Force and Pressure

CLASS 8 SCIENCE NCERT

Introduction to Force

What is Force?

> **Definition: A force is a push or a pull.**

- Examples
  - Pushing the door
  - Pulling a suitcase
  - Kicking a football

> Forces are acting around us all the time.
>
> A force can start or stop motion.

Force as a Vector Quantity

Force has:

- **Magnitude (strength)**
- **Direction**

- Represent force using arrows.
- Changing direction changes the effect.

Effects of Force

1. **Move a Stationary Object**
2. **Stop a Moving Object**
3. **Change Speed**
4. **Change Direction**
5. **Change Shape or Size**

Force can change the state of object

Move a Stationary Object

PUSHING THE STATIONARY BOOK O THE TABLE

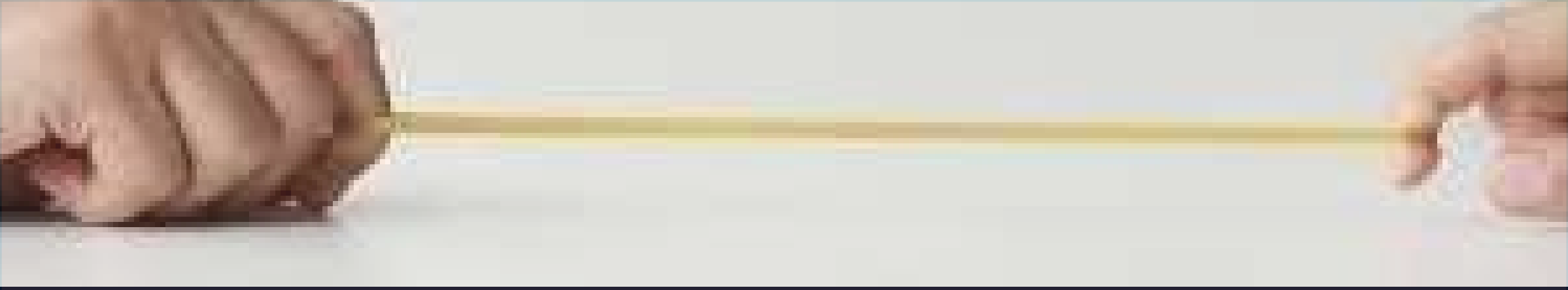
The example of the **stationary cart** (or a football) shows that an object at rest has a speed of zero.

- **The Concept:** When you apply a force (a push), the object gains speed.
- **NCERT Key Point:** Force is required to make a stationary object move. Without an external force, the cart would stay still forever.

Force can change the state of object-

Stop a Moving Object

- When you apply brakes to a bicycle or a goalkeeper stops a moving football, you are applying force in the **opposite direction** of the motion.
  - **The Concept:** If the force is applied in the direction opposite to the motion, it results in a decrease in the speed of the object.
  - **NCERT Key Point:** If the force is large enough, the speed becomes zero, bringing the object to a complete stop.



MINI ACTIVITY:PRESS A SMILEY BALL.

Effects of Force – Change in Shape

- A force can change the shape of an object.

> Examples:
>
> Pressing a sponge
>
> Stretching a rubber band
>
> Squeezing a stress ball

Effects of Force – Change in Speed

Force can:

- Increase speed
- Decrease speed

Examples:

  - Pushing a trolley
  - Applying brakes on a bicycle

Effects of Force – Change in Direction

- Force can change direction of motion.
- Example:
  - Hitting a moving cricket ball

Types of Forces

Two main types:	1. Contact Forces
	   a. Muscular force
	   b. Friction force
	2. Non-Contact Forces
	   a. Magnetic force
	   b. Gravitational force
	   c. Electrostatic force

Muscular Force

- Force applied using muscles.
- It is a **contact force**.

- Examples:
  - Lifting school bag
  - Pushing table
  - Kicking football

ACTIVITY:

Two students push a desk together. Observe increased force.

Frictional Force

- **Friction is the force that opposes motion between two surfaces in contact.**
- Acts opposite to motion.

