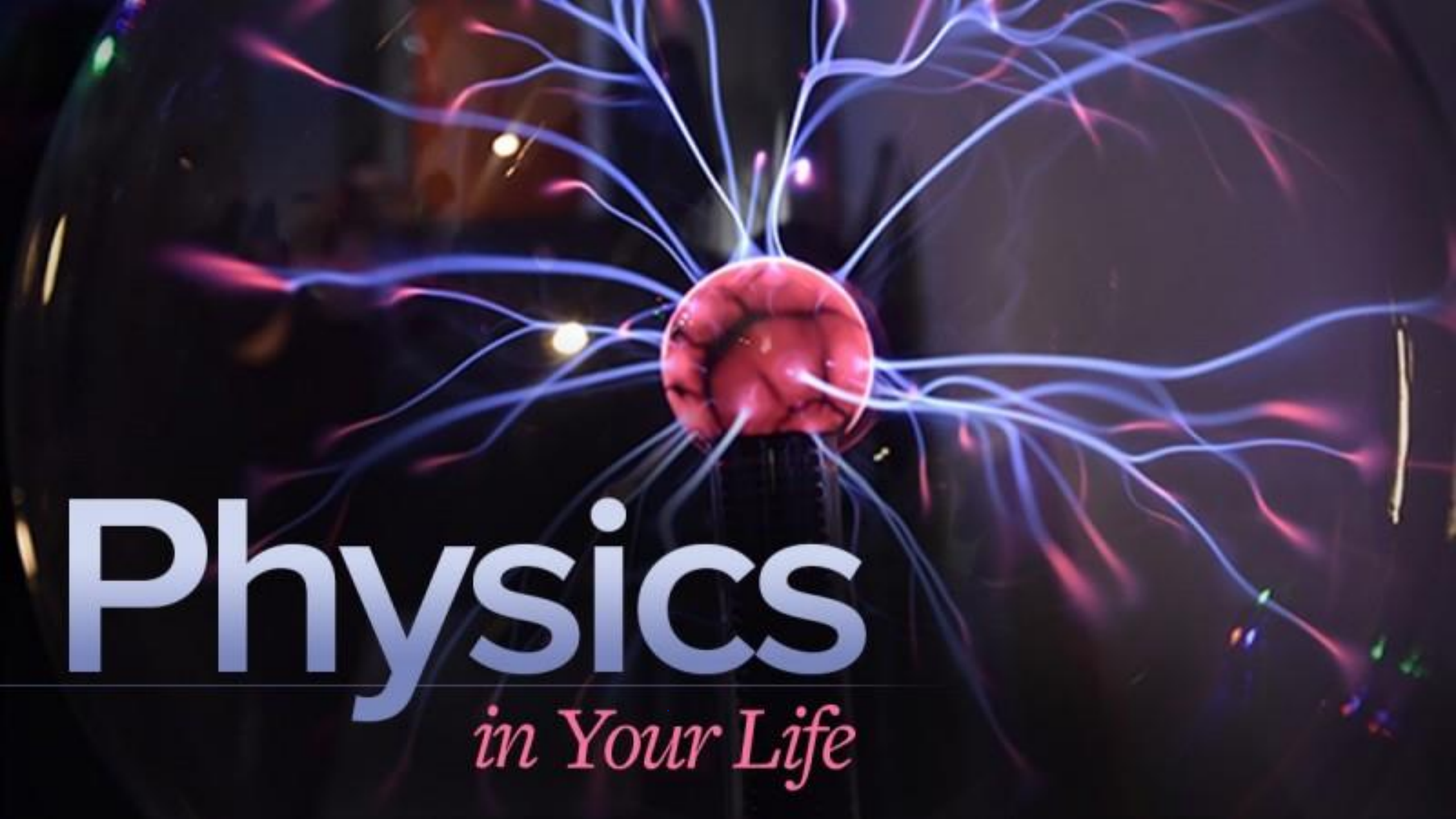




SAFALTA CLASSTM

An Initiative by **अमरउजाला**



Physics

in Your Life

CLASS - 1

MECHANICS

Fundamental and Derived Quantities (मौलिक और व्युत्पन्न मात्राएँ)

- The quantities that are independent of other quantities are called **fundamental quantities**.

