5 Exploring Forces

Class 8 · Science (Curiosity) · Handwritten Revision Notes

"While cycling uphill, Sonali & Ragini had to pedal harder against the wind. On the way down, even without pedalling, their bicycles picked up speed on their own – **something was pulling them downhill!** This chapter explores what a force is, what it can do, and the different kinds of forces around us."

5.1 What Is a Force?

Activity 5.1: Try moving a large cardboard box in as many ways as possible – pushing, pulling, lifting, carrying.

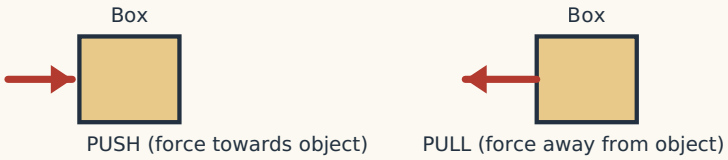

Fig 1: Push and Pull – two ways of applying force on a box

Force: A push or a pull applied on an object is called force.

Remember!

Every way of moving the box (pushing, pulling, lifting, carrying) is simply a **push** or a **pull** applied on it – that push/pull is what science calls "force".

5.2 What Can a Force Do to the Object It Acts On?

Activity 5.2: List everyday situations where a push/pull is applied, and note the effect it produces.

S.No.	Action	Push/Pull	Effect
1	Friend holding your moving bicycle from behind	Pull	Stops/decreases speed of bicycle
2	Hitting a moving ball with a bat	Push	Changes direction of the ball
3	Pressing an inflated balloon	Push	Changes shape of the balloon
4	Opening a drawer / kicking a football	Pull / Push	Object moves from rest

A force applied on an object may:
1) make it move from rest 2) change its speed 3) change its direction of motion
4) change its shape 5) cause some or all of these together.

Doubt & Answer

"Does this mean whenever there's a change in speed, direction, or shape, a force is acting?"
→ **Yes**, none of these changes take place without the action of a force.

Remember!

If an object is at rest, it does NOT mean no force acts on it – it may mean the forces acting on it are **balancing** each other (you'll study "balanced forces" in higher grades).

Other everyday examples: opening a drawer (pull), kicking a football (push → changes direction), stretching a rubber band, a fielder stopping a ball, applying brakes on a bicycle, rolling a chapati, turning the steering handle of an autorickshaw.

5.3 Are Forces an Interaction Between Two or More Objects?

When you push a table, your hand is one object applying force on another object – the table. At least **two objects must interact** for a force to come into play.

> **Force: A push or pull on an object, resulting from the object's interaction with another object.**
> **SI unit of force = newton (small 'n'); symbol = N.**

A Step Further

When you push a table, you feel a force on your hand too! The moment you stop pushing, that force disappears. Whenever two objects interact, **each** experiences a force from the other; when the interaction stops, both forces vanish together.

5.4 What Are the Different Types of Forces?

5.4.1 Contact Forces

Forces that act only when there is **physical contact** (direct, e.g. hands; or indirect, e.g. a stick or rope) between the objects are called contact forces.

Muscular Force

The force caused by the action of our (or an animal's) **muscles** – occurs when muscles contract & elongate during any activity (walking, running, lifting, pushing, jumping, stretching).

Used by animals, birds, fish and insects for movement & survival, and by humans using animals (bullocks, horses) to carry out tasks like ploughing or pulling a cart.

Ever Heard Of...

Muscular force also works inside our body – it helps chew food & push it through the alimentary canal (digestion), and the heart's muscles contract/expand to circulate blood.

> **Muscular force: The force resulting from the action of muscles in the body.**

Friction

A rolling ball / a bicycle (once you stop pedalling) gradually slows and stops on its own – even though no visible force seems to act. **Activity 5.3/5.4:** Push a flat-based object (lunch box, notebook) on different surfaces (glass, cloth, wood, tile, sand) and observe how far it travels before stopping.

