CLASS - XI PHYSICS
Chapter -3 : Motion in a straight line
Module -2 (handout)

Distance
The length of the actual path traversed by an object is called the distance.
It is a scalar quantity and it can never be zero or negative during the motion of an object.
Its unit is metre.

Displacement
The shortest distance between the initial and final positions of any object during motion is called displacement. The displacement of an object in a given time can be positive, zero or negative.
It is a vector quantity.
Its unit is metre.

Speed
The time rate of change of position of the object in any direction is called speed of the object.
Speed (v) = Distance travelled (s) / Time taken (t)
Its unit is m/s.
It is a scalar quantity.
Its dimensional formula is $[LT^{-1}]$.

Uniform Speed
If an object covers equal distances in equal intervals of time, then its speed is called uniform speed.

Non-uniform or Variable Speed
If an object covers unequal distances in equal intervals of time, then its speed is called non-uniform or variable speed.

Average Speed
The ratio of the total distance travelled by the object to the total time taken is called average speed of the object.

Average speed = Total distanced travelled /
Total time taken

Instantaneous Speed
When an object is travelling with variable speed, then its speed at a given instant of time is called its instantaneous speed.

Velocity
The rate of change of displacement of an object in a particular direction is called its velocity.

Velocity = Displacement / Time taken
Its unit is m/s.
Its dimensional formula is $[LT^{-1}]$.
It is a vector quantity, as it has both, the magnitude and direction.
The velocity of an object can be positive, zero and negative.

Uniform Velocity
If an object undergoes equal displacements in equal intervals of time, then it is said to be moving with a uniform velocity.

Non-uniform or Variable Velocity
If an object undergoes unequal displacements in equal intervals of time, then it is said to be moving with a non-uniform or variable velocity.

Average Velocity
The ratio of the total displacement to the total time taken is called average velocity.

Average velocity = Total displacement / Total time taken

Acceleration
The time rate of change of velocity is called acceleration.

Acceleration (a) = Change in velocity (Δv) / Time interval (Δt)
Its unit is m/s^2
Its dimensional formula is $[LT^{-2}]$.
It is a vector quantity.

Acceleration can be positive, zero or negative. Positive acceleration means velocity increasing with time, zero acceleration means velocity is uniform while negative acceleration (retardation) means velocity is decreasing with time.

If a particle is accelerated for a time t_1 with acceleration a_1 and for a time t_2 with acceleration a_2, then average acceleration

$$\mathbf{a_{av} = a_1t_1 + a_2t_2 / t_1 + t_2}$$