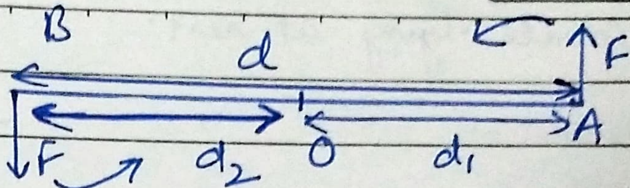
Date:- Jan 27, 2025
Subject:- PHYSICS

TENDER HEART HIGH SCHOOL; SEC-33B, CHD.
Force (Chapter-1) Continue
CLASS-IX

From the diagram,



Anticlockwise moment of force F at the end A, = $F \times OA = F \times d_1$
Anticlockwise moment of force F at the end B, = $F \times OB = F \times d_2$
Total moment of couple = $Fd_1 + Fd_2$
" " = $F(d_1 + d_2)$
" " = $F \times d$

Examples of Couple in everyday life:→
(a) Opening or Closing a water tap.
(b) Turning a screw driver.
(c) Turning the key in a lock.
(d) Turning a steering wheel.
(e) Loosening the cap of an ink bottle.

⇒ Equilibrium :→ A body is said to be in equilibrium if there is no change in its state of rest or motion.

* The motion of a body, in its simplest form, can be either translational or rotational. The conditions for equilibrium of a body, having these two types of motions, are somewhat different.

Translation Equilibrium
⇓
When a body is either at rest or moving with a constant velocity

Rotational Equilibrium
⇓
When a body does not rotate at all or keeps on rotating with constant angular speed.

Page No.
Date: / /20

Principle of Moments :→ According to the principle of moments, in equilibrium;

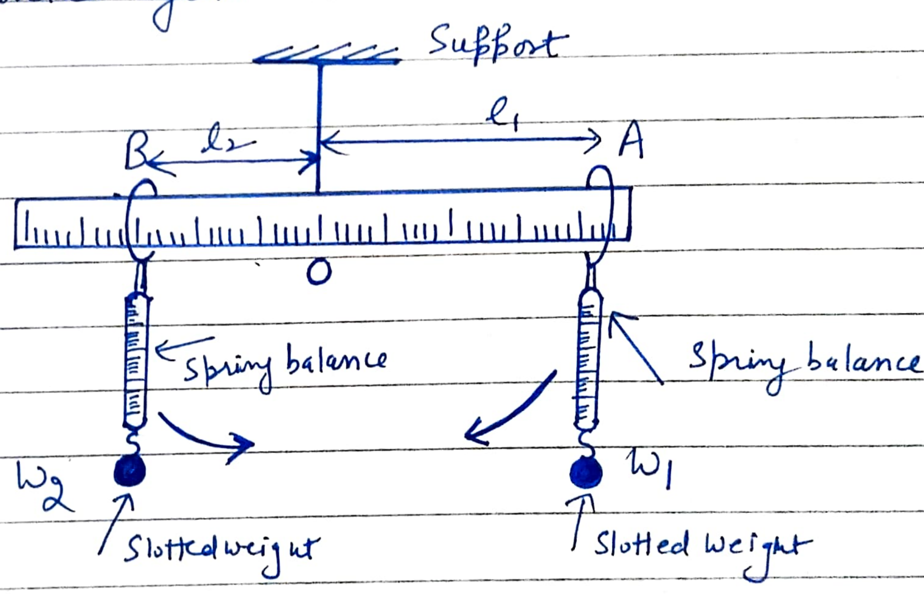
Sum of the anticlockwise moment = Sum of the clockwise moments.

⇒ A physical balance works on the Principle of moments.

* Physical Balance is also called as a Beam Balance.

Verification of the principle of moments :→

Suspend a metre scale horizontally from a fixed support by means of a strong thread at O as shown in fig. Now suspend two spring balances A and B on the metre rule on either side of the thread from point O in such a way that the metre rule becomes horizontal again.



W_1 = weight suspended at a distance, $OA = l_1$ on the right side of the thread

W_2 = " " " " ", $OB = l_2$, on the left side of .

W_1 weight tends to turn the metre rule clockwise, while the

Teacher's Signature ....

weight W_2, tends to turn the metre rule anticlockwise.

Clockwise moment of weight W_1 about the point O = $W_1 \times l_1$

Anticlockwise " " " W_2 about the point O = $W_2 \times l_2$

In Equilibrium, when the metre rule is horizontal, it is found that $W_1 l_1 = W_2 l_2$

i.e Clockwise moment = Anticlockwise moment

* This verifies the principle of moments.

Chapter-1(b) – Centre of gravity

Centre of gravity :→ It is a point about which the algebraic sum of moments of weights of all the particles consisting the body is zero. Or it is the point at which the whole weight of the body may be supposed to be act.

* It is not essential that centre of gravity always be within the material of the body.

* The centre of gravity position depends upon the distribution of mass (of particles). It changes if the body is deformed.

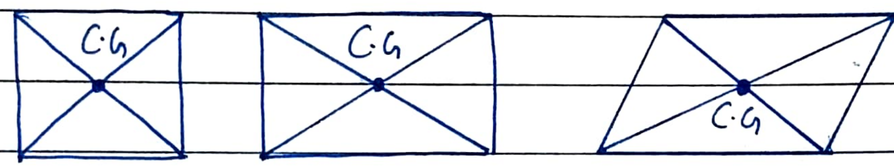
for example :→ (Question) One half of a rod is made of copper and other half of steel. Is the centre of gravity of rod at the geometrical centre of the rod? If not, where it is likely to be? Assume copper to be heavier than steel.

Solution :→ No, the C.G is not at the geometric centre as the rod is not uniform, the copper half being heavier. As the C.G of a non uniform body shifts towards the heavier part of the body. So, C.G in this case will be towards the 'copper half of the rod' which is the heavier part of the rod

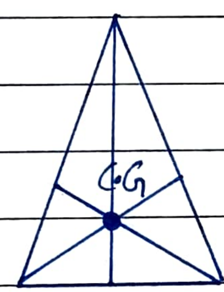
Position of Centre of gravity (C.G) of some uniform regular and Irregular bodies

* Regular body :— Which has definite geometrical shape and density is uniform.

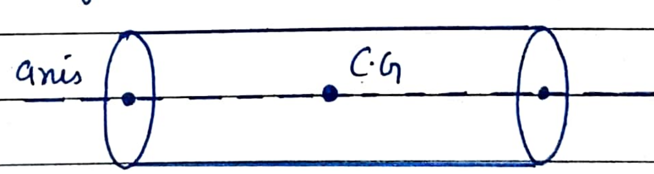
⇒ The CG of of a rectangular or a square or parallelogram lamina is a point on the intersection of its diagonals.



⇒ The C.G of a triangular lamina is the point on the intersection of the medians.



⇒ The C.G of a (solid) cylinder is a point at the centre of its axis.



⇒ The C.G of a hollow sphere or a circular lamina or a ring is at its geometrical centre / or of a solid sphere is at its geometrical centre.