Chapter -2

Types of Forces

8th Class

M.Srinivasa Rao,SA(PS)
SPSMHS, Gudivada
PH: 9848143855
Visit: srini science mind

FORCE
(Push or Pull)

Contact Forces

Muscular

Frictional

Non-contact Forces

Magnetic

Electrostatic

Gravitational

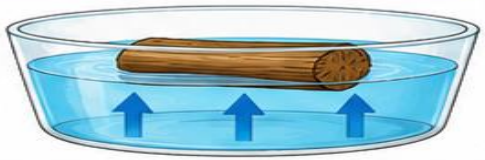
Changes Motion

Move • Stop • Speed • Direction • Shape

Acts Without Contact

Weight (Spring Balance)

Floating & Buoyant Force



Introduction: A Ride with Swathi and Geetha

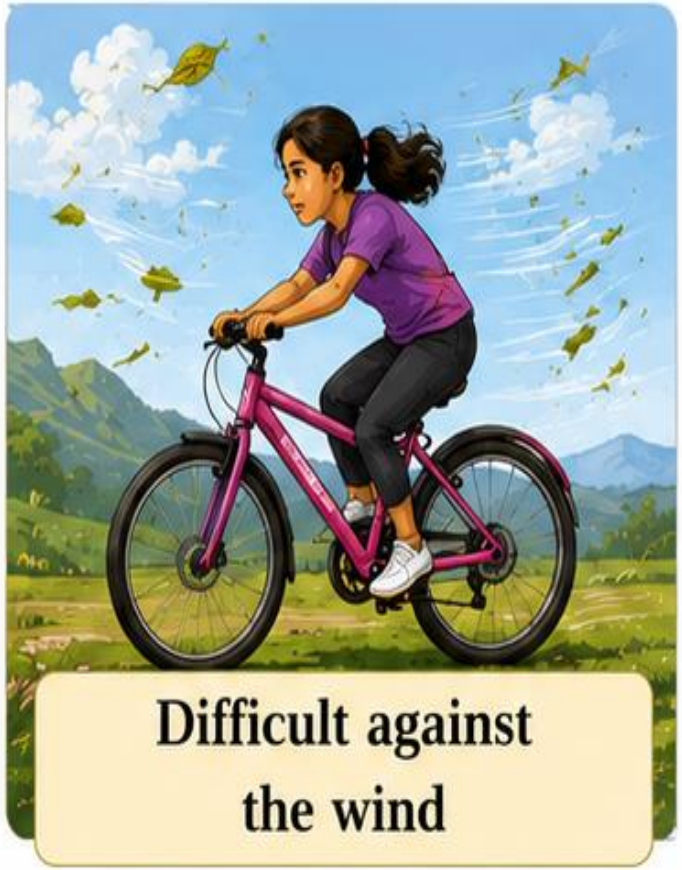
- Swathi and Geetha went cycling during their summer vacation.
- They found it difficult to ride against the wind.
- Some roads were rough, while others were smooth.
- While returning downhill, their bicycles moved without pedalling.
- They wondered, ***"What is pushing or pulling the bicycle?"***

