Force and Pressure

• Force:

- A push or a pull on an object.
- Can cause a change in the state of motion of an object (make it move, stop, change speed, or change direction).

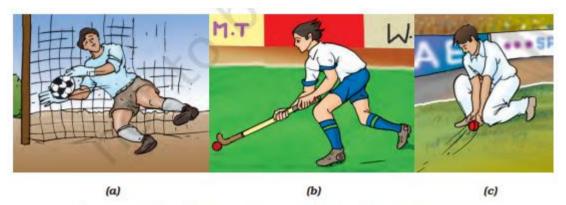


Fig. 8.1: (a) A goal keeper saving a goal, (b) A hockey player flicking a ball, and (c) A fielder stopping a ball

• Examples of Force:

- Kicking a ball
- Pushing a box
- o Pulling a drawer
- Throwing a ball
- Flicking a hockey stick
- o A goalkeeper stopping a ball
- o Fielders stopping a ball

• Effects of Force:

- Can make a stationary object move.
- Can stop a moving object.
- Can change the speed of a moving object.
- o Can change the direction of a moving object.

Forces and Interactions

- Force arises from interaction: For a force to exist, there must be an interaction between at least two objects.
- Interaction: When two objects influence each other.
- Examples:

- $_{\circ}$ Pushing a car: The person interacts with the car, applying a force to move it.
- o Two people arm wrestling: Each person exerts a force on the other.
- o Pulling a rope: The person interacts with the rope, applying a force to pull it.





Fig. 8.3 (b): Who is pulling whom?

Fig. 8.3 (c): Who is pulling whom?

Exploring Forces

Combining Forces:

- Forces in the same direction add together.
- o Forces in opposite directions subtract from one another.

Balanced Forces:

- When two equal forces act in opposite directions, they cancel each other out.
- o Result: No change in motion (e.g., a rope in a tug-of-war not moving).

Unbalanced Forces:

- o When forces acting on an object are not equal, there is a net force.
- Result: Change in motion (the object will move, speed up, slow down, or change direction).

• Magnitude and Direction:

- o Magnitude: The strength of a force.
- Direction: The way the force acts.
- Both magnitude and direction are important in determining the effect of a force.

Force and State of Motion

• Force can change the state of motion:

Change in Speed:

- Force in the same direction as motion increases speed.
- Force in the opposite direction decreases speed.

- Change in Direction:
 - Force can change the direction of motion (e.g., hitting a ball with a bat).
- o State of Motion: Includes both speed and direction of motion.

State of Rest:

- o A special case of the state of motion with zero speed.
- Force doesn't always cause motion:
 - Sometimes, applying a force doesn't change the state of motion (e.g., pushing a wall).
 - This could be due to:
 - The force not being strong enough to overcome other forces (like friction or the weight of the object).
 - Balanced forces cancelling each other out.

Force and its Effects

- Force can change the shape of an object:
 - Examples:
 - Pressing a balloon
 - Rolling dough
 - Pressing a rubber ball
- Summary of Effects of Force:
 - Can make an object move from rest.
 - o Can change the speed of a moving object.
 - o Can change the direction of motion.
 - o Can change the shape of an object.
- Force is essential for any change in the state of motion or shape.
- Types of Forces:
 - o Contact Forces: Require contact between objects.
 - Muscular Force: Force exerted by muscles (e.g., lifting, pushing, pulling).
 - Friction: Force that opposes motion between two surfaces in contact.

- Non-Contact Forces: Act from a distance.
 - Magnetic Force: Force exerted by a magnet on another magnet or a magnetic material (iron).
 - Electrostatic Force: Force between charged objects.
 - Gravitational Force: Force of attraction between any two objects with mass.
 - Every object in the universe attracts every other object.
 - The Earth's gravitational force pulls objects towards the ground.

• Pressure:

- Definition: Force acting per unit area.
- Formula: Pressure = Force / Area
- Effect of Area:
 - Smaller area = greater pressure (for the same force)
 - Larger area = less pressure (for the same force)

o Examples:

- Sharp knife cuts better due to higher pressure.
- Broad straps on bags reduce pressure on the shoulder.

Important Notes:

- Non-contact forces act without direct contact between objects.
- Pressure is directly proportional to force and inversely proportional to area.
- Understanding pressure helps explain many everyday phenomena.

Pressure Exerted by Liquids and Gases

- Liquids exert pressure:
 - Pressure in a liquid increases with depth.
 - o Liquids exert pressure in all directions.

• Gases exert pressure:

- o Gases exert pressure on the walls of their container.
- Air exerts pressure in all directions.
- o Atmospheric Pressure: The pressure exerted by the weight of the atmosphere.

Important Notes:

- The pressure exerted by a liquid depends on the height of the liquid column above the point.
- Gases exert pressure because their particles are in constant motion and collide with the walls of the container.
- Atmospheric pressure is the reason why we don't get crushed by the weight of the air above us.

Atmospheric Pressure

- Atmosphere: The layer of air surrounding the Earth.
- Atmospheric Pressure: The pressure exerted by the weight of the atmosphere.
 - o It is the force exerted by the air on a unit area.
 - The pressure inside our bodies balances the atmospheric pressure, preventing us from being crushed.
- Examples of Atmospheric Pressure in Action:
 - o Rubber sucker: Sticks to a surface due to atmospheric pressure.
 - Drinking through a straw: We reduce air pressure in the straw, and atmospheric pressure pushes the liquid up.

Important Notes:

- Atmospheric pressure is a significant force.
- It decreases as altitude increases (because there is less air above).
- It plays a vital role in various everyday phenomena.