Class 9 Science Practice Worksheet

New NCERT Syllabus (2026-27) - Exploration Science

Chapter 2: Forces and Laws of Motion

Section A: Conceptual Section (5 Questions)

Q1. Identify the fundamental terms of dynamics:

(a) The natural tendency of an object to resist any change in its state of rest or uniform motion is called _____.

(b) The total momentum of an isolated system of interacting bodies always remains completely _____ if no external unbalanced force acts on it.

(c) The SI unit of force is named after a famous scientist and is equal to one kilogram-metre per second squared, written as _____. [1]

Q2. Match the everyday examples with the specific law of motion they demonstrate (Newton's First, Second, or Third Law):

(a) A swimmer pushes the water backward to move forward: _____

(b) Passengers lean forward when a moving bus suddenly hits the brakes: _____

(c) A fielder pulls their hands backward while catching a fast-moving cricket ball: _____

Q3. State whether the following statements are True or False:

(a) A balanced set of forces acting on an object can change its speed or direction of motion. (*)

***(b) The inertia of an object depends entirely on its structural mass. (*)**

(c) Action and reaction force pairs always act on two completely different objects, which is why they never cancel each other out. (_____)

Q4. Write down the complete mathematical formulas matching the descriptions:

(a) Linear momentum of an object (p): _____

(b) Force in terms of mass and acceleration (Newton's Second Law): _____

(c) Conservation of momentum for a collision between two masses (m1 and m2): _____

Q5. A constant force acts on an object of mass 5 kg for a duration of 2 seconds. It increases the object's velocity from 3 m/s to 7 m/s. Calculate the exact magnitude of the applied force. Show your steps. [1, 2]

Section B: Logical Section (5 Questions)

Q6. Look carefully at two structural items: Block A is a solid iron brick of mass 10 kg. Block B is a soft sponge brick of mass 1 kg but is identical to Block A in physical size.
(a) Logically deduce which block possesses more inertia: _____
(b) Why is it harder to kick and move Block A compared to Block B? Explain the relationship between force and mass.

Q7. A martial artist strikes a pile of tiles with their bare hand and breaks them instantly, while a normal slow push does not break them. Explain logically how the time duration of the impact changes the force exerted. [1]

Q8. A high-speed bullet is fired forward from a heavy rifle. Logically deduce why the heavy rifle recoils or moves backward with a much lower speed compared to the incredibly high forward speed of the light bullet.

Q9. Look at two distinct motion scenarios: Scenario A shows a car moving at a perfectly constant speed of 60 km/h along a straight highway. Scenario B shows a car moving at a constant speed of 60 km/h around a sharp circular turn.
(a) Logically deduce the net external unbalanced force acting in Scenario A: _____
(b) Logically deduce if a net external unbalanced force is present in Scenario B: _____

Q10. Predict force patterns logically: A heavy stone is resting completely undisturbed on the floor of a room. If Newton's Third Law states that every action has an equal and opposite reaction, name the force acting as the "action" and the corresponding "reaction" force holding the stone stable.

Section C: High Thinking Section / HOTS (5 Questions)

Q11. A massive truck of mass 2000 kg moving at 10 m/s collides head-on with a small stationary car of mass 500 kg. Upon collision, the two vehicles get locked together completely. A student claims that the truck will exert a larger force on the car than the car exerts on the truck during the impact. Explain why this logic is incorrect, and calculate the final common velocity of the combined wreck. [1]

Q12. Analyze an advanced dynamic scenario: A rocket is blasting upward into space. It works by burning fuel and ejecting hot exhaust gases downward at a high uniform velocity.

(a) Explain how the rocket accelerates upward by applying the principles of conservation of momentum.
(b) As the rocket flies higher, it continuously burns up and loses its fuel mass. If the thrust engine force remains constant, logically deduce what will happen to the rocket's acceleration over time. [1]

Q13. Derivation logic challenge: Use Newton's Second Law statement—which states that force is directly proportional to the rate of change of momentum—to logically derive the standard algebraic formula F = ma, showing how mass stays constant while velocity changes over time. [1, 2]

Q14. A motorcar is moving with a velocity of 108 km/h. It takes 4 seconds to come to a stop after the brakes are applied. If the total mass of the motorcar along with its passengers is 1000 kg:
(a) Convert the initial velocity into standard SI units.
(b) Calculate the uniform force exerted by the braking system to stop the vehicle. [1]

Q15. Think deeply about everyday physics loops: When you walk on a slippery, icy floor or a muddy path, you find it incredibly difficult to move forward and often slip. However, walking on a rough concrete road is easy. Explain why you cannot walk properly without an opposing reaction force, and trace the direction of the forces involved.

