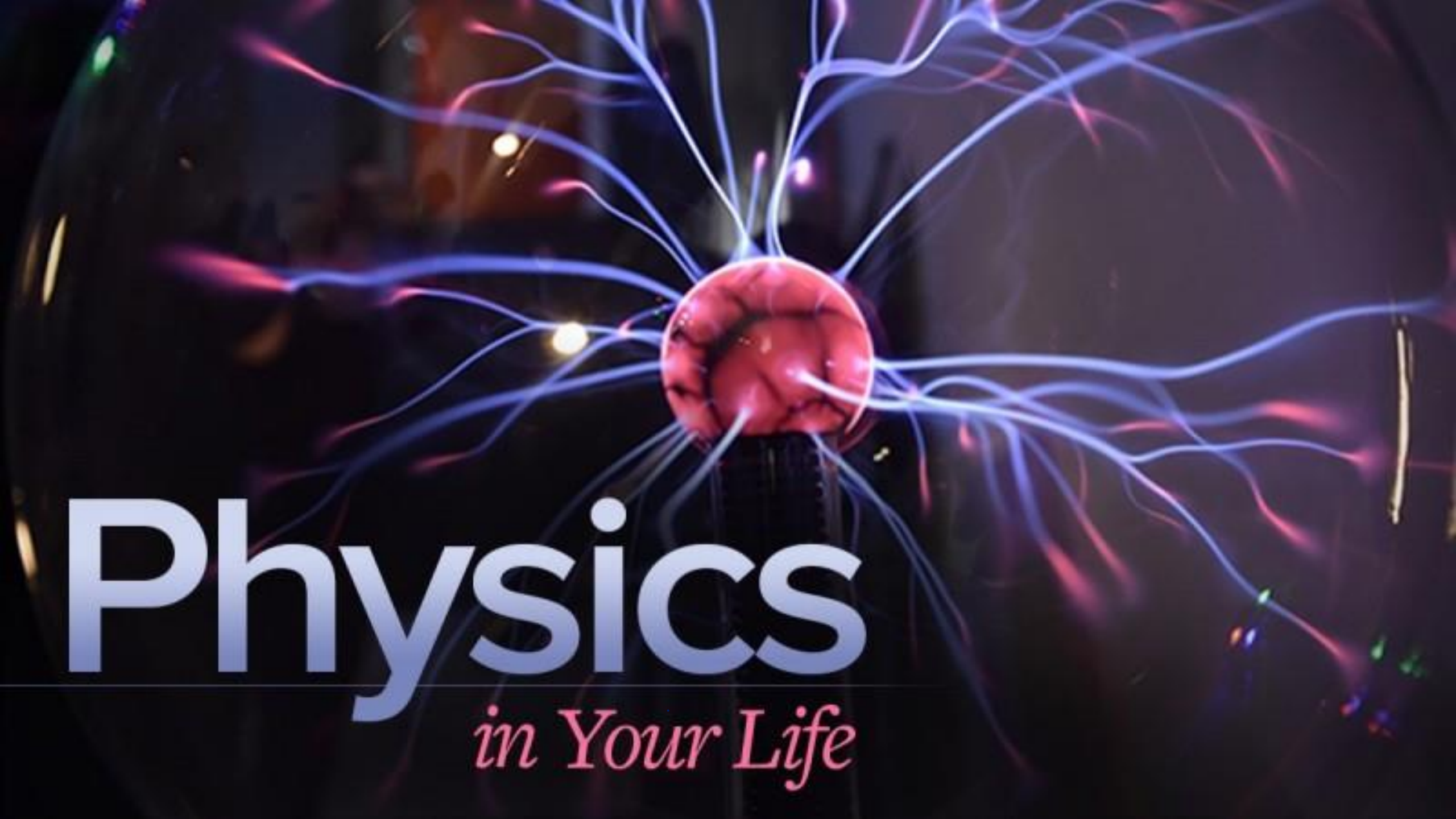




SAFALTA CLASSTM

An Initiative by **अमरउजाला**



Physics

in Your Life

UNIT & DIMENSION PRACTICE

Q. Dimensions of frequency is आवृत्ति \rightarrow परिधि

\Rightarrow

$$f = \frac{1}{T}$$

$$f \Rightarrow \underline{\underline{[T^{-1}]}}$$

Q. • Conversion of 1 kWh to Joule is equal to?

$$P = \frac{W}{t} = \frac{E}{t}$$

$$P = \frac{J}{s} = \text{Watt}$$

$$J = \frac{W \cdot s}{}$$

$$1 \text{ kWh} = 3.6 \times 10^6 \text{ J}$$

$$1 \text{ kWh} = (\text{Energy})$$

$$1 \text{ HP} = 746 \text{ W}$$

$$1 \text{ kW} = 1000 \text{ W}$$

Q. $[ML^{-1}T^{-2}]$ is the dimensional formula of

(A) force

(B) coefficient of friction

(C) modulus of elasticity ✓✓

(D) energy

Q. VELOCITY = $\sqrt{\frac{\text{PRESSURE}}{X}}$. Find the dimension formula of x?

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}$$

$$v = \sqrt{\frac{P}{x}} \Rightarrow \left(\frac{P}{x}\right)^{1/2}$$

$$v^2 = \frac{P}{x}$$

$$x = \frac{P}{v^2}$$

$$= \frac{[ML^{-1}T^{-2}]}{[L^2 T^{-2}]}$$

$$= \underline{\underline{[ML^{-3}T^0]}}$$

$$\epsilon_0 = \frac{q_1 q_2}{F r^2}$$
$$\mu_0 = \frac{B}{H}$$

Q. Velocity of a particle is given by : $v = At^2 + Bt + C$

Find the dimension of A, B & C?