> **Friction: The force that comes into play when an object moves (or tries to move) over another surface. It always acts opposite to the direction of motion.**

- Friction is a **contact force** – arises due to two surfaces touching.
- Greater on **rough** surfaces, less on smooth ones.
- Even liquids & gases exert friction → aeroplanes, ships, high-speed trains are shaped to reduce it.

Fig 3: Friction arises from tiny irregularities in surfaces

5.4.2 Non-Contact Forces

Forces whose effect is felt even **without contact** between objects.

Magnetic Force

Activity 5.5: Two ring magnets on a vertical stick, like poles facing each other → the upper magnet **floats** without touching the lower one (repulsion). Reverse a pole → magnets pull together (attraction).

> **Magnetic force: The force exerted by a magnet on another magnet or a magnetic material – a non-contact force. Like poles repel, unlike poles attract.**

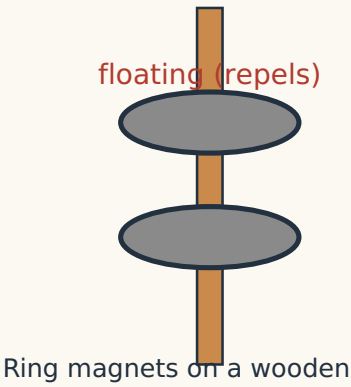

Fig 4: Force between two ring magnets (like poles facing → float/repel)

Electrostatic Force

Activity 5.6: Rub a plastic scale/straw with polythene → bring it near small paper bits → paper bits get **attracted** and stick to it.

Activity 5.7: Rub two balloons with a woollen cloth; hang them close → they **repel** (move apart). Bring the woollen cloth near a rubbed balloon → they **attract.**

> ***Static charge: Electric charge that builds up on a surface when two objects are rubbed together (does not move by itself). Object with static charge = charged object. Electrostatic force: Force exerted by a charged body on another charged/uncharged body – non-contact. Like charges repel; unlike (+/–) charges attract.***

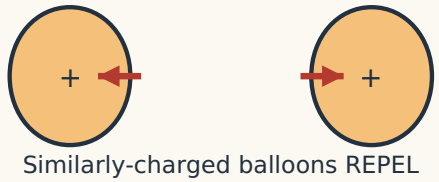

Fig 5: Two similarly-charged balloons repelling each other

> *Remember!*
> Moving charges constitute an **electric current** in a circuit – the same current that lights a lamp or produces heating/magnetic effects (Chapter 4)!

Gravitational Force

Activity 5.8: Throw a ball vertically upward – it always falls back down. All objects thrown up eventually fall towards the Earth.

> ***Gravitational force (gravity): The force with which the Earth attracts objects towards itself. It is a non-contact force and always attractive (unlike magnetic/electrostatic force, which can attract or repel).***

Going up: speed decreases till the object stops momentarily & direction reverses. Coming down: speed increases. This is called **vertical motion** under gravity.

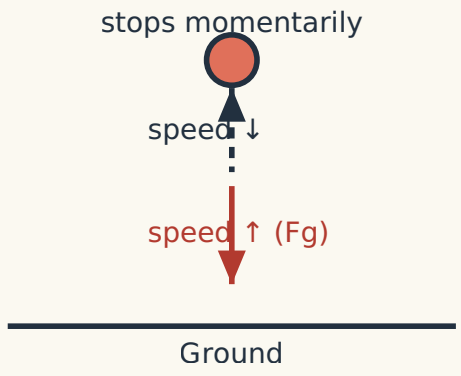

Fig 6: Ball thrown up – slows, stops, then falls (gravity acts throughout)

5.5 Weight and Its Measurement

> **Weight: The force with which the Earth pulls an object towards itself. Since weight is a force, its SI unit is also newton (N).**

Activity 5.9–5.12: Hang different objects, one at a time, from a spring → the spring **stretches** by different amounts → Earth pulls different objects with different force (weight). A **spring balance** uses this stretching to measure weight.

