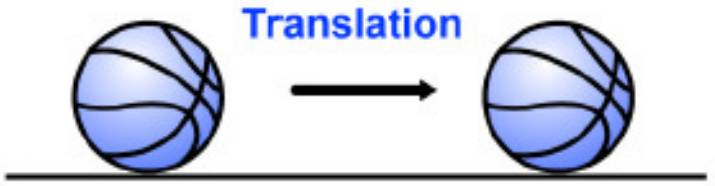
CHAPTER 1

FORCES

Std 10

TRANSLATIONAL MOTION OR LINEAR MOTION

WHEN FORCE ON ASTATIONARY OBJECT WHICH IS FREE TO MOVE, THE BODY STARTS MOVING IN A STRAIGHT PATH IN THE DIRECTION OF FORCE. Example : On pushing a ball lying on the floor and it begins to move on application of force.



ROTATIONAL MOTION

If a body is pivoted and the force is applied on the body at a suitable point, it rotates the body at a suitable point, it rotates the body about the axis passing Through the pivoted point. This is the turning effect of the force and the motion of the body is called the rotational motion. Example – If a wheel is pivoted at its centre and force is applied tangentially on its rim, the wheel rotates about its centre.

Some important definitions :-

1. Rigid body

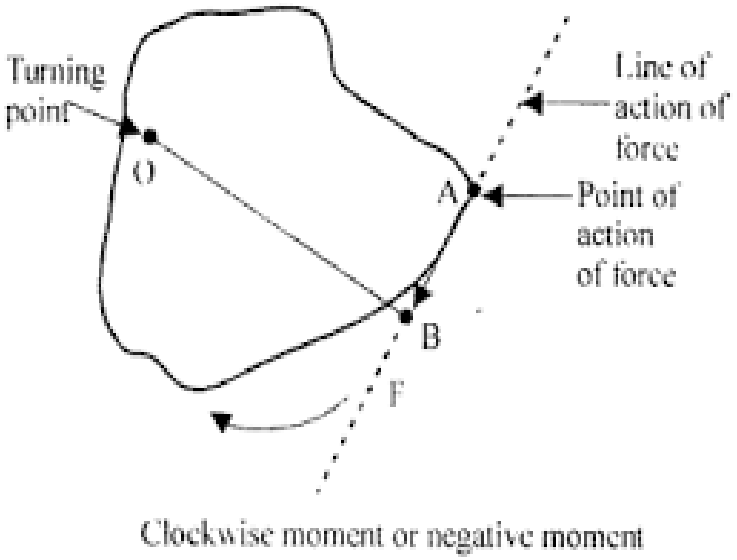
A body which does not get deformed under the action of a force or a number of forces is called a rigid body.