Introduction: A Ride with Swathi and Geetha

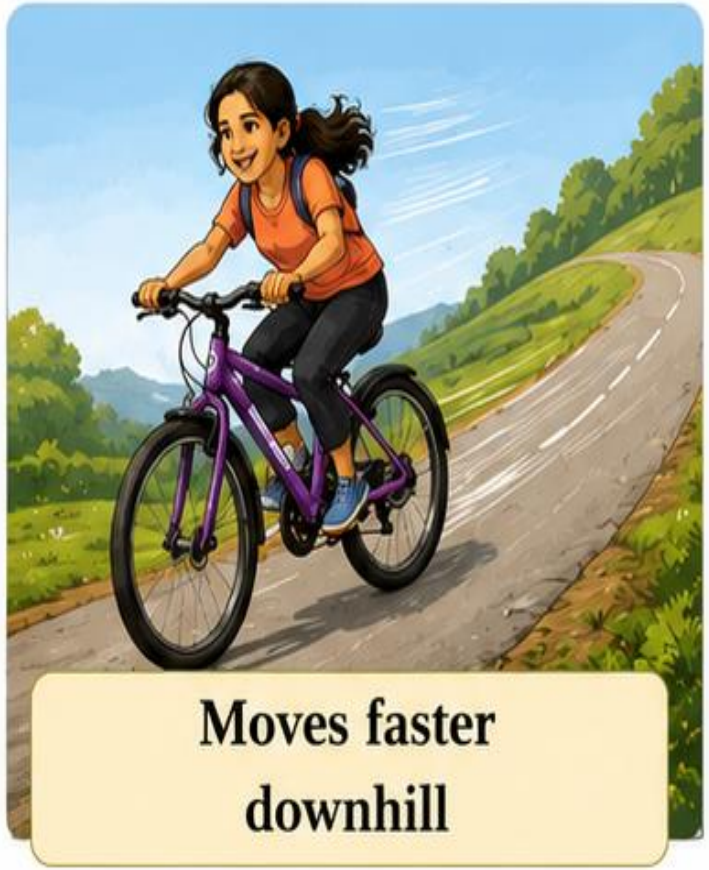
Think

? Why is cycling difficult against the wind?

? Why does a bicycle move faster downhill?



Difficult against the wind



Moves faster downhill

What is a Force?

Activity 2.1 – Let Us Explore

- Take a large cardboard box.
- Try moving the box in as many different ways as possible.

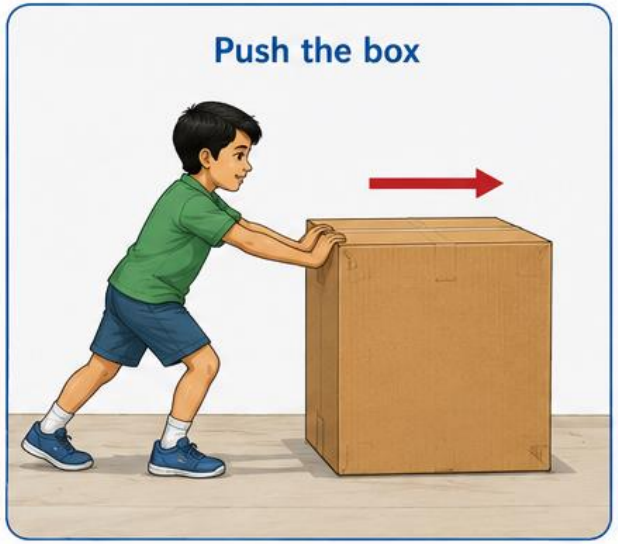
You may

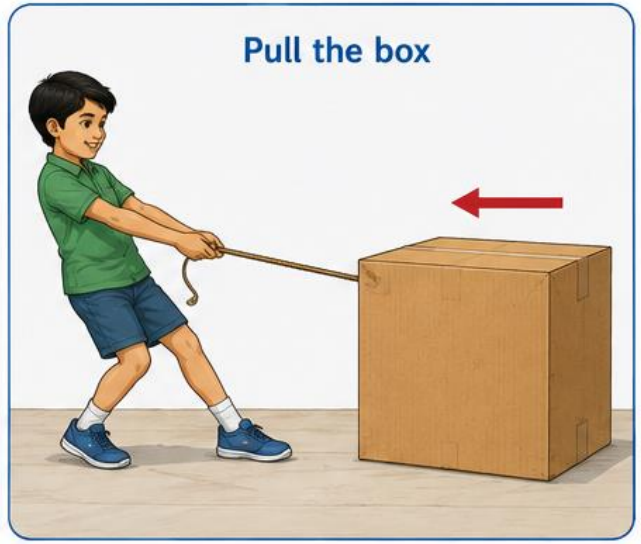
- Push the box.
- Pull the box.
- Lift the box.
- Carry the box.

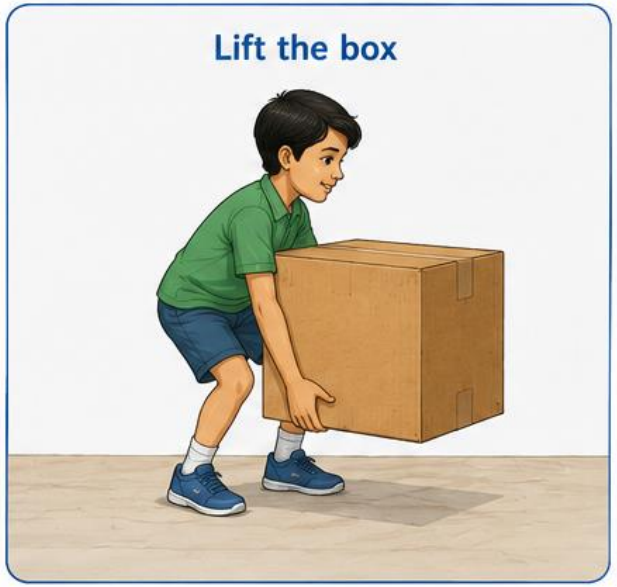
All these actions involve applying a push or a pull.

