Forces 💥

Push and Pull

5.1 What is a force?

5.1.1 Intro

-It is a push or a pull, which can:

~change the <u>state of rest or motion</u> of a body

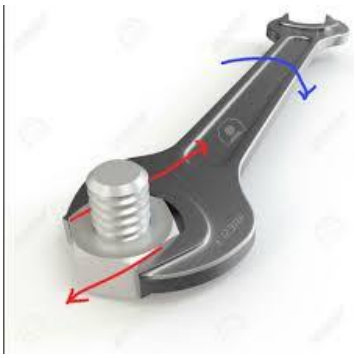
~change the <u>shape and size</u> of a body

~bring about <u>turning effects</u> in a body(eg levers)

~exert <u>pressure</u> on a body

Examples:

1. rotating of nut using spanner
2. turning doorknob
3. Lifting a heavy stone with a lever



The S.I unit of force is Newton(N).

Eg. force F=2.7N

The magnitude of a force is measured using a force meter (or newton metre) eg. spring balance, digital force gauge

5.1.2 Weight Vs Mass

	Mass	Weight
Definition	Amount of substance in a body or object (no. and composition of atoms and molecules make up the mass of a body)	A body on earth's surface experiences a downward gravitational force which is the pulling force of it due to earth. The force is also called the weight of the body
S.I Unit	Kilogram (kg)	Newton (N)
Other common Units	milligram(mg) and gram(g)	
Instruments used to measure	Electronic balance or beam balance	Extension spring balance or compression spring balance

Note: Don't mix mass and weight ‼️

Formula of force: **W = mg**

W= weight **(N)**

m= mass **(kg)**

g= gravitational field strength **(N/kg)**

Note: Weight and Force is the same thing ‼️

→ both of them have the SI unit of Newton(N)

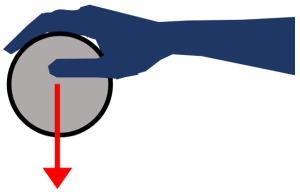
Types of Forces

Gravitational Force, *W* (non-contact)

Aka weight, it is a gravitational force or force due to gravity acting on a body.

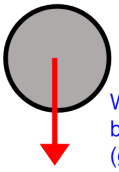
Gravitational Force, *W*

- **Weight** is a gravitational force / force due to gravity acting on a body.
- E.g. When a ball is released from rest, gravitational force acts on the ball by the Earth in a downward direction, causing the ball to accelerate vertically downward.



Gravitational Force, *W*

- It is an example of a **non-contact force**. (The earth and the ball are not touching one another)
- Weight is drawn from the centre of gravity (c.g.) of the body.
- Centre of gravity (c.g.) is a **point** in the body through which the whole weight appears to act.



Weight acting on ball by earth. (gravitational force acting on the ball by earth)

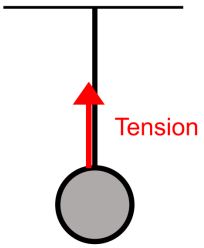
Friction, *F* (contact)

Occurs when 2 surfaces rub against each other. It can be solids, liquid or gases.(In liquid and gases: commonly called viscous force or drag force)

- **In air: called air resistance**
- **Smooth surface has negligible resistance**

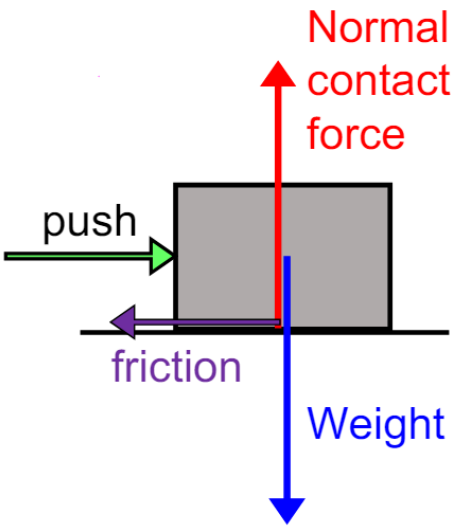
Friction, *f*

- When a box is initially pushed to the right and released horizontally along the floor, friction *f* acts on the box by the floor (to the left), opposes its motion and causes it to slow down and stop.
- Representation
  - Starting from **centre** of contact surface, draw along the surface.
  - Direction is **opposite** to relative motion of the object.

Tension, *T* (contact)	Tension, *T*
	• Tension acts through a stretched rope, string or cable.
	• Example:
	  • When a ball is hung from the ceiling by a string, the tension *T* in the string acts on the ball vertically upwards.
	• Representation:
	  • Starting from **end** of the string, draw towards **centre** of string.
	 

Normal Contact Force, *N* (contact)	Normal contact force, *N* • This force is exerted on a body by a surface in contact with it. It is exerted on the body **perpendicular** to the surface.  • Normal contact force is the force exerted by the surface which prevents objects from being able to move through each other.

5.1.3 How To Draw Free Body Diagram



Normal Contact force: touches the bottom of the box, upwards

Weight: starts exactly in the middle of the box, downwards

Push/Pull: from the outside surface of the box, in the direction of the force

Friction: On top of the surface of the box touching the floor (to allow the cher to see what u draw),against the direction of the force