Answer Key (For Teachers and Parents)

Section A:
Q1: (a) inertia, (b) conserved, (c) Newton (N).
Q2: (a) Newton's Third Law, (b) Newton's First Law (Inertia of motion), (c) Newton's Second Law (increasing time reduces impact force).
Q3: (a) False (balanced forces can change shape but cannot change state of motion/speed), (b) True, (c) True.
Q4: (a) $p = mv$, (b) $F = ma$, (c) $m1u1 + m2u2 = m1v1 + m2v2$.
Q5: Initial velocity $u = 3$ m/s, final velocity $v = 7$ m/s, time $t = 2$ s.
Acceleration $a = (v - u) / t = (7 - 3) / 2 = 4 / 2 = 2$ m/s².
Force $F = ma = 5$ kg × 2 m/s² = 10 Newtons. [1, 2]

Section B:

Q6: (a) Block A (iron brick) has more inertia. (b) Inertia is directly proportional to mass. Block A has 10 times more mass than Block B, meaning it offers a much larger resistance to any change in its state of rest. Therefore, a much larger force is required to move it.

Q7: Force is equal to the rate of change of momentum (F = change in momentum / time). Because the martial artist's hand strikes with immense speed and stops in an extremely short split-second interval, the time denominator is tiny. This creates a massive, explosive impact force that shatters the tiles instantly.

Q8: According to the Law of Conservation of Momentum, the forward momentum of the bullet must equal the backward momentum of the rifle ($m_{bullet} \times v_{bullet} = m_{rifle} \times v_{rifle}$). Because the mass of the rifle is vastly larger than the tiny mass of the bullet, its resulting recoil velocity must be proportionally much smaller to keep the momentum balanced.

Q9: (a) Zero, because moving in a straight line at a constant speed means acceleration is zero. (b) Yes, an external force is present. Even though the speed is constant, the direction changes continuously, which means the velocity is changing (accelerated motion). This requires a net centripetal force.

Q10: The "action" is the downward gravitational pull of the Earth acting on the stone (its weight pushing down on the floor). The "reaction" is the equal and upward normal contact force exerted by the floor back onto the bottom of the stone. [1]

Section C:

Q11: The student's logic is incorrect because Newton's Third Law dictates that action and reaction forces are always exactly equal and opposite; hence, both vehicles experience the exact same impact force magnitude.

To find the final velocity, use conservation of momentum:

Total initial momentum = (2000 kg × 10 m/s) + (500 kg × 0 m/s) = 20000 kg·m/s.

Total final mass = 2000 kg + 500 kg = 2500 kg.

Combined velocity v = 20000 / 2500 = 8 m/s.

Q12: (a) The downward momentum of the rushing exhaust gases must be perfectly balanced by an equal and opposite upward momentum gained by the rocket shell body. (b) Since acceleration a = F / m, and the total mass (m) is continuously dropping as fuel burns away while the engine force (F) remains constant, the rocket's acceleration will steadily increase over time.

Q13: Force F is proportional to (Change in momentum / time) -> $F = k \times (mv - mu) / t$.

Factoring out the constant mass: $F = k \times m(v - u) / t$.

Since $(v - u) / t$ is the definition of acceleration (a), the expression becomes $F = k \times ma$. In SI units, the constant k is chosen to be 1, yielding the standard equation $F = ma$.

Q14: (a) Initial velocity u = 108 km/h = 108 × (5 / 18) = 6 × 5 = 30 m/s. Final velocity v = 0

m/s.
(b) Acceleration a = (0 - 30) / 4 = -7.5 m/s².
Braking Force F = ma = 1000 kg × (-7.5 m/s²) = -7500 Newtons (the negative sign indicates the force opposes motion).
Q15: To walk forward, your foot must push the ground backward with an action force. By Newton's Third Law, the ground reacts by pushing your foot forward with an equal reaction force, moving you ahead. On ice or wet mud, the friction is too low to sustain your backward action push without slipping, meaning the ground cannot generate the necessary forward reaction force to safely propel you. [1, 2]
