FORCES, DENSITY , PRESSURE

Force: Rate of change of momentum
Pressure: Force per unit area
Density: Mass per unit of volume of a substance

Gravitational fields: A region of space in which a mass experiences an (attractive) force due to the presence of another mass.

Electric fields: A region of space where a charge experiences an (attractive or repulsive) force due to the presence of another charge.

Upthrust: An upward force exerted by a fluid on a submerged or floating object.

Origin of Upthrust:
  Pressure on Bottom Surface > Pressure on Top Surface

  $\therefore$ Force on Bottom Surface > Force on Top Surface
    $\Rightarrow$ Resultant force upwards

Frictional force: Force that arises when two surfaces rub

- Always opposes relative or attempted motion

- Always acts along a surface

- Value varies up to a maximum value

Viscous forces:
- A force that opposes the motion of an object in a fluid

- Only exists when there is motion.

- Its magnitude increases with the speed of the object

Centre of gravity: Point through which the entire weight of the object may be considered to act.

Couple: A pair of forces which produce rotation only

Condition to form a couple:

- Equal in magnitude

- Parallel but in opposite directions

- Separated by a distance *d*

-

Moment of a Force: Product of the force and the perpendicular distance of its line of action to the pivot

$$Moment = Force \times \perp Distance\ from\ Pivot$$

Conditions for Equilibrium:

- Resultant force acting on it in any direction equals zero.

- Resultant torque about any point is zero.

Principle of Moments: For a body to be in equilibrium, the sum of all the anticlockwise moments about any point must be equal to the sum of all the clockwise moments about that same point.

Pressure in Fluids

- Fluids refer to both liquids and gases

- Particles are free to move and have E_K ∴ they collide with each other and the container. This exerts a small force over a small area causing pressure to form.

Derivation of Pressure in Fluids

Volume of water $= A \times h$

Mass of water $=$ density $\times$ Volume $= \rho \times A \times h$

Weight of Water $=$ mass $\times$ g $= \rho \times A \times h \times g$

$$\text{Pressure} = \frac{Force}{Area} = \frac{\rho . g . h . A}{A}$$
$$\therefore Pressure = \rho g h$$

Volume $= Ah$

A

$w = mg$

h

A