Motion in One Dimension

Scalar and Vector Quantities

Scalar Quantity: *The quantities which have only magnitude but no direction*

Vector Quantity: *The quantities which have both magnitude and direction*

Terms Related to Motion

- *Distance*
- *Displacement*
- *Speed*
- *Velocity*
- *Acceleration*

Distance & Displacement

Distance: *It is the length of path taken by a body when moving from one point to another.*

Displacement: *It is the shortest path taken by the body.*

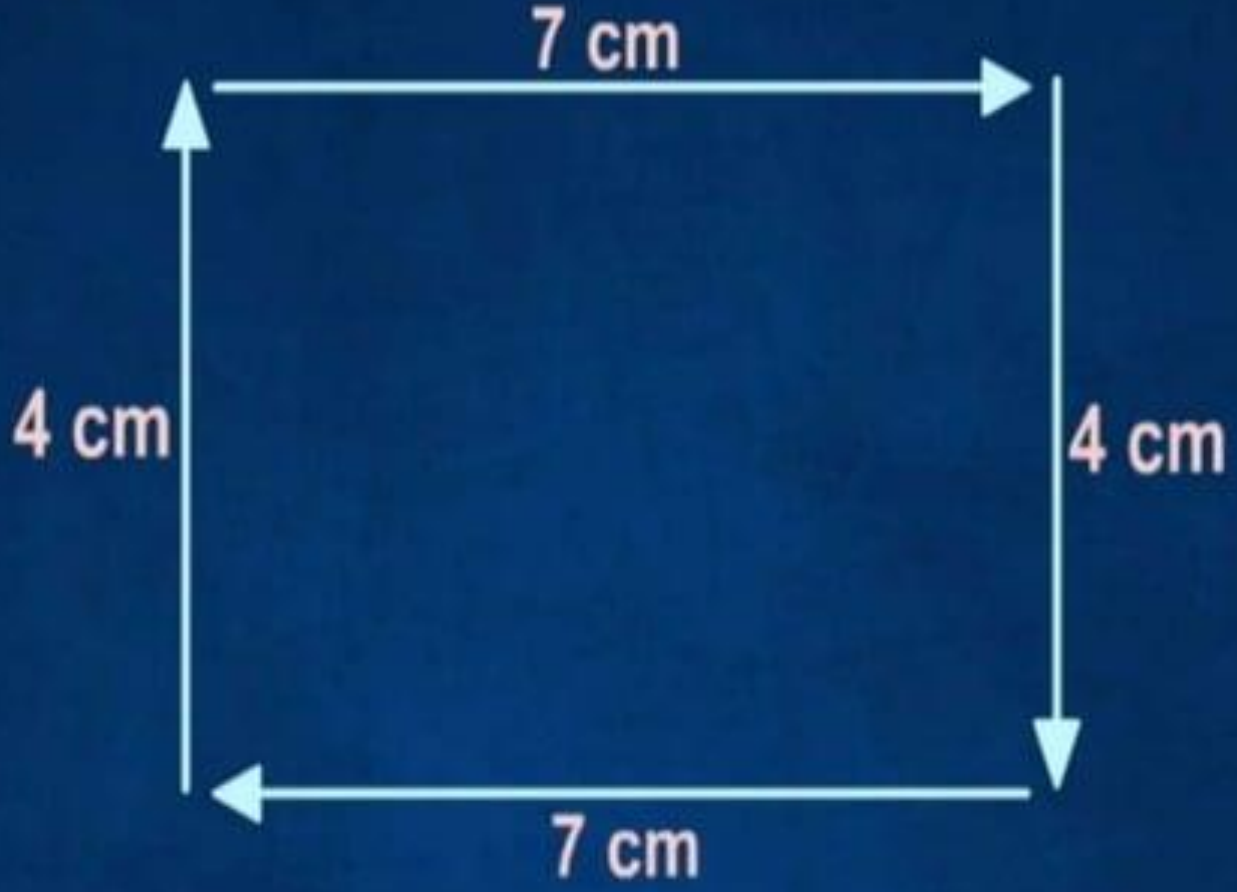
Distance

- Scalar quantity
- No direction

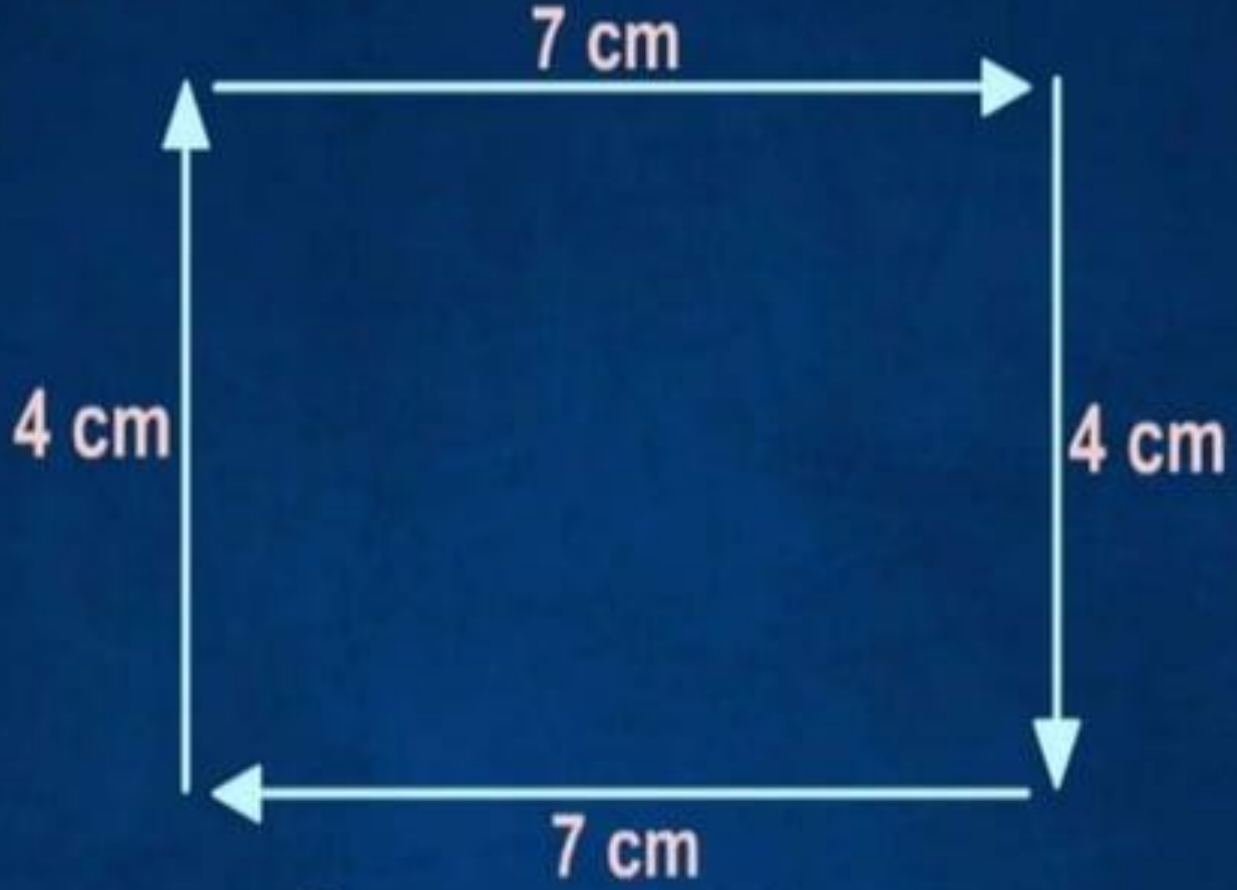
Displacement

- Vector quantity
- Magnitude and direction

Example 1: Distance and displacement



