NEET Physics

Short Notes

Motion in a Straight Line

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Motion in a straight line is an important topic from NEET Exam Point of view. This short notes on Motion in a straight line will help you in revising the topic before the NEET Exam.

Motion in a Straight Line

Position- Position of an object is essential to describe the motion of the object. The position of the object is the set of axes from a reference point.

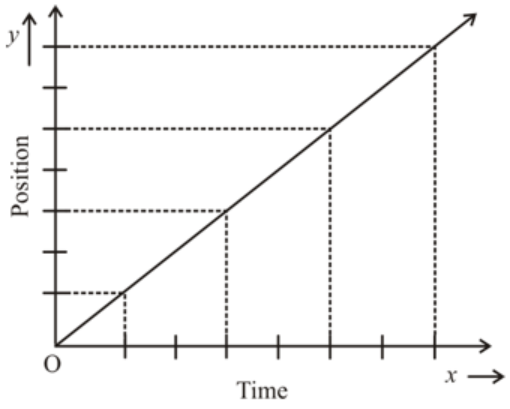
e.g. In the above image, the position of point A from the reference point is, $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

Motion- An object is said to be in motion if it changes its position with time, with respect to its surroundings.

Motion of the object can be represented by the position-time graph. The position-time graph helps to analyse the motion of an object.

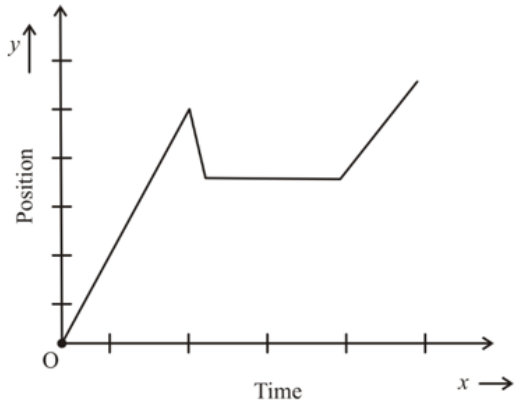
Uniform Motion

If an object is moving along the straight line covers equal distances in equal interval of time, then the motion is known as uniform motion.



Non- Uniform Motion

If an object covers unequal distances in equal interval or equal distance in unequal time interval, then it is known as non-uniform motion.



Distance- The length of the actual path between initial and terminal position of a particle in an interval of time is called distance covered by the particle. Distance is also known as the path length.

i) Distance is a scalar quantity.

ii) It never reduces with time.

iii) The distance covered by the object can't be negative.

iv) SI unit of distance is metre (m).

v) The dimension of the distance is $[M^oL^1T^o]$

Distance-time graph- The gradient of the distance-time graph represents the speed of the object.

Displacement- The difference between the final and initial position is called displacement.

i) Displacement is a vector quantity.

ii) Displacement of the object changes with time.

iii) Displacement of the object can be negative, positive or zero.

iv) SI unit of displacement is metre (m).

v) The dimension of the distance is $[M^oL^1T^o]$

Displacement-time graph- The gradient of displacement time graph represents the velocity.

Speed– Speed of an object is the ratio of distance travelled by the object to the time taken.

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

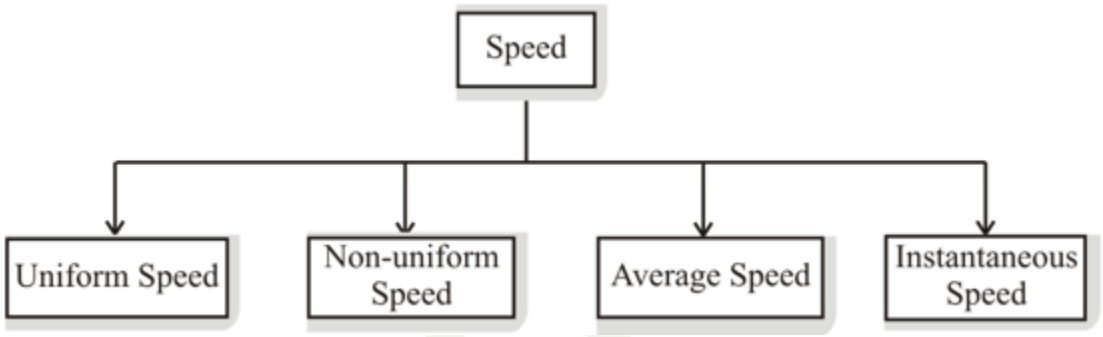
i) Speed is a scalar quantity.

ii) SI unit of speed is m/s.

iii) The dimension of the speed is $[M^oLT^{-1}]$

iv) The speed of an object can't be negative.

Types of Speed



Uniform speed- An object is said to be moving with a uniform speed if it covers the equal distance in equal intervals of time.

Non-Uniform speed- An object is said to be non-uniform speed if it covers the equal distance in the unequal time interval or unequal distance in the equal time interval.