2. Point of action of force

The point on a rigid body where a force acts is called point of action of force

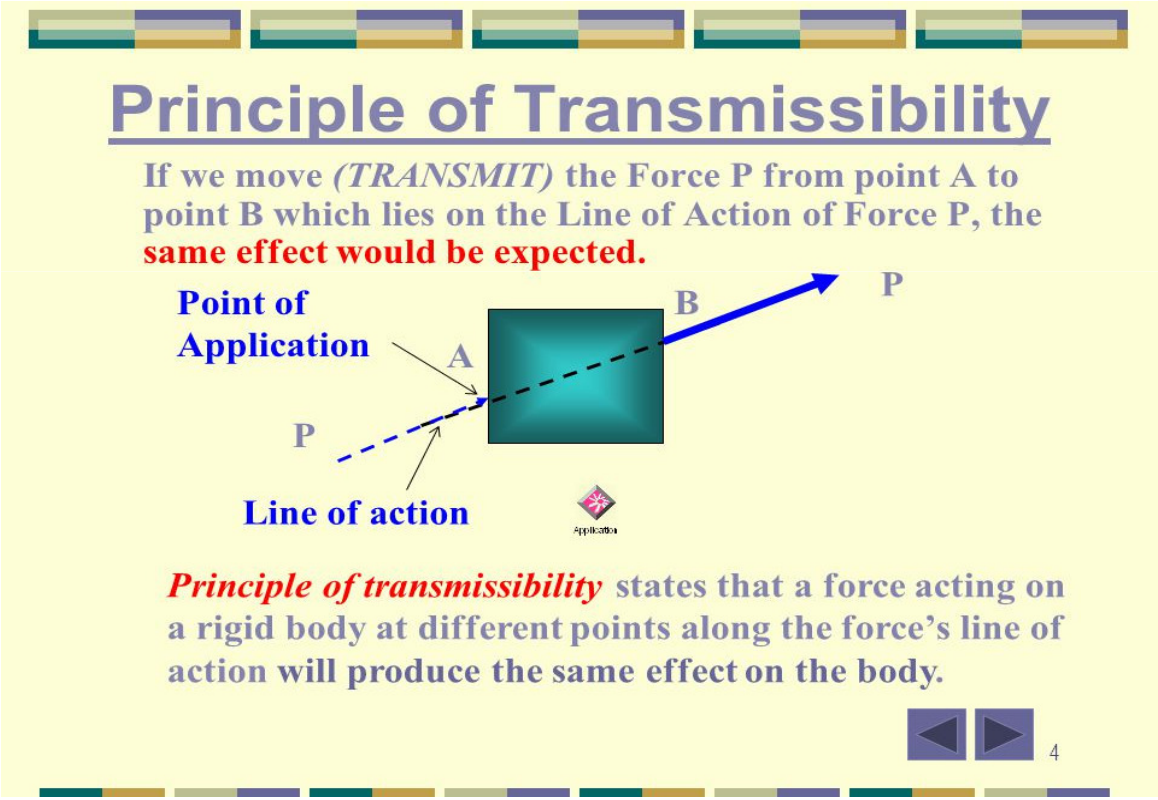
3. Line of action of force

An imaginary line passing through the point of action of force and drawn in the same Direction in which the force acts is called line of action of fo



PRINCIPLE OF TRAMISSIBILTY OF FORCE

It states that the point of action of force can be transmitted anywhere along the line of action of force without causing any material difference in the movement of the body.



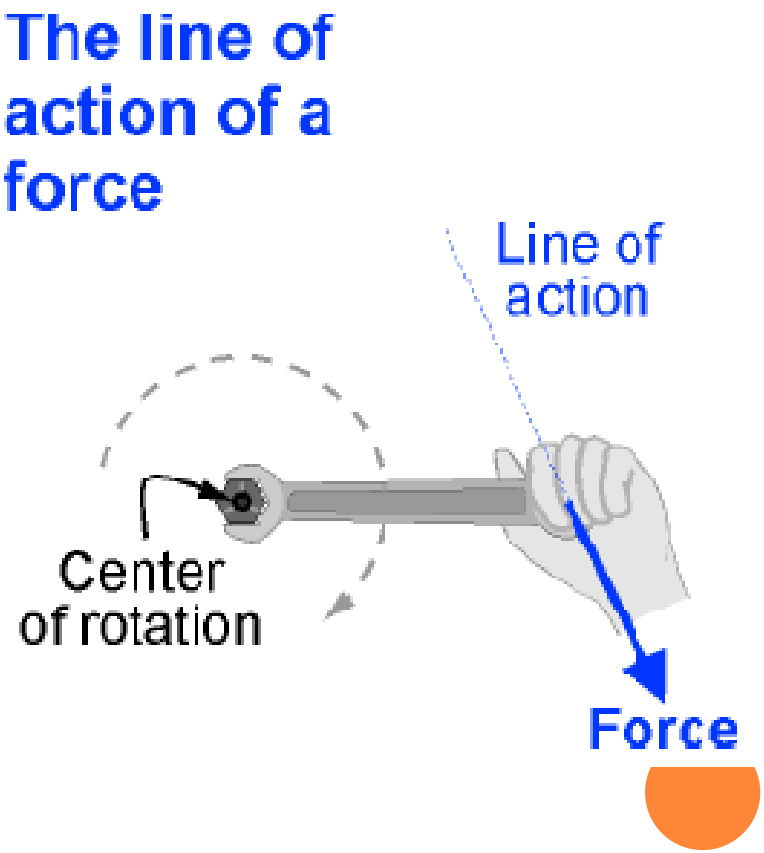
Think of these!