🏃 ACTIVITY:🧪

🏃 🧪 RUB HANDS TOGETHER → FEEL HEAT.

- Examples:
  - Walking
  - Brakes
  - Writing with pencil

Non - Contact Force

Gravitational Force

- Force by which Earth attracts objects.
- Acts towards the center of Earth.

Examples:

- Falling apple
- Objects thrown up return

Magnetic Force

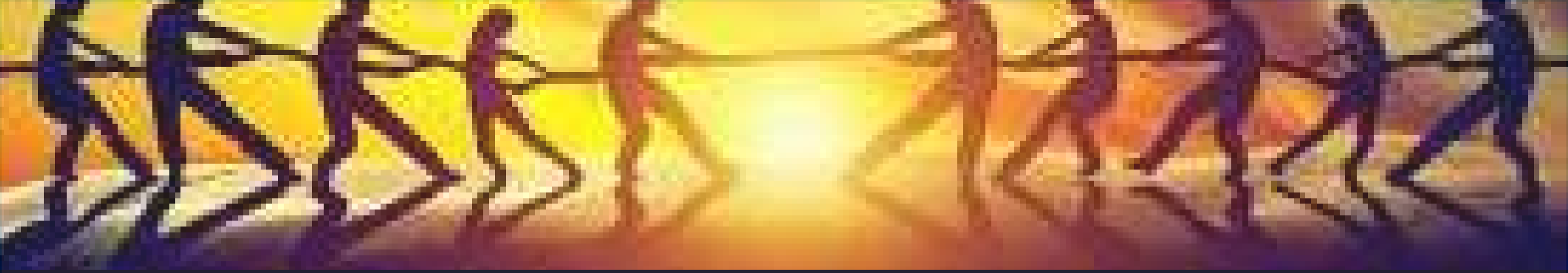
- Force exerted by magnets.
- Attracts iron, nickel, cobalt.
- **Like poles repel; unlike poles attract.**
- Non-contact force.

🧪 Bring magnet near pins.

Electrostatic Force

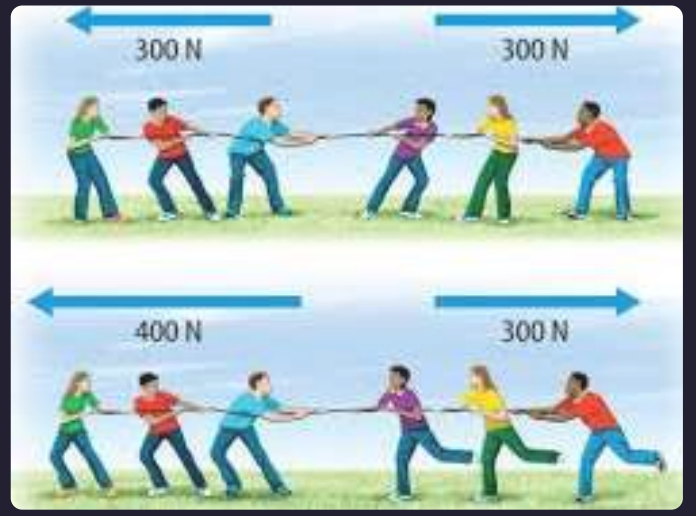
- Force due to electric charges.
- Non-contact force.

🧪 Activity:
Rub balloon on hair → Attract paper bits.



Balanced and Unbalanced Forces

- **Balanced Forces:** Equal forces in opposite directions → No change in motion.
- **Unbalanced Forces:** Unequal forces → Change in motion.



Pressure

What is Pressure?

Pressure is the force acting on a unit area of a surface.