Definition

The push or pull applied on an object is called **force.**







What can a force do to the bodies on which it is applied?

Effects of Force

A force (push or pull) can produce different effects on an object.

Activity 2.2 – Let Us Analyse

Think of situations where a force is applied and observe its effect.

Examples

Action		Push/Pull	Effect
	Your friend holds your moving bicycle from behind to stop it	Pull	Stops or decreases the speed of the bicycle
	Hitting a moving ball with a bat	Push	Changes the direction of the moving ball
	Pressing an inflated balloon	Push	Changes the shape of the balloon

What do you conclude?

A force can:

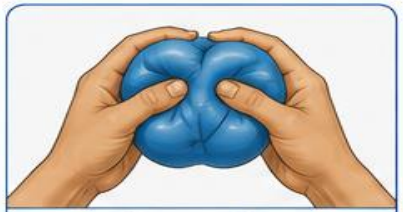
- Make an object move from rest.
- Stop a moving object.
- Increase or decrease the speed of an object.
- Change the direction of motion.
- Change the shape of an object.
- Produce one or more of these effects at the same time.

Makes an object move from rest

Stops a moving object

Increases or decreases the speed

Changes the direction of motion



Changes the shape of an object

Effects of force in everyday life

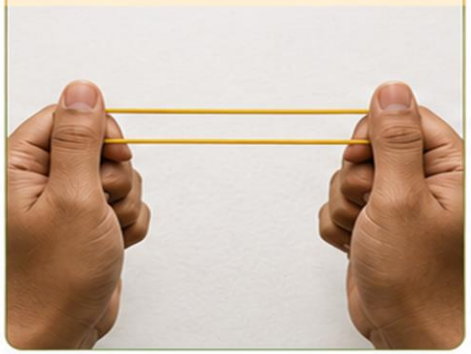
Force Around Us

In our daily life, we come across many situations where force is applied.

Examples

Opening a drawer

Stretching a rubber band



A fielder stopping a moving ball

Kicking a football

Applying brakes to a bicycle

Rolling a chapati

Turning the steering handle of a bicycle or autorickshaw

Effects of Force

The force applied on an object may:

- ✔ Make an object move from rest.

- ✔ Stop a moving object.

- ✔ Change the speed of an object.

- ✔ Change the direction of motion.

- ✔ Change the shape of an object.

- ✔ Produce more than one effect at the same time.

Are forces an interaction between two or more objects

Force is an Interaction

Have you ever wondered why a force cannot act by itself?

Whenever a force is applied, two objects interact with each other. One object applies the force, and the other object experiences the force.

Observation

- Your foot applies a force on the football.
- The football starts moving.

Here,

Foot → applies force

Football → experiences force

This shows that force is the result of interaction between two objects.

Activity 2.3 – Let Us Explore

1. Take a football.
2. Place it on the ground.
3. Kick the football.
4. Observe what happens.

Are forces an interaction between two or more objects

More Examples

A bat hits a cricket ball.

A person pushes a trolley.

A magnet attracts an iron nail.

The Earth attracts all objects towards it.

Types of forces

How Can We Classify Forces?

Forces are broadly classified into two types.

1 Contact Forces

These forces act only when two objects are in **physical contact** with each other.

Examples

Muscular Force

Frictional Force

2 Non-contact Forces

These forces act **without physical contact** between the objects.

Examples

Magnetic Force

Electrostatic Force

Gravitational Force

Flow Chart

TYPES OF FORCES

Contact Forces
- Muscular Force
- Frictional Force

Non-contact Forces
- Magnetic Force
- Electrostatic Force
- Gravitational Force

Contact forces

What are Contact Forces?

- A contact force is a force that acts only when two objects are in physical contact with each other.
- In other words, the objects must touch each other for the force to act.

Characteristics of Contact Forces

- Physical contact between objects is necessary.
- The force disappears when contact is removed.
- Contact forces help us perform many daily activities.

