Motion - Notes

Notes Important Questions

Motion - Notes

Motion:- When a body changes its position with respect to time then the body is said to be in motion.

Rest:- A body is said to be in rest if it does change its position with respect to time.

Rectilinear Motion:- Motion in a straight line is called rectilinear motion.

Scalar Quantity:- The physical quantity which depends only on magnitude is called scalar quantity. **Ex:-** distance, mass, speed etc.

Vector Quantity:- The physical quantity which depends on both magnitude and direction is called vector quantity. **Ex:-** displacement, velocity, weight, acceleration etc.

Distance:- The length of the actual path covered by an object is called distance.

- S.I. unit:- **meter** (**m**)
- It is a **scalar** quantity.

Displacement:-The shortest distance between initial and final point is called displacement.

- S.I. unit:- **meter** (**m**)
- It is a **vector** quantity.

Uniform Motion:- The motion of an object is said to be uniform if it covers equal distances in equal intervals of time.

Non-uniform Motion:- The motion of an object is said to be non-uniform if it does not cover equal distances in equal intervals of time.

Speed:- The distance covered by an object per unit time is called speed.

- **Speed = Distance/Time**
- S.I. unit:- **meter/second**
- Quantity:- **Scalar**
- **Average speed = Total distance covered/Total time taken**

Velocity:- The displacement of an object per unit time is called velocity.

- **Velocity = Displacement/Time**
- S.I. unit:- **meter/second**
- Quantity:- **Vector**
- **Average velocity = (Initial velocity + Final velocity)/2 = (u + v)/2**

Acceleration(a):- The change in velocity of an object per unit time is known as acceleration.

- **a = (v - u)/t**
- S.I. unit:- **meter/second^2** Or, **m/s^2**
- Quantity:- **Vector**

Note:-

- **Odometer** measures the distance covered by vehicles.
- **Speedometer** measures the speed of the vehicles.

