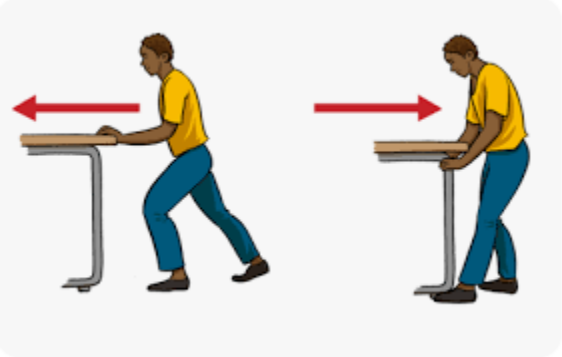
Lesson 1: The Concept of Force

Key Terms and Concepts

- **Dynamics:** The subdivision of mechanics that deals with the motion of objects in relation to the physical factor that causes the motion, the force.
- **Force:** An external agent of a body that changes state of rest or state of motion of that body.
- **Inertia:** The tendency of a body to oppose any change in its state of rest or its state of uniform motion
- **Net force:** The sum of two or more forces (Resultant force)
- **Acceleration:** The time rate of change of velocity. It could happen when a body changes its speed or direction of motion or both.
- **System:** A collection of objects, elements or components that are organized for a common purpose. Anything outside the system is the surrounding.
- **Action and reaction:** During an interaction between two objects the force one exertion the other is Action and the force it is acted upon by the other is Reaction
- **Weight:** The gravitational pull on an object
- **Normal forces:** A force with which to objects push one another and acting perpendicularly at the surface of contact

The concept of force

- Dynamics is the study of motion and its causes,
- **Force is the push or pull on an object with mass that causes it to change its velocity**
- **Push and pull** are caused by objects interacting with one another.
- **Push** is described as an action of force that **causes an object to move from its initial position.**
- Pushing the table, Pushing thumb pins, Walking, etc. are **examples of Push**.
- The **pull is described as an act that makes anything move by tugging or dragging**.
- Plucking the string of a guitar, Opening the drawer, Pulling ropes while playing tug of war, etc. are **examples of Pull**.
- Force is a **vector quantity**.
- The **SI unit of force is Newton (N)**.
- The dimensional formula of force is **[M L T^{-2}]**.
- **1 Newton is equivalent to 1 kg m/s^2**
- **1 Newton is defined as the force required to accelerate a body of mass 1 kg with acceleration 1 m/s^2.**



Effects of Force

The following are the **effects of force**

1.Can change the **state of the rest of a body**.
2.It can change the **state of motion of the body**.
3.It can change the **direction of the body**.
4.It can Force change the **shape and size of the body**.

Types of Force

- **The following are the** different types of force

1. **Contact forces:- are forces that result from physical contact between two bodies.**

The following are some examples of contact forces:

Muscle Power	**Mechanical Force**
Force of Friction	**Tension Force**
Viscous Drag	**A girl stretching a spring,**
a man pulling a box on the floor, and	**a girl kicking a ball**

2. Non-Contact Force

- **Non-contact forces or field force :-are those that work across**
- The following are **some examples of non-contact forces:**
- **Gravitation Force**
- **Electrostatic Force**
- **Magnetic Force**

Fundamental forces in nature

- The known fundamental forces in nature are all field forces. These are, in order of decreasing strength:
- the **strong nuclear force** between subatomic particles;
- the **electromagnetic forces** between electric charges;
- the **weak nuclear force**, which arises in certain radioactive decay processes; and
- the **gravitational force** between objects.
- The strong force keeps the nucleus of an atom from flying apart due to the repulsive electric force of the protons.
- The weak force is involved in most radioactive processes and plays an important role in the nuclear reactions that generate the Sun's energy output.
- The strong and weak forces operate only on the nuclear scale, with a very short range on the order of 10-15 m.

Balanced and Unbalanced Forces

- **When balanced forces are applied to a body, there is no net effective force acting upon it.** Balanced forces **do not cause** any changes in motion.
- **Unbalanced forces exerted on a body change its velocity and/or direction of motion.** It moves in the direction of the force with the highest magnitude

Net Force

- **When many different forces act on a body, they can be resolved into a single component called the net force acting on the body.** The net force determines the direction of motion.

Weight

- **Weight is the gravitational force with which the earth pulls an object**. It is given by
- **Weight (W) = mg**

- Where m is the **mass of the body**
- g is the **acceleration due to gravity**

Normal Reaction

- **Normal reaction is a force between the surfaces in contact.**
- This force is normal to the surfaces in contact.
- The normal reaction **occurs to stop two bodies in contact to merge into each other**