Example 1: Distance and displacement



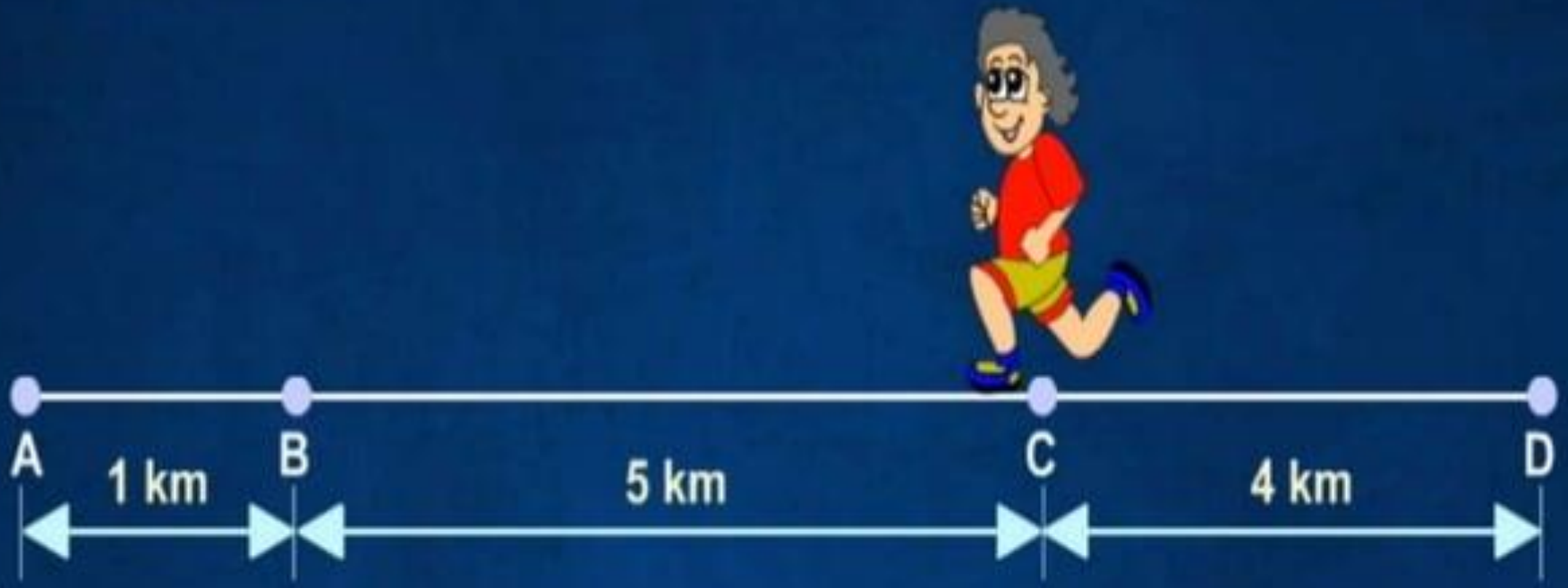
- Distance = 22 m
- Displacement = 0 m

Example 2: Distance and displacement

Example 2: Distance and displacement

- Distance = (1 km + 5 km + 4 km

Example 2: Distance and displacement



- Distance = (1 km + 5 km + 4 km + 4 km

Example 2: Distance and displacement

- Distance = (1 km + 5 km + 4 km + 4 km + 4 km)

Example 2: Distance and displacement

- Distance = 18 km
- Displacement = 10 km east of A

Speed

- Definition: Distance travelled in a certain interval of time
- Scalar quantity
- $$\text{Speed} = \frac{\text{distance travelled}}{\text{time taken}}$$
- SI Unit : (ms^{-1}), ($cm\ s^{-1}$), ($km\ h^{-1}$)

Speed

- Example :

Speed

- Example :