Distance - Time Graphs:-

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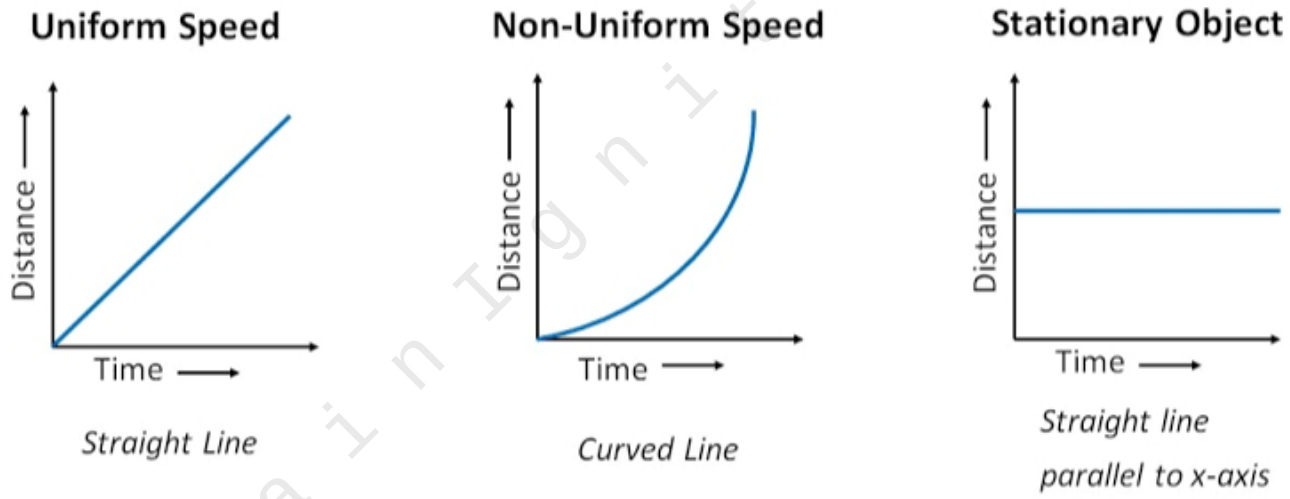
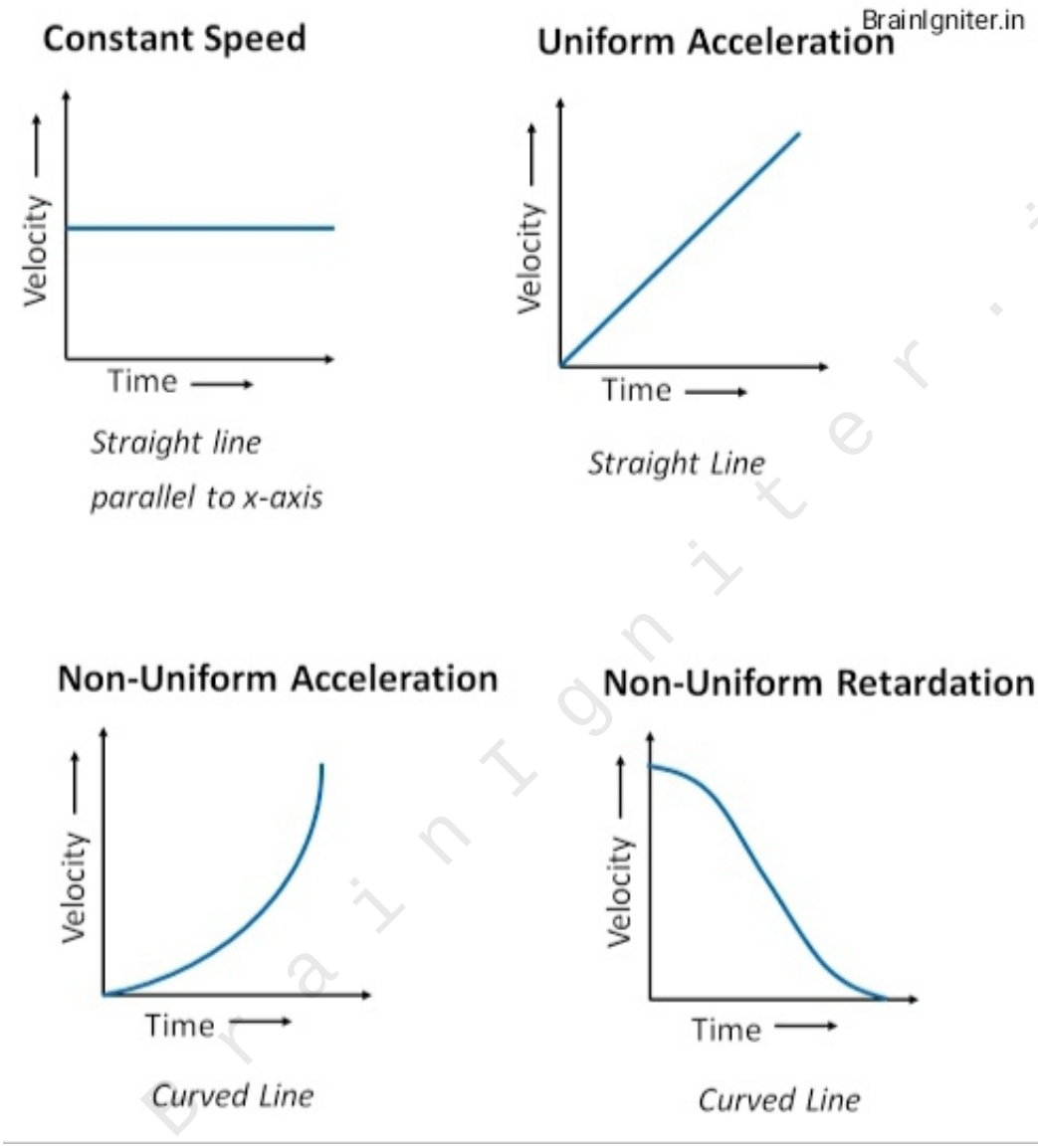