ϵ_0

Unit \rightarrow

$$v = \cancel{At^2} + \underline{Bt} + \underline{C}$$
$$\underline{m/s} = \left(\frac{m}{s} + \frac{m}{s} + \frac{m}{s} \right) \underline{m/s} \checkmark$$

$$Bt \rightarrow m/s$$

$$\frac{m}{s^2} \times s$$

$$\frac{m}{s}$$

$$= \left(\frac{m s^2}{s^2} + \frac{m s}{s^2} + \frac{m}{s} \right)$$

$$A = [LT^{-3}]$$

$$B = [LT^{-2}]$$

$$C = [LT^{-1}]$$

$$\textcircled{At^2} \text{ m/s}$$

$$A \rightarrow \frac{m}{s^2} \times s^2 = \underline{m/s}$$

Distance .

(effect of motion)

Displ.

Speed चल

Vel. वेग

Acc. अत्त

KINEMATICS

(गति की)

Motion

- Motion is relative
- Origin
- Position is compared to an origin
- Coordinate system or a *reference frame*

Motion Diagram



t=0.75 sec



t=0.50 sec



t=0.25 sec



t=0 sec

Particle Model

t=0

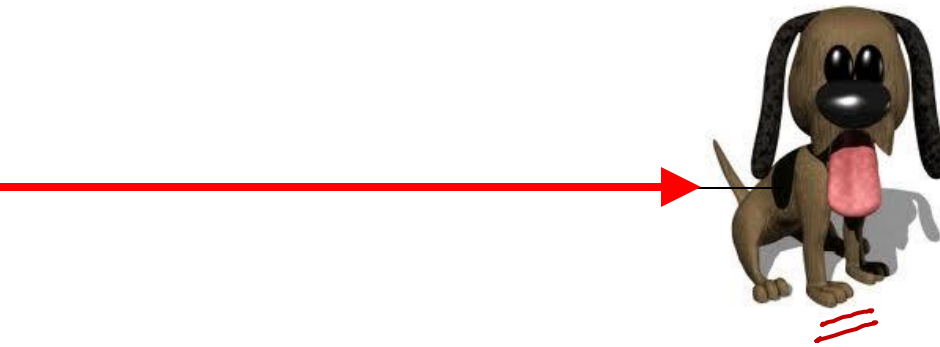
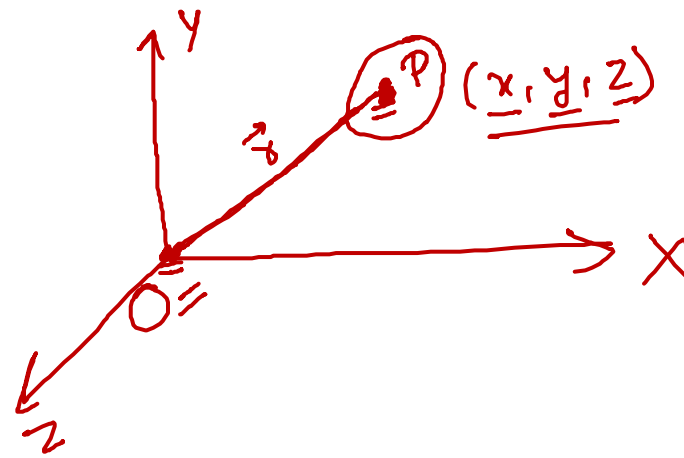
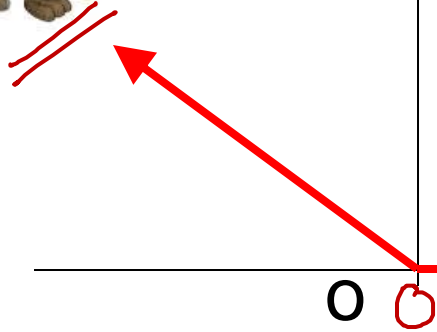
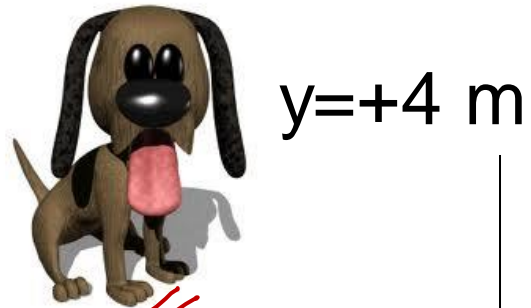
t=0.25s

