SCIENCE

By Ankita Ma'am For Class 8th

Force and Pressure

Lecture No.- 02

Topics To Be Covered

1. Forces
2. Types and Effects of Forces
3. Forces are due to an interaction
4. Pressure

A Push or a Pull

Push

Pull

Force- a Push or a Pull

- **Push:** Kicking, Hitting, Throwing, Pushing, Flicking etc.
- **Pull:** Picking, Lifting, Shutting, Pulling etc.

Force-a Push or a Pull

magnitude
direction

Force

- A push or pull on an object is called force. Force is a vector quantity and its SI unit is newton (N).

Force–a Push or a Pull

Push and Pull Actions

Pushing a door to open it – force is applied as a push

Pulling a drawer to open it – force is applied as a pull

Kicking a football – your leg exerts a push force

Lifting a school bag – your arms apply an upward pulling force

Types of Forces

Different Types of Forces

Contact Forces

Force which can be applied only when it is in contact with object.

Examples:

- Muscular Force
- Friction
- Drag (Fluids)

Non-Contact Forces

Force which can be applied without contact with object

Examples:

- Magnetic Force
- Electrostatic Forces
- Gravity

Types of Forces

Contact Forces

- These forces require physical contact between objects.
- Examples: Muscular Force and Friction

Non-Contact Forces

- These forces act without physical contact.
- Examples: Magnetic Force, Electrostatic Force and Gravitational Force

Contact Forces

Lifting a school bag

Muscles in the arms apply upward force to raise the bag.

Pushing a chair

Arm and shoulder muscles generate force to move the chair forward.

Opening a door

Muscular force from the arms turns or pushes the door.

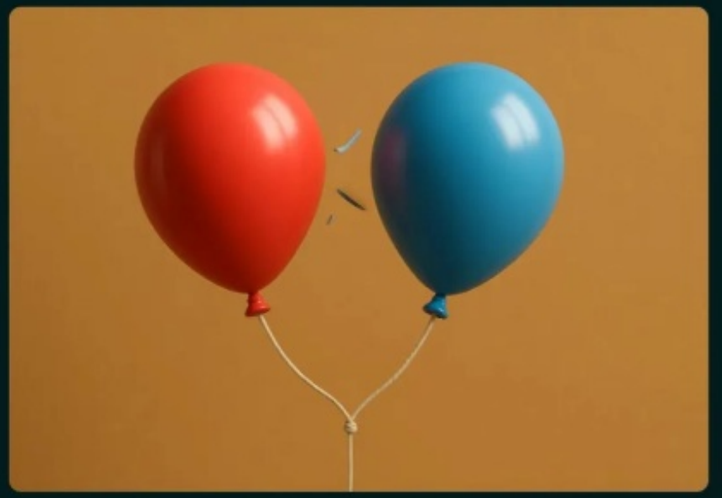
Cycling

Leg muscles push the pedals to create motion.

Non-Contact Forces

A pencil falling from the table

A magnet attracting iron filings placed nearby



Two balloons rubbed and then repelling each other

Contact Forces

Define

(a) Muscular force:

- The force applied due to the action of muscles is called muscular force.

(b) Frictional force:

- The force which opposes the relative motion between two surfaces in
- contact is called friction.

Non-Contact Forces

(a) Magnetic force:

- The force exerted by a magnet on another magnet or iron piece is called magnetic force.

(b) Electrostatic force:

- The force exerted by a charged object on another charged or uncharged object is known as electrostatic force.

(c) Gravitational force:

- The force of attraction between two objects having mass is called gravitational force.

Effect of Force

What force can do to an object

A force can:

Move an object at rest

Rest → Motion

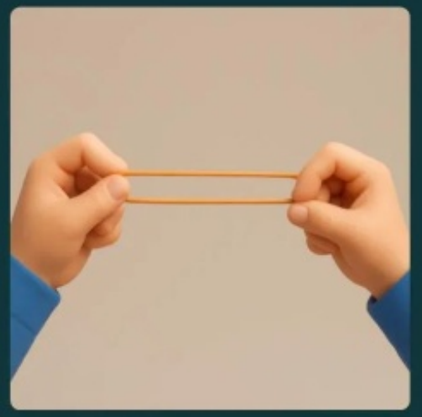
Change the speed of a moving object

Change the direction of motion

Change the shape of an object

Effect of Force

Force can cause:



Stretching

The rubber band becomes longer when pulled from both ends.

Squashing

The dough flattens as force compresses it from above.