अन्य राशियों से स्वतंत्र होने वाली राशियों को मौलिक राशियाँ कहा जाता है।

- The units that are used to measure these fundamental quantities are called **fundamental units**.
- इन मूलभूत मात्राओं को मापने के लिए जिन इकाइयों का उपयोग किया जाता है, उन्हें मूलभूत इकाइयाँ कहा जाता है

- There are four systems of units namely C.G.S, M.K.S, F.P.S, and SI.

C.G.S, M.K.S, F.P.S, और SI जैसी इकाइयों की चार प्रणालियाँ हैं।

- The quantities that are derived using the fundamental quantities are called **derived quantities**.

मौलिक मात्राओं का उपयोग करके जो मात्राएँ प्राप्त की जाती हैं, उन्हें व्युत्पन्न मात्राएँ कहा जाता है।

- The units that are used to measure these derived quantities are called **derived units**.

इन व्युत्पन्न मात्राओं को मापने के लिए उपयोग की जाने वाली इकाइयों को व्युत्पन्न इकाइयाँ कहा जाता है।

Fundamental Quantity	System of units		
	<u>C.G.S.</u>	^{Imp.} <u>M.K.S. (SI)</u>	<u>F.P.S.</u>
✓ Length →	<u>centimeter</u>	<u>Meter</u>	<u>foot</u>
Mass	<u>gram</u>	<u>Kilogram</u>	<u>pound</u>
Time	<u>second</u>	<u>Second</u>	<u>second</u>

7 FUNDAMENTAL UNITS

(S I)

Physical quantity	Unit	Symbol
✓ Length	Meter ✓	m
Mass ✓	kilogram ✓	kg
Time ✓	second ✓	s
Electric current ✓	ampere ✓	A
<u>Temp.</u> Thermodynamic temperature ✓	<u>kelvin</u>	K
Intensity of light ✓	candela ✓	cd
Quantity of substance ✓	mole ✓	mol

Supplementary Quantities: ✓✓

Plane angle ✓	radian ✓	rad
Solid angle ✓✓	<u>steradian</u>	sr

DERIVED UNITS: ✓✓

(चयनित मात्रा)

$$\text{Area} = l \times b = \underline{m} \times \underline{m} = \underline{\underline{m^2}}$$

MACRO Prefixes

metex

Kilo (K) 10^3 ✓

Mega (M) 10^6 ✓

Giga (G) 10^9 ✓

Tera (T) 10^{12}

Peta (P) 10^{15}

Exa (E) 10^{18}

Zetta (Z) 10^{21}

Yotta (y) 10^{24}

kg

MICRO Prefixes

Milli (m) 10^{-3} ✓

(μ) 10^{-6} ✓ (micro)

✓ nano (n) 10^{-9}

✓ pico (p) 10^{-12}

✓ femto (f) 10^{-15} (fermi)

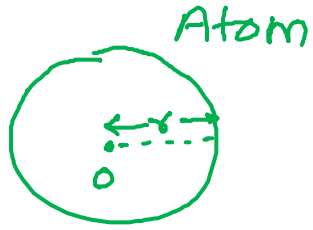
atto (a) 10^{-18}

zepto (z) 10^{-21}

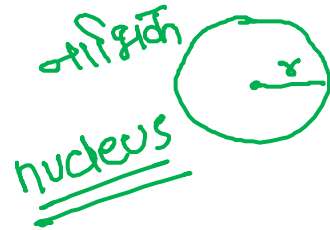
yocto (y) 10^{-24}

* SI → meters

(small units of length)



$$\begin{aligned} \text{radius} &= 10^{-12} \text{ m} \\ &= 1 \text{ pm} \end{aligned}$$



$$\begin{aligned} \text{radius} &= 1 \text{ fermi} \\ &= 10^{-15} \text{ m} \end{aligned}$$

nm (nanometers \AA) ⇒ Wave length
⇒ Light

$$1 \text{ \AA} = 10^{-10} \text{ m}$$

$$1 \text{ nm} = 10^{-9} \text{ m}$$



* Length:- large units → ① Ast. unit (खगोलीय दूरी);



$$\underline{1 \text{ AU}} = \underline{1.496 \times 10^{11} \text{ m}} \checkmark$$

mtr
② Light year:- (प्रकाश वर्ष): $1 \text{ LY} = \underline{9.46 \times 10^{15} \text{ m}}$

