



كلية المستقبل الجامعة

قسم الفيزياء الطبية

المرحلة الثالثة

Medical Physics

Lecture One

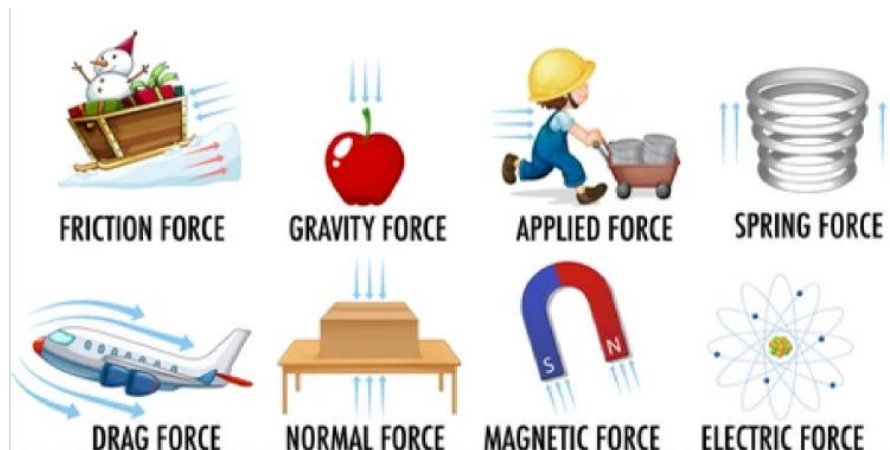
Forces Inside and Outside the Body

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Forces Inside and Outside the Body :

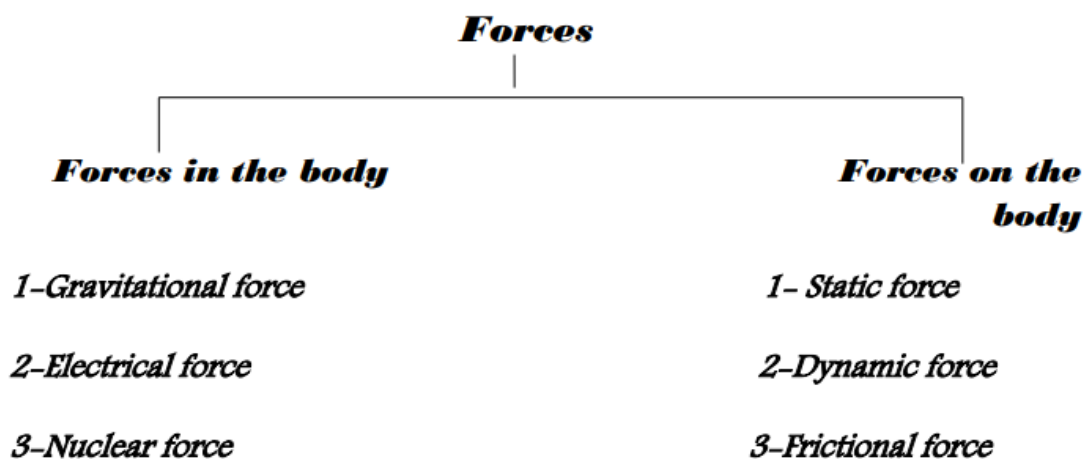
Physicists recognize four fundamental forces. In order of their relative strength from weakest to strongest.

Gravitational force - Electrical force - Weak nuclear force – Strong nuclear force .



Only the gravitational and electrical forces are importance in our study of the force affecting the human body . The electrical force important at molecular and cellular levels, e.g affecting binding together of our bones and controlling the contraction of our muscles .

Force controls all motion in the world; we are usually unaware of important forces in the body, for example, the muscular forces that cause the blood to circulate and the lungs to take in air.



Gravitational Forces :

The force of attraction between any two bodies is directly proportional to the product of their masses and is inversely proportional to the square of the distance between them .

Gravity is a force of acceleration. This means that it acts on objects to change their rates of velocity. All objects exert a gravitational force over one another and this force is unique because it can act over very large distances .