- Why is it easier to open the tight lid of a can of paint using a long screw driver than a 5-peso coin?
- Why are door knobs placed at the other end of the door opposite the hinges and not at the middle?
- Why is it easier to maneuver a bicycle with handle bar than one without?

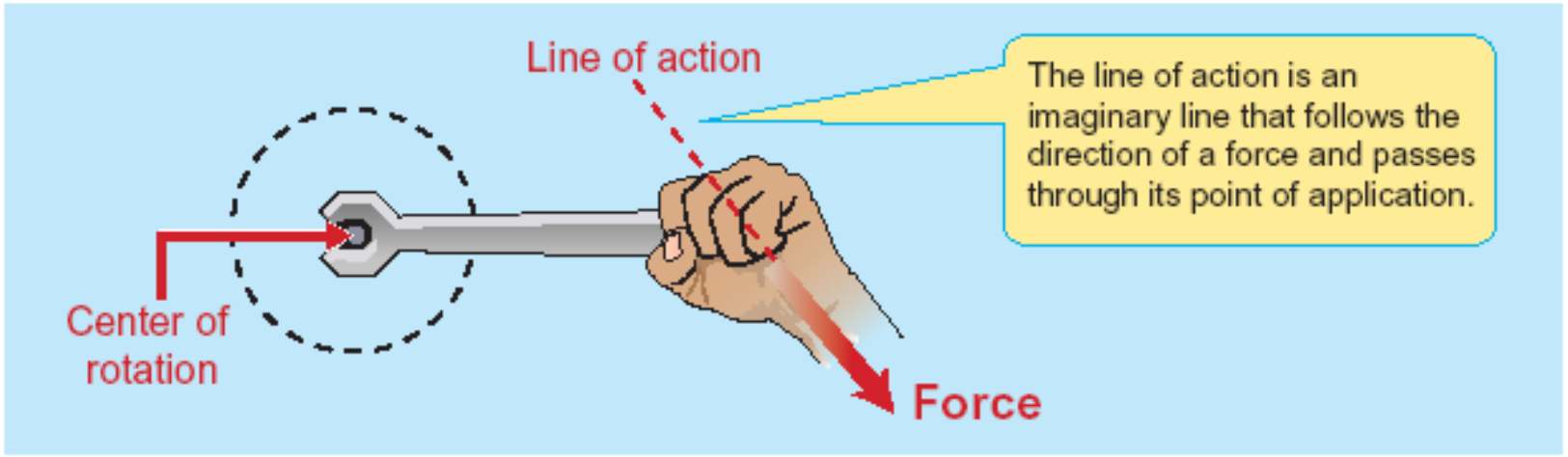
The answer to all these is TORQUE!