③ Parsec:- largest unit of length, $1 \text{ P} = \underline{3.08 \times 10^{16} \text{ m}}$

⇓

④ Parallex Second:-

$$\underline{1 \text{ P} = 3.26 \text{ LY}}$$

* Mass:-



ICSL (1 च-दशैखर सीमा):

$$\underline{\underline{ICSL}} = 1.5 \times \text{mass of the Sun}$$

$ICSL < \text{mass of the star} \Rightarrow \text{Black Hole}$

$ICSL \geq \text{" " " " } \Rightarrow \text{White Dwarf}$

DIMENSION FORMULA

[]

→
→
→
→
→

Fundamental quantity	Dimension
Length ✓	L ✓
Mass ✓	M ✓
Time ✓	T ✓
Temperature ✓	K ✓, θ
Electric current ✓	A ✓
Luminous intensity ✓	cd ✓
Amount of substance ✓	mol ✓

[L ✓
M ✓
T ✓
K ✓, θ
A ✓
cd ✓
mol ✓]^x

$$\# \text{ Area} \Rightarrow \text{m}^2 = [L][L] = [L^2]$$

$$\# \text{ Volume} \Rightarrow \text{m}^3 = [L^3]$$

$$\# \text{ Density} \Rightarrow \frac{M}{V} = \frac{[M]}{[L^3]} \\ = \underline{\underline{[ML^{-3}]}}$$

Work, G , g , ϵ_0 , μ_0

$$\# \text{ Acceleration} = \text{m/s}^2 = \frac{[L]}{[T]^2} = [LT^{-2}]$$

$$\text{Force} = \text{kg} \cdot \text{m/s}^2 = \frac{[M][L]}{[T]^2} = \underline{\underline{[MLT^{-2}]}}$$

* Work (कार्य):- $W = F \cdot d = [MLT^{-2}][L]$
 $= [ML^2T^{-2}]$

$Work = Energy = [ML^2T^{-2}]$

$\Rightarrow T = F \cdot d$
(Torque \rightarrow बल आघूर्ण)
 $T = W = E$

* G DT Dimension formula:-

$$F = G \frac{m_1 m_2}{r^2}$$

$$G = \frac{F \cdot r^2}{\underline{m_1} \underline{m_2}} = \frac{[M L T^{-2}] [L^2]}{[M][M]}$$

$$\underline{\underline{G}} = \underline{\underline{[M^{-1} L^3 T^{-2}]}}$$

* $g \rightarrow D.M. \Rightarrow \underline{\underline{[L T^{-2}]}}$

* ϵ_0

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

$$\epsilon_0 = \frac{q_1 q_2}{F \cdot r^2}$$

$$= \frac{[AT] [AT]}{[MLT^{-2}] [L^2]}$$

$$= \underline{\underline{[M^{-1}L^{-3}T^4A^2]}}$$

$$q = it$$

$$= [A][T]$$

$$q = [AT]$$

*
|

* $\mu_0 \Rightarrow$ H.W.

KINEMATICS

Distance

Effect of motion

Displacement

Speed

Velocity

Acceleration

(गति की)

Scalar Quantity

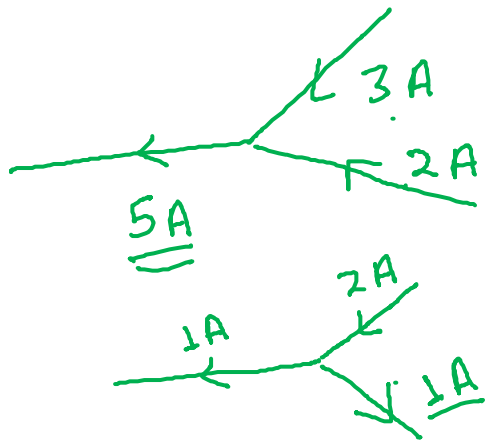
Scalar quantity is defined as the physical quantity with magnitude and no direction.

