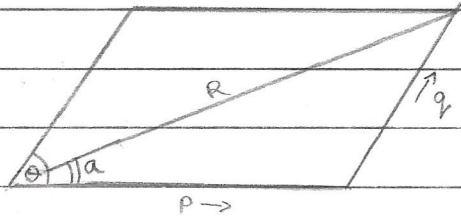


Forces Vectors and Moments

Q-1) Finding the resultant force



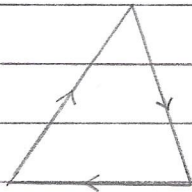
$$R = \sqrt{p^2 + q^2 + 2pq \cos \alpha}$$

$$\tan a = \frac{q \sin \alpha}{p + q \cos \alpha}$$

Direction (angle) \vec{R} makes with \vec{p} .

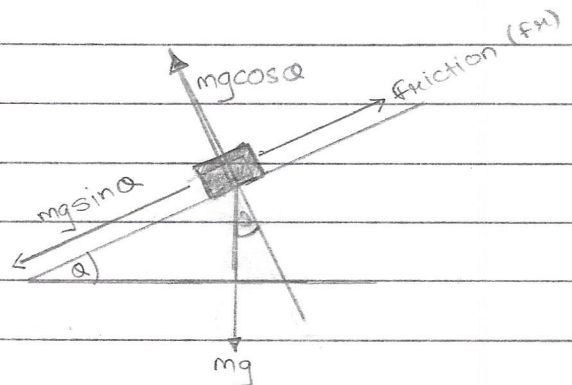
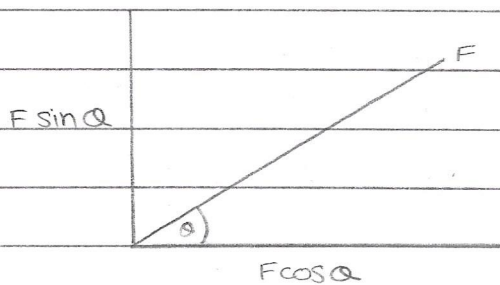
Q-2) Equilibrium.

- ① Net force on body = 0
- ② Sum of clockwise moments = sum of anti-clockwise moments.



Forces acting on an body same direction = equilibrium.

Q-3) Components of vectors



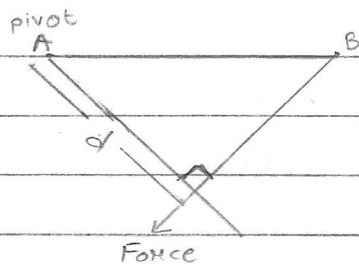
$$a = \frac{\text{force}}{\text{mass}} \quad a = \frac{mg \sin \alpha - F_f}{m}$$

$a = g \sin \alpha$ - without friction.

Q-4) What is moment of a force?

>

Moment = force \times distance of pivot from line of action of force.

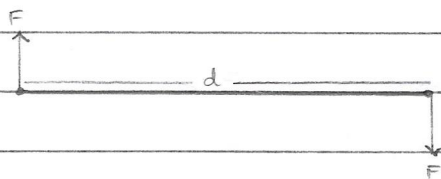


$$\text{moment} = F \times d$$

$$\text{unit} = \text{Nm}$$

Q-5) What is a couple?

> Two equal and opposite forces acting on a body at different points in parallel direction is called a couple.



Q-6) What is torque?

> Torque is the rotational effect produced by a couple.

$T = \text{one force} \times \text{perpendicular distance between the 2 forces}$

$$T = F \times d \quad (\text{for above diagram - Q-5})$$

Q-7) What is the centre of gravity?

> The point at which the whole weight of a body acts is called the centre of gravity.

Q-8) Distinguish between moment and torque.

| Moment of a force | Torque of a couple |
|--|--|
| * Distance of pivot from line of action of force is important. Position of pivot important. | Only distance between 2 forces is taken. Position of pivot not needed |
| * The force can produce acceleration (linear motion) | It produces rotational motion only. |

→ If resultant force/moment on a body = 0

- ① body moves with a constant speed
- ② body is at rest.

→ Resultant torque = 0

clockwise + anticlockwise = 0

↳ constant speed / rest

↳ body rotates with constant angular velocity.