

Motion in One Dimension Summary Note

Learning Objectives

- Understand the difference between vector and scalar
 - displacement VS distance
 - velocity VS speed
- Know how to calculate displacement by using Pythagorean theorem
- Know motions diagram, and know how to extract information from different diagrams
 - Velocity VS Time
 - Acceleration VS time
- Understand kinematics equation and be able to solve problems
- Understand freefall motion
 - Motion diagram: Acceleration VS Time, Velocity VS Time

Vector and Scalar

Vector

- Contains both magnitude/size and direction
- Direction is expressed by a negative sign “-” or a positive sign “+”.
- Usually, right/east/north/upward are expressed with a positive sign, and left/west/downward/south are expressed with a negative sign

Scalar

- Has not direction
- The value is always greater or equal to zero

Example

- A person is running at 1.5 meter per second to the left
- 1.5 meter per second is the magnitude
- To the left is the direction
- Expressed in mathematical way: -1.5m/s

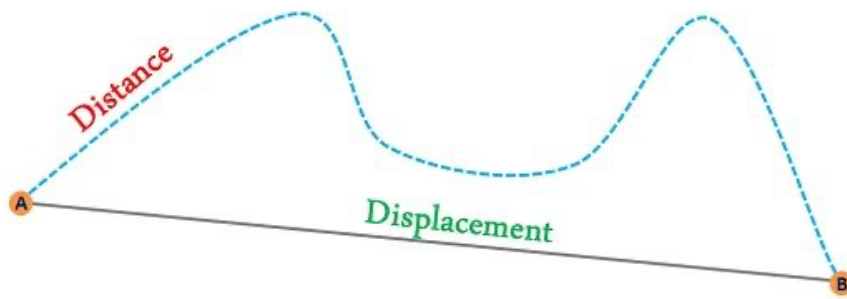
Displacement and Distance

Displacement

- A vector quantity
- Final position subtracted by initial position

Distance

- A scalar quantity



Kinematics Formula

- $a = \frac{\Delta v}{\Delta t} = \frac{(v_f - v_i)}{\Delta t}$
- $v_f = v_i + at$
- $X_f = X_i + \frac{(v_f + v_i)}{2} t$
- $X_f = X_i + v_i t + \frac{1}{2} at^2$
- $v_f^2 = v_i^2 + 2as$

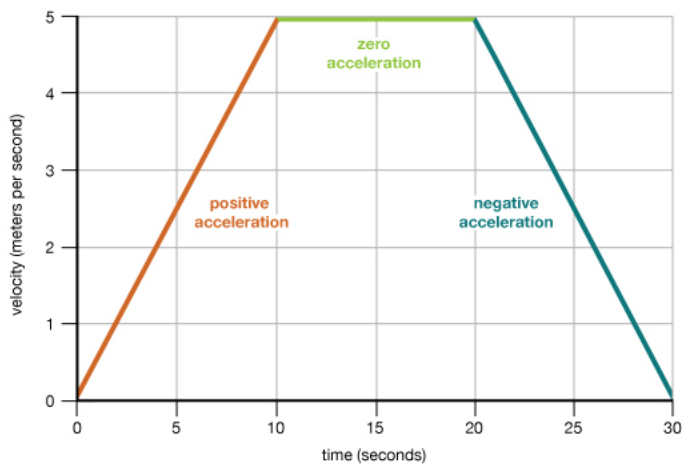
For IB Student, the symbol in the test might be different. u=initial velocity, v=final velocity, s=displacement, a=acceleration

Motion Diagram

Velocity VS Time

- Area under the curve is equal to displacement
- Slope of the graph is equal to acceleration
- Constant slope means constant acceleration
- Positive slope means the acceleration is greater than zero
- Negative slope means the acceleration is less than zero = the object is decelerating
- Slope of zero means not acceleration. The object is moving at a constant velocity

Velocity-time graph



Free-Fall Motion

- $h = \frac{1}{2}gt^2$ (gravitational acceleration $g = -9.81$)
- An object is dropped (initial velocity of zero) at height h
- Horizontal velocity of zero
- Affected by gravity only
- Gravity is equal to the object's vertical acceleration
- Acceleration VS Time graph is constant (Acceleration = -9.81 , slope is zero)
- Velocity VS time Graph has a slope of -9.81 . The graph starts at its origin

Acceleration