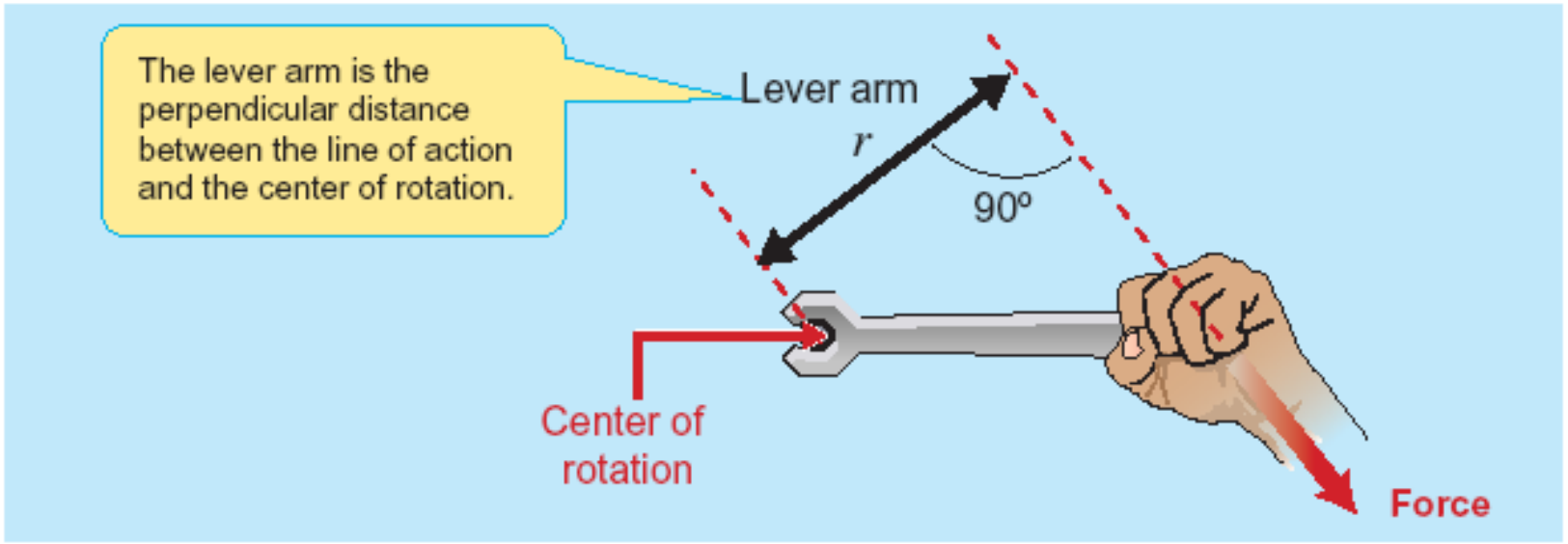
TORQUE

- Torque is created when the line of action of a force does not pass through the center of rotation.
- The line of action is an imaginary line that follows the direction of a force and passes though its point of application.



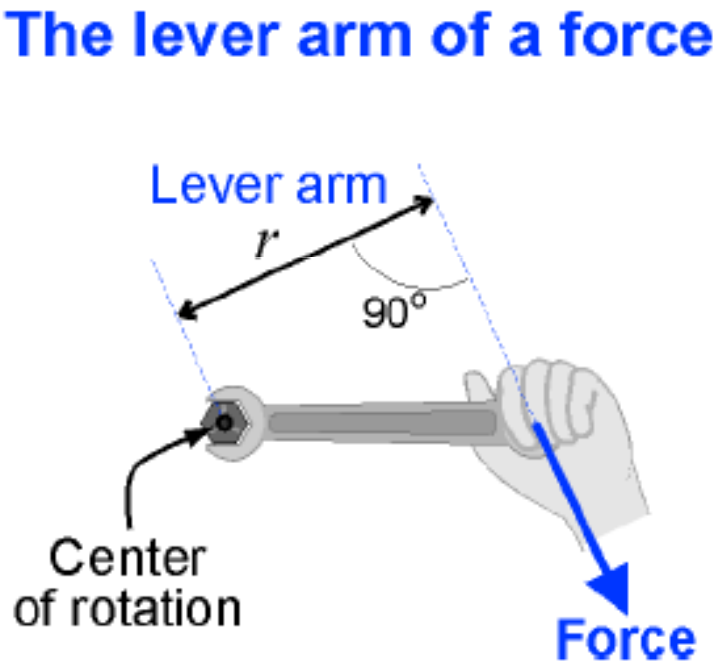
Torque Created by Force





Torque

- To get the maximum torque, the force should be applied in a direction that creates the greatest lever arm.
- The lever arm is the perpendicular distance between the line of action of the force and the center of rotation



Moment of Force or Torque

The turning effect of force is called Torque.

The turning effect on the body about an axis is due to the moment of force (or torque) applied on the body.