100 m

5 s

Speed = 20 ms^{-1}

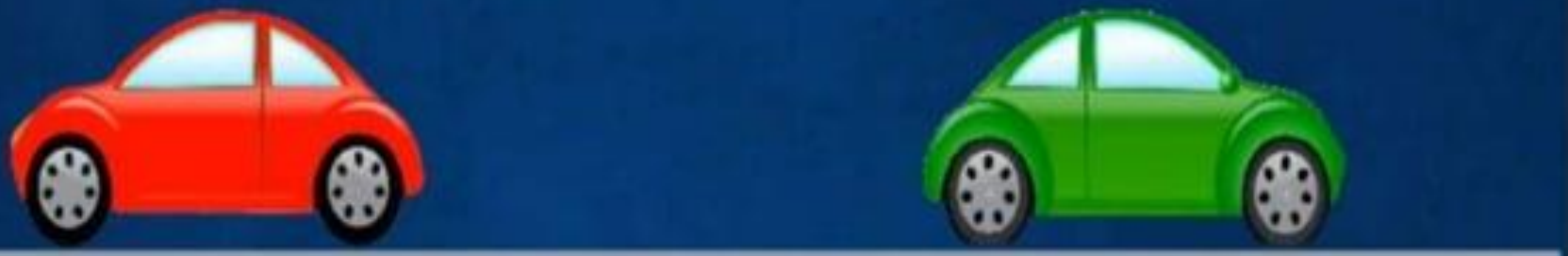
Velocity

- Definition: A measure of the distance an object travels in a stated direction in a given length of time
- Vector quantity
- $\text{Velocity} = \frac{\text{displacement}}{\text{time}}$
- SI Unit : (ms^{-1}), $(cm\ s^{-1})$, $(km\ h^{-1})$

Velocity

- Example :

100 km/h



Velocity

- Example :

100 km/h

Acceleration

- Acceleration = $\frac{\text{change of velocity}}{\text{time taken for the change}}$
- Vector quantity
- $a = \frac{v - u}{t}$ where, u = initial velocity
  v = final velocity
  t = time taken for change
- SI Unit : (ms^{-2}) , $(cm\ s^{-2})$

Acceleration

- Acceleration positive : Velocity increases
- Acceleration negative(Deceleration) : Velocity decreases
- Uniform acceleration
- Zero acceleration : Constant velocity

Acceleration

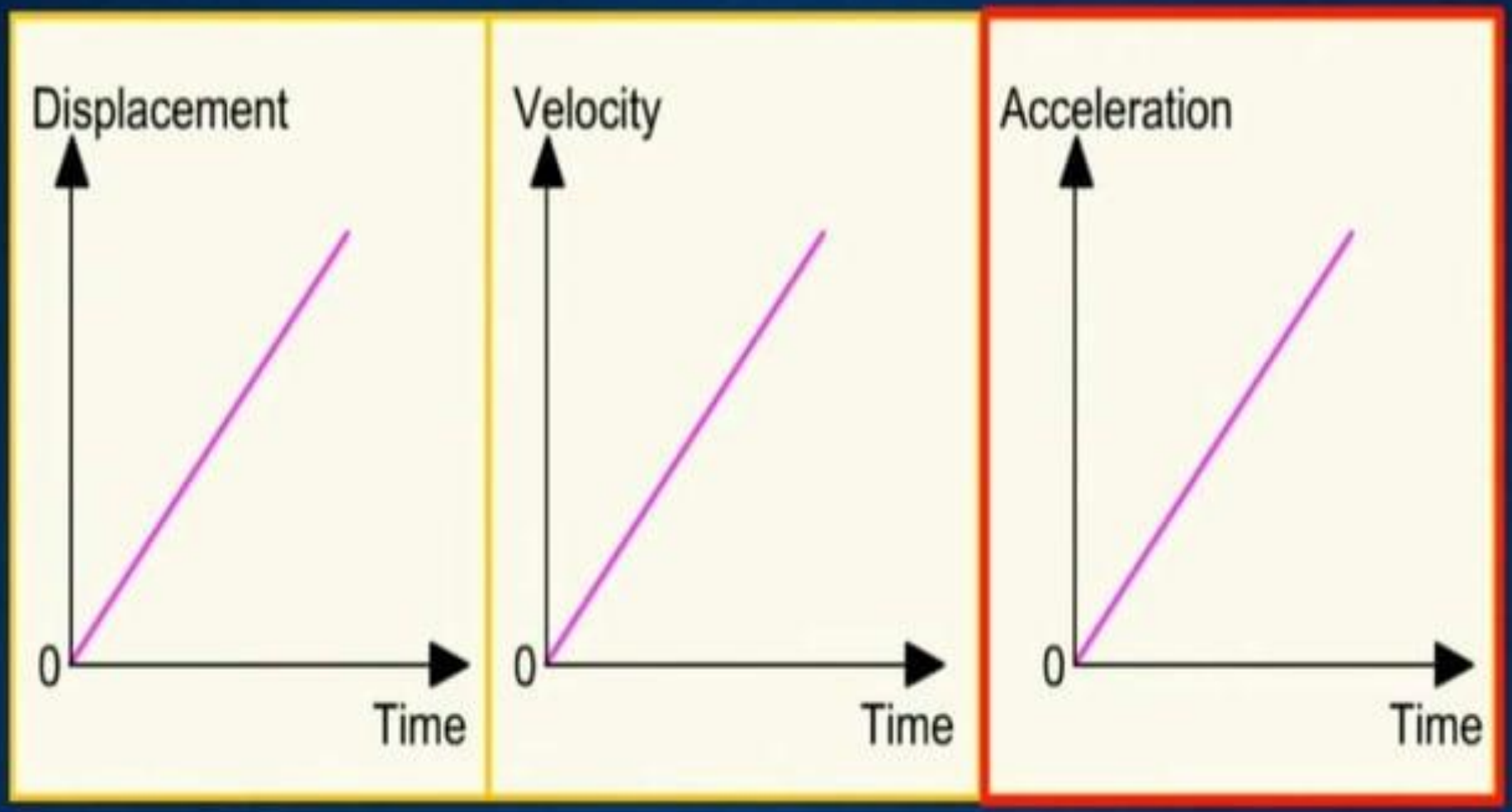
- Example :