t=0.50s

t=0.75s



Position Vectors



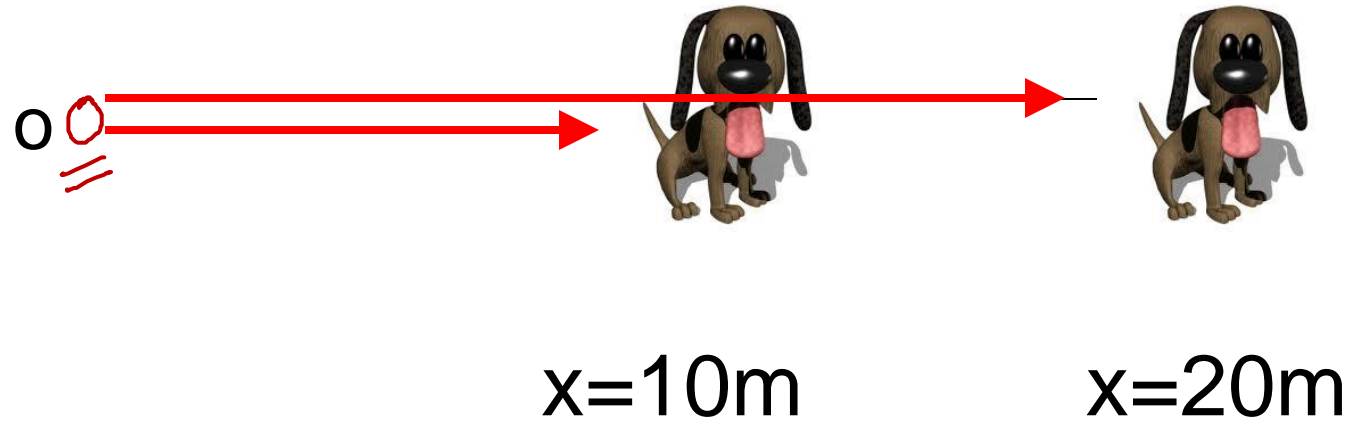
$x = -5 \text{ m}$

$x = 5 \text{ m}$

$x = 10 \text{ m}$

Position (m)

Position Vectors



Position (m)

Scalar Quantity (अदिश राशि)

Tensor \rightarrow current (zero order scalar)

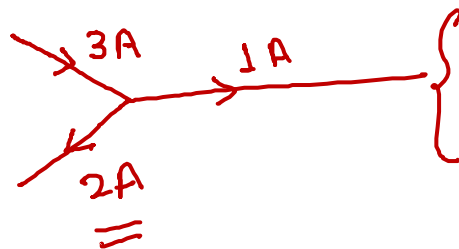
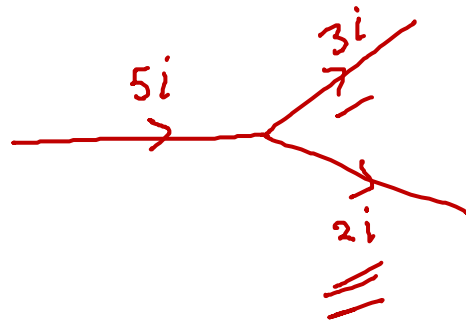
Scalar quantity is defined as the physical quantity with magnitude and no direction.

वैसी भौतिक राशि, जिनमें केवल परिमाण होता है. दिशा नहीं, उसे अदिश राशि कहा जाता हैः.

नोट: विद्युत धारा (current), ताप (temperature), दाब (pressure) ये सभी अदिश राशियां हैं।

Examples : Mass, Speed, Distance, Time, Volume, Density, Temperature etc.....

जैसे - द्रव्यमान, चाल, आयतन, कार्य, समय, ऊर्जा आदि



Vector Quantity (संदिश \rightarrow संदिश योग का नियम) Vector Addition

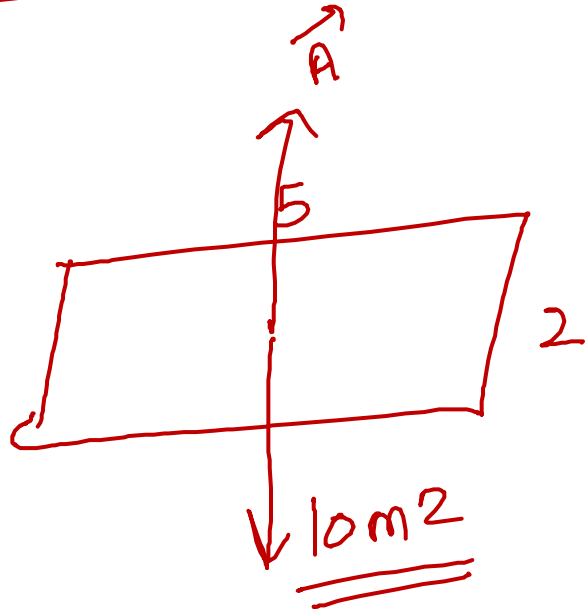
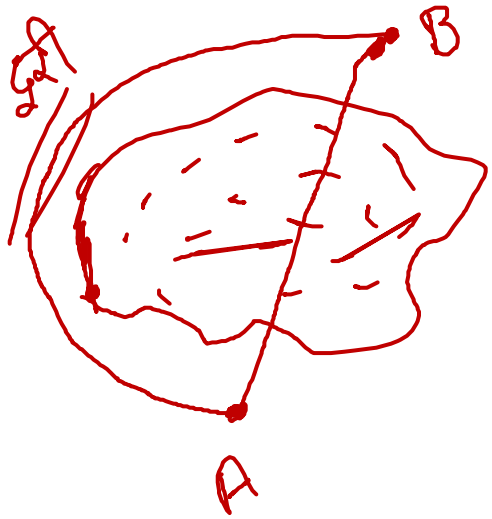
A vector quantity is defined as the physical quantity that has both direction as well as magnitude.

