Short Questions & Answers.

Q.1. **Define Force & Write its Units.**

Ans. *Force is defined as an external agent which changes either the state of rest or state of motion of a body.*

It is denoted by F :

Mathematically, $\boxed{F = M.a}$ *Where M = Mass of a body, a = acceleration due to gravity.*

Units : In S.I .. M.K.S $\Rightarrow$ Kg × m/sec^2 = Newton (N)

In C.G.S $\Rightarrow$ gm × Cm/sec^2 = Dyne
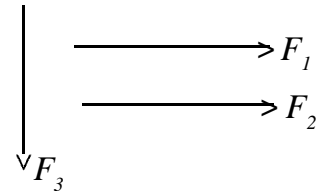
$\boxed{IN = 10^5 \ dyne}$

Q.2. **Define co-planar forces and concurrent forces.**

Ans. **Co-planer forces :**

It is defined as lines of action of forces lie on the same plane, known as co-planer force.

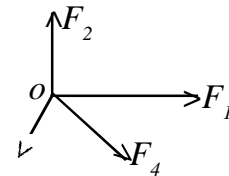*e.g : The lines of action of forces F$_1$, F$_2$ and F$_3$ lie on the same plane.*

*Hence these forces are called co-planar forces.*

Concurrent forces :

It is defined as lines of action of forces pass through the common point, known as concurrent forces.

e.g. : The lines of action of forces F$_1$, F$_2$, F$_3$, F$_4$ pass through the common point 'o'. Hence they are called con-current forces.

**Q.3.** **State Principle of Trensmissibility of a force ?**

Ans. *The principle states that "The condition of equilibrium or motion of a regid body will not be charged if a force acting on a body at a certain point is re-placed by a force of same magnitide and same direction but applied at a different point provided the two forces act along the same straight line".*

$\boxed{P = P_1 = P_2}$

40
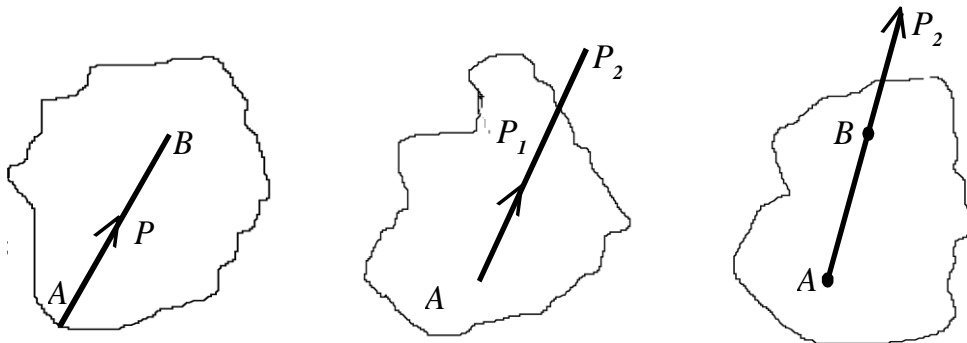
Q.4.   What do you mean by free body diagram ?

Ans.   Free Body Diagram may be drawn for the single body or for a sub system or for whose structure irrespective of whether the system is in equilibrium or not. All the internal as well as external forces must be taken into consideration.
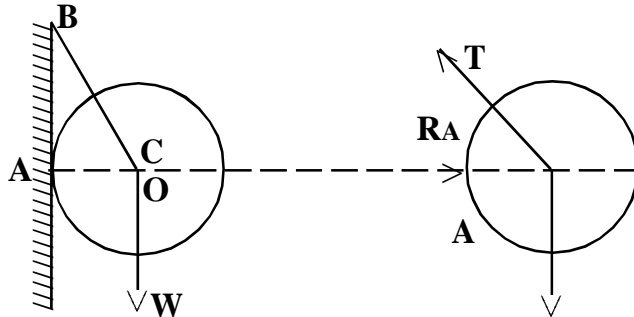
Q.5.   What do you m   n by Resolution of a Force

Ans.   The process of finding the components of a given force in two given directions is called resolution.
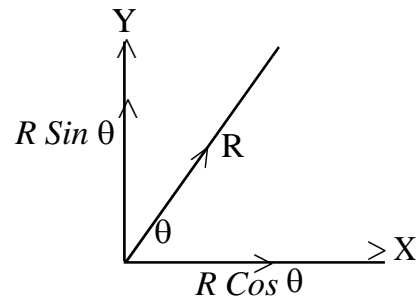
A force is generally resolved along two mutually perpenticular direction.

Harizental Component = R Cos θ

Vertical Cmponent = R Sin F

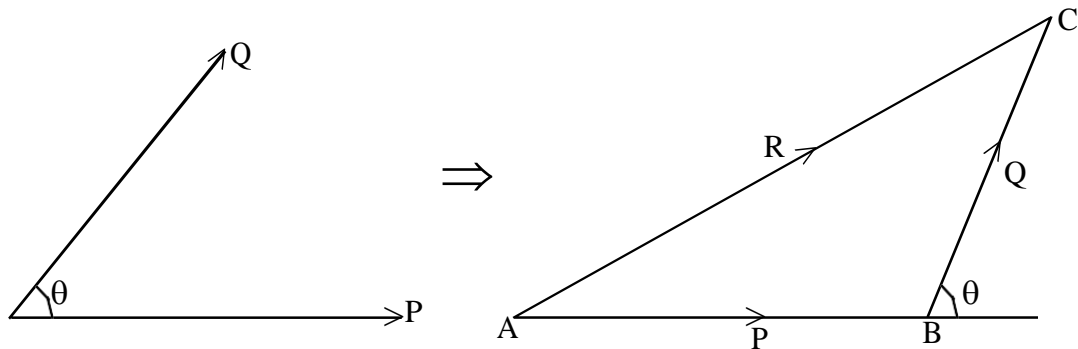Resultant, R = $\sqrt{(R \, Cos \, θ)^2 + (R \, Sin \, θ)^2}$

Direction, tan θ = $\dfrac{R \, Sin \, θ}{R \, Cos \, θ}$

Q.6.   State Triangle Law of Forces.

