COUPLE

"Two equal opposite and parallel forces, whose line of action are different, form a couple"

ARM, Moment and DIRECTION of A COUPLE :-

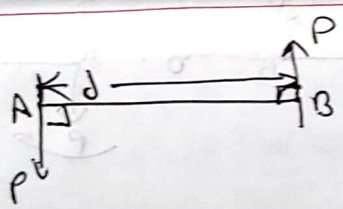
(i) Arm of a couple :-

The ⊥ distance (d) between the line of actions of the two equal, opposite and parallel forces, is known as "Arm of a couple"

(ii) Moment of a couple :-

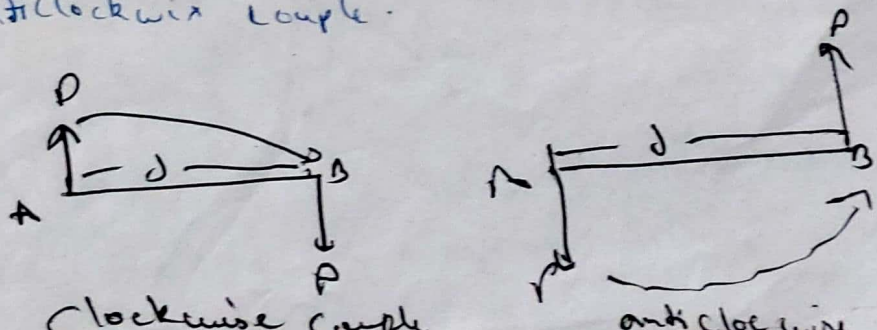
The moment of a couple is the product of the forces and the arm of the couple.

Moment of a couple $M = P \times d = P \times AB$



(iii) Direction of a couple :-

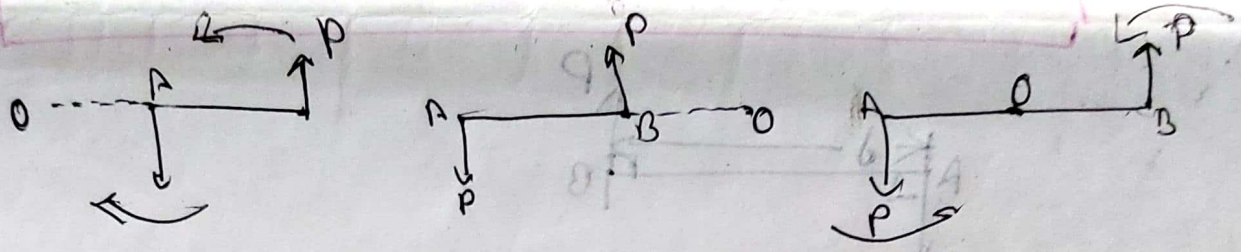
A couple, having the tendency to rotate the body in the direction of hands of clock is clockwise couple and a couple having the tendency to rotate the body in the direction, opposite to the hands of clock is called anticlockwise couple.



Theorems of Couple:-

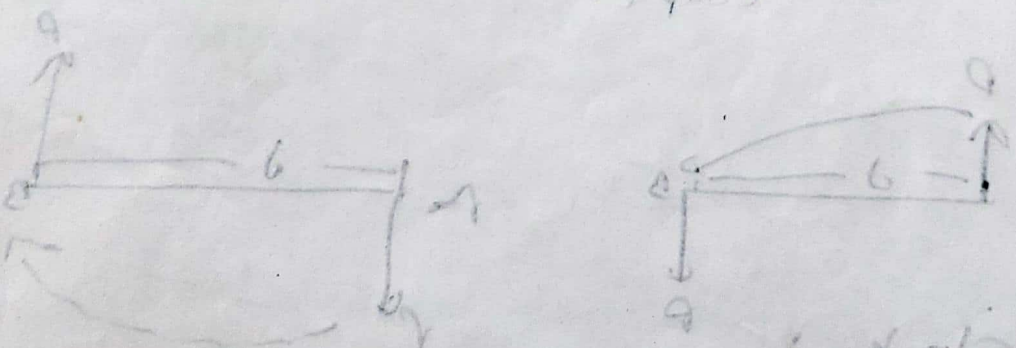
Theorem 1:-

The algebraic sum of the moment of the forces, constituting a couple about any pt. in a plane will remain same and equal to the moment of couple itself.



$P \times OB - P \times OA = P \times AB$ $\quad -P \times OB + P \times OA = P \times AB$ $\quad P \times OA + P \times OB = P \times AB$

Theorem 2 ⇒ Resultant of many couples acting in the same plane will also equal to a couple, whose moment equal to algebraic sum of moments of all the couples.



Theorem 3:- Two equal and opposite couples acting on parallel planes, balance each other.

Theorem 4:- If the three forces acting on a rigid body be represented in magnitude as well as in direction, by the three sides of a triangle taken in order, then the forces are equivalent to a couple whose moment is equal to twice the area of the triangle.

Silent Aspects of a Couple: (Properties of a couple)

(i) A couple cannot be balance by a single force. It can be balanced only by a couple of opposite sence.

(ii) The algebraic sum of the vertical and horizontal components of the forces forming a couple is zero.

(iii) A couple consists a pair of equal and opposite forces seprated by a definite distance.

Ans. Any number of coplanar couples can be reduced to a single couple of moment equal to the algebraic sum of moments of all the couples.