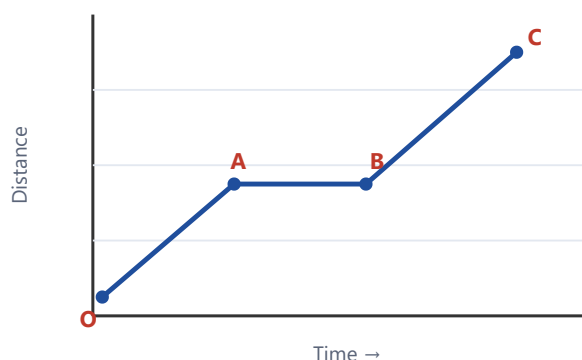
- There are **18 questions** in this worksheet. All questions are compulsory.
- Each question has four options (A), (B), (C) and (D). Exactly **one** option is correct.
- Questions 1–15 carry **1 mark** each. Questions 16–18 (Achievers Section) carry **3 marks** each.
- There is no negative marking. Study every graph and table carefully.

Section A — Scientific Reasoning

Q1–Q8 · 1 mark each

- The SI unit of acceleration is _____.
 (A) m/s (B) m/s²
 (C) km/h (D) N
- A stone tied to a string is whirled in a circle at a steady speed. Its velocity is _____.
 (A) Constant, because the speed does not change (B) Changing only when the string breaks
 (C) Zero at every instant (D) Changing, because the direction keeps changing
- Newton's first law of motion introduces the idea of _____.
 (A) Inertia (B) Momentum
 (C) Action and reaction (D) Gravitation
- The SI unit of force is the _____.
 (A) Joule (B) Newton
 (C) Pascal (D) Watt
- The momentum of a body is given by _____.
 (A) mass × acceleration (B) force × time
 (C) mass × velocity (D) mass ÷ velocity
- According to Newton's third law, action and reaction forces _____.
 (A) Act on the same body and cancel out (B) Act in the same direction
 (C) Are unequal in magnitude (D) Act on two different bodies
- The slope of a distance–time graph gives the _____.
 (A) Speed of the body (B) Distance travelled
 (C) Acceleration of the body (D) Momentum of the body
- For a body moving with uniform acceleration a , which equation is correct?
 (A) $s = ut + at^2$ (B) $s = ut + \frac{1}{2}at^2$
 (C) $v = u + at^2$ (D) $v^2 = u^2 + as$

9. The distance–time graph of a moving body is shown. During which part is the body at **rest**?



Distance–time graph of a body moving along a straight line

- (A) OA
(B) BC
(C) AB
(D) The body is never at rest
10. A car starting from rest reaches a speed of 20 m/s in 5 seconds. Its acceleration is _____.
(A) 2 m/s²
(B) 100 m/s²
(C) 5 m/s²
(D) 4 m/s²
11. A bus travelling at 72 km/h is brought to rest in a distance of 50 m. Its retardation is _____.
(A) 4 m/s²
(B) 2 m/s²
(C) 8 m/s²
(D) 20 m/s²
12. In a velocity–time graph, the area enclosed between the graph line and the time axis gives the _____.
(A) Acceleration
(B) Distance travelled
(C) Momentum
(D) Force applied
13. One row of the table below is **incorrectly** matched. Which row is it?

Row	Quantity	Type and SI unit
(A)	Speed	Vector, m/s
(B)	Displacement	Vector, metre
(C)	Distance	Scalar, metre
(D)	Momentum	Vector, kg·m/s

Table 4.1 — Quantities used in describing motion

- (A) (A)
(B) (B)
(C) (C)
(D) (D)
14. A force acting on a body of mass 5 kg produces an acceleration of 10 m/s². The magnitude of the force is _____.
(A) 0.5 N
(B) 2 N
(C) 50 N
(D) 15 N
15. When a bullet is fired, the gun recoils backwards. This is best explained by _____.
(A) Newton's first law
(B) The law of inertia of rest
(C) The law of gravitation
(D) Newton's third law and conservation of momentum

16. Assertion (A): Passengers in a bus lurch forward when the driver brakes suddenly.

Reason (R): The lower part of a passenger's body stops with the bus while the upper part tends to stay in motion.

(A) Both A and R are true and R is the correct explanation of A

(B) Both A and R are true but R is not the correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

17. A trolley of mass 2 kg moving at 6 m/s collides with a stationary trolley of mass 4 kg, and the two move off together. Their common velocity is _____.

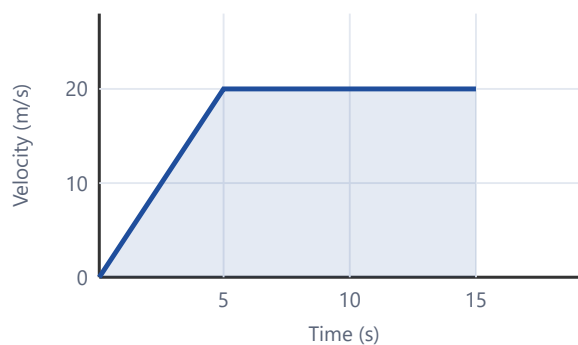
(A) 2 m/s

(B) 1 m/s

(C) 3 m/s

(D) 6 m/s

18. The velocity–time graph shows a body that accelerates uniformly from rest and then travels at a steady velocity. The total distance covered in the 15 seconds is _____.



