## Physics - Kinematics

## Topics: Computer engineering

Written on March 18, 2024

Kinematics is the branch of classical mechanics that deals with the motion of objects without considering the forces causing the motion.

## 1. Basic Concepts:

- Position: The location of an object relative to a reference point. It is typically described using coordinates in a coordinate system.
Displacement: The change in position of an object. It is a vector quantity and has both magnitude and direction.
Velocity: The rate of change of displacement with respect to time. It is also a vector quantity.
- Speed: The magnitude of velocity without regard to direction. It is a scalar quantity.
- Acceleration: The rate of change of velocity with respect to time. Like velocity, it is also a vector quantity.
- Scalar vs. Vector Quantities: Scalar quantities have only magnitude (e.g., speed), whereas vector quantities have both magnitude and direction (e.g., velocity, displacement).


## 2. Equations of Motion:

- Constant Velocity (Uniform Motion): If an object moves with a constant velocity, its displacement can be calculated using the equation $\Delta \mathrm{x}=\mathrm{v} \cdot \mathrm{t}$, where v is the velocity and t is the time.
Constant Acceleration (Uniformly Accelerated Motion): If an object accelerates with a constant acceleration a, its displacement can be calculated using the equation $\Delta \mathrm{x}$ $=\mathrm{v}_{0} \cdot \mathrm{t}+1 / 2 \cdot \mathrm{a} \cdot \mathrm{t}^{2}$, where $\mathrm{v}_{0}$ is the initial velocity.
- Equations of Motion with Uniformly Accelerated Motion: The following equations describe the relationships between displacement ( $\Delta \mathrm{x}$ ), initial velocity ( $\mathrm{v}_{0}$ ), final velocity (v), acceleration (a), and time ( t ):
- $\mathrm{v}=\mathrm{vo}+\mathrm{at}$ (Velocity-Time equation)
- $\mathrm{v}^{2}=\mathrm{vo}^{2}+2 \mathrm{a} \Delta \mathrm{x}$ (Velocity-Displacement equation)


## 3. Graphical Representation:

- Kinematic quantities can be represented graphically, where displacement, velocity, and acceleration are plotted against time.
- The slope of the displacement-time graph represents velocity, while the slope of the velocity-time graph represents acceleration.


## 4. Projectile Motion:

- Projectile motion refers to the motion of an object projected into the air and subject to the force of gravity.
- It consists of both horizontal and vertical motion components.
- The horizontal motion is uniform, while the vertical motion is uniformly accelerated due to gravity.


## 5. Relative Motion:

- Relative motion describes the motion of one object with respect to another object.
- It involves considering the motion of one object as observed from the frame of reference of another object.
© Copyright Aryatechno. All Rights Reserved. Written tutorials and materials by Aryatechno