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 (vector Addition Law follow)

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,

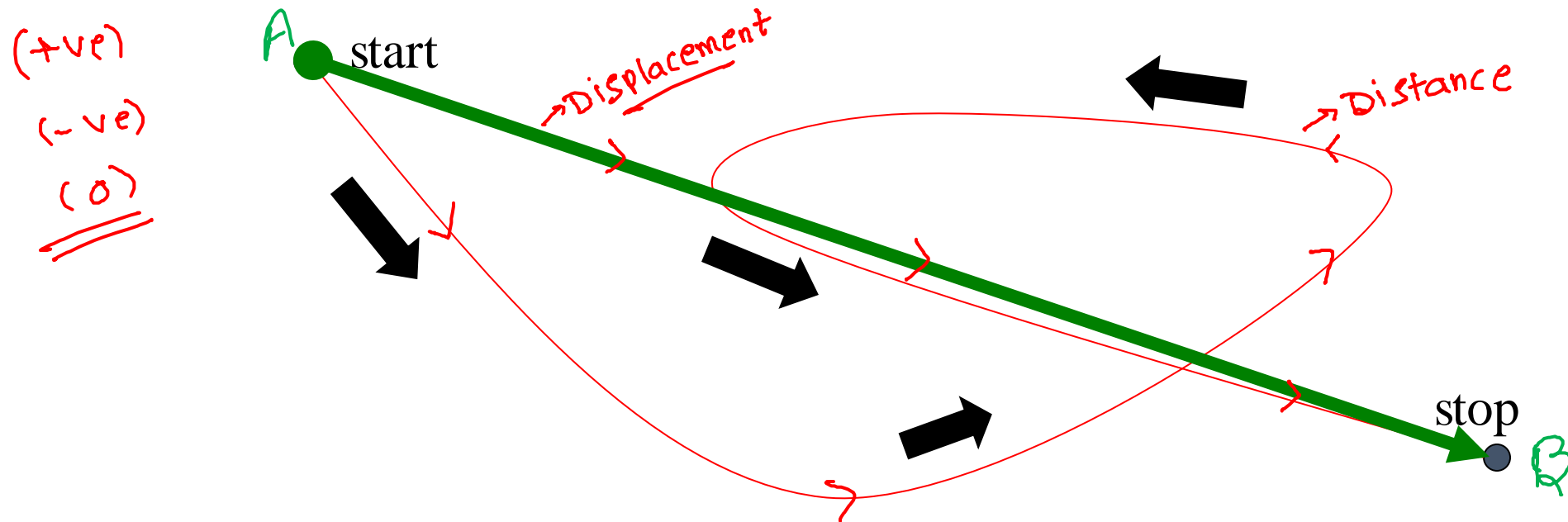
उन्हें सदिश राशि कहते हैं:

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

जैसे- वेग, विस्थापन, बल, त्वरण आदि.

Distance vs. Displacement

- 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।

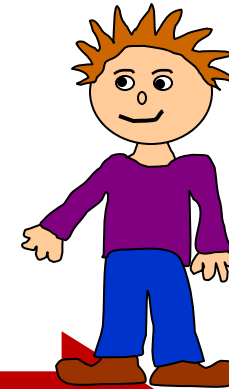
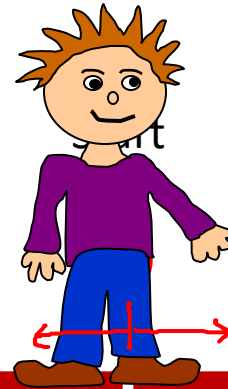
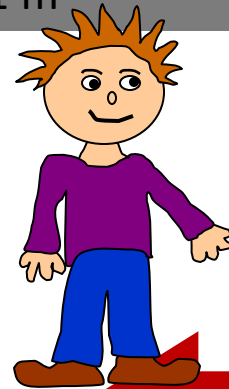


Let's Practice!

