

CHAPTER 6: HOW FORCES AFFECT MOTION

Board: CBSE | Class: 9 | Subject: Science (Exploration) | Session: 2026–2027

CHAPTER OVERVIEW

- **Introduction:** Welcome to Chapter 6. This chapter explores pushes, pulls, objects, and states of motion.
- **Why this chapter is important:** Lays the fundamental groundwork for classical mechanics, engineering principles, and higher-class physics.
- **Learning Outcomes:** Master balanced/unbalanced forces, Newton's three laws, friction, inertia, and numerical problem-solving.

COMPLETE THEORY

1. Force

Definition: A push or pull acting upon an object that tends to change or changes its state of rest or uniform motion, its direction, or its shape.

Easy Explanation: An invisible hand interaction. When you kick a football or push a door, you apply force.

NCERT Explanation: Force cannot be seen, but its effects can be observed and measured.

[Push ----->] Object [<----- Pull]

Formula: $F = m \times a$ | **SI Unit:** Newton (N)

2. Effects of Force

Definition: The observable results when a force is applied to a body.

NCERT Explanation: Forces can (1) start/stop motion, (2) change speed, (3) change direction, (4) change shape/size.

3. Contact Force vs. Non-Contact Force

Contact Force: Forces that act only when objects are in physical contact (e.g., Muscular force, Friction).

Non-Contact Force: Forces that act across a distance without physical contact (e.g., Gravitational, Magnetic, Electrostatic).

4. Balanced vs. Unbalanced Forces

Balanced Forces: Equal in magnitude and opposite in direction. **Net Force = 0**. Does not change the state of motion.

Unbalanced Forces: Unequal forces resulting in a non-zero net force (**Net Force $\neq 0$**). Causes acceleration.

5. Friction

Definition: The opposing contact force that arises when surfaces are in relative motion or try to move.

Types of Friction: Static Friction > Sliding Friction > Rolling Friction.

6. Newton's Laws of Motion

Newton's First Law (Law of Inertia): An object remains in a state of rest or uniform motion in a straight line unless compelled by an external unbalanced force.

Inertia: The natural tendency to resist changes. **Mass is a measure of inertia.**

Newton's Second Law: The rate of change of momentum is directly proportional to the applied unbalanced force. **$F = ma$.**

Newton's Third Law: To every action, there is an equal and opposite reaction (acting on two different bodies).

ALL FORMULAS

Formula	Symbols	SI Units	Application
$F_{\text{net}} = F_1 + F_2$	F = Force	Newton (N)	Forces in same direction
$p = m \times v$	p =Momentum, m =Mass, v =Velocity	$\text{kg} \cdot \text{m/s}$	Calculating momentum
$F = m \times a$	m =Mass, a =Acceleration	Newton (N)	Calculating force/ acceleration

QUICK REVISION & MEMORY TRICKS

- **Newton's Laws Mnemonics:** 1st law = Inertia; 2nd law = Force ($F=ma$); 3rd law = Pairs (Action-Reaction).
- **Friction Order:** Static > Sliding > Rolling.
- **Most Important Topics:** Newton's Second Law derivation, Balanced vs Unbalanced forces, Types of friction.