Torque acting on a body can be measured by the following :

Mathematically,

Moment of force = Force X perpendicular distance

* Units of Moment of Force

S. I unit of Moment of Force is N.m

C.G.S unit is dyne.cm

1 Nm= 10^5 dyne x 100 cm

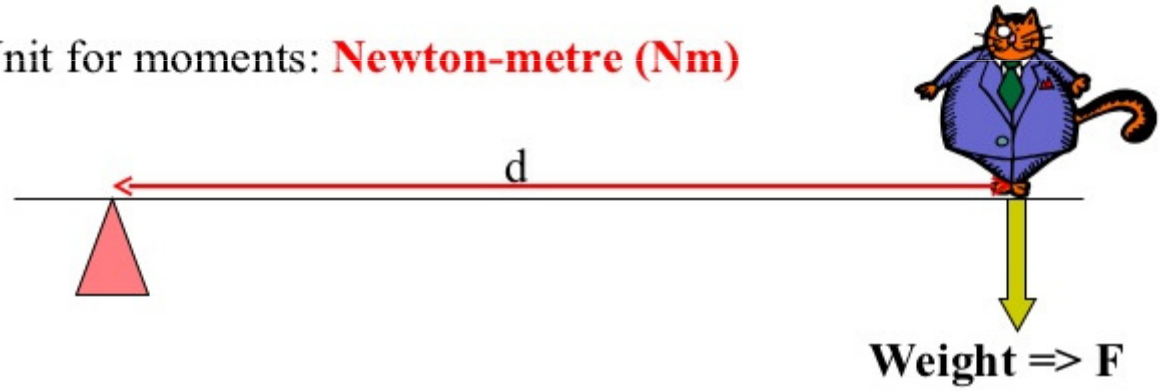
= 10^7 dyne.cm

CALCULATING MOMENTS

Moment = force × perpendicular distance between force and pivot

In symbols: **Moments = F × d**

Unit for moments: **Newton-metre (Nm)**

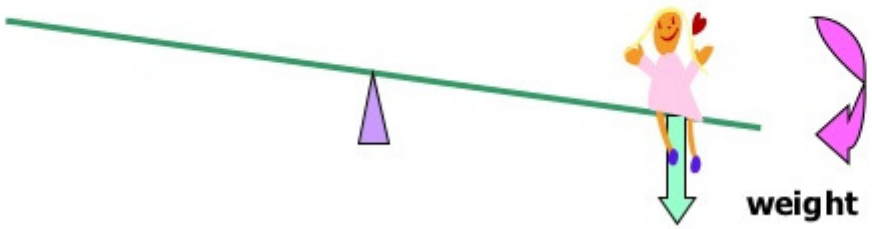


Clockwise Moment

When a force causes an object to turn in a clockwise direction, it is called a **CLOCKWISE MOMENT**.

To determine if the force causes a clockwise or anticlockwise moment, we have to ignore all other forces acting on the object.

When the girl sits on the see-saw, her weight is the force exerted on the see-saw.



ANTI-Clockwise Moment

When a force causes an object to turn in an anti-clockwise direction, it is called a **ANTI-CLOCKWISE MOMENT**.

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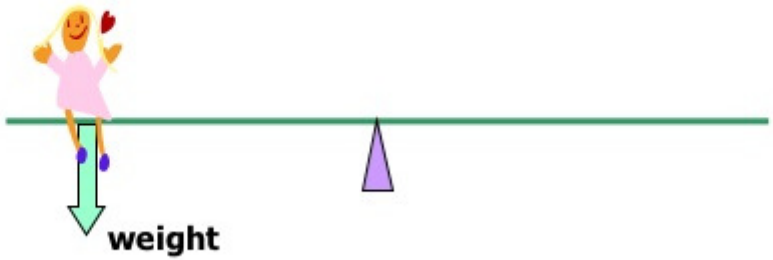

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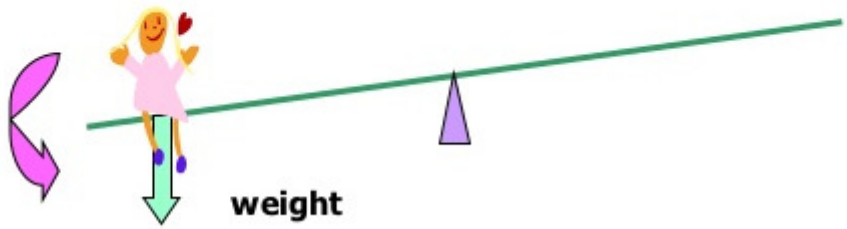