वैसी भौतिक राशि जिनमें परिमाण के साथ-साथ दिशा भी रहती है और जो योग के निश्चित नियमों के अनुसार जोड़ी जाती हैं,

उन्हें संदिश राशि कहते हैं:

Examples: Linear momentum, Acceleration, Displacement, Momentum, Angular velocity, Force, Electric field, Polarization

जैसे- वेग, विस्थापन, बल, त्वरण आदि.



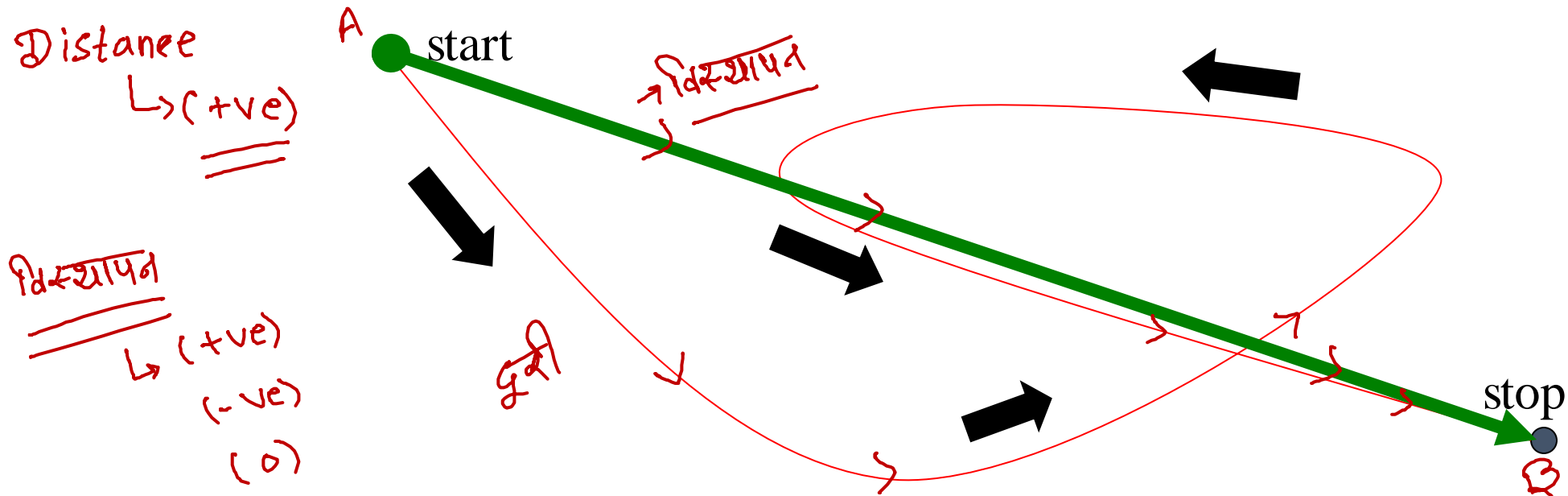
Area \vec{A} \Rightarrow Vector

Distance vs. Displacement (दूरी तथा विस्थापन)

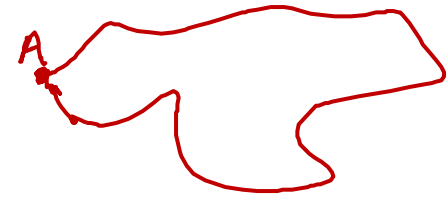
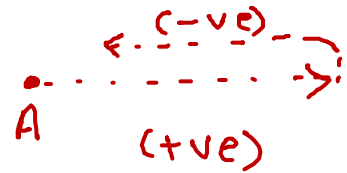
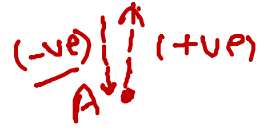
अदिश

सदिश

- Distance is the total movement of an object without any regard to direction.
- किसी दिए गए समयान्तराल में वस्तु द्वारा तय किए गए मार्ग की लंबाई को दूरी कहते हैं। यह एक अदिश राशि है। यह सदैव धनात्मक (+ve) होती है।
- Displacement is defined as the change in position of an object. It is a vector quantity and has a direction and magnitude.
- एक निश्चित दिशा में दो बिन्दुओं के बीच की लंबवत दूरी को विस्थापन कहते हैं। यह सदिश राशि है। इसका S.I. मात्रक मीटर है। विस्थापन धनात्मक, ऋणात्मक और शून्य कुछ भी हो सकता है।



Let's Practice!