Example (Activity 5.11): If the gap between two big marks = 1 N, and it has 5 small divisions, then 1 small division = 1/5 = **0.2 N** (smallest measurable value).

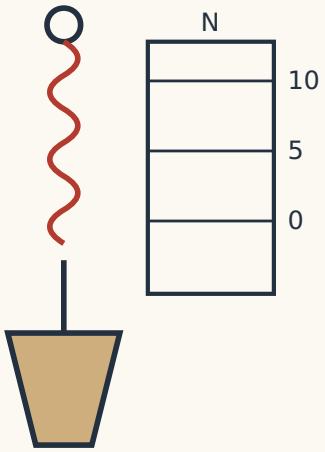

Fig 7: A spring balance measuring weight (N)

Weight vs Mass

Mass	Weight
Amount of matter in an object	Gravitational force pulling the object
SI unit: kilogram (kg) / gram (g)	SI unit: newton (N)
Same everywhere (constant)	Varies from place to place / planet to planet

.	Earth	Moon	Mars	Venus	Jupiter
Mass of object	1 kg	1 kg	1 kg	1 kg	1 kg
Weight of object	10 N	1.6 N	3.8 N	9 N	25.4 N

Remember!

In everyday speech we say "weight of the wheat bag is 10 kg" – scientifically incorrect (kg is a mass unit), but common in casual usage. In science, always use **N for weight** and **kg/g for mass.**

5.6 Floating and Sinking

Activity 5.13: Push an empty, tightly-closed bottle into a bucket of water → you feel an **upward push**; release it → it bounces back up.

> **Upthrust (buoyant force): The upward force applied by a liquid on an object placed in it.**

- Gravity pulls the object **down**; buoyant force pushes it **up**.
- If gravity > buoyant force → object **sinks**.
- If gravity = buoyant force → object **floats**.
- Buoyant force depends on the **density** of the liquid.

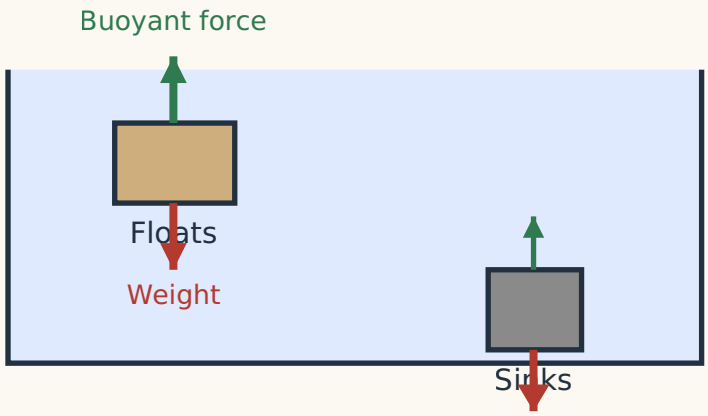

Fig 8: Floating (forces balance) vs sinking (weight > buoyant force)

A Step Further – Archimedes' Principle

An object fully/partially immersed in a liquid experiences an upward force equal to the **weight of the liquid it displaces.** If displaced-liquid weight < object's weight → sinks; if equal → floats.

Remember!

Pumice (a volcanic rock) floats on water! Rapidly-cooled lava traps gas bubbles inside, making it light & porous – less dense than water.

Snapshot – Quick Recap

- Force = push/pull from an object's **interaction** with another object. SI unit: **newton (N).**
- Force can: start motion, change speed, change direction, change shape.
- **Contact forces:** muscular force, friction. **Non-contact forces:** magnetic, electrostatic, gravitational.
- **Friction** opposes motion; depends on nature of surfaces (rough > smooth).
- **Gravitational force** is always attractive; **weight** = Earth's pull on an object (N).
- **Mass** stays constant everywhere; **weight** varies place to place / planet to planet.
- **Upthrust/buoyant force**: upward force by a liquid; decides floating or sinking.