




AL- MUSTAQBAL UNIVERSITY COLLEGE

# Medical physics

first year

MSC. Ban salam alshammari

# FORCES ON AND IN THE BODY



**Forces in the body:**

- Gravitational force
- Electrical force
- Nuclear force

**Forces on the body:**

- Static force
  - Dynamic force
  - frictional force
-

# A: FORCES IN THE BODY

## **1.Gravitational force G.F:**

This law state that “there is a force of attraction between any two objects”

e.g(our weight is due to attraction between earth and our bodies).

## **Effect of G.F:**

A – formation of varicose veins in leg

B – the loss of some bone minerals when a person become weightless such as in an orbiting satellite

C – long-term bed rest removes much of the force of body weight from the bones can lead to a serious bone loss.

---

- Gravitation force  $F = mg$  Where  $F$  is the force of gravity  $m$  is the mass
  - $g$  is the acceleration due
  - to the gravity
-

## 2. ELECTRIC FORCES E.F:

The forces produced by the muscles are caused by electrical charges attracting or repelling other electrical charges.

E.F between e- and p-  $H_2$  atoms ( $10^{39}$ ) time greater than G.F

### There are two types of E.F :

A – static force :(either attractive or repulsive → each of billions of living cells in the body has electrical potential difference across cell membrane )

B – magnetic force :( produced by moving electrical charge in muscle and nerves).

---

### 3. NUCLEAR FORCE N.F

A – strong nuclear force : is much larger than the other → it acts as the “glue” to hold the nucleus together against the repulsive force produced by the protons on each other

B – weaker nuclear force : is involved with electron (beta) decay from the nucleus

---

## B: FORCES ON THE BODY

1- static forces :

When object are stationary ( static) they are of equilibrium means sum of force in any direction is equal to zero and the sum of the torques about axis also equal zero .

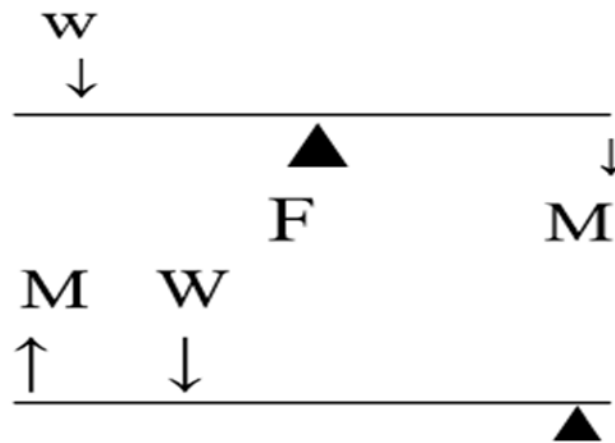
Torque The sum of the torque's about any axis is equals to zero .

Torque = force x length

The sum of the torque's about  
any axis is equals to zero .

---

- Man of muscle and bone system of the body acts as levers which are classified to
- A - First class lever : the force at the fulcrum point (F) between the muscle force ( M ) and the weight ( W ) ( e : g : the head )

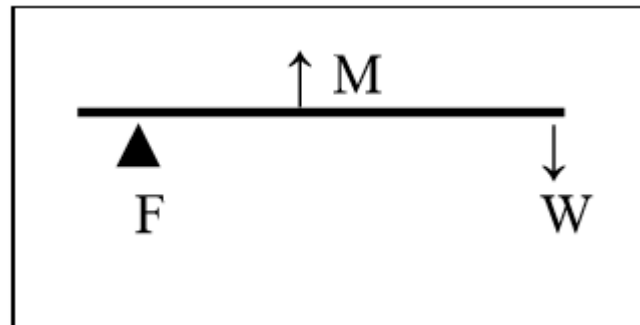




B – Second class level : W between F and M

( e . g : standing on toes)

c – Third class levers : M between F and W ( e . g : the elbow joint of the arm)



# DYNAMIC FORCE

The force on the body under the constant acceleration or deceleration of one dimensional motion .

The newton's second law force equal mass times acceleration can be written as:-

$$F=ma$$

F: the force (N, dyne)

m : the mass (Kg, g)

a : acceleration ( $\text{cm}/\text{sec}^2$  or  $\text{m}/\text{sec}^2$ )

---

# THE CENTRIFUGE

Is way to increase apparent weight, it is especially useful for separating in a liquid , the centrifuge works using the sedimentation principle . It speed up the sedimentation that occur at a slow rate under the force of gravity .

In a laboratory centrifuge that uses sample tubes ,the radial acceleration causes denser particles to settle to the bottom of the tube , while low density substance