Ans.   <u>Statement</u> : "If two forces acting simultaneously on a body, be represented in magnitude and direction by two sides of a triangle take in order their resultant may be represented in magnitude and directin by the third of side of the tringle taken in opposite order."

$$\overrightarrow{R} = \overrightarrow{P} + \overrightarrow{Q}$$

Q.10. Two forces are acting at an angle of 120^0. The greater force is 40N and the resultant is acting at 90^0 to the smaller force. Find the magnitude of the smaller force ?
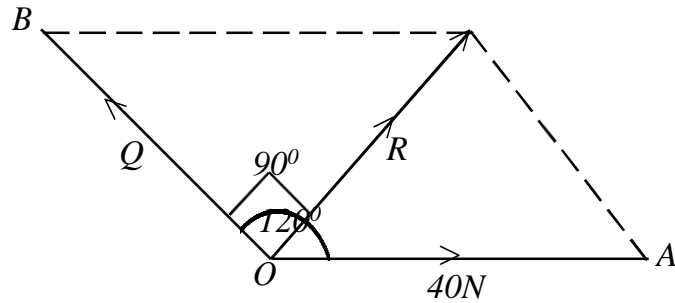
Ans. Here, $\theta = 120^0$

$\alpha = 90^0$

$\alpha = 120^0 - 90^0 = 30^0$

$P = 40N$

$Q = ?$

$\therefore \tan \alpha = \dfrac{Q.\sin \theta}{P+Q.\cos \theta}$

$\Rightarrow \tan 30^0 = \dfrac{Q.\sin 120^0}{40+Q.\cos 120^0} \quad \Rightarrow \boxed{Q = 20N}$

Q.11. The resultant of two eual forces acting at a point also equal to 'P'. Determine the angle between the two forces.

Ans. When the two forces ar equal and θ is the angle between them.

We know, $R = \sqrt{P^2+Q^2 + 2\,P.Q \cos \theta}$ ($\because R=P=Q$)

$\Rightarrow P = 2P.\cos \dfrac{\theta}{2} \quad \Rightarrow \boxed{Q = 120^0}$

Q.12. Define moment of a force and write its units.

Ans. Moment of a force about a point may be defined as the turning effect of the force about that point.

Moment of the force is expressed as the product of the force and the perpendiculr distance of the point, about which the moment is to be found.

Mathemeticall, $\boxed{M = F \times L}$

Where, $F = $ Force acting on the body

$L = $ Perpendicular distance between the point, about which the moment is   to be found out.

Units : In SI $\Rightarrow N$ - m or N - mm

In C.G.S $\Rightarrow dyne$ - Cm

Q.13. State Varigon's Theorem.

Ans. _Statement_ : "The algebraic sum of moments of a number of co-planar forces about any point in their plane is equal to the moment of their resultant about the same point."

✦ When all the forces are concurrent.

✦ When all the forces are parallel.

Q.14. *Define Couple and Arm of Couple.*

Ans. **Couple :** *A couple is defined as a pair of two equal and unlike parallel forces, separated by a finite distance.*
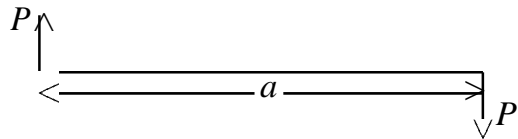
Arm couple : *The perpendicular distance between the lines of action of the couple, is called Arm of Couple.*

The product of either force of the couple with the arms of the couple is called **Moment of Couple.**

$$M = P \times a$$

Where, P = magnitude of the force.

a = Arm of Couple.

Q.15. *A rectangular PQRS has sides PQ = RS = 100mm and QR = 5P = 80mm. Forces of 200N each act along PQ and RS and forces 150N each act along QR and SP. Find out the resultant moment of the system of forces.*
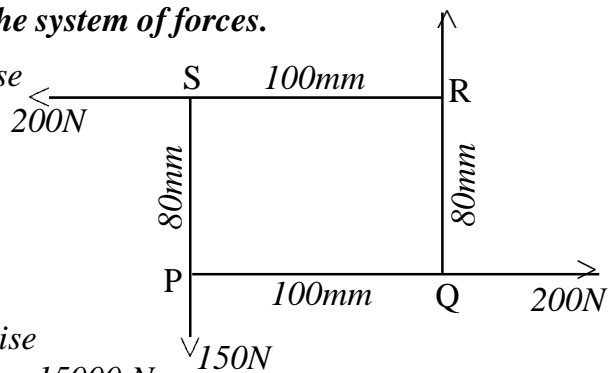
Ans. *The force of 200N each will give rise to a couple of moment.*

= 200 x 80

= 16000 N-mm

= 16 N - m.

The forces of 150N each will give rise to a couple of moment = 150 x 100 = 15000 N-.

= 15 N-m

Resultant moment of the system = 16 + 15 = 31 N-m
This will be an anti-clock wise moment.

LONG QUESTIONS :

Q.1. *State and proves parallelogram law of force.*

Q.2. *State and proves Varigon's Theorem.*

Q.3. *Three forces of 4P, 5P and 6P are acting along three edges of an equilateral triangle of 100mm side taken in order.*
Determine the magnitude and position of the resultant force. Ans:3.6P & 433.012mm.