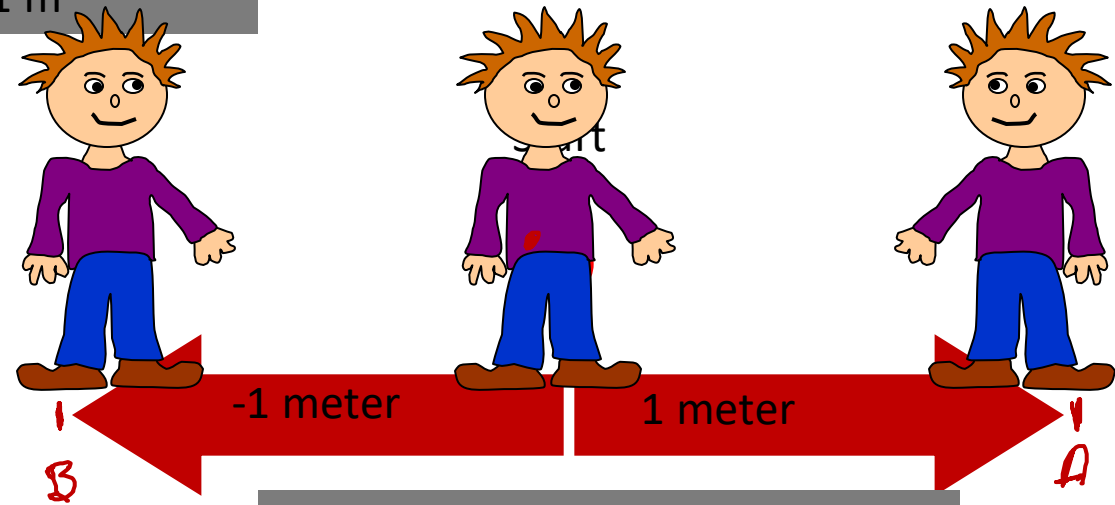
REMEMBER:

- "Distance" is how far you have gone. "दूरी आप कितनी दूर चले गए हैं"
- "Displacement" is how far you are from the starting point. "विस्थापन" आप शुरुआती बिंदु से कितनी दूर हैं



Distance = 3 m
Displacement = - 1 m

Distance = 1 m
Displacement = + 1 m



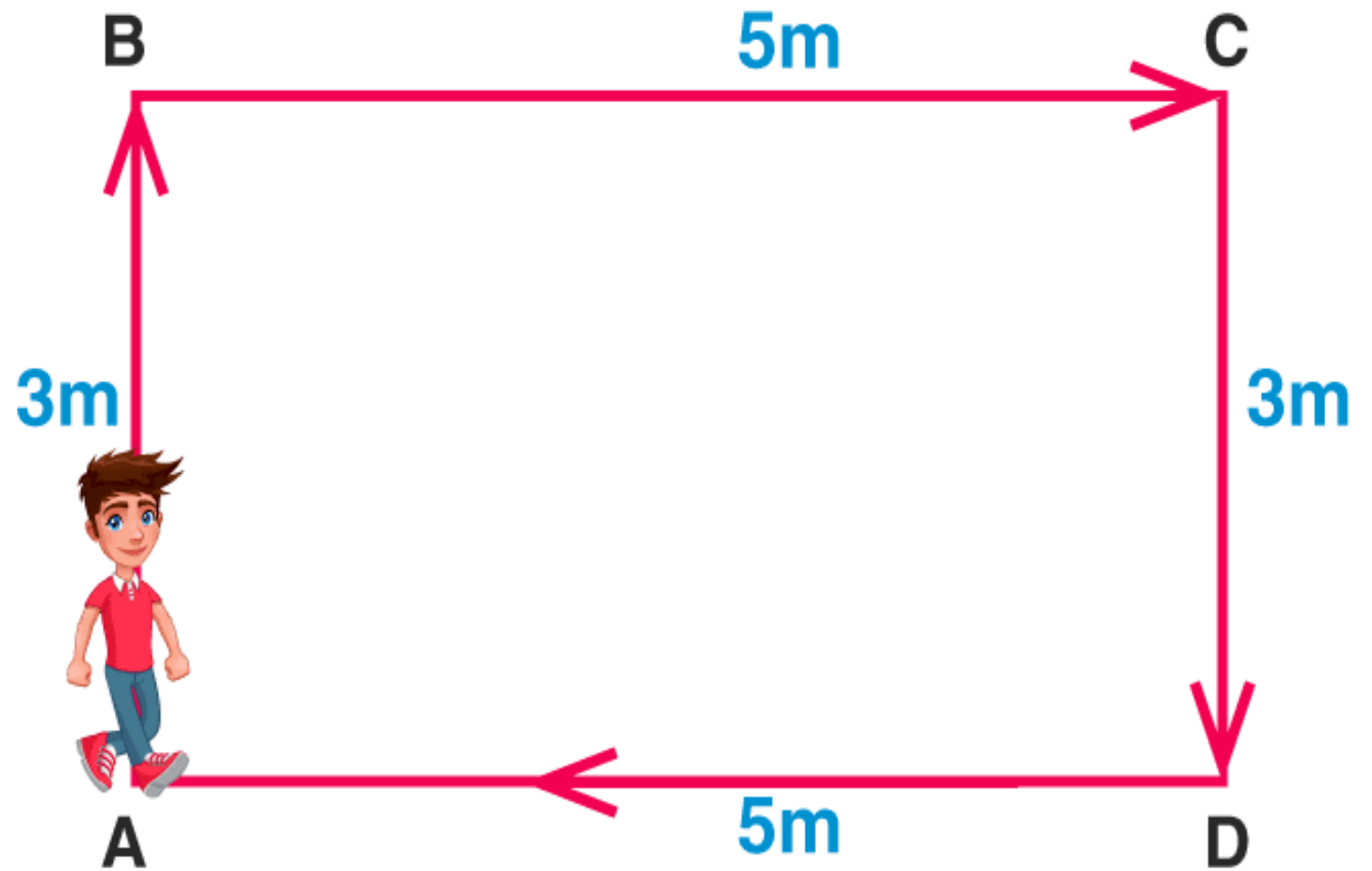
Dis Distance = 4 m
Dis Displacement = 0 m

