Grade 10 Science

Reading Material

Unit 4

Newton's Laws of Motion

MASS OR WEIGHT

$W = mg$

W = weight
m = mass
g = gravitational field strength

momentum
the force of a moving body.
the mass times velocity of an object

$p = m \cdot v$

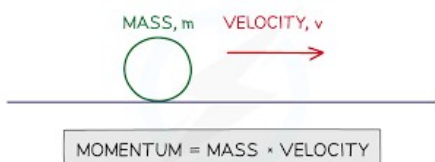Momentum = mass × velocity
(Kgrams) (meters/second)

$F = mg$
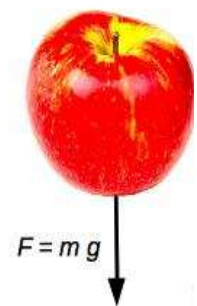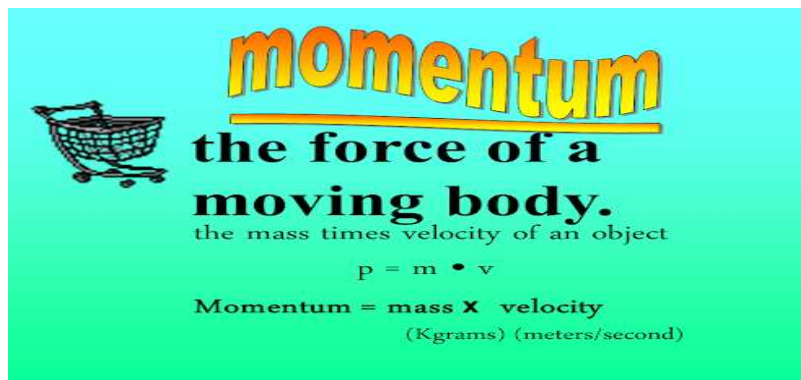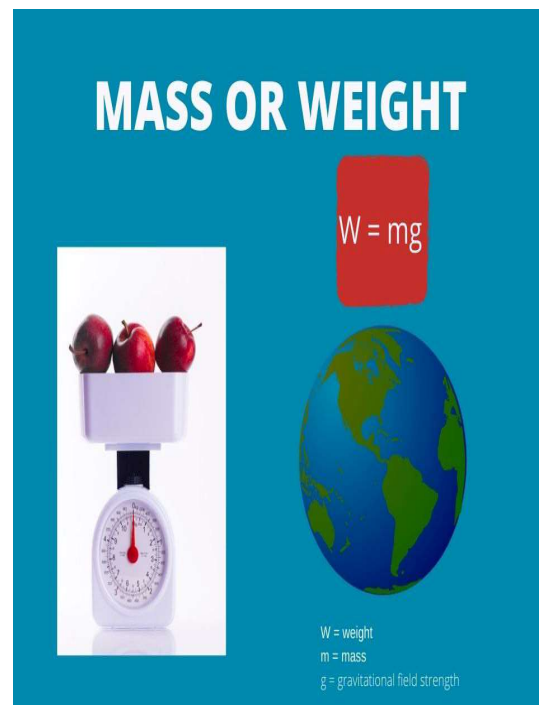
Momentum, mass and weight

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Momentum, mass and weight

Momentum

The product of the mass(m) of the object and its velocity(v) is known as momentum.

- SI unit of momentum:

$$\text{Momentum} = \text{Mass} \times \text{Velocity}$$

$$= \text{kg} \times \text{ms}^{-1}$$

$$= \text{kgms}^{-1}$$

- Momentum is a vector quantity.

E.g.: -

1. What is the momentum of a body of mass 1000kg moving at a velocity of 20ms⁻¹?

$$\text{Momentum} = \text{Mass} \times \text{Velocity}$$

$$= 1000\text{kg} \times 20\text{ms}^{-1}$$

$$= 20\,000 \text{ kgms}^{-1}$$

2. A bullet of mass 15g fired by a gun moves at a velocity of 500ms⁻¹. Find its momentum.

$$\text{Momentum} = \text{Mass} \times \text{Velocity}$$

$$= 15/1000 \text{ kg} \times 5000\text{ms}^{-1}$$

$$= 7.5 \text{ kgms}^{-1}$$

Mass and weight

➤ **Mass: -**

-The amount of matter in an object.

-SI unit is kg.

➢ **Weight**: -

-The force of the object with which it is attracted towards the earth.

-That is the force acting on the object due to gravitational attraction of the earth.

-SI unit is Newton (N).

-Because the weight is defined as the force.

❖ According to Newton's second law, the force acting on a body moving at an acceleration is given by;

$$F = ma$$

❖ Therefore: **Weight = m × a**

❖ If it is moving under gravity, then its acceleration would be the gravitational acceleration (g). Then, the force exerted on the object is its weight.

❖ The gravitational acceleration near the surface of the earth at sea level is $9.8ms^{-2}$, approximately.
❖ Therefore, the weight of a body of mass m is $10ms^{-2}$.
❖ The weight of an object of mass 1kg would be 10N.

$$1kg = 10 \text{ N}$$

E.g.: -   **5kg = 50N**

3.5kg = 35N