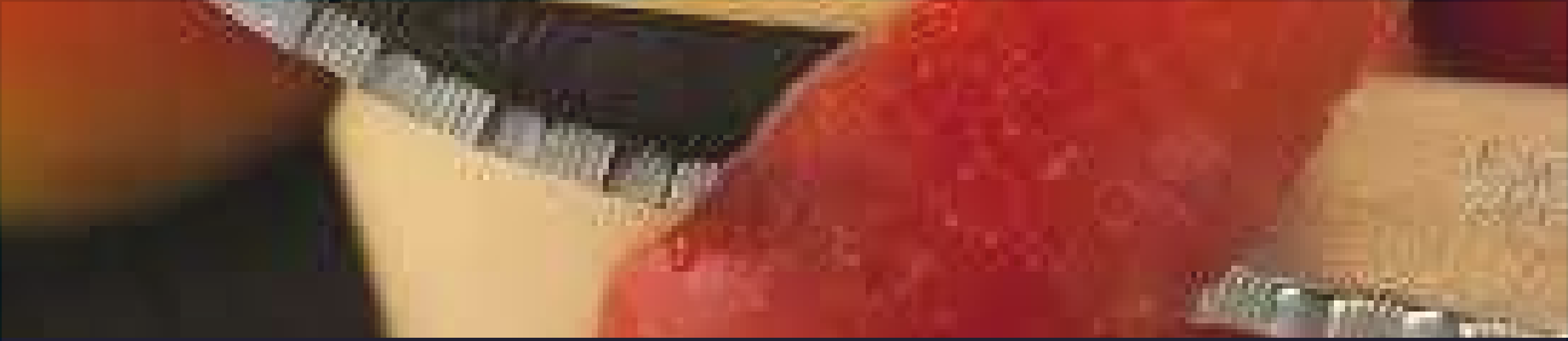
- **Formula:**

$$P = \frac{\text{Force}}{\text{Area}}$$

- **Unit:** The SI unit is the **Pascal (Pa)**.
- **Key Concept:** For the same force, a **smaller area** exerts **larger pressure**, while a **larger area** exerts **smaller pressure**.

Conceptual Challenge

Why is it easier to cut an apple with a sharp knife than with a blunt one, even if you apply the same force?



It is easier to cut an apple with a sharp knife because **it has a smaller surface area at the edge, resulting in higher pressure applied to the fruit for the same amount of force**. A sharp blade concentrates the force, allowing it to easily break the skin and flesh of the apple.

Conceptual Challenge_

The Balloon Experiment

If you press a balloon with your finger, it might not burst, but if you press it with a needle using the same force, it pops instantly. Why?

Answer:-

🎈 When You Press with Your Finger

- Your finger has a **large contact area**.
- The force is spread out over that area.
- This creates **low pressure**.
- The balloon's rubber stretches and distributes the force without breaking.

📍 When You Press with a Needle

- The needle tip has an **extremely tiny contact area**.
- The same force is concentrated in that tiny spot.
- This creates **very high pressure**.
- The rubber can't stretch enough at that point — it tears instantly.

Pressure in Daily Life

Camel walking on sand

Their broad feet prevent them from sinking into the sand by distributing their weight over a larger area.

Broad school bag straps

They have wide straps (large area) so the weight of the bag exerts less pressure on your shoulders.