Displacement= $\Delta x = x_f - x_0$

x_f = Final Position

x_0 = Initial Position

Δx = Displacement



Displacement at point **A** = 0

Distance travelled at point **A** = 0

Speed vs. Velocity (चाल तथा वेग)

- Velocity can be defined as the rate at which an object changes position in a certain direction. किसी वस्तु के विस्थापन की दर को या एक निश्चित दिशा में प्रति सेकंड वस्तु द्वारा तय की दूरी को वेग कहते हैं।

$$|\vec{v}| \text{ or } \frac{(+ve)}{\text{चाल}} = \frac{\text{दूरी}}{\text{समय}} \text{ (अदिश (Scalar)) m/s}$$

- Vector quantity. यह एक सदिश राशि है।

$$\vec{v} = \frac{\text{विस्थापन}}{\text{समय}} \text{ (सदिश)} \text{ m/s}$$

→ (+ve) (-ve)

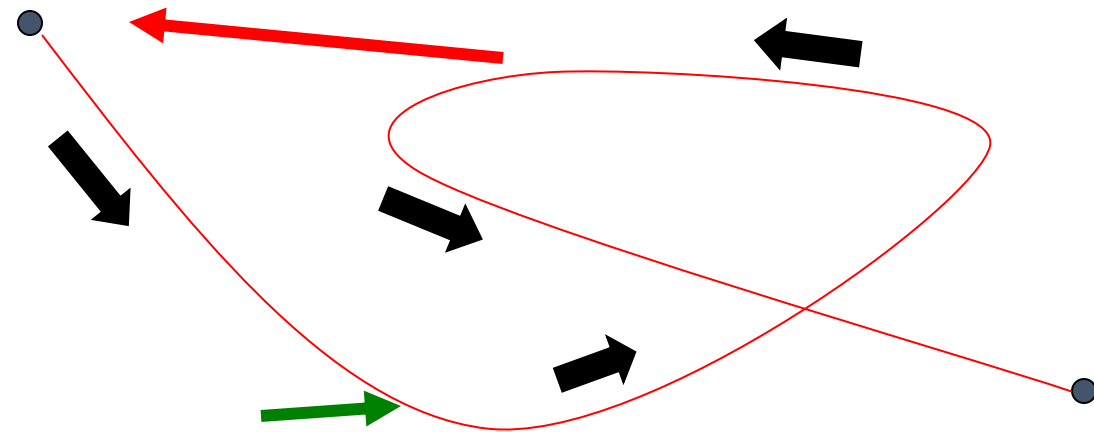
- Velocity can be zero, negative, or positive.
- An object may possess different velocities but the same speed.
- Velocity is measured in m/s. इसका S.I. मात्रक मीटर/सेकंड है।

Speed vs. Velocity

- The rate at which an object covers a certain distance is known as speed.

किसी वस्तु के विस्थापन की दर को चाल कहते हैं। Scalar quantity. यह एक अदिश राशि है।

- Speed can never be negative or zero.
- Speed may or may not be equal to velocity.
- इसका S.I. मात्रक मीटर/सेकंड है।
- चाल = दूरी / समय