$$a = \frac{v - u}{t} = \frac{20 - 10}{5}$$

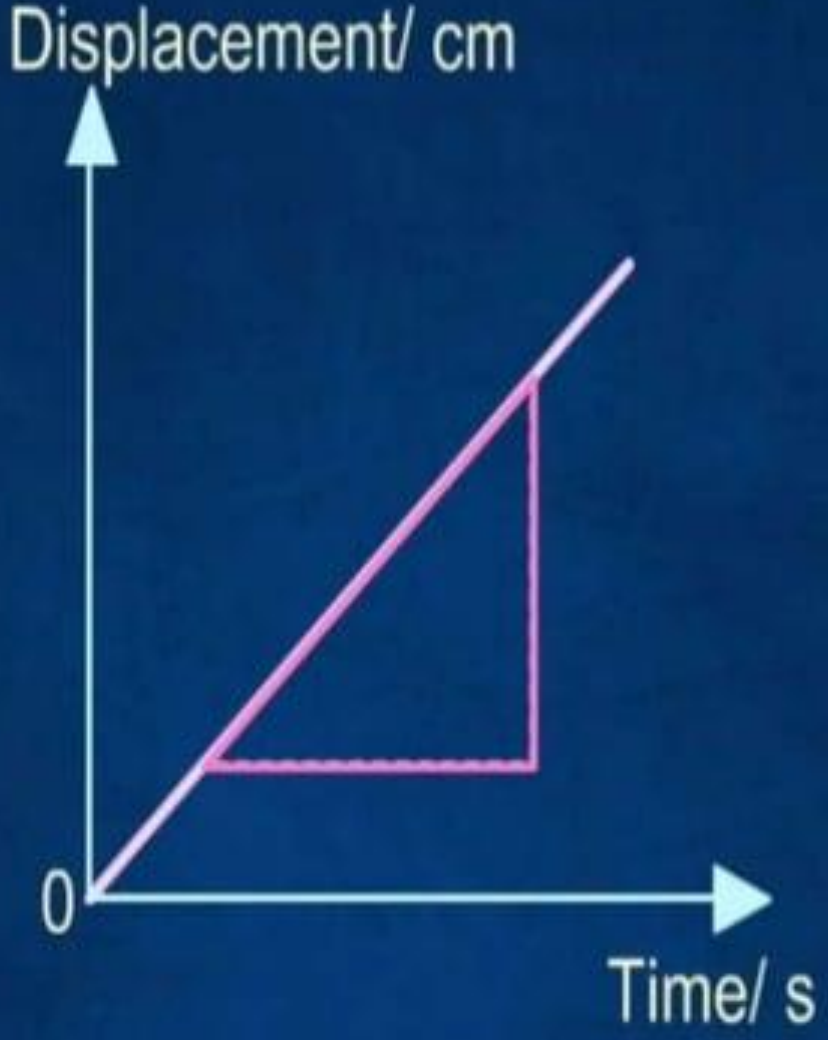
$$= 2 \text{ ms}^{-2}$$

Motion Graph

Types of motion graph



Displacement-Time Graph

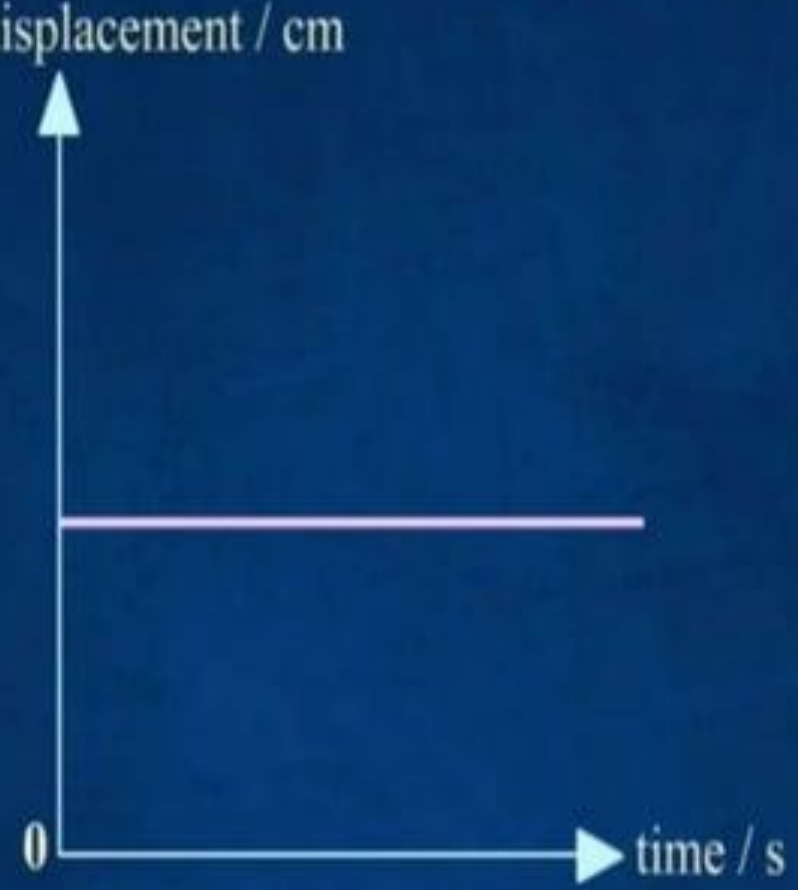


- Gradient = Velocity of the o

Displacement-Time Graph

- Types of displacement-time graph

(a)