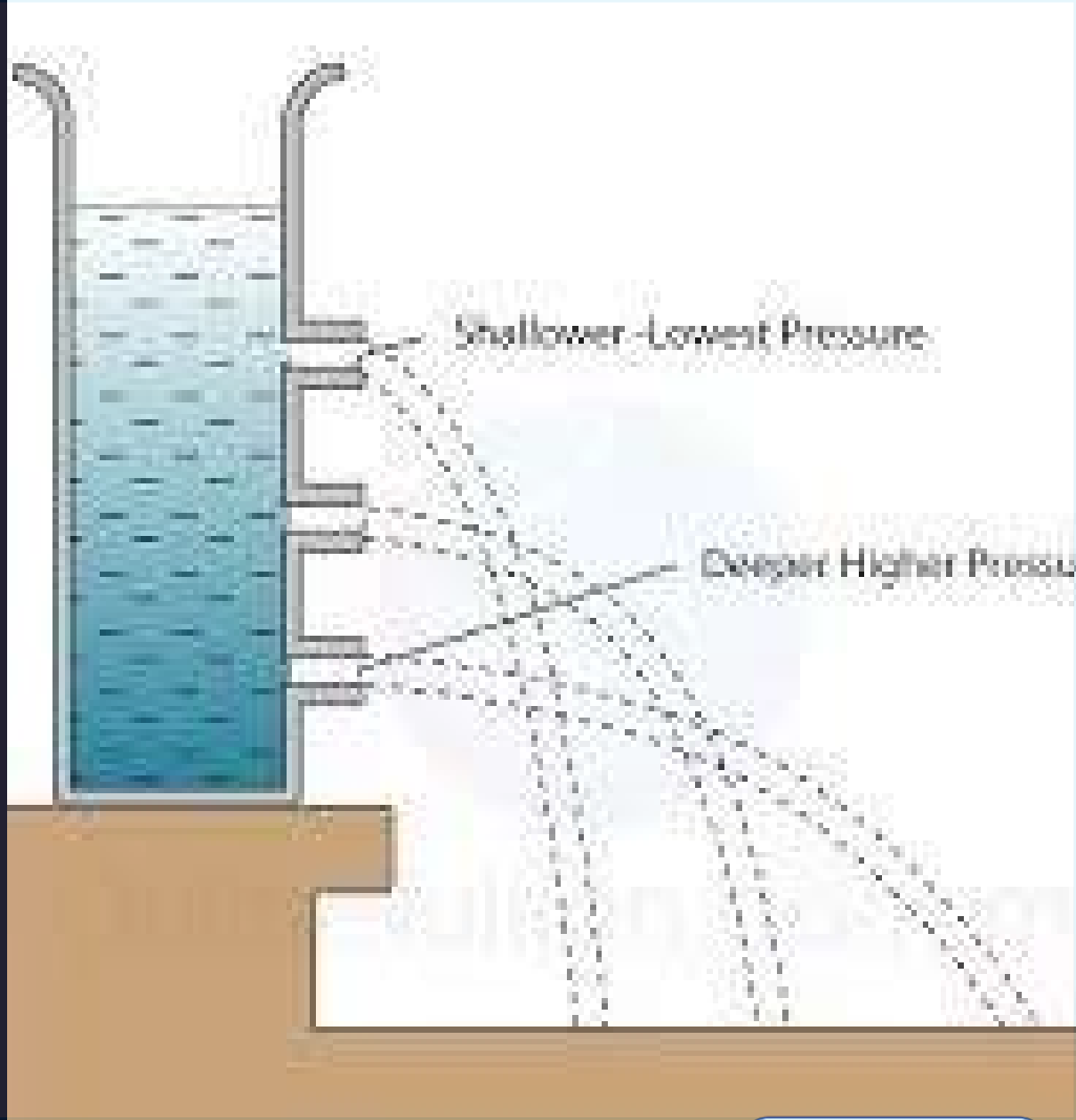
High heel vs flat shoes

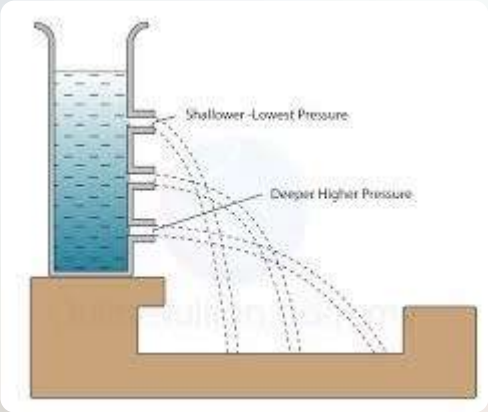
High heels exert **high pressure** due to their **small surface area**, whereas flat shoes exert **low pressure** by spreading weight over a **large surface area**.

Pressure in Liquids

Liquids exert pressure on the walls and the bottom of their containers.

- **Depth Matters:** Pressure increases as the **depth** of the liquid increases. This is why dams are made thicker at the bottom.





Pressure in Liquids

- **Direction:** Liquids exert pressure in **all directions** (downwards and sideways).
- **Level:** At the same depth, a liquid exerts equal pressure in all directions.