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

-1 meter 1 meter

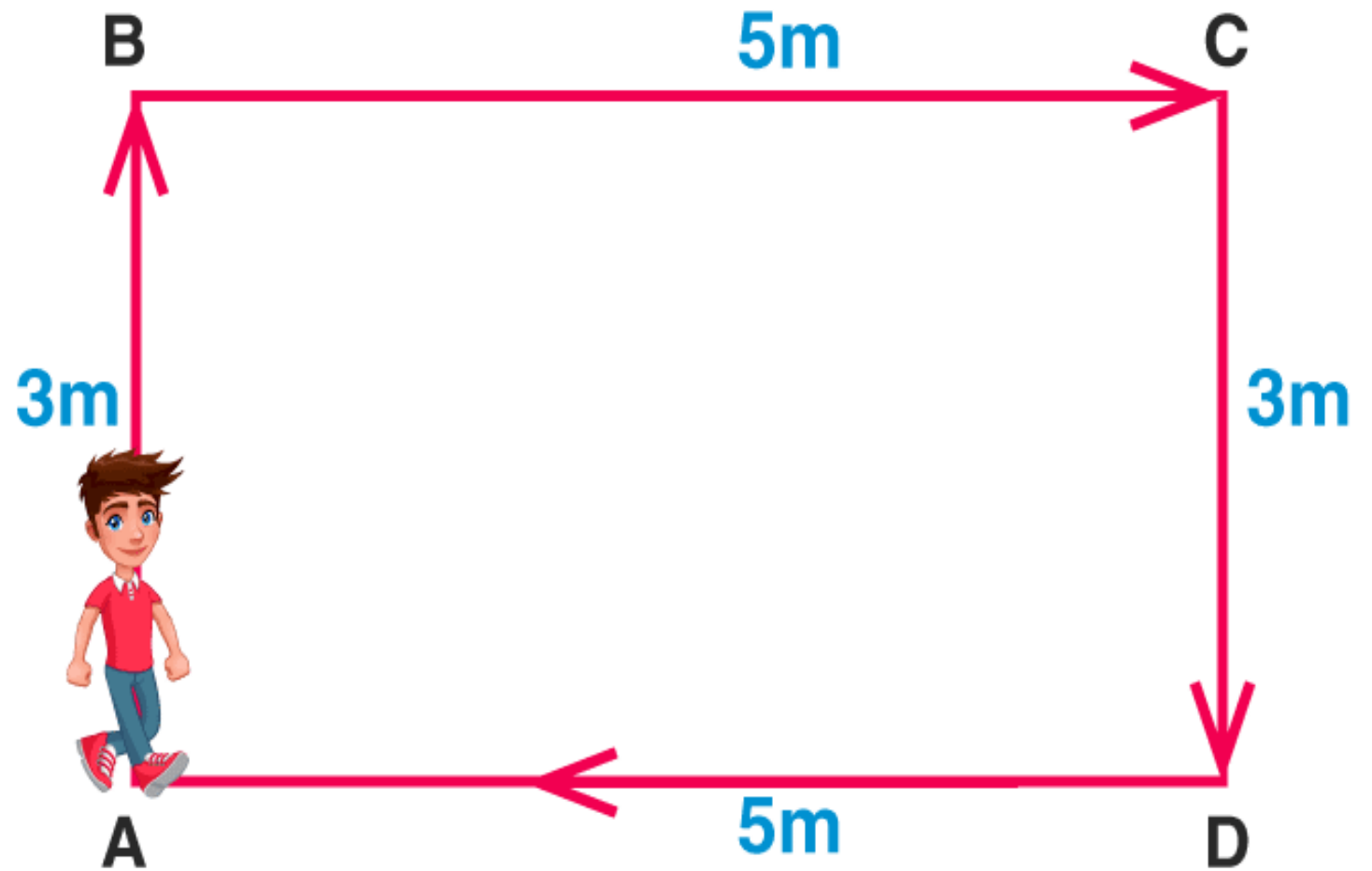
Dis Distance = 4 m
Dis Displacement = 0 m

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

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।

$$(+ve) \text{ Speed} = \frac{\text{Distance (scalar)}}{\text{Time}} = \underline{\underline{m/s}}$$

- Vector quantity. यह एक सदिश राशि है। $(+ve) \text{ Velocity} = \frac{\text{Displacement (vector)}}{\text{Time}}$
 $(-ve)$

- 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।

* Linear motion (रखीम गति)