Pressing

The balloon's shape changes as air inside shifts under pressure.

Bending

The plastic ruler bends when force is applied at both ends.

Effect of Force

Increasing speed of a bicycle

Decreasing speed of a bicycle on applying brakes

Change in direction of a ball

Change in direction and speed of a skater

Forces affecting Speed and Direction

In the same direction as motion, speed increases

Opposite to motion, speed decreases

At an angle, direction changes

Effect of Force

An external force acting on an object can change

1. The shape and size of an object.
2. The state of motion of an object.
3. The speed and direction of a moving object.

Forces are due to Interaction

- Whenever there is an interaction of one object with another object, there is a force between the two objects.

Forces are due to Interaction

Recognizing force interactions

Force is observed when an object is:

Pushed – e.g., girl pushing a swing

Pulled – e.g., pulling a suitcase

Mutual Forces – two teams in tug-of-war

Exploring Forces

If we want to describe a force and how it affects an object, we must specify its **magnitude** (how strong the force is) and **direction** (the direction in which it is applied)

Magnitude of the Forces (Fa and Fb)	Direction of the Applied Forces	Net Force
Equal Magnitude (Fa = Fb) $f_a = 5N$, $f_b = 5N$	Similar Direction → →	$F_a + F_b$
Unequal Magnitude (Fa > Fb) $F_a = 5N$, $f_b = 3N$	Similar Direction → →	$F_a + F_b$
Equal Magnitude (Fa = Fb) $f_a = 5N$, $f_b = 5N$	Opposite Direction → ←	0 (Zero) N
Unequal Magnitude (Fa > Fb) $F_a = 5N$, $f_b = 3N$	Opposite Direction ⟶ ⟵	$F_a - F_b$

Pressure

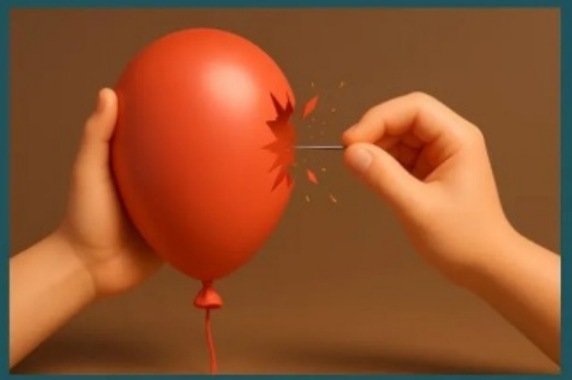
- The force acting per unit area on a surface is called Pressure.

Pressure = Force/Area

- The SI unit of pressure is Pascal (Pa) or (N/m^2).

Effect of Pressure on objects

Popping a balloon with a needle



- When the same amount of force is applied on a small contact area, the pressure becomes very high.
- This high pressure easily changes the shape of soft or flexible materials.