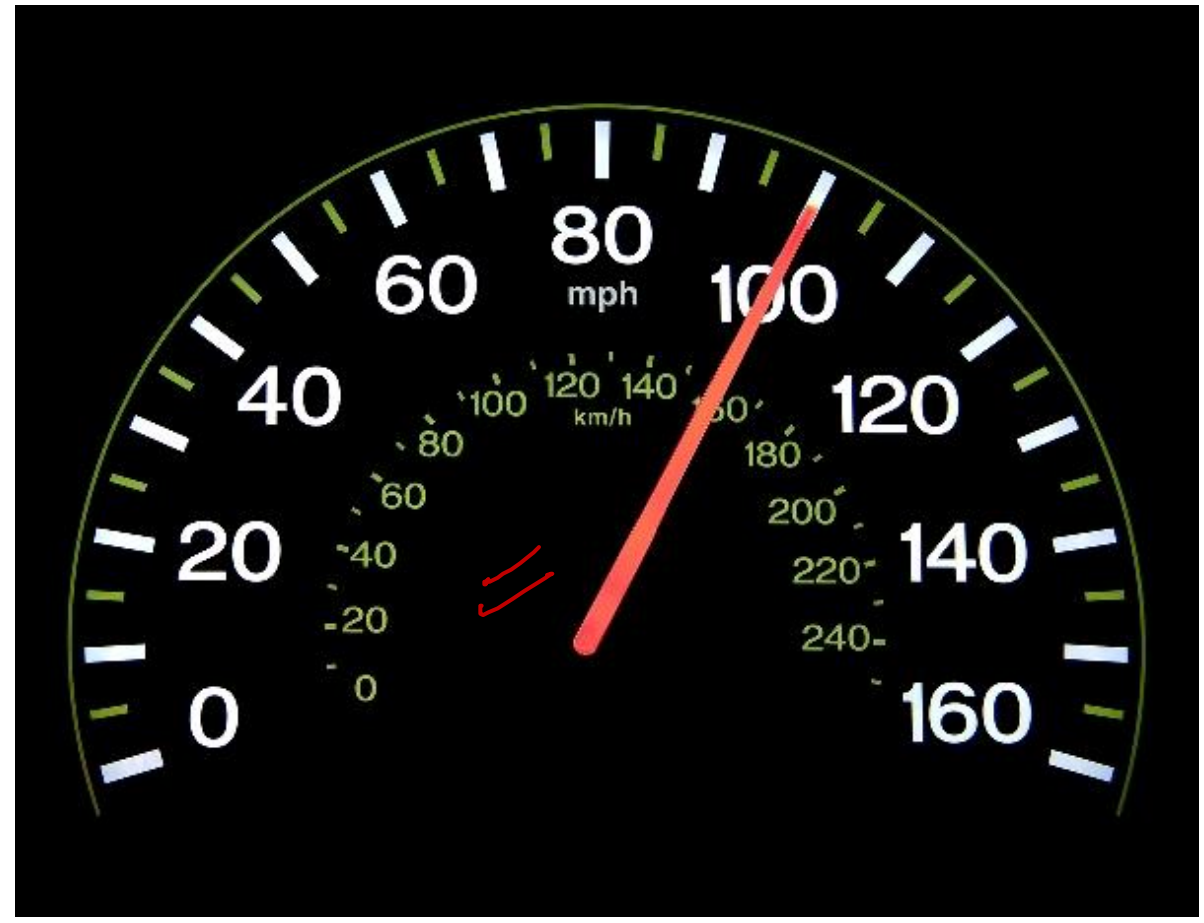
VELOCITY: 500 MILES PER HOUR WEST



①

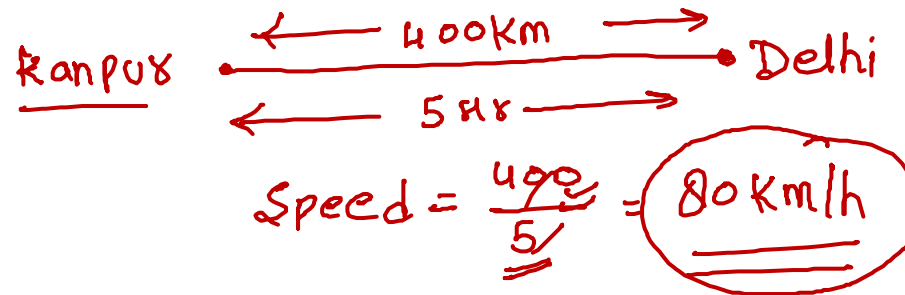
②

Speedometer



AVERAGE SPEED AND VELOCITY

- The average speed of a body in a certain time interval is the distance covered by the body in that time interval divided by time.

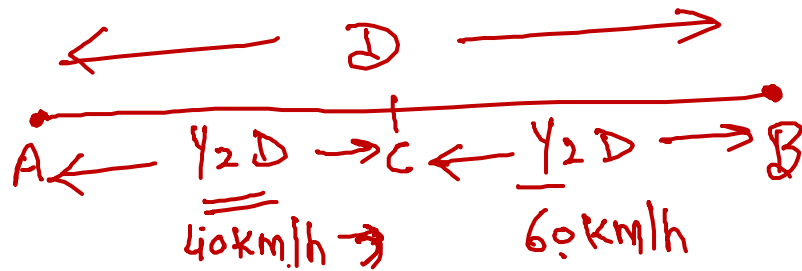


$$\left\{ \begin{array}{l} \text{Average Speed} = \frac{\text{कुल दूरी}}{\text{कुल समय}} = \frac{\text{T. D.}}{\text{T. T.}} \end{array} \right.$$

$$\left\{ \begin{array}{l} \text{Velocity} = \frac{\text{कुल विस्थापन}}{\text{कुल समय}} = \frac{\text{T. Disp}}{\text{T. T.}} \end{array} \right.$$

- The average velocity of a body in a certain time interval is given as the displacement of the body in that time interval divided by time.