Atmospheric Pressure

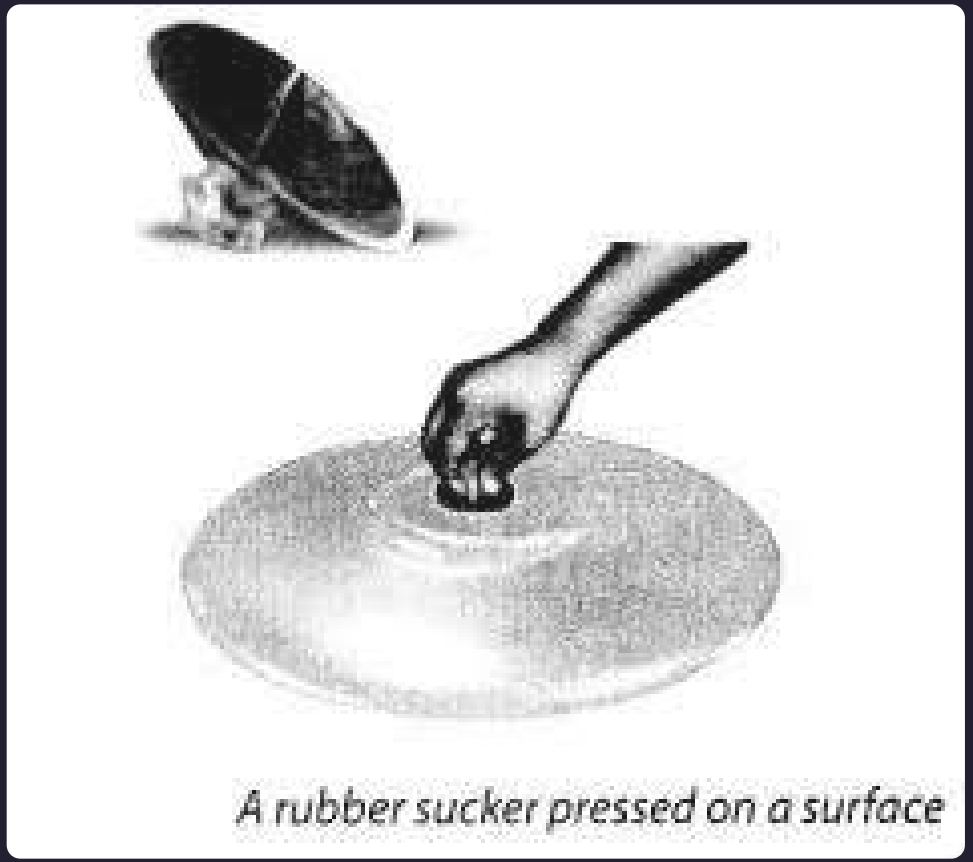
Our Earth is surrounded by a layer of air called the **Atmosphere**. The weight of this air column exerts pressure on everything.

- **Magnitude:** Atmospheric pressure is very high, but we don't feel it because the **internal pressure** of our bodies balances it out.