Contact forces

Examples of Contact Forces

Muscular Force

Frictional Force

In all these examples, the object is directly touched before the force acts.

Daily Life Examples

Pushing a chair

Pulling a suitcase

Kicking a football

Lifting a school bag

Writing with a pen

Opening a door

Muscular force

Muscular Force

- The force applied by the muscles of humans or animals is called **muscular force**.
- Muscular force is a **contact force** because it acts only when our body comes into contact with an object.

Characteristics

- Produced by the muscles of humans and animals.
- Requires physical contact.
- Used in almost all daily activities.
- Muscular force alone cannot move very heavy objects.

Muscular force

Examples ----------

Lifting a school bag

Pushing a bicycle

Pulling a rope

Carrying a bucket of water

Writing with a pencil

Kicking a football

Rowing a boat

A bullock pulling a cart

A horse pulling a carriage

Frictional force

What is Friction?

- When one object moves or tries to move over the surface of another object, a force acts between the two surfaces. This force is called **friction or frictional force**.
- Friction always opposes the motion of an object.

Definition:

The force that opposes the motion of one surface over another surface in contact is called **frictional force**.

Characteristics of Friction

- It is a contact force.
- It acts between two surfaces in contact.
- It always acts opposite to the direction of motion.
- It slows down moving objects.

Frictional force

Examples of Friction

Walking on the ground	Writing with a pencil on paper	Applying brakes to a bicycle	Rolling a ball on the floor	Pushing a wooden box across the ground
				
Friction between the shoes and the ground allows us to walk without slipping.	Friction between the pencil tip and the paper helps us write.	Friction between the brake pads and the wheel slows down and stops the bicycle.	Friction between the ball and the floor slows down the ball and stops it.	Friction between the box and the ground opposes its motion and slows it down.

Activity 2.4: Friction depends on the nature of surfaces

Aim

To show that friction depends on the nature of the surfaces in contact.

Materials Required

- A toy car or wooden block
- Smooth floor
- Rough floor
- Sandpaper
- Cloth

Procedure

1. Roll the toy car on a smooth surface.
2. Observe the distance travelled.
3. Now roll it on a rough surface.
4. Compare the distances.

Observation

- The toy car travels farther on the smooth surface.
- It travels a shorter distance on the rough surface.

Smooth surface (long distance)

Rough surface (short distance)

Conclusion

Friction is less on smooth surfaces and more on rough surfaces.

Advantages and Disadvantages of friction

Advantages of Friction

Friction is useful in many daily activities.

Because of friction, we can:

- Walk without slipping.
- Write on paper.
- Hold objects firmly.
- Apply brakes to stop vehicles.
- Climb trees and stairs.
- Light a matchstick.






Disadvantages of Friction

Too much friction can also cause problems.

Friction:

- Causes wear and tear of machine parts.
- Produces unwanted heat.
- Reduces the efficiency of machines.
- Requires extra force to move objects.
- Wastes energy.





Friction can be reduced by:

- Applying lubricants such as oil or grease.
- Using ball bearings.
- Polishing surfaces.
- Using wheels and rollers.

Reducing Friction

Lubricants (Oil/Greece)


Ball Bearings


Polishing Surfaces


Wheels and Rollers

Non-contact forces

What are Non-contact Forces?

- A **non-contact force** is a force that acts on an object without any physical contact between the objects.
- Unlike contact forces, these forces can **act from a distance**.

Characteristics of Non-contact Forces

- No physical contact is required.
- They can act from a distance.
- They influence objects without touching them.

Non-contact forces

Examples of Non-contact Forces

1. Magnetic Force

Magnetic force acts between a magnet and iron objects.

2. Electrostatic Force

Electrostatic force acts between a charged object and light objects.

3. Gravitational Force

Gravitational force is the force by which the Earth attracts all objects.

Everyday Examples

- A magnet attracts iron pins.

- A rubbed plastic comb attracts tiny bits of paper.

- An apple falls from a tree due to Earth's gravity.

Magnetic force

Magnetic Force

- The force exerted by a magnet on magnetic materials such as iron, nickel and cobalt is called **magnetic force**.
- Magnetic force is a **non-contact force** because it acts without touching the object.