Pressing a balloon with a palm

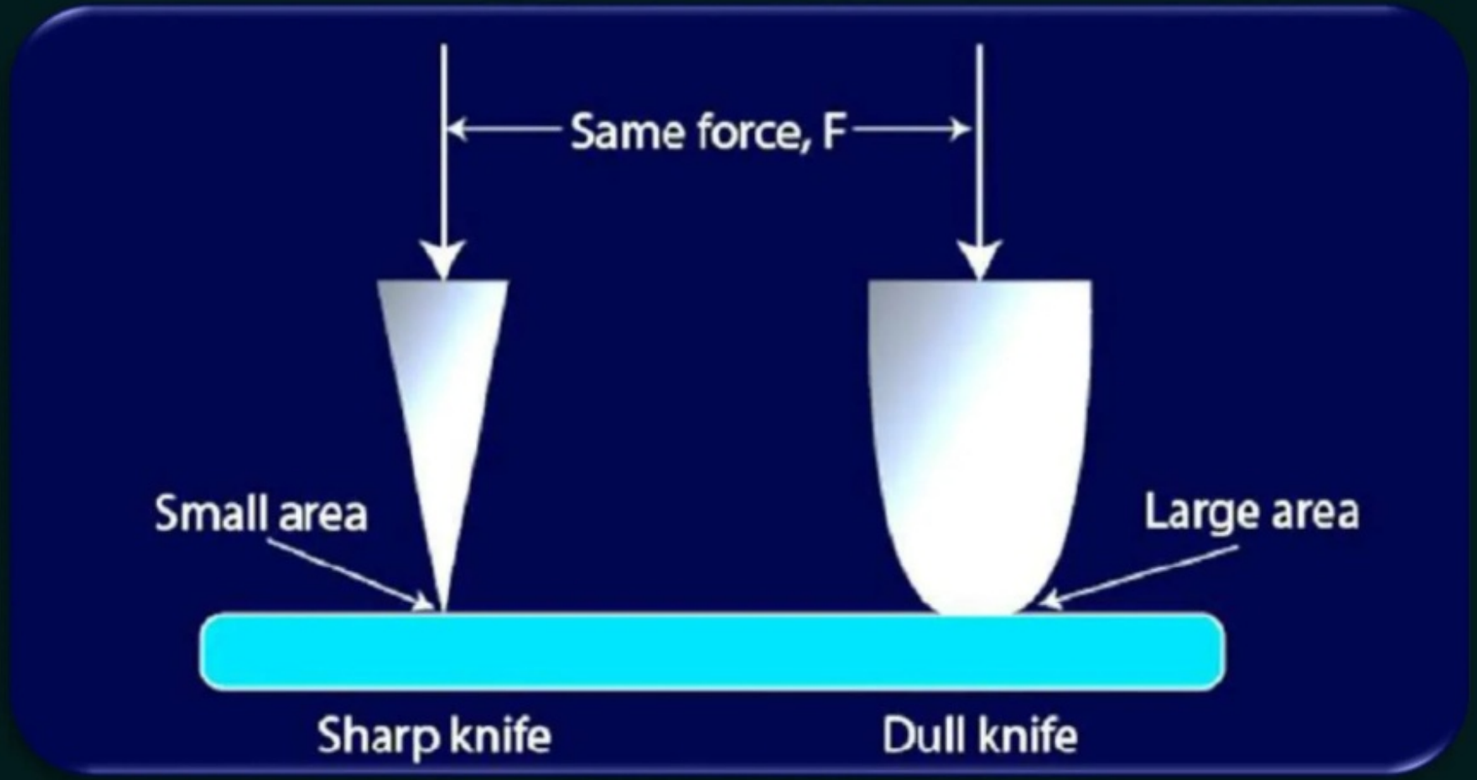
- When the same force is spread over a larger area, the pressure becomes lower.
- Lower pressure means less impact on the shape of the object.

Effect of Pressure on objects

Porters using Head Pads spreads the weight over a larger area, reducing pressure and preventing discomfort while carrying loads.

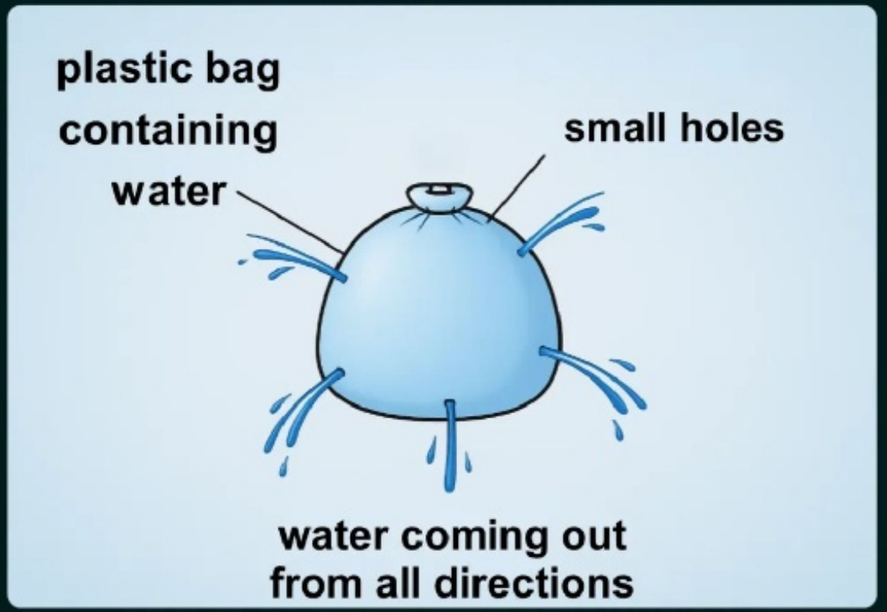
Wide bag straps distribute weight better, causing less pressure on shoulders, while thin straps can create high pressure and discomfort.

Pressure



Pressure Exerted by Liquids and Gases

- Liquids and gases exert pressure on the walls of their containers and on objects submerged in them.
- Pressure in liquids increases with depth.
- Pressure acts equally in all directions at the same depth.
- Pressure is the same at all points at a given depth.
- Gases also exert pressure in all directions inside containers.
- Atmospheric pressure adds to the pressure at the liquid's surface.