Gravitational Force Formula :

$$F \propto \frac{(m_1 m_2)}{r^2}$$

F: is the gravitational force between two bodies .

m_1 : is the mass of the first body .

m_2 : is the mass of the second body .

r : is the distance between the centres of two bodies .

Gravitation Force Formula :

$$\mathbf{F} = \mathbf{mg}$$

Where F : is the force of gravity.

m : is the mass .

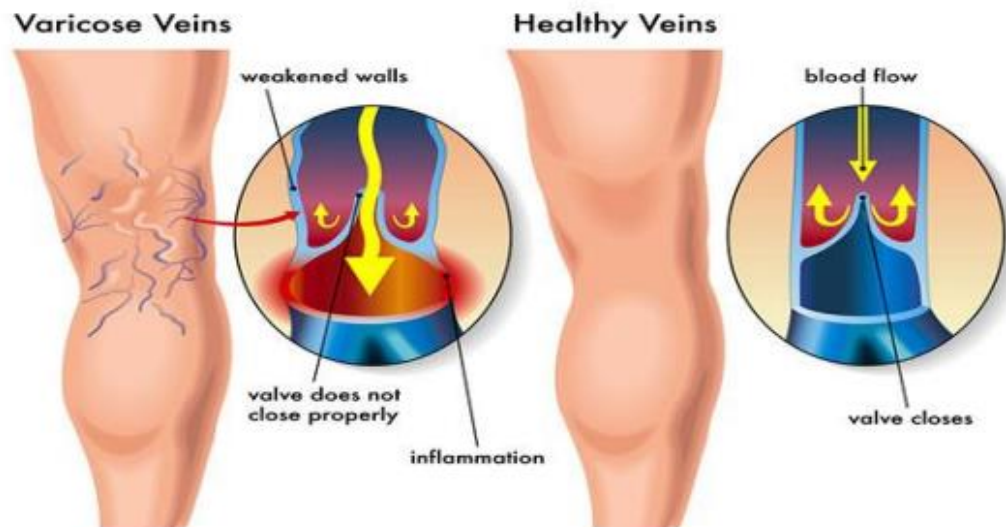
g : is the acceleration due to the gravity .

(**F= mg**) It is important to note that in accordance with Newton's Second Law of Motion .

Medical Effects of Gravitational Force :

Gravitational force: is attraction between any two objects our weight is due to the attraction between the earth and our bodies.

medical effects of gravitational force is the formation of varicose veins in the legs as the venous blood travels against the force of the gravity on its way to the heart.



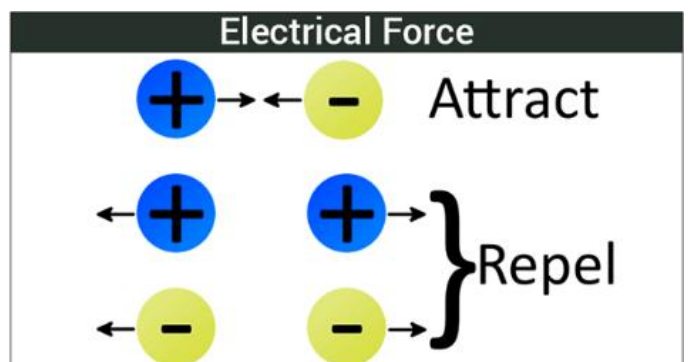
Electrical Forces :

The repulsive or attractive interaction between any two charged bodies is called as electric force. Similar to any force, its impact and effects on the given body are described by Newton's laws of motion. The electric force is one of the various forces that act on objects .

Types of Electric Force :

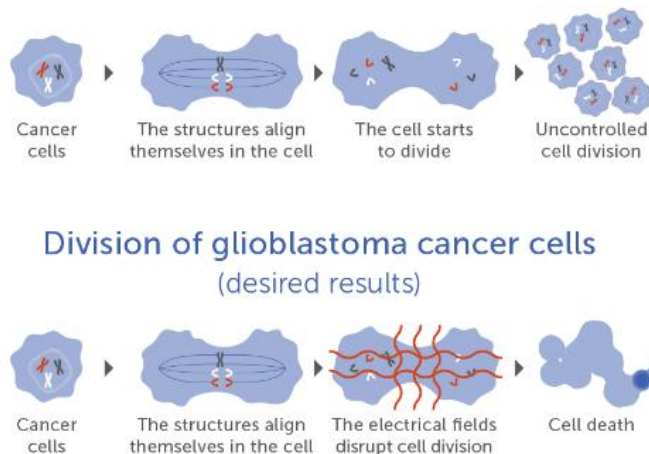
1- Attractive electrical forces

2- Repulsive electrical forces



Electrical Forces in Medical Field :