Activity 2.5 – Explore Magnetic Force

Bring a magnet near:

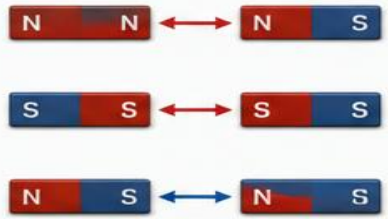
- Iron pins
- Paper clips
- Iron nails

Observation

The iron objects move towards the magnet even before the magnet touches them.

Properties of Magnetic Force

- Magnets attract iron, nickel and cobalt.
- Like poles repel each other.
- Unlike poles attract each other.
- Magnetic force acts from a distance.



Applications

Refrigerator door magnets

Magnetic compass

Magnetic cranes in industries

Magnetic door locks

Electric motors

Magnetic force

Electrostatic Force

- The force exerted by electrically charged objects is called **electrostatic force**.
- It is also a **non-contact force**.

Activity 2.6

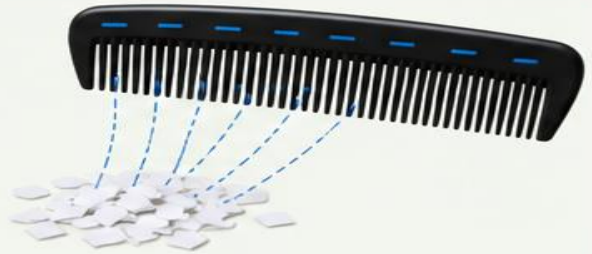
- Take a plastic comb.
- Comb your dry hair several times.
- Now bring the comb near:
  - Tiny pieces of paper
  - Dry grass
  - Small bits of thread

Observation

The tiny paper pieces move towards the comb without touching it.

Why does this happen?

- Rubbing the comb produces electric charges.
- The charged comb attracts light objects.



Examples

Balloon sticking to a wall

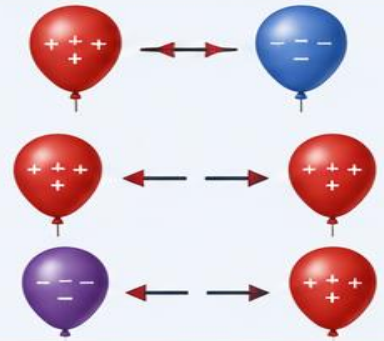
Plastic ruler attracting paper bits

Clothes sticking together after drying

Lightning during thunderstorms

Important Points

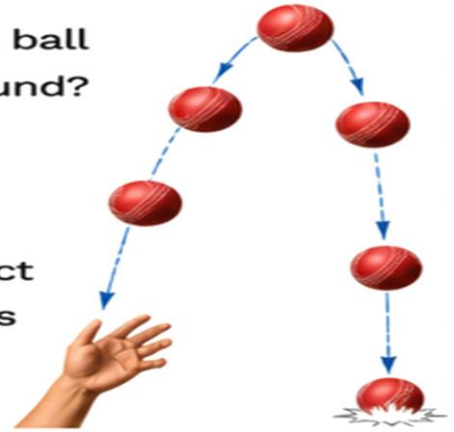
- Electrostatic force acts without contact.
- Charged objects can attract or repel other charged objects.
- It acts from a distance.



Gravitational force

Gravitational Force

- Have you noticed that when you throw a ball upward, it always comes back to the ground? **Why does this happen?**



- It is because the Earth attracts every object towards its centre. This attractive force is called **gravitational force**.

Definition:

- The force by which the Earth attracts objects towards its centre is called **gravitational force.**

Gravitational force is a **non-contact force** because it acts without physical contact.

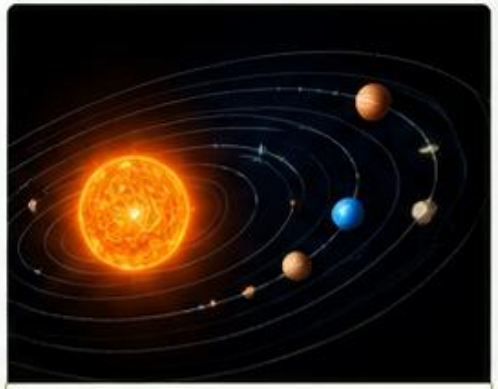
Gravitational force

Examples of Gravitational Force

1. Fruits fall from trees.

2. Rainwater falls to the ground.

3. A dropped book falls to the floor.



4. Planets revolve around the Sun.

5. The Moon revolves around the Earth.

Characteristics of Gravitational Force

1. Acts on every object.

2. Always acts towards the centre of the Earth.

3. It is always an attractive force.

4. No physical contact is required.

Weight of an object

Weight

- Every object is pulled towards the Earth by gravitational force.