Pressure acts in all directions

Pressure Exerted by Liquids and Gases

Pressure at depth

- The pressure at any point in a liquid depends on how deep it is.
- The deeper the point, the higher the pressure because more liquid is above pushing down.

Pressure on walls

- Liquids push on the walls of their container with equal force at the same depth.
- This pressure causes water to leak from holes at the same level equally far from the container.

Effects of Atmospheric Pressure

Atmospheric pressure acts on all objects and people constantly

It keeps liquids inside containers, like water in a glass or bottle

It helps balloons stay inflated by pressing on the air inside

Devices like suction cups work because of differences in atmospheric pressure

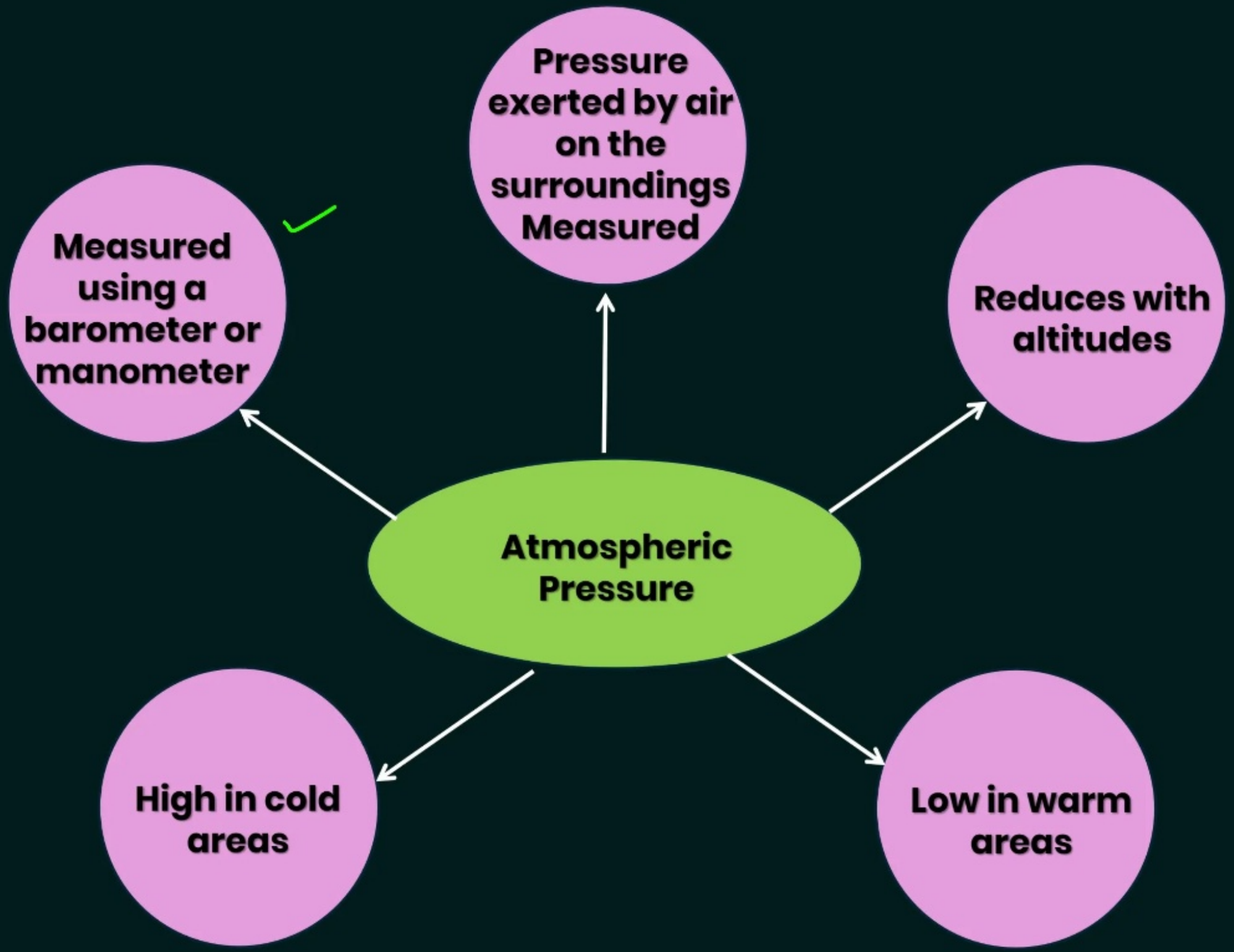
Role of Atmospheric Pressure in Nature

Atmospheric pressure affects:

Weather patterns: High and low pressure cause winds and storms

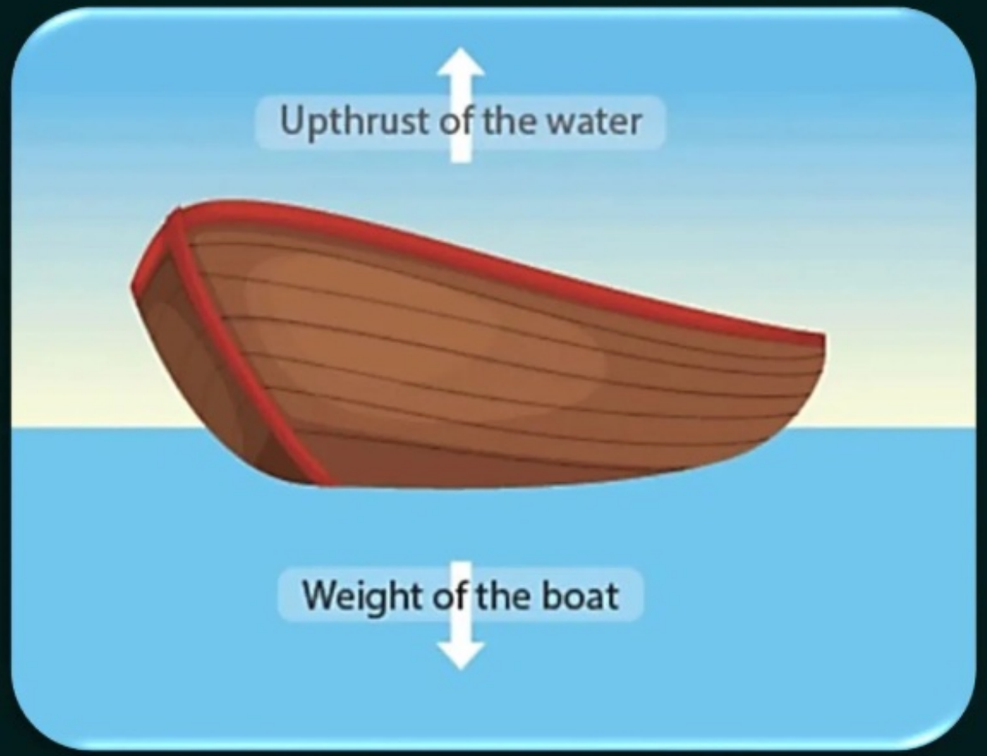
Breathing: Our lungs work by balancing internal and atmospheric pressure

Flight: Air pressure differences help planes lift


Pressure exerted by air on the surroundings Measured
Measured using a barometer or manometer
Reduces with altitudes
Atmospheric Pressure
High in cold areas
Low in warm areas

Upthrust

- The upward force exerted by a fluid on an object is known as upthrust or buoyant force.



Question

Why the thickness of the walls of a dam is increased towards the bottom?

Sol. The pressure exerted by a liquid at a point increased with an increase in depth of the liquid.

Therefore, the thickness of the walls of a dam is increased towards the bottom so that the dam is withstand with the increasing pressure of water.

Question

While sieving grains, small pieces fall down. Which force pulls them down?

Ans. Gravitational force

Question

A force of 100 N is applied on an area of ~~4 m2~~ $4m^2$. Compute pressure being applied on the area.

Ans. Given:

Force = 100 N, Area = 4 m^2

Pressure = Force/Area = 100/4 = 25 pa.

$$\frac{F}{A} = \frac{100}{4} = 25\ N/m^2$$

Question

What is the similarity between electrostatic and magnetic forces?

Ans. Both are non-contact forces.

Both are attractive as well as repulsive forces.

Question

Why it is easier to walk on soft sand if we have flat shoes rather than shoes with sharp heels (or pencil heels)?

Ans. A flat shoe has a greater area in contact with the soft sand and exerts less pressure on the soft ground. Due to this the 'flat' shoes do not sink much in soft sand and it is easy to walk on it. On the other hand, a sharp heel has a small area in contact with the soft sand and exerts a greater pressure on the sand. Due to this, the sharp heels sink deep into soft sand making it difficult for the wearer to walk on it.

Homework

What is pressure? What is the relation of pressure with area on which it is applied?

Thank
You