(fix Direction) →

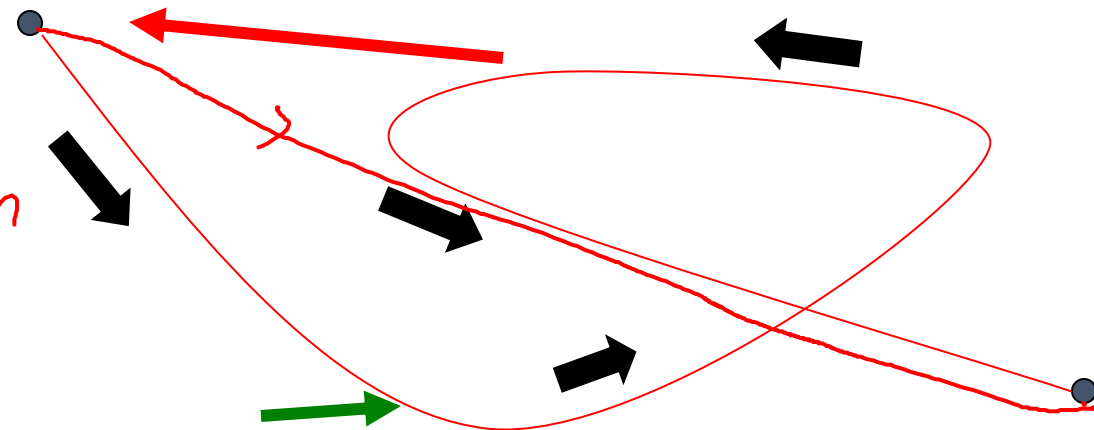
Dist = DISP

Speed = vel.

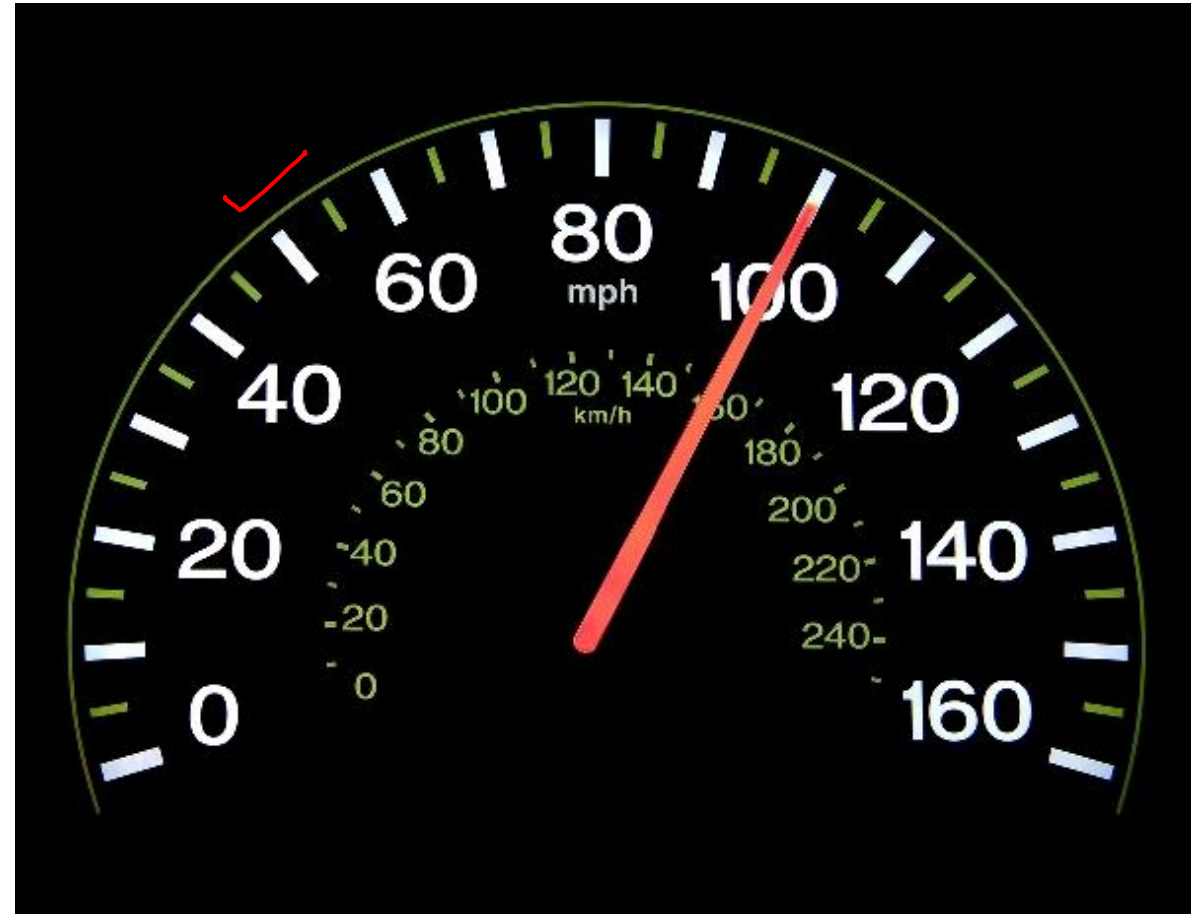
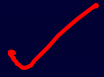
- चाल = दूरी / समय

