NEWTON'S LAWS OF MOTION

Assumptions:

1. The bodies are not of atomic size

2. The speed of any body is small as compared to the speed of light

NEWTON'S 1st LAW OF MOTION:

Everybody continues in its state of rest or in uniform motion in a straight line unless compelled by some external force to act otherwise

INERTIA

This is the tendency of a body to remain at rest or if moving continue its motion in a straight line

OR

This is the reluctance of a body at rest to start moving and its reluctance to stop once it started moving in a straight line

LINEAR MOMENTUM (P)

LINEAR MOMENTUM, **P** IS DEFINED AS

$$P = mv$$

Where **m** = mass in kg

v = velocity in m/s

NEWTON'S 2nd LAW OF MOTION:

The rate of change of linear momentum is proportional to the applied force and takes place in the direction of the force.

If a force **F** acts on a body of mass, **m** and causes its velocity to change from **u** to **v** in a time **t**

Then from Newton's 2nd **Law of Motion,** we have

F α Rate of change of momentum

$$F \alpha \frac{mv - mu}{t}$$

$$\alpha \frac{m(v-u)}{t}, \qquad \text{but acc. a} = \frac{v-u}{t}$$

$$\Rightarrow \quad F \alpha m a$$

$$\Rightarrow \quad F = k\,m\,a \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

When $F = 1N$, $m = 1kg$ and $a = 1\ ms^{-2}$
then

$$F = ma$$

Note. If a body of mass m falls with an acceleration due to gravity g, then from F = ma,

The force acting on it or its **Weight** is given by

$$W = mg$$

Example

Calculate the weight or the force gravity of a mass 500g

[$g = 9.8\ ms^{-2}$] Answer W = 4.9 N

MOMENTUM CHANGE AND IMPULSE

From Newton's $\mathbf{2^{nd}}$ Law of Motion

$$f = ma \qquad \text{but } a = \frac{v - u}{t}$$

$$f = \frac{mv - mu}{t}$$

$$= \frac{change\ of\ momentum}{time}$$

$$ft = mv - mu$$

$$= \textit{Change of momentum}$$

The quantity **ft** is known as the **IMPULSE** of the force on the body

END OF LESSON ONE