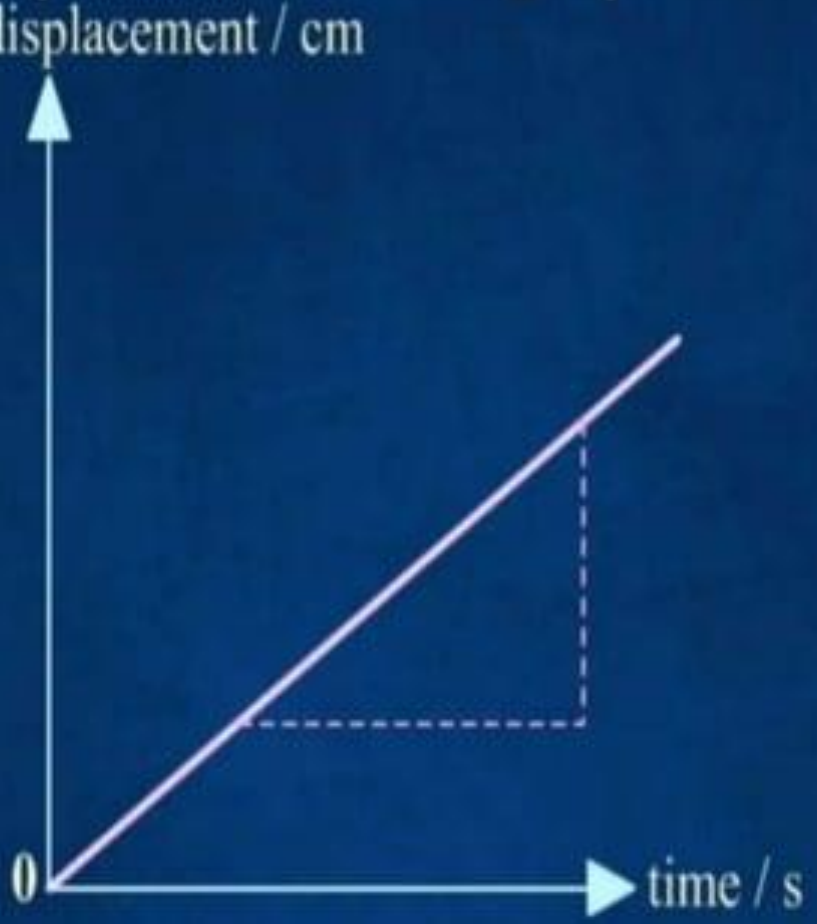


- Zero gradient - object stationary
- Velocity = 0 m s^{-1}

Displacement-Time Graph

- Types of displacement-time graph

(b)

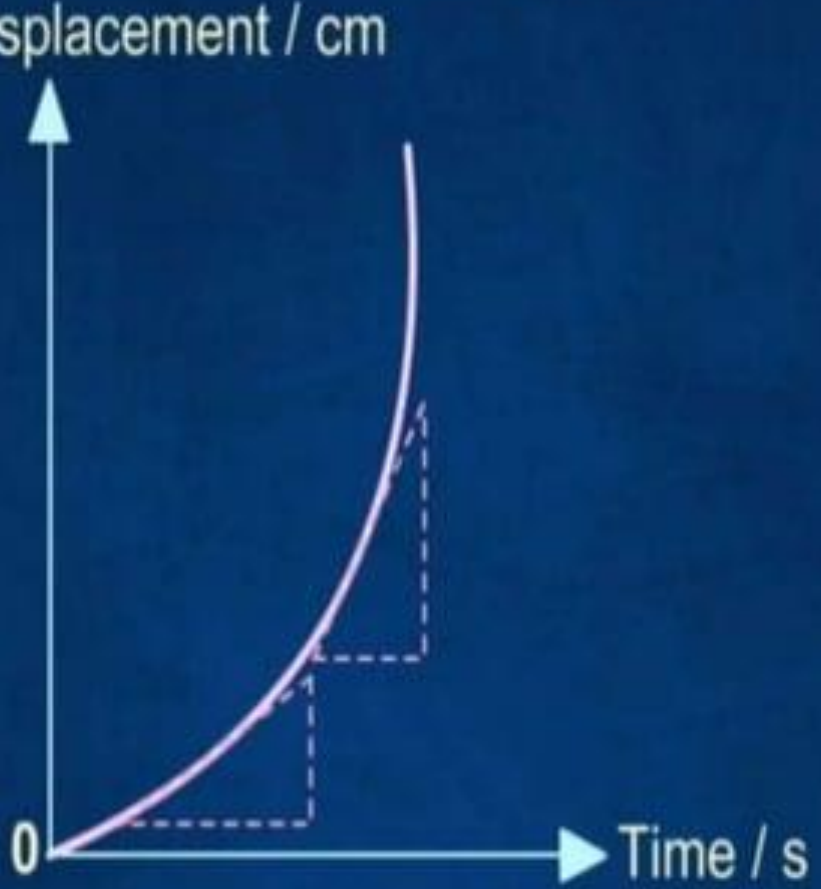


- Fixed gradient - uniform velocity
- Acceleration = 0 m s^{-2}

Displacement-Time Graph

- Types of displacement-time graph

(c)