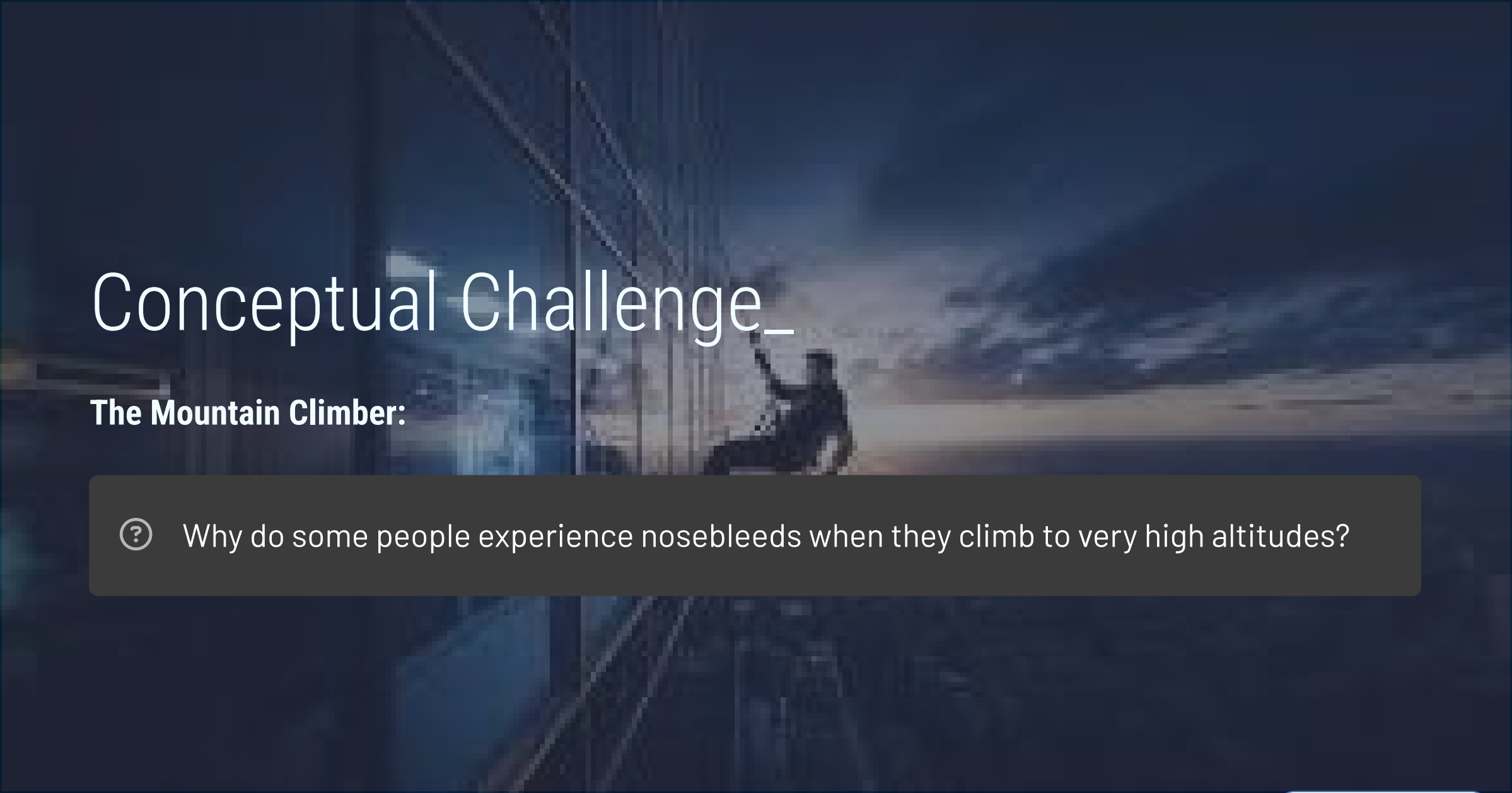
Atmospheric Pressure

EXAMPLE

1. **The Sucker Example:** When you press a rubber sucker, air is forced out from under it. The atmospheric pressure from outside pins it to the surface.
2. **The Straw:** When you suck through a straw, you reduce the air pressure inside it. The atmospheric pressure pushing on the liquid's surface then forces the drink up into the straw.