Velocity–time graph of a body over 15 seconds

(A) 150 m

(B) 250 m

(C) 200 m

(D) 300 m

Answer Key

1	B	2	D	3	A	4	B	5	C
6	D	7	A	8	B	9	C	10	D
11	A	12	B	13	A	14	C	15	D
16	A	17	A	18	B				

Solutions

1. Answer: (B) m/s^2

Acceleration is the change in velocity per unit time, so its unit is $(\text{m/s}) \div \text{s} = \mathbf{m/s^2}$. The unit m/s belongs to velocity and N to force.

2. Answer: (D) Changing, because the direction keeps changing

Velocity is a vector: it has both magnitude and direction. Along a circular path the direction of motion changes continuously, so the velocity is **changing** even though the speed is constant — which means the stone is accelerating.

3. Answer: (A) Inertia

The first law states that a body keeps its state of rest or of uniform motion unless an unbalanced external force acts on it. This tendency to resist a change of state is **inertia**, which is why the law is also called the law of inertia.

4. Answer: (B) Newton

Force is measured in **newtons**: one newton is the force that gives a mass of 1 kg an acceleration of 1 m/s^2 . The joule is a unit of energy, the pascal of pressure and the watt of power.

5. Answer: (C) mass $\times$ velocity

Momentum $p = \mathbf{\text{mass} \times \text{velocity}}$, measured in $\text{kg}\cdot\text{m/s}$. It is a vector pointing along the velocity. (Mass $\times$ acceleration gives force, not momentum.)

6. Answer: (D) Act on two different bodies

The two forces are equal in magnitude and opposite in direction, but they **act on two different bodies**. That is why they never cancel each other — cancellation would require both to act on the same body.

7. Answer: (A) Speed of the body

Slope = change in distance $\div$ change in time, which is exactly the **speed**. A steeper line therefore means faster motion, and a horizontal line means the body is at rest.

8. Answer: (B) $s = ut + \frac{1}{2}at^2$

The second equation of motion is $\mathbf{s = ut + \frac{1}{2}at^2}$. The other two standard equations are $v = u + at$ and $v^2 = u^2 + 2as$, so the versions shown in the remaining options have their factors wrong.

9. Answer: (C) AB

Along **AB** the graph is horizontal, so the distance from the starting point does not change as time passes — the body is at rest. OA and BC both slope upward, and BC is the steeper of the two, so the body moves fastest there.

10. Answer: (D) 4 m/s^2

Acceleration $a = \frac{v - u}{t} = (20 - 0) \div 5 = \mathbf{4 \text{ m/s}^2}$.

11. Answer: (A) 4 m/s^2

First convert: $72 \text{ km/h} = 72 \times \frac{5}{18} = 20 \text{ m/s}$. Using $v^2 = u^2 + 2as$ with $v = 0$: $0 = 400 + 2a(50)$, so $a = -4 \text{ m/s}^2$. The retardation is therefore $\mathbf{4 \text{ m/s}^2}$.

12. Answer: (B) Distance travelled

Velocity $\times$ time has the units of distance, so the enclosed area represents the **distance travelled**. The slope of the same graph, meanwhile, gives the acceleration.

13. Answer: (A) (A)

Speed has magnitude only and no direction, so it is a *scalar*, not a vector — row **(A)** is wrong. Velocity is the vector version of speed. The other three rows are correctly described.

14. Answer: (C) 50 N

By Newton's second law, $F = ma = 5 \times 10 = \mathbf{50 \text{ N}}$.

15. Answer: (D) Newton's third law and conservation of momentum

The gun pushes the bullet forward and the bullet pushes the gun back with an equal and opposite force, so the total momentum stays zero: the small forward momentum of the fast bullet is balanced by the backward momentum of the heavy gun. This is **Newton's third law together with conservation of momentum**, and it is why the heavy gun recoils only slowly.

16. Answer: (A) Both A and R are true and R is the correct explanation of A

Braking applies a backward force through the floor and seat to the lower body, but no such force acts directly on the upper body, which keeps moving forward because of its inertia of motion. Both statements are true and the second is exactly **why** the lurch happens, so R explains A.

17. Answer: (A) 2 m/s

Momentum is conserved in the collision. Before: $(2 \times 6) + (4 \times 0) = 12 \text{ kg}\cdot\text{m/s}$. After, the combined mass is 6 kg moving at v , so $6v = 12$ and $v = \mathbf{2 \text{ m/s}}$ in the original direction.

18. Answer: (B) 250 m

The distance is the area under the graph. The first 5 s form a triangle of area $\frac{1}{2} \times 5 \times 20 = 50 \text{ m}$, and the next 10 s a rectangle of area $20 \times 10 = 200 \text{ m}$. The total is $50 + 200 = \mathbf{250 \text{ m}}$.