Mechanics

Contents

Basic Definitions

Distance is defined as the length an object has covered during its motion. It is a scalar quantity,i.e., it has magnitude but no direction. The SI unit of distance is metre(m).

Displacement is defined as the change in an object's position. It is a vector quantity, i.e., it has both magnitude and direction. The SI unit of distance is metre(m).

Difference between distance and displacement: Let's assume that your school is at a distance of 10KM from your home. Everyday you go to school and come back home. The distance travelled by you in the whole process is 2x10 KM = 20 KM. The displacement however is 0 since there is no difference between your starting position and your ending position.

Speed is defined as the rate of change of distance with time. Speed is a scalar quantity and its SI unit is metre per second(m/s)

Speed= Distance/Time

Velocity is defined as the rate of change of displacement with time. Velocity is a vector quantity and its SI unit is metre per second(m/s)

Velocity= Displacement/Time

Acceleration is defined as the rate of change of velocity with time. Acceleration is a vector quantity and its SI unit is metre per square second(m/s^2)

Acceleration= Velocity/Time

Force can be defined as any interaction, which, when unstopped, will change the motion of the object on which it is acting. It is a vector quantity. The SI unit of Force is Newton(N).

Work is defined as the scalar product of Force and Displacement. Since it is a scalar product, it is a scalar quantity. The SI unit of Work is Joule(J).

Work= Force x displacement x cosine of angle between direction of force and direction of displacement (You will learn about Trigonometry in the next Maths notes)

If the direction of force applied and the direction of displacement is same, then

Work done= Force x displacement

If the direction of force is opposite to the direction of displacement, then

Work done = -Force x displacement

Energy is defined as the capability to do work. It is a scalar quantity. The SI unit of Energy is Joule(J).

Kinetic Energy is defined as the energy possesed by a body by virtue of its motion.

KE= ½ mv^2 where m=mass of the moving body and v=velocity of the moving body

Potential Energy is defined as the energy possessed by a body by virtue of its position.

Work Energy Theorem

Work done on a body= Change in its Kinetic Energy/Potential Energy

Important formulae

1. **v=u+at** where v=final velocity, u= initial velocity, a=acceleration, t= time
2. **$v^2=u^2+2as$** where s= displacement during this time interval
3. **$s=ut+\frac{1}{2}at^2$**

Note: In problems dealing with acceleration due to gravity, 2 cases arise-

1. When the you are throwing the body up and acceleration due to gravity impedes its motion
2. When you are throwing the body down and acceleration due to gravity supports its motion

In the first case, the formulae of Kinematics will become:

1. v=u-gt
2. $v^2=u^2-2gs$
3. $s=ut-\frac{1}{2}gt^2$

In the second case, the formulae of Kinematics will become:

1. v=u+gt
2. $v^2=u^2+2gs$
3. $s=ut+\frac{1}{2}gt^2$

Also, the various aspects of kinematics can be well analyzed through graphs. We shall discuss this in detail when we tell you more about how graphs work.