A rubber sucker pressed on a surface



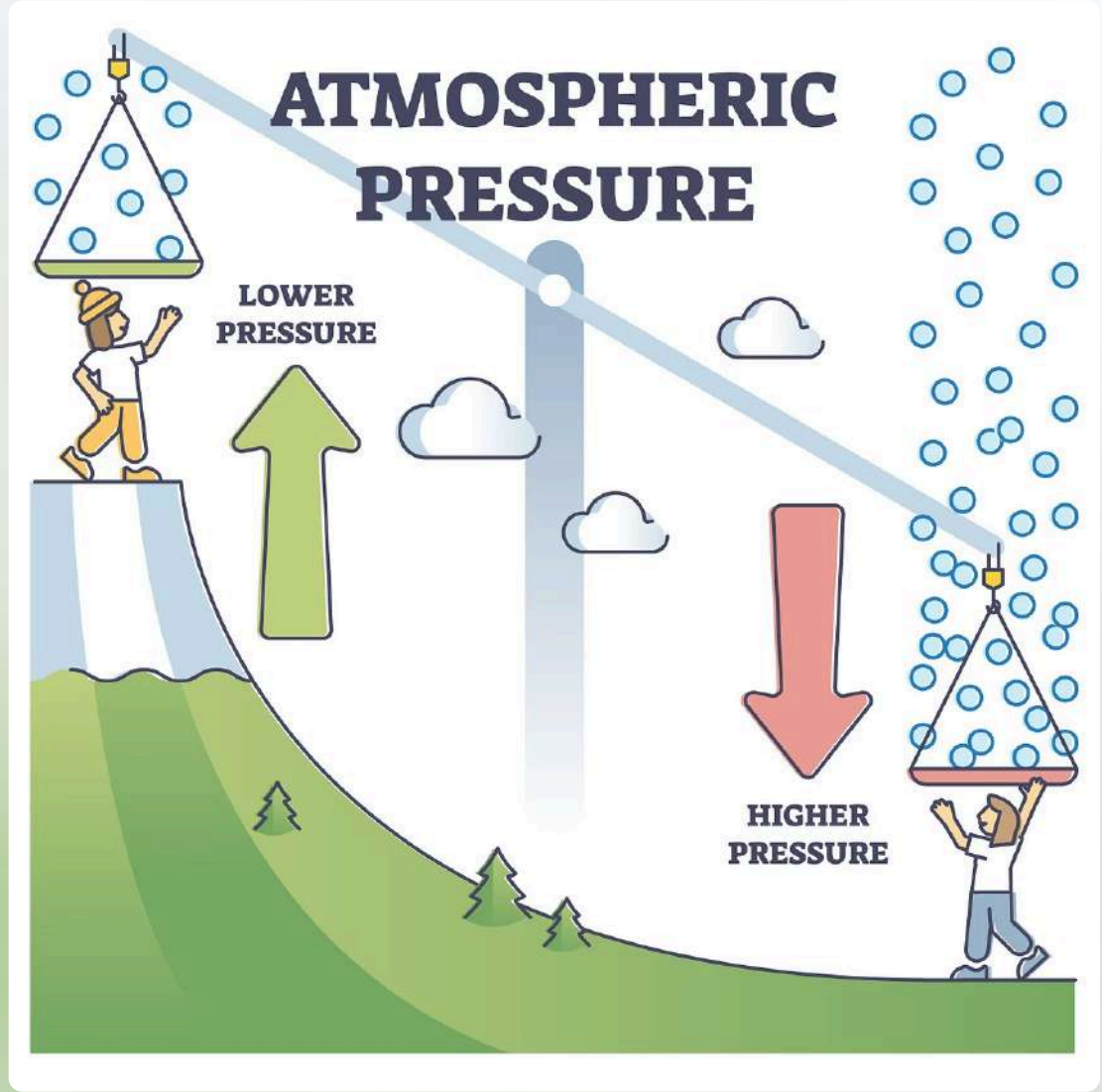
Conceptual Challenge_

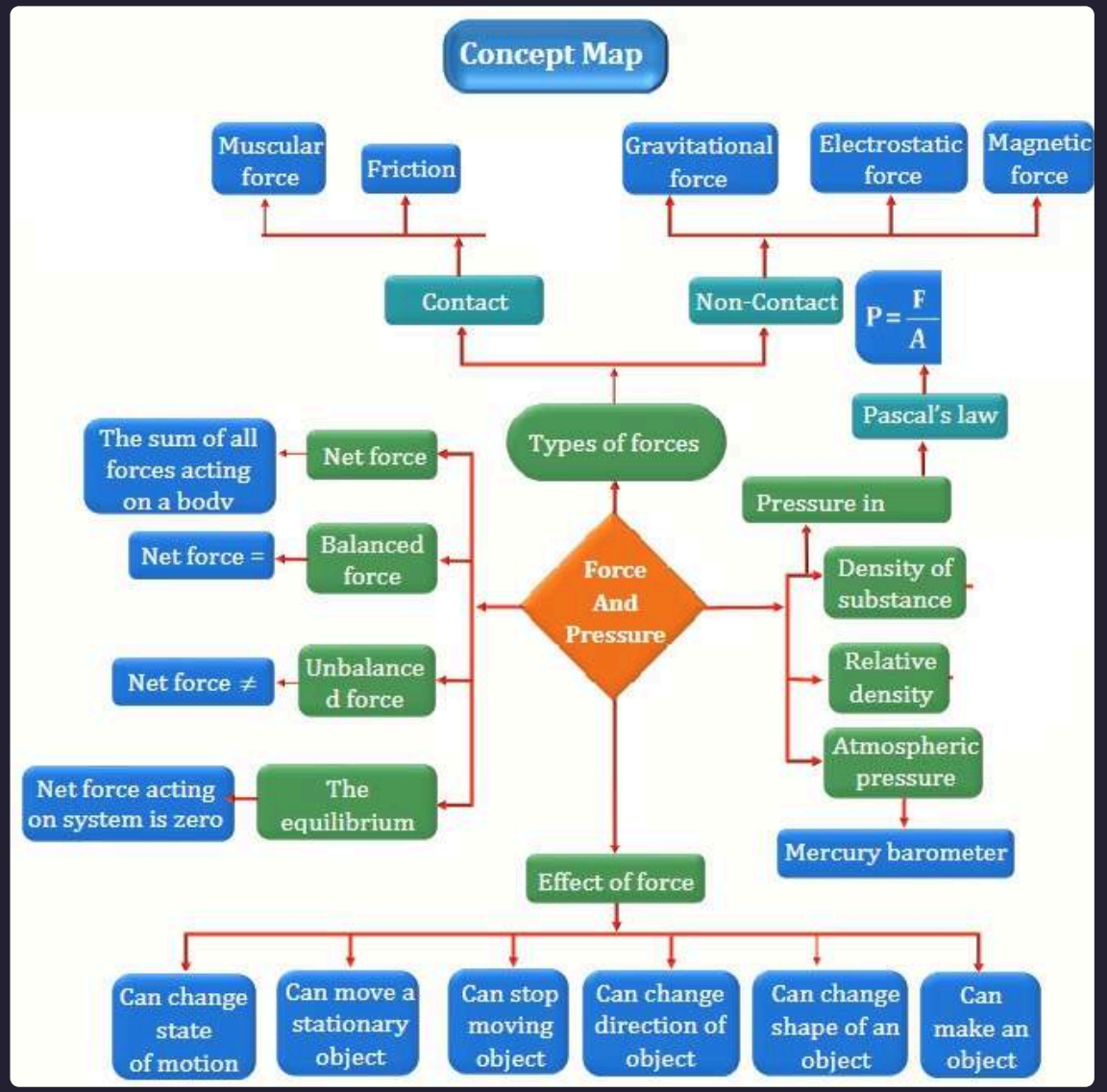
The Mountain Climber:

Why do some people experience nosebleeds when they climb to very high altitudes?

Answer:-

- **Low air pressure:** Blood vessels in the nose expand slightly and can burst more easily.
- **Very dry air:** Dries and cracks the nasal lining, making it fragile.
- **Low oxygen levels:** Body increases blood flow, putting extra stress on tiny nose vessels.




Concept Map
Muscular force
Friction
Gravitational force
Electrostatic force
Magnetic force
Contact
Non-Contact
P = F/A
Pascal's law
Types of forces
Pressure in
The sum of all forces acting on a body
Net force
Net force =
Balanced force
Force And Pressure
Density of substance
Net force ≠
Unbalanced force
Relative density
Atmospheric pressure
Net force acting on system is zero
The equilibrium
Mercury barometer
Effect of force
Can change state of motion
Can move a stationary object
Can stop moving object
Can change direction of object
Can change shape of an object
Can make an object