Torque or Moment of Force

Torque (N·m)

Lever arm length (m)

$$t = r \times F$$

Force (N)

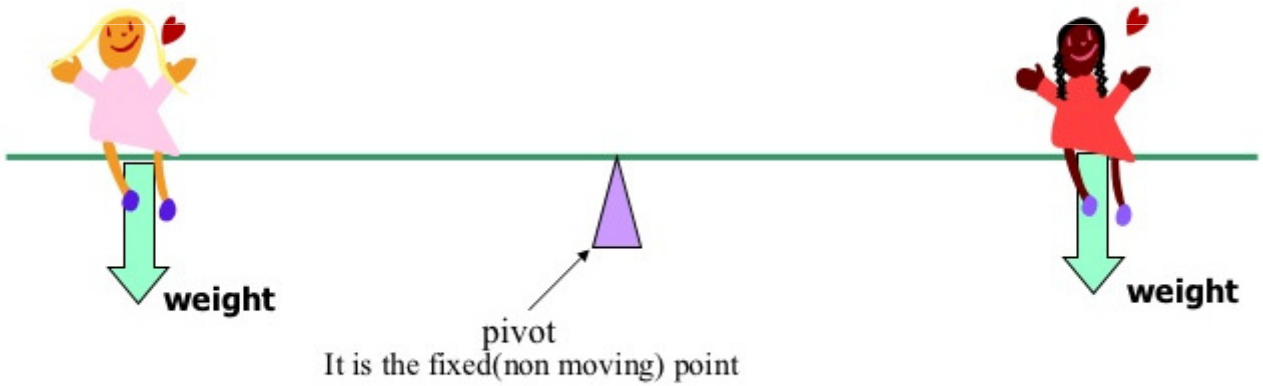
Clockwise rotation is a negative torque.

Anti clockwise rotation is a positive torque

Showing torque in diagrams

Principle of Moments

For an object to be in equilibrium(stable/not moving), the total clockwise moment must be equal to the anticlockwise moment about the same pivot point.



Points to note:

1. **The unit for force must be in Newtons, the unit for distance must be in metres.**

2. **The distance must measured from the force to the pivot.**

Example 1:

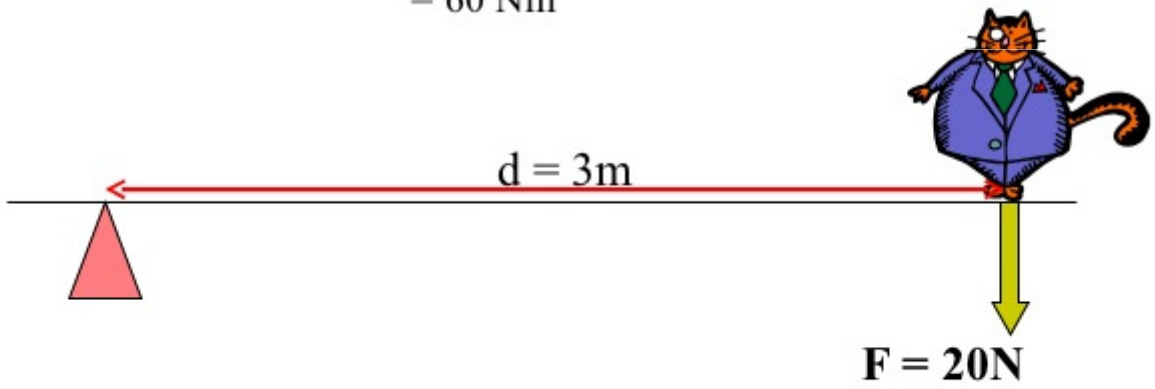
A cat of weight 20N stands on one end of a see-saw and the distance between the cat and the pivot is 3m, find the moment.