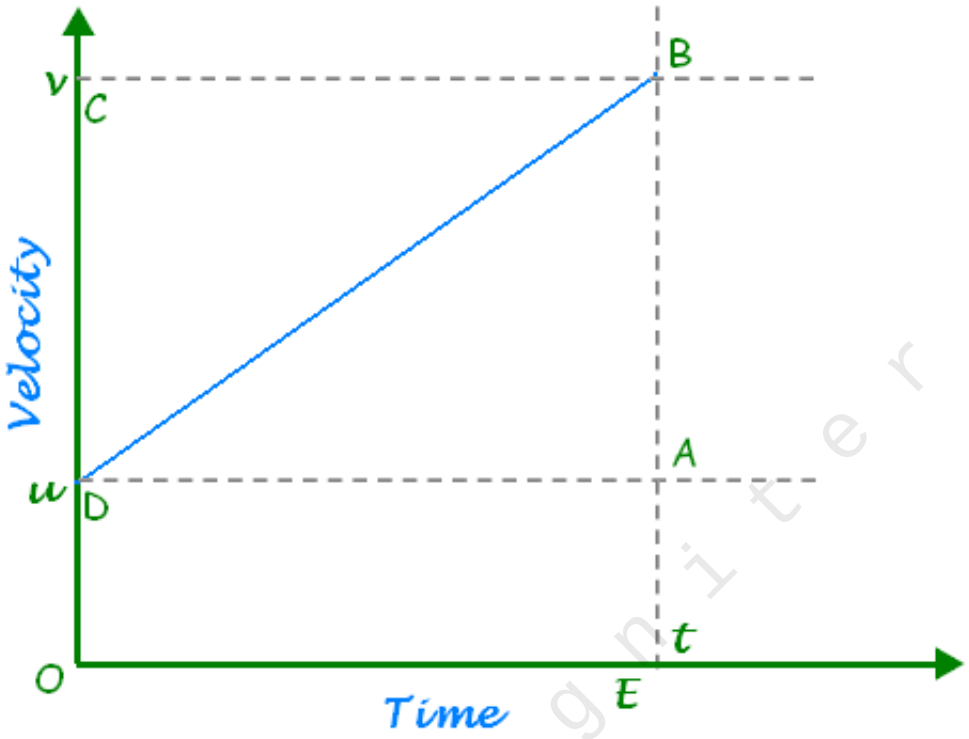
Note:- The slope of distance - time graph gives the speed of the object.

Velocity - Time Graphs:-



Note:- The area under the velocity-time graph gives the distance (magnitude of displacement).

Equation For Velocity - Time Relation:-



Consider an object moving with initial velocity 'u' and acceleration 'a'. Let after time 't', its final velocity is 'v'.

