

1. Forces:

A. Gravitational force and mass

1. Units of the mass and force of gravity.
2. Acceleration of gravity **g**. (unity, number, **direction**)

B. Normal force and friction.

1. Directions of the normal forces and frictions.
2. Static friction and kinetic friction.
3. What is the relation between friction and the normal force?

c. Equilibrium state of multiple forces.

1. If there are multiple forces exerting on an object and the object is in rest or moving at constant velocity, **the total force is zero**. $\sum \vec{F} = 0$ which means

$$\sum F_x = 0 \text{ and } \sum F_y = 0$$

2. Newton's Laws and dynamics:

A. Newton's 1st Law:

A body at rest will remain at rest, and a body in motion will remain in motion, unless it is compelled to change its state by forces acting on it.

B. Newton's 2nd Law:

The sum of forces acting on a body is equal to its mass times its acceleration. $\vec{F} = m\vec{a}$, which means $\sum F_x = ma_x$ **AND** $\sum F_y = ma_y$

D. Application of Newton's Laws:

1. System in rest (equilibrium require the total force is zero)
2. System in motion with acceleration needs to apply the Newton's second Law.
4. Examples: tilted surfaces, projectile objects, object balanced with multiple forces.

3. Circular motion, especially uniform circular motion.

Centripetal acceleration, centripetal force.
Understand the concept and the calculation.