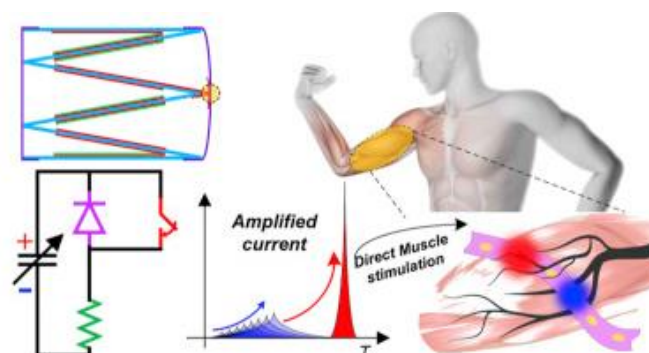
Alternating electric field therapy : This is a type electromagnetic field therapy with low-intensity electric fields which can disrupt the division of cancer cells and slow the growth of brain tumors .



Treatment Side Effects :

- 1- Killing of healthy cells .
- 2- Skin rashes caused by electrodes .
- 3- Severe nausea .

Muscle Stimulation : Electric field is usually used to relieve pain. Electrical field is created in biological tissues to stimulate or alter healing process. Electric field is created on the skin surface to drive ions beneficial to the healing process into or through the skin. The effects of these are at cellular level e.g. excitation of nerves, changes in the cell membrane permeability etc .



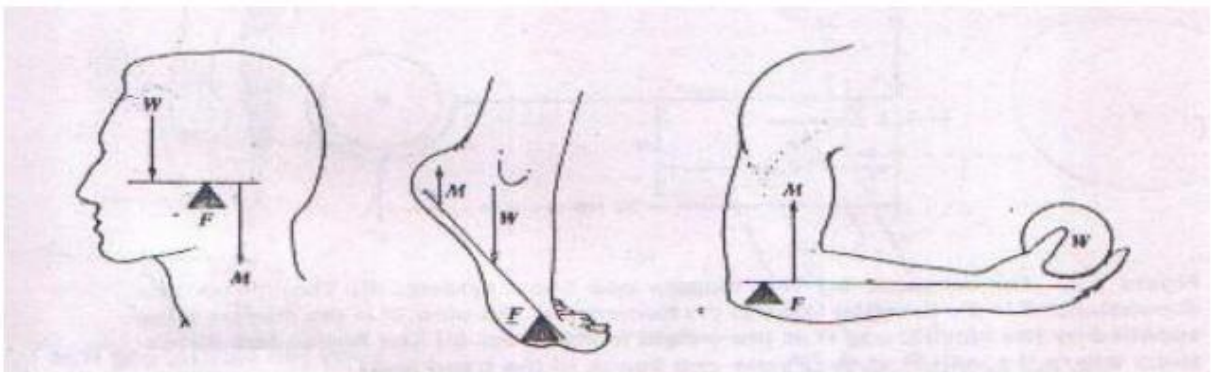
Forces on the Body :

Statics Force :When objects are stationary (static) they are in a state of equilibrium. The sum of the forces in any direction is equal to zero, and the sum of the torques about any axis also zero . Many of the muscle and bone systems act as levers which are classified to:

1- First class levers: They are least common in the body. The fulcrum point (F) is between the muscle forces (M) and the weight (W), for example the head.

2- Second class levers: They are found more than first class levers. Weight (W) is between the fulcrum point (F) and muscle forces (M), for example standing on the toes .

3- Third class levers: They are most common in the body. Muscle forces (M) is between fulcrum point (F) and weight (W).For example, the arm in the elbow joint.



Three Classes of Lever