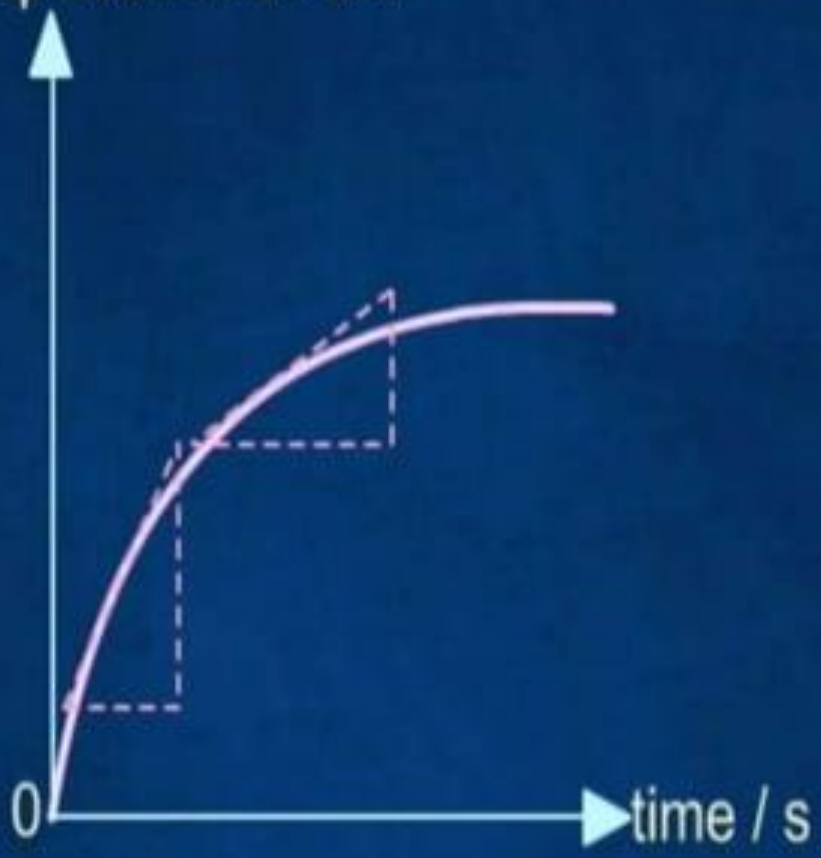


- Increasing gradient - Increasing velocity

Displacement-Time Graph

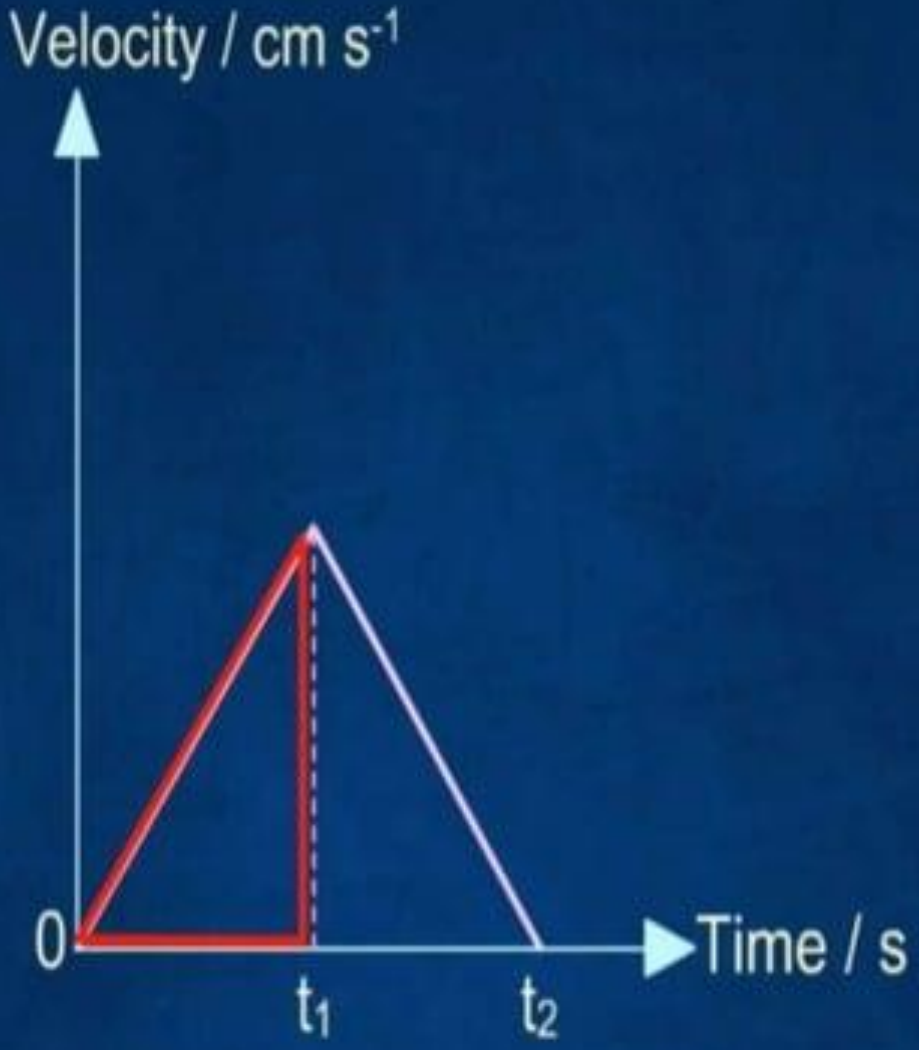
- Types of displacement-time graph

(d)



