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).

(a) (b) (c)

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
    - Pulling a drawer
    - Throwing a ball
    - Flicking a hockey stick
    - A goalkeeper stopping a ball
    - 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.
    - 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:**

- Pushing a car: The person interacts with the car, applying a force to move it.
- Two people arm wrestling: Each person exerts a force on the other.
- 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.
  - Forces in opposite directions subtract from one another.
- **Balanced Forces:**
  - When two equal forces act in opposite directions, they cancel each other out.
  - Result: No change in motion (e.g., a rope in a tug-of-war not moving).
- **Unbalanced Forces:**
  - 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:**
  - **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).
- **State of Motion:** Includes both speed and direction of motion.

- **State of Rest:**
    - 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.
    - Can change the speed of a moving object.
    - Can change the direction of motion.
    - Can change the shape of an object.
- **Force is essential for any change in the state of motion or shape.**

- **Types of Forces:**
    - **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)
    - **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.
    - Liquids exert pressure in all directions.
- **Gases exert pressure:**
    - Gases exert pressure on the walls of their container.
    - Air exerts pressure in all directions.
    - **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.
    - 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:**
    - **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.