$$\vec{v} = |\vec{v}| \cdot \hat{v}$$

velocity = Speed × Direction



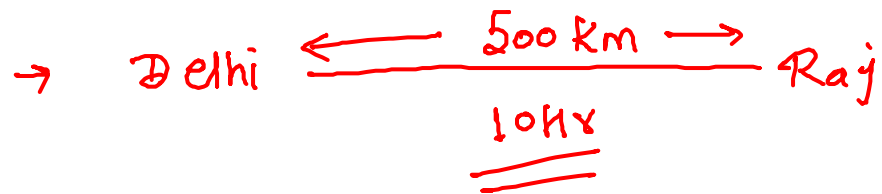
VELOCITY: 500 MILES PER HOUR WEST



* Average Speed / velocity:-

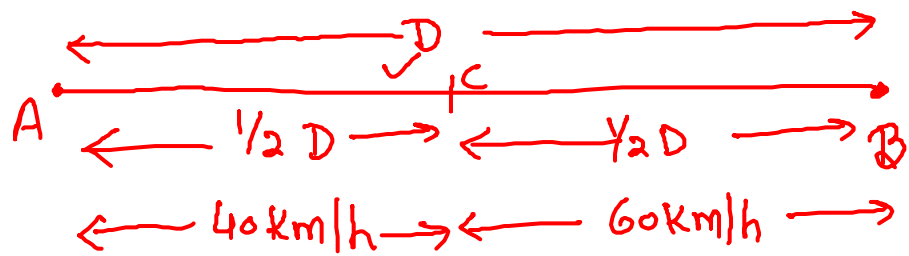
$$\text{Av. Speed} = \frac{\text{Total Distance}}{\text{Total time}}$$

$$\text{Av. Velocity} = \frac{\text{Total Displacement}}{\text{Total time}}$$



$$\text{Av. Speed} = 50 \text{ km/hr}$$

*



Avg Speed = ?

⇒

Total Dist = D

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

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

$$T = t_1 + t_2 = \frac{D}{80} + \frac{D}{120} = \frac{3D+2D}{240} = \frac{5D}{240}$$

$$\text{Av. Sp} = \frac{D}{\frac{5D}{240}} = \frac{240}{5}$$

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

$$= \frac{2v_1 v_2}{v_1 + v_2}$$

$$= \frac{2 \times 40 \times 60}{100} = \underline{\underline{48}}$$

* Distance \rightarrow equal parts में Divide \rightarrow

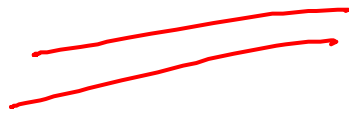
$$\Rightarrow \text{Av. Speed} = \frac{2v_1v_2}{v_1+v_2} \quad (\underline{2 \text{ equal parts}})$$

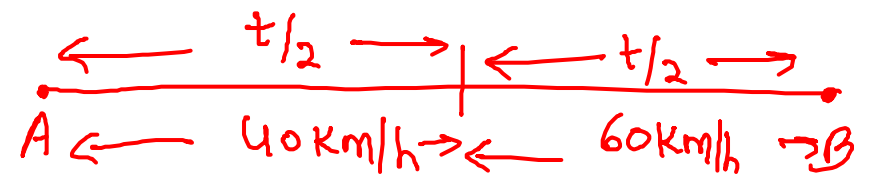
$$\Rightarrow \text{" " " " } = \frac{3v_1v_2v_3}{v_1v_2 + v_2v_3 + v_3v_1} \quad (3 \text{ equal parts})$$

* Time \Rightarrow equal parts:-

$$(2 \text{ equal parts}) \Rightarrow \text{Av. Speed} = \frac{v_1+v_2}{2}$$

$$(3 \text{ " " "}) \Rightarrow \text{" " " } = \frac{3(v_1+v_2+v_3)}{3}$$





$$\text{Av. S.} = \frac{v_1 + v_2}{2} = \underline{\underline{50}}$$



www.Youtube.com/safaltaclass



www.Facebook.com/safaltaclass



www.Instagram.com/safaltaclass



Google Play
Store



SAFALTACLASS