- The force with which the Earth attracts an object is called its **weight**.

Definition:

Weight is the gravitational force acting on an object.

Weight of an object

Important Points

- Weight is a force.
- It depends on the mass of the object.
- Weight is measured using a spring balance.
- The SI unit of weight is newton (N).

Example

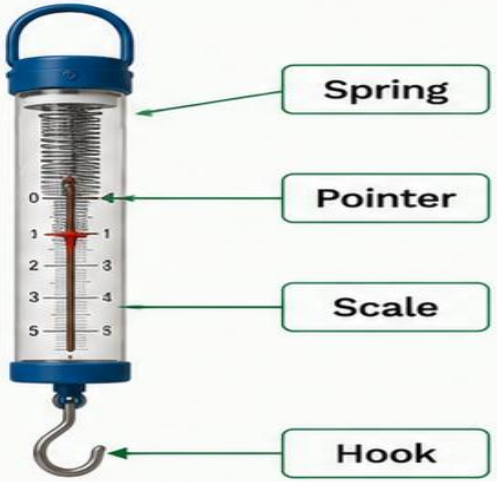
A school bag feels heavier than a notebook because the Earth pulls it with a greater gravitational force.

Measuring weight using a spring balance

Spring Balance

A **spring balance** is an instrument used to measure the weight of an object.

Parts of a Spring Balance



How to Measure Weight

1. Hold the spring balance vertically.
2. Suspend the object from the hook.
3. Allow the spring to come to rest.
4. Read the value shown by the pointer.

Observation

- The spring stretches when an object is hung.
- Greater the weight,
- **Greater the stretching of the spring.**

Mass and Weight

Mass and Weight Are Different

People often use the words mass and weight as if they mean the same thing. However, **they are different.**

Mass

- Mass is the amount of matter present in an object.
- It remains the same everywhere.
- The SI unit of mass is **kilogram (kg).**
- Mass is measured using a **beam balance** or **electronic balance.**

Beam Balance

Electronic Balance

Weight

- Weight is the gravitational force acting on an object.
- Weight changes from place to place because gravitational force is different at different places.
- The SI unit of weight is **newton (N).**
- Weight is measured using a **spring balance.**

Spring Balance

Mass and Weight

Mass vs Weight

Mass		Weight
Amount of matter in an object		Gravitational force acting on an object
Constant everywhere		Changes with gravity
Measured in kilogram (kg)		Measured in newton (N)
Measured using a beam balance		Measured using a spring balance

Floating and Sinking

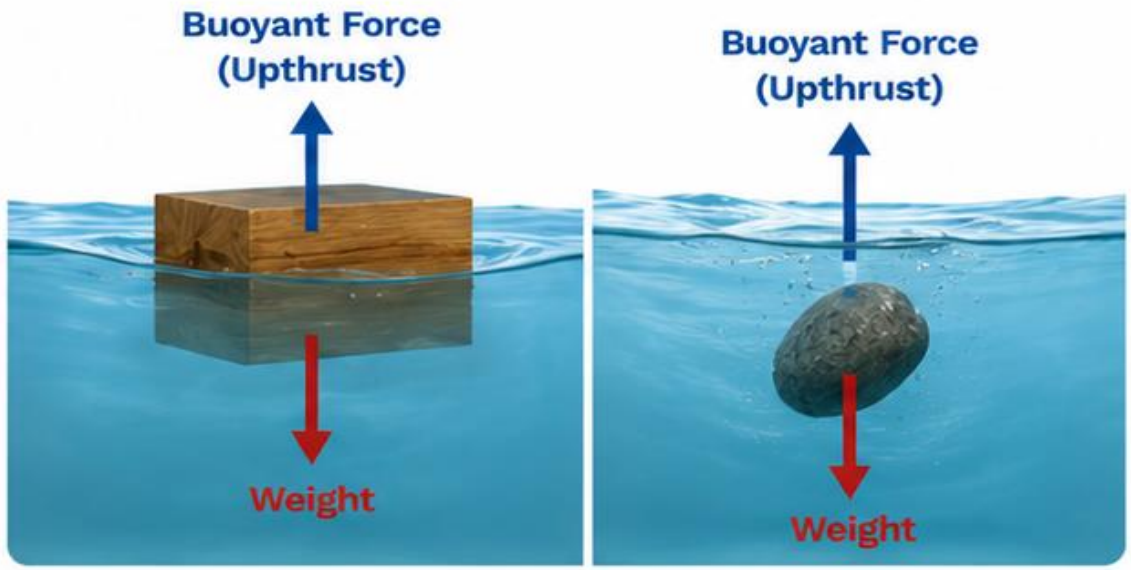
Why Do Some Objects Float While Others Sink?

