CHAPTER THREE

FORCE, WEIGTH AND MASS

- Force simply refers to either a push or a pull.
- If an object such as a stone is not moving but lying on the ground, it is said to be in a state of rest.
- If we apply a force to this object, it can cause it to start moving, and for this reason we say that the state of rest of the object has been changed, as a result of the force.
- Also if a body is moving at a constant speed or at a certain particular speed, we can apply a force to slow down or increase the speed of the moving body.
- In this case there has been a change in the uniform motion of the moving object.
- For these reasons force is defined as the agent, which changes an object state of rest or the uniform speed of an object, in a straight line.

THE EFFECTS OF FORCE:

- Force has certain effects and some of these effects are :

(a) It can stop a moving body :

- If a body or an object is moving or is in motion, we can apply a force to stop this moving object.
- For example a very strong man can stand in front of a slowly moving car, and apply a force by pushing against the car to stop its movement.

(b) It can increase the speed of a moving body:

- If a body or an object is moving slowly, we can cause an increase in its speed by applying a great force or push.

(c) Causing a change in a body's movement direction:

- If a body is moving in the forward direction, we can apply a great force in the opposite or backward direction to the body.
- This will cause the body to now start moving in the backward or opposite direction.

. TYPES OF FORCES:

- *There are different types of forces and some examples are:*

(1) Magnetic force:

- This is the type of force which acts between two magnets, or between a magnet and a magnetic material.
- A magnetic material is a material which can be pulled or attracted by a magnet.
- If a magnetic material such as an iron nail is being brought towards or near a magnet, then at a certain point or distance away from the magnet, the magnetic force will cause the nail to be attracted towards the magnet.
- Also if two magnets are being brought towards each other, the magnetic force will either cause them to be attracted towards each other, or repel or move away from each other.

(2) Centripetal force:

- This is the type of force which is needed, in order to enable a body to move in a circular motion or path.
- Every object moving in a circular path or motion has this force acting on it, for without it no object can move round in a circular path .

(3) Surface tension :

- Because the surface of water acts as an elastic material, light and small objects such as blades and needles can be made to float on the water's surface.
- Surface tension is the force which acts on the surface of a liquid such as water, so as to enable the surface to act as an elastic material.

(4) Tension force:

- When an elastic material such as a spring or a rubber is stretched, a force tries to make the spring or rubber contract, and this force is referred to as the tension force.
- Tension force is therefore defined as the force, which tends to make an elastic material such as a rubber to contract, when it is stretched.

(5) The force of gravity :

- This is the type of force which attracts us and any object on the surface of the earth, towards the centre of the earth.
- If an object is thrown into the sky, it is this force which pulls it back to the earth's surface.
- Also if we jump into the sky or air, it is this force which pulls us back onto the surface of the earth.

(6)**Cohesive force:**

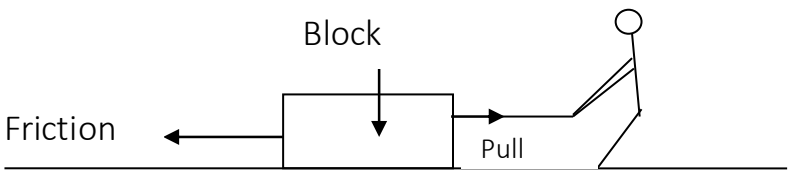
- This is the type of attractive force, which acts between the molecules of the same kind.
- It is this force which pulls small amounts of a liquid into droplets.

(7) Adhesive force:

- This is the type of attractive force, which acts between the molecules of a liquid and another material.

. FRICTION:

- If we put an object such as a cement block on the floor , and cause it to move in the forward direction either by pushing or pulling it , we will detect that as if a force to preventing the block from moving .
- This force which acts in the opposite direction to the movement of the block, and which also tires to prevent it from moving is called friction.
- Friction becomes high when the surface is rough or not smooth, and becomes low when the surface becomes smooth.



ADVANTAGES OF FRICTION:

- It enables us to walk, for without friction which acts between the sole of our shoes and the ground, walking will be difficult.
- When the brakes of a car are applied, the friction which acts between the road and the tyres causes the car to stop.

DISADVANTAGES OF FRICTION:

- It causes the sole of our shoes to wear out.
- As a result of friction acting between the moving parts of a machine, a machine may not work properly.

WAYS OF REDUCING FRICTION:

- Friction can be reduced by :
  (a) Making the surface smooth.
  (b) By covering the surface with oil or lubricants.

SCALAR AND VECTOR QUANTITIES: A scalar quantity is a quantity which has only magnitude but no direction. Examples of such a quantity are a mass of 50kg and a speed 60km/h. Avector quantity is a quantity which has both magnitude and direction. Examples of such a quantity are a force 70 newtons acting east, and a velocity 80 km/h acting in the vertical direction.

Weight and mass:

- The mass of a body is the amount of matter it contains.
- But the weight of a body is the force, which it exerts on anything which freely supports it.
- A body has weight because the force of gravity is pulling it, towards the surface or the centre of the earth.
- This enables it to exert a force on its support which is referred to as its weight.

Differences between weight and mass:

(1) The weight of a body is the force which it exerts on its support, but the mass of a body refers to the amount of matter it contains.
(2) Mass is a scalar quantity but weight is a vector quantity.
(3) Weight is measured in kilogram force (kgf) or gram force (gf), but mass is measured in kilogram or grams.
(4) The mass of a bodyremains always constant but the weight of a body changes from place to place.