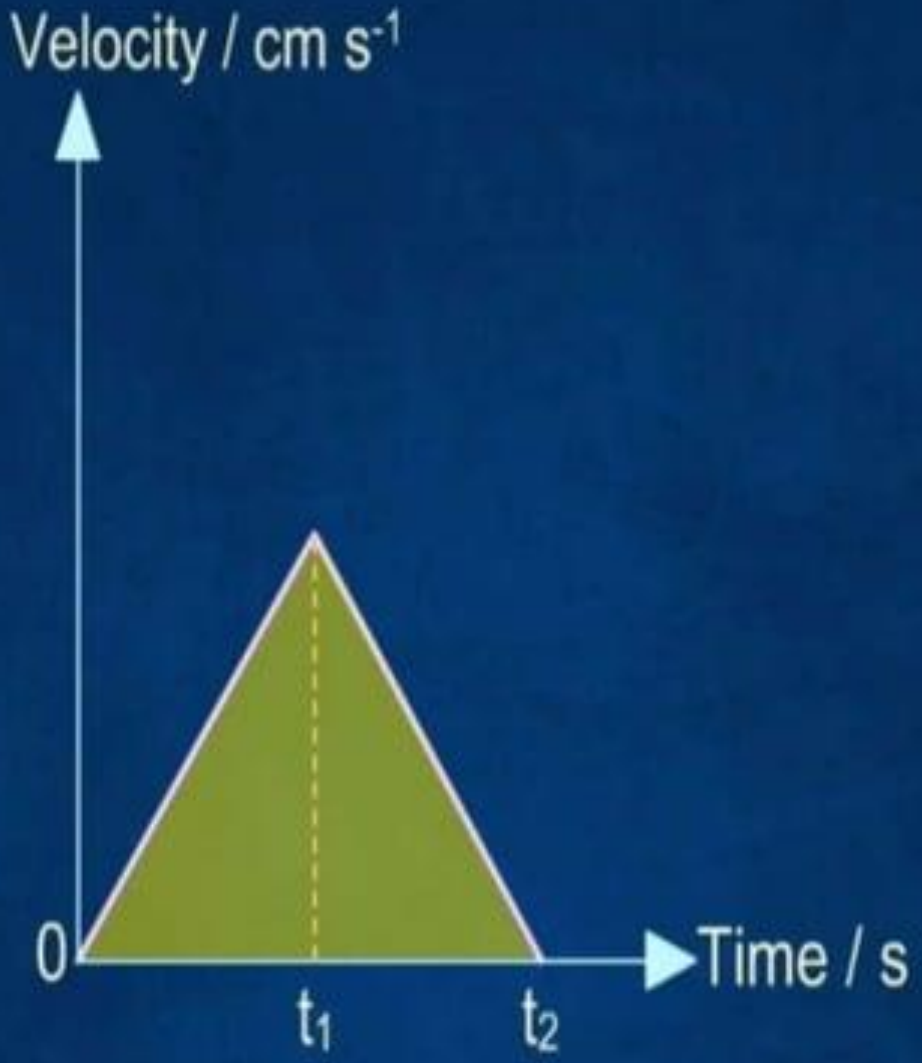
- Decreasing gradient - decreasing velocity