Solution: In this case the cat is causing a clockwise moment.

Clockwise moment = F x d

= 20 x 3

= 60 Nm



Instructions for the students:

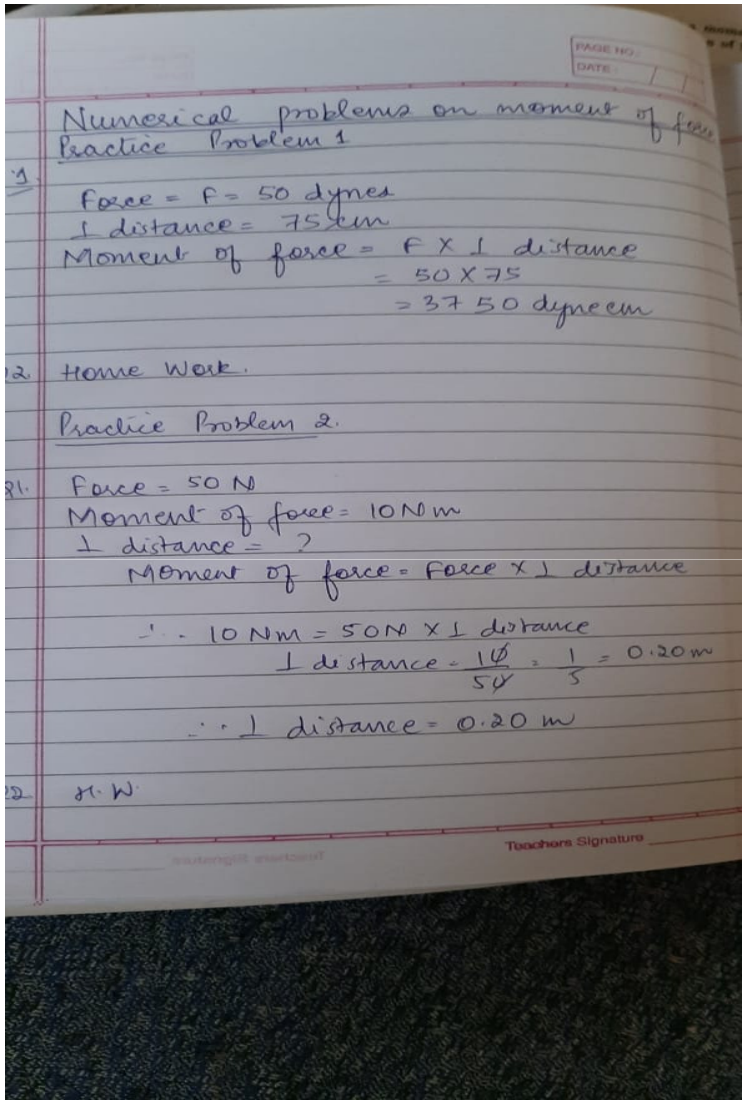
Refer to pages 1 to 4(before the topic couple) for better understanding of the topic.

You can also follow the YouTube link ,
https://m.youtube.com/watch?v=22VGQM1jCn8

Practice problem 1 and 2, to be done in the notebook. (Page No. 12) (Q1(i) and Q2 (i) is solved for you all. Please see the next slide for the solution . Q1 (ii) and Q2. (ii) is home work)

Exercise -1 ,Questions1 and 2 (Page No. 10), to be done in the notebook. (All the answers can be found in the first 4 pages of the chapter).

Numericals



Numerical problems on moment of force

Practice Problem 1

Force = F = 50 dynes

⊥ distance = 75 cm

Moment of force = F × ⊥ distance

= 50 × 75

= 3750 dyne cm

Home Work.

Practice Problem 2.

Force = 50 N

Moment of force = 10 N m

⊥ distance = ?

Moment of force = Force × ⊥ distance

∴ 10 N m = 50 N × ⊥ distance

⊥ distance = $\frac{10}{50} = \frac{1}{5} = 0.20$ m

∴ ⊥ distance = 0.20 m

H. W.

Teachers Signature

Thank You!!