Average speed- The ratio of total path length travelled divided by the total time interval during the motion is known as the average speed of the object.

$$\frac{x_1 + x_2 + x_3 + \ldots}{t_1 + t_2 + t_3 + \ldots} = \frac{\sum_{i=1}^{n} x_i}{\sum_{i=1}^{n} t_i}$$

Average speed =

Instantaneous speed- The speed of the body at any instant of time or at a position is called instantaneous speed.

$$\lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$$

Instantaneous speed =

Velocity- Velocity of an object is the ratio of displacement to the total time taken by the object.

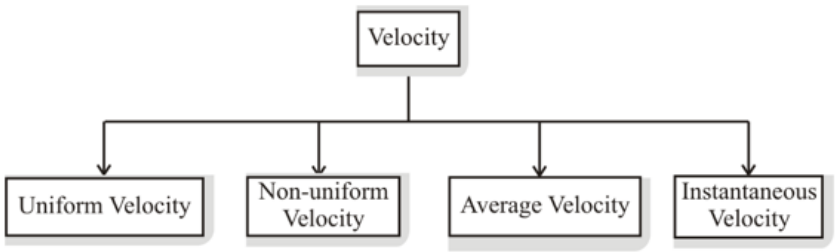
i) Velocity is a vector quantity.

ii) SI unit of velocity is m/s.

iii) Dimension of the velocity is $[M^oLT^{-1}]$

iv) Velocity of an object can be zero, negative, or positive.

Types of Velocity



Uniform velocity- An object is said to be moving with a uniform velocity if it covers the equal distance in equal intervals of time.

Non-Uniform velocity- An object is said to be non-uniform velocity if it covers equal distance in unequal time interval or unequal distance in an equal time interval.

Average velocity- The ratio of total path length travelled divided by the total time interval during the motion is known as the average velocity of the object.

$$\frac{x_1 + x_2 + x_3 + \ldots}{t_1 + t_2 + t_3 + \ldots} = \frac{\sum_{i=1}^{n} x_i}{\sum_{i=1}^{n} t_i}$$

Average velocity =

Instantaneous velocity- The velocity of the body at any instant of time or at a position is called instantaneous velocity.

Instantaneous velocity = $\lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t} = \frac{dx}{dt}$

Acceleration- The rate of change in velocity of an object is known as the acceleration of the object.

Acceleration $a = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t}$

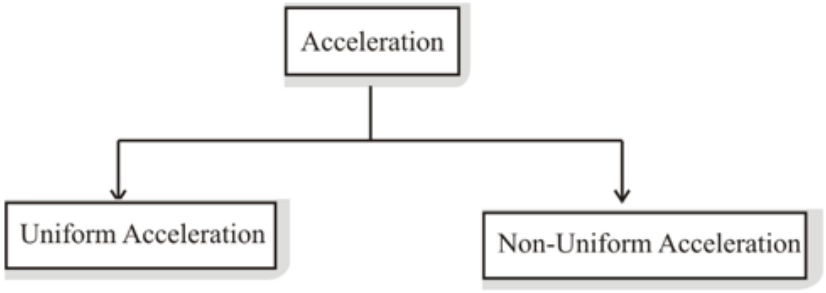
i) Acceleration is a vector quantity.

ii) SI unit of acceleration is m/s^2.

iii) The dimension of the acceleration is $[M^oLT^{-2}]$

iv) Acceleration of an object can be zero, negative, or positive.

Types of Acceleration



Uniform Acceleration- A body is said to have uniform acceleration if magnitude and direction of the acceleration both remains constant during motion.

Non-Uniform Acceleration- A body is said to have non-uniform acceleration if magnitude and direction of the acceleration both change during motion.

Equation of motion for a uniformly accelerated motion

$v = u + at$, where v is the final velocity, u is initial velocity, a is the acceleration and t is the time taken during the motion.

$v^2 = u^2 + 2as$, where v is the final velocity, u is initial velocity, a is the acceleration and s is the distance travelled by object during the motion.

$s = ut + \frac{1}{2}at^2$, u is initial velocity, a is the acceleration, t is the time taken and s is the distance travelled by object during the motion.

$s_n = u + \frac{a}{2}(2n-1)$, u is initial velocity, a is the acceleration, s_n is the distance covered by the object in nth second.

Equation of motion for a free-falling body under gravity

v = u + gt, where v is the final velocity, u is initial velocity, g is the acceleration due to gravity and t is the time taken during the motion.

$v^2 + u^2 = 2gh$, where v is the final velocity, u is initial velocity, g is the acceleration due to gravity and h is the height covered by object.

$h = ut + \frac{1}{2}gt^2$, u is initial velocity, g is the acceleration due to gravity, t is the time taken and h is the height covered by object.

$h_n = u + \frac{g}{2}(2n-1)$, u is initial velocity, g is the acceleration due to gravity, h_n is the height covered by object in nth second.

Relative Velocity

Consider two object X and Y are moving uniformly with velocities v_x and v_y in one dimension.

Velocity of object Y relative to object X is, $|v_{YX} = v_Y - v_X|$

Velocity of object X relative to object Y is, $|v_{XY} = v_X - v_Y|$

All the best!

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