Velocity-Time Graph



- Gradient = Velocity of the object

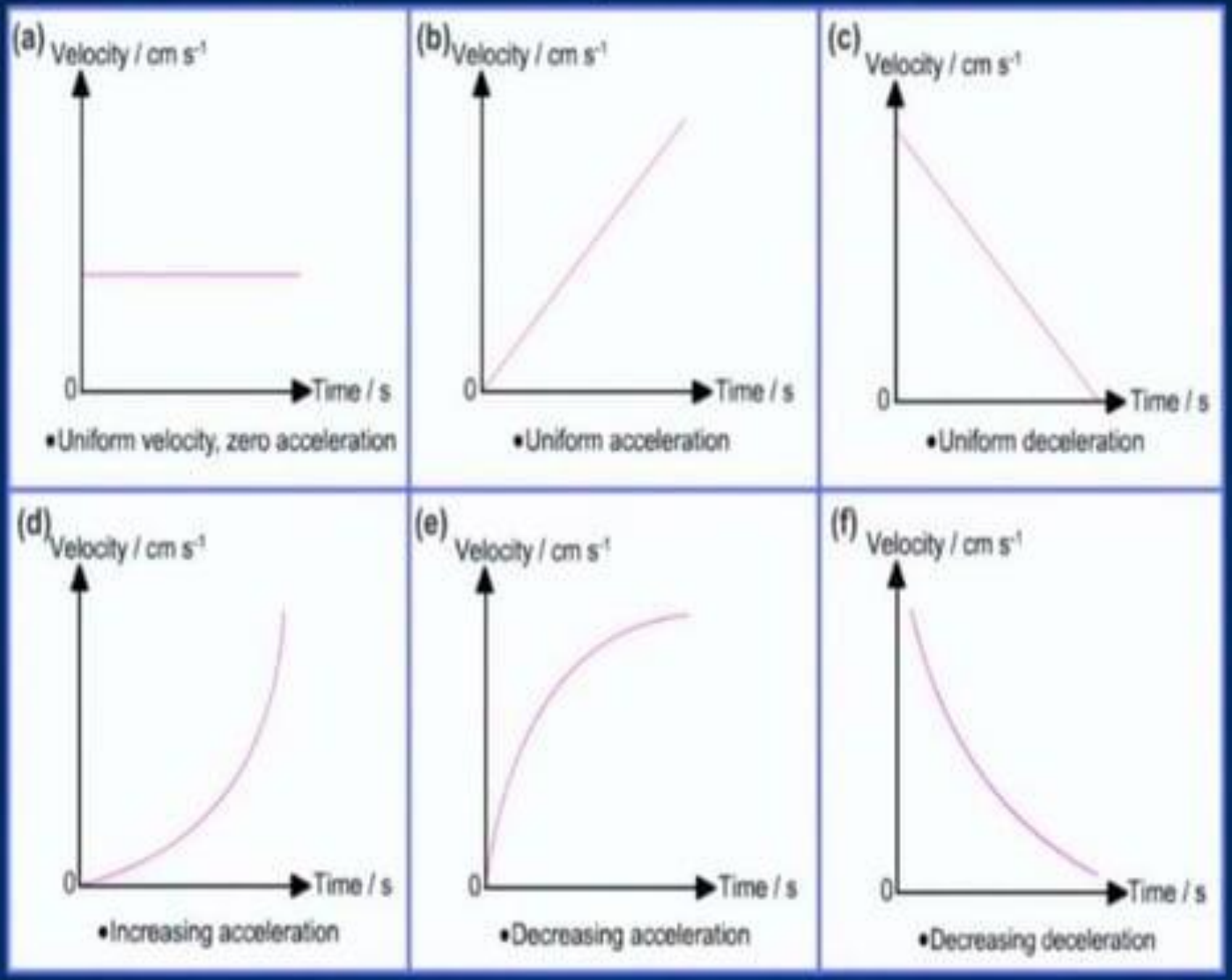
Velocity-Time Graph



- Distance travelled = area under v-t graph

Velocity-Time Graph

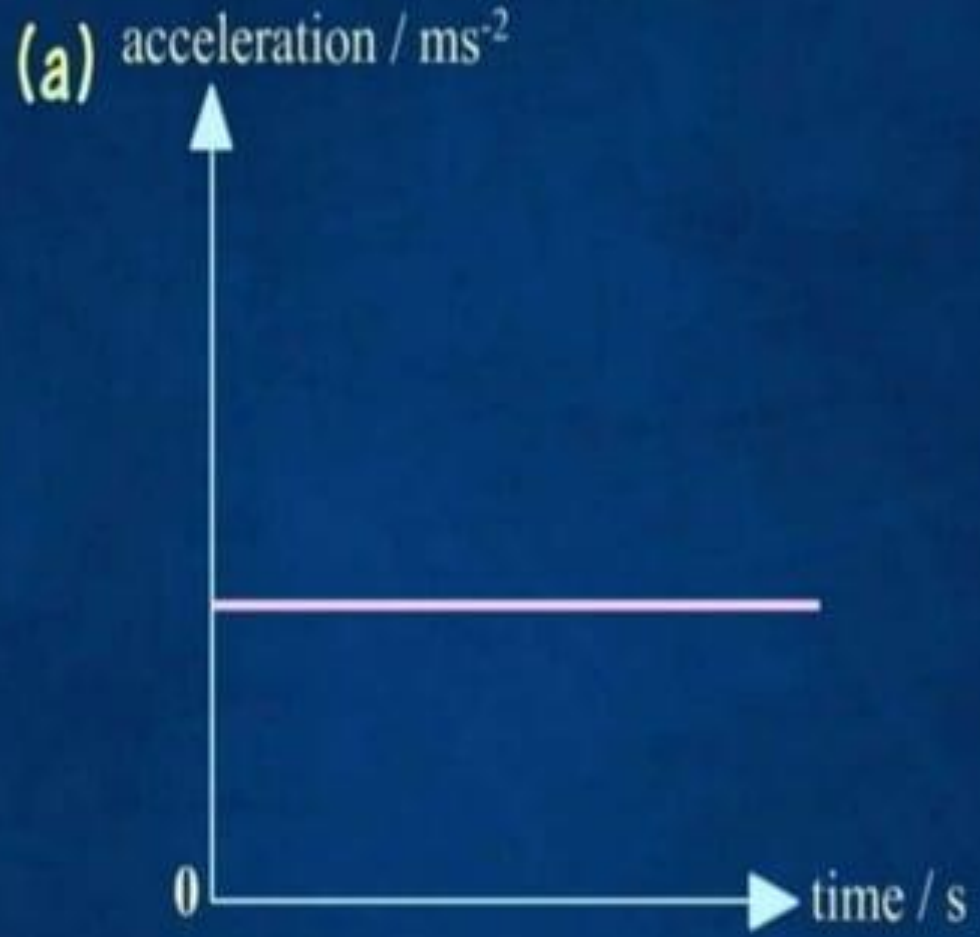
- Types of velocity-time graph



Acceleration-Time Graph

Types of acceleration-time graph :

- Uniform acceleration

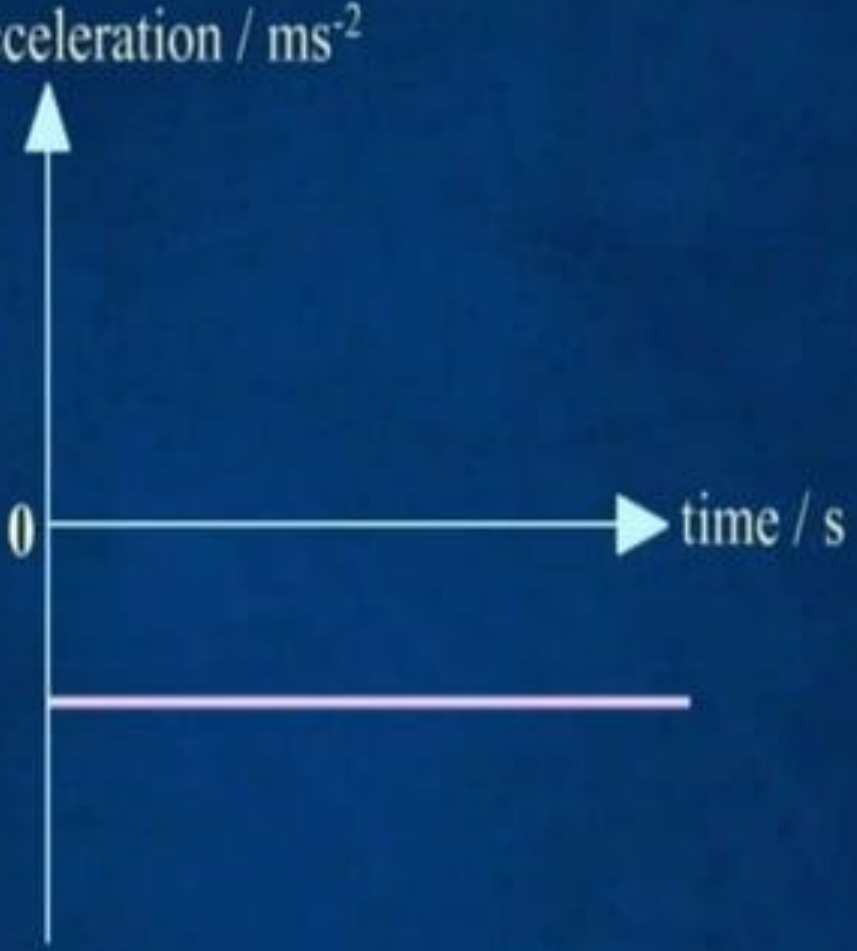


Acceleration-Time Graph

Types of acceleration-time graph :

- Uniform deceleration

(b)



Acceleration-Time Graph

Types of acceleration-time graph :

- Stationary or constant velocity

(c)