From graph, OD = u, OC = v and OE = t

acceleration = Change in velocity/Time

or, a = DC/OE

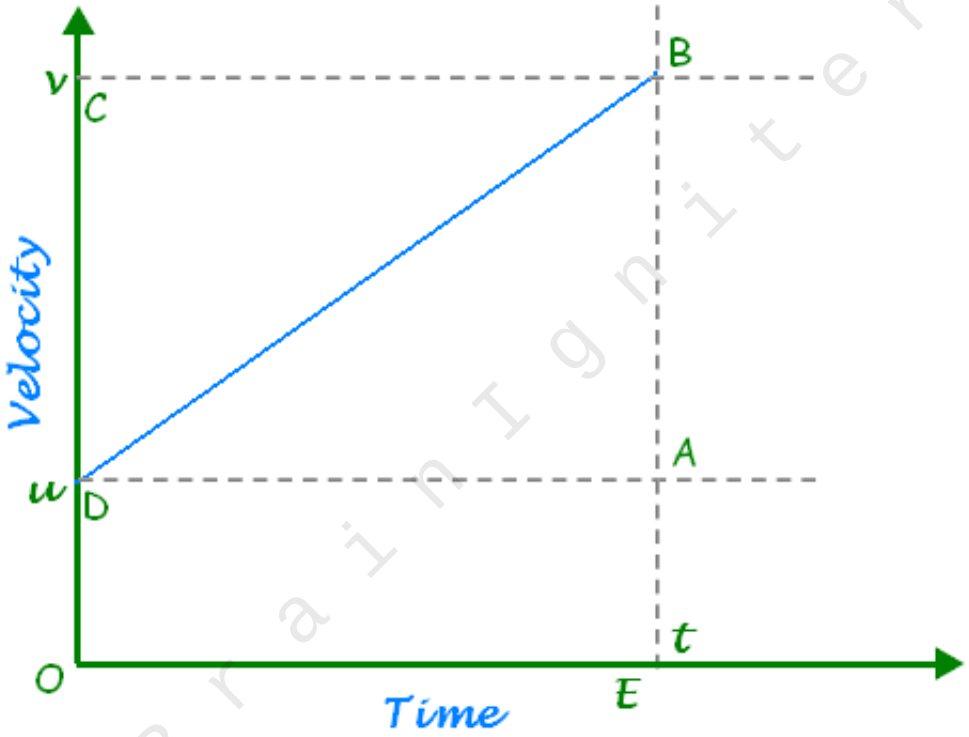
or, a = (OC - OD)/OE

or, a =(v - u)/t

or, at = v - u

or, **v = u + at**

Equation For Position - Time Relation:-



Consider an object moving with initial velocity 'u' and acceleration 'a'. Let after time 't', its final velocity is 'v'.

From graph, OD = u, OC = BE = v and OE = t

Distance traveled = area of trapezium ODBE

or, S = 1/2(sum of parallel sides) x distance between them

or, S = 1/2(OD + BE) x OE

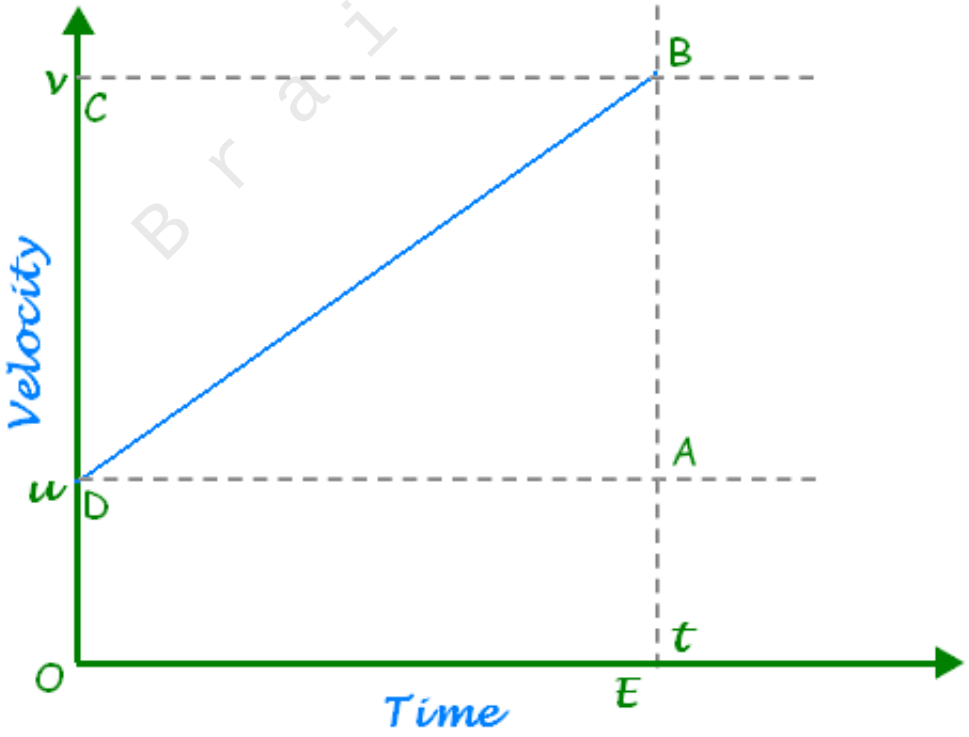
or, S = 1/2(u + v) x t

or, S = 1/2(u + u + at) x t **[since, v = u + at]**

or, S = 1/2(2u + at) x t

or, **S = ut + (1/2)at^2**

Equation For Position - Velocity Relation:-



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From graph, OD = u, OC = BE = v and OE = t

Distance traveled = area of trapezium ODBE

or, S = 1/2(sum of parallel sides) x distance between them

or, S = 1/2(OD + BE) x OE

or, S = 1/2(u + v) x t

or, S = 1/2(u + v)(v - u)/a **[since, v = u + at So, t = (v - u)/a]**

or, S = $(v^2 - u^2)/2a$

or, **$2aS = v^2 - u^2$**

Uniform circular motion: When a body moves in a circular path with uniform speed, its motion is called uniform circular motion.

Note:- Circular motion is always an accelerated motion.

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