①



Average Speed = ?

$$v_{av} = \frac{\text{Total Dist}}{\text{Total Time}}$$

Total Dist = D

$$\underline{A \rightarrow C} \quad t_1 = \frac{D/2}{40} = \frac{D}{80} \text{ hr}$$

$$\underline{C \rightarrow B} \quad t_2 = \frac{D/2}{60} = \frac{D}{120} \text{ hr}$$

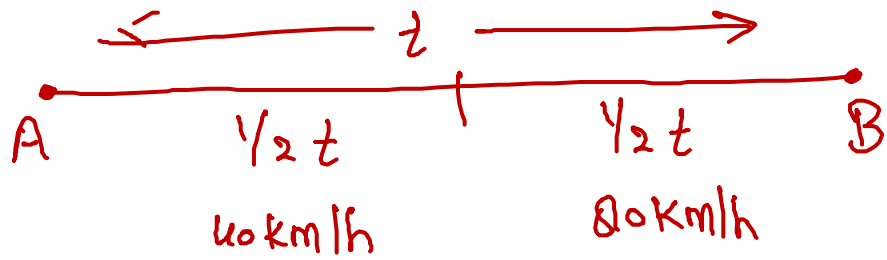
$$T = t_1 + t_2 = \frac{D}{80} + \frac{D}{120}$$

$$= \frac{3D + 2D}{240} = \frac{5D}{240} \text{ hr}$$

$$v_{av} = \frac{D}{\frac{5D}{240}} = \frac{240}{5}$$

$$= \underline{\underline{48 \text{ km/h}}}$$

②



av. speed = ? 60 km/h

* ① case:- Distance \Rightarrow 2 equal part में, 2 equal part,

av. speed = $\frac{2 v_1 v_2}{v_1 + v_2}$

3 equal part \Rightarrow

av. sp. = $\frac{3 v_1 v_2 v_3}{v_1 v_2 + v_2 v_3 + v_3 v_1}$

Case 2:- AMM (Time) \rightarrow 2 equal parts,

$$\text{av. sp.} = \frac{v_1 + v_2}{2}$$

3 equal part,

$$\text{av. sp.} = \frac{v_1 + v_2 + v_3}{3}$$



①

→ 1st Hx → 60 km/h

→ 2nd Hx → 90 km/h

→ av. speed = ?

$$v_{av} = \frac{150}{2} = \frac{v_1 + v_2}{2}$$

$$= \underline{\underline{75 \text{ km/h}}}$$

v → speed

\vec{v} → velocity

⇒ Instantaneous Speed Instantaneous Velocity

तात्क्षणिक चाल/वेग



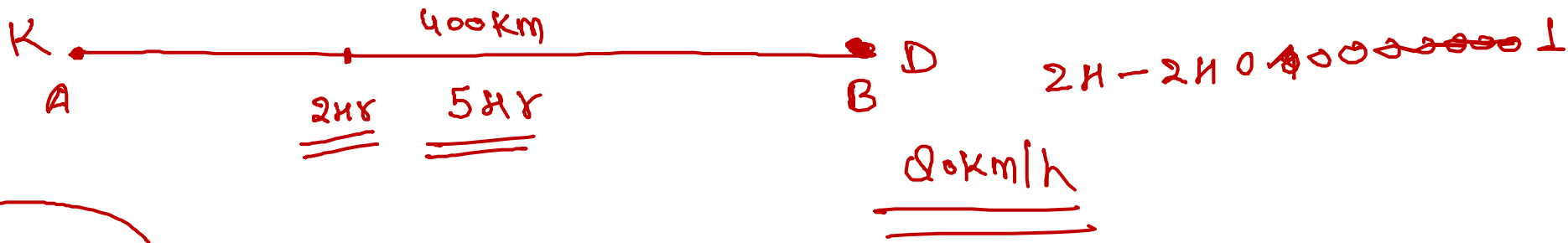
- Instantaneous Speed

- Speed at a given instant. (Time is very very small)

- Instantaneous Velocity

- Velocity at a given instant. (Time is very very small)

- Instantaneous speed is the magnitude of instantaneous velocity.



① $2H \text{ --- } 2H \text{ } \underline{10 \text{ min}}$

→ $\frac{\cancel{200 \text{ m}}}{\cancel{200 \text{ m}}} \rightarrow \underline{2 \text{ km}}$

→ $\frac{2 \text{ km}}{10 \text{ min}} = \underline{0.2 \text{ km/min}}$

①

② $2H \text{ --- } \underline{2H 5 \text{ min}}$

$\underline{500 \text{ m}}$

→ $\frac{500}{5 \text{ min}} = \underline{100 \text{ m/min}}$

②

③ $2H \text{ --- } \underline{2H 1 \text{ sec}}$

$\underline{50 \text{ m}}$

$\underline{50 \text{ m/s}}$

④

$A_v \rightarrow I_{nst}$

समय ↓ दूरी ↓

~~Δt~~

$$\Delta v = \frac{\Delta x}{\Delta t}$$

$$\Delta v = \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t}$$

$v = \frac{dx}{dt}$ → Speed ^{dist}

$\vec{v} = \frac{d\vec{s}}{dt}$ → DISP.



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