Have you observed that:

- A wooden block floats on water.
- A stone sinks in water.

Why does this happen?

➡ Water exerts an upward force on objects immersed in it. This upward force is called **buoyant force** or **upthrust**.



Observation

- If the buoyant force is greater than or equal to the weight of the object, the object **floats**.

- If the buoyant force is less than the weight of the object, the object **sinks**.

Floating and Sinking

Examples

Boat floating on water

Wooden log floating

Stone sinking

Iron nail sinking

Buoyant force (Upthrust)

Buoyant Force

- When an object is immersed in a liquid, the liquid exerts an upward force on it.
- This upward force is called **buoyant force.**

Definition

The upward force exerted by a liquid on an immersed object is called **buoyant force (or upthrust).**

Buoyant force (Upthrust)

Examples

- Swimming becomes easier in water.

- Boats float on rivers and seas.

- Ships float despite being made of steel.

- Life jackets help people float.

Applications of Buoyant Force

Boats and ships

Submarines

Life jackets

Fishing floats

Important Points

Buoyant force acts **upward**.

It acts **opposite** to the weight of the object.

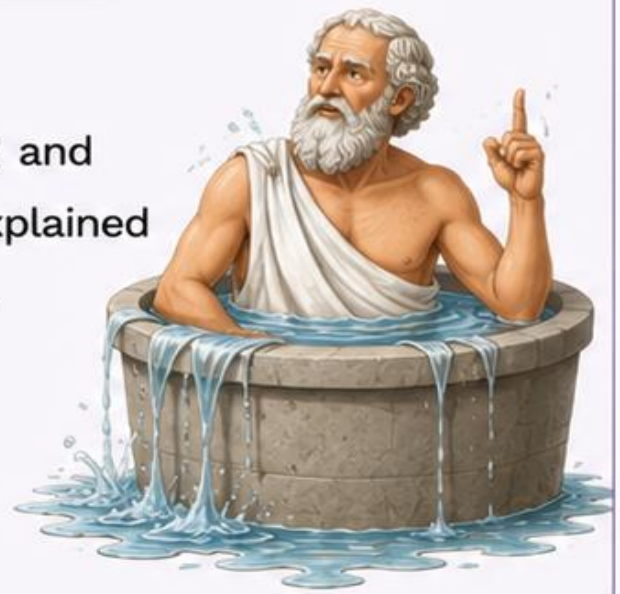
It helps objects **float**.

Archimedes' Principle

Slide 24 Archimedes' Principle

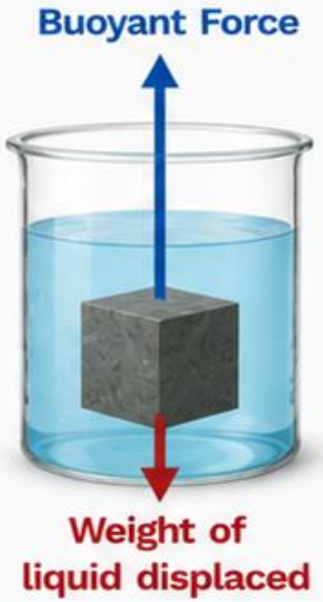
Archimedes' Principle

The behaviour of floating and sinking objects can be explained by Archimedes' Principle.



Statement

"When an object is wholly or partially immersed in a liquid, it experiences an upward buoyant force equal to the weight of the liquid displaced by it."



Archimedes' Principle

Applications

- Designing ships and boats

- Construction of submarines

- Hydrometers

- Hot-air balloons (similar principle in gases)

Daily Life Examples

▶ Ships float on water.

▶ Divers feel lighter underwater.

▶ Inflated tubes help people float.


thank you