* Unit of Temperature :-

(*) Relation between Celsius, Fahrenheit and Kelvin.

(*) $°C = \frac{(°F - 32)}{1.8}$

(*) Celsius to Kelvin

$$K = °C + 273$$

Ex:-

10°c

$K = 10 + 273$

$= 283\,K$

(*) Fahrenheit to celsius

$\frac{5}{9} \times (°F - 32)$

(*) Ex:-

50°F

$\frac{5}{9} \times (°F - 32)$

$= \frac{5}{9} \times (50 - 32)$

$= \frac{5}{9} \times 18^2$

$= 10°C$ Ans

(*) Units of Force :-

S.I unit of force (F) $= (1kg) \cdot (m/s^2)$

$= Kg\ m s^{-2}$

↳ newton (N)

CGS unit

dyne

$1N = 10^5 dyne$

$1 dyne = 10^{-5} N$

* Unit of Density (घनत्व)

$$\text{Density}(\rho) = \frac{\text{mass}}{\text{Volume}}$$

$$\rho = \frac{m}{V} \quad \frac{kg}{m^3} = kg\,m^{-3}$$

↳ S.I. unit.

↳ Kilograms per cubic meter.

* gram per milliliter (g/mL)

* gram per cubic centimeter (g/cm^3)

$$1\ g/cm^3 = 1.000\ kg/m^3$$

* Unit of volume (आयतन)

Volume = Length × breadth × height

$m \times m \times m = m^3$ ↳ S.I unit.

* $1\ m^3 = 1000$ litre

* 1 litre $= 0.001\ m^3$

(*) 1 barrel = 158.98 litre

≈ 159 litre

(*) 1 gallon(US) = 3.78 litre

(*) Unit of Energy (SI)

S.I unit of Energy :- Joule.

1 Joule = 10^7 erg

1 erg = 10^{-7} Joule

1 Joule = 4.187 calorie

1 KWh = 3.6×10^6 J

* Unit of Power (शक्ति)

Power = $\frac{\text{Work}}{\text{time}} = \frac{J}{s}$

1 J/s = 1 Watt = 1 kg-m^2/s^3

1 HP = 746 Watts | 1 KW = 1×10^3 W
(Kilowatts)

* Unit of Work

W = Force x displacement

Nm = Joule (S.I unit)

CGS unit → dyne-cm (ergs)

1 Nm = 1 Joule (J)

(newton metre)

* Unit of Torque :-

Torque (τ) = Force x ⊥r. distance

(आघूर्ण)

= Nm = kgm^2s^{-2}

* Unit of Momentum :-

Momentum (P) = Mass (m) x velocity (v)

(संवेग) P = mv

= kgms^{-1}

* Unit of viscosity :-
(श्यानता)

$$F_v = \eta A \frac{du}{dy}$$

Coefficient of viscosity

$$\eta = \frac{F_v dy}{A\, dv}$$

$$= \frac{N\, m}{m^2\, m/s}$$

$$= \frac{N\, m}{m^2 \cdot m s^{-1}}$$

$$= \frac{N\, s}{m^2}$$

= Pascal-second (Pa-s) (S.I unit)

CGS → $\frac{\text{dyne-sec}}{cm^2}$ (Poise)

* Unit of frequency (ν) (आवृत्ति)

frequency → Hertz (Hz) (1/s)

1 KHz = 1×10^3 Hz

(1 Kilo Hertz)

* Surface Tension (पृष्ठ तनाव) :

Surface Tension (T) : $\frac{\text{force}}{\text{Length}}$

$$\frac{N}{m} = N\,m^{-1}$$

CGS → dyne per centimetre

dyne cm^{-1}

* Unit of Pressure (दाब) :-

Pressure = $\frac{\text{force}}{\text{Area}}$

$$\frac{N}{m^2} = \text{Pascal}$$

$1\,Pa = 1\,N \cdot m^{-2}$

$1\,atm = 101325\,Pa = 760\,torr \simeq 760\,mm\,Hg$

$1\,bar = 10^5\,N/m^2$

$1\,atm = 1.01325 \times 10^5\,Pa = 1.013 \times 10^5\,Pa$

* Electric charge (आवेश) = Time × current

(S A) (Coulomb) (C)

(A S)

* Electrical Potential = $\frac{\text{Work}}{\text{Charge}}$

$= \frac{J}{C}$ (volt)

* Resistance (प्रतिरोध) = $\frac{\text{Potential difference}}{\text{current}}$

$V = IR$

$\boxed{R = \frac{V}{I}}$ Unit: ohm (Ω)

* Conductance (विद्युत चालकता) (G)

$G = \frac{1}{R}$

Unit: $\frac{1}{\Omega} = \Omega^{-1}$ (mho)

(siemen)

* **Resitivity (ρ)**
(प्रतिरोधकता)

$R \propto l$

$R \propto \frac{1}{A}$

$$\boxed{R = \frac{\rho l}{A}}$$

$RA = \rho l$

$$\boxed{\rho = \frac{RA}{l}}$$

↑ Resitivity

$\frac{\Omega m^2}{m} = \Omega m$

* **Conductivity (σ)**

प्रवाहकत्व

$$\boxed{\sigma = \frac{1}{\rho}}$$

$\frac{1}{\Omega m} = \Omega^{-1} m^{-1}$

↑

$mho\ m^{-1}$

Siemen m^{-1}

✳ Electric field
(विद्युत क्षेत्र)

$$E = \frac{f}{q} \quad N/C = N C^{-1}$$

$$E = -\frac{dv}{dr}$$

$$\frac{Volt}{m} = \frac{V}{m}$$

✳ Magnetic field (B) :-
(चुंबकीय क्षेत्र)

$$B = \frac{F}{qv\sin\theta}$$

charge = current × time

$$q = I \times t$$

$$I = \frac{q}{t} = C/s$$

= Ampere

$$\frac{N}{C\frac{m}{s}} = \frac{N}{(\frac{C}{s})m} = \frac{N}{Am}$$

$$= N A^{-1} m^{-1} \text{ (Tesla) (T)}$$

CGS → gauss (G)

1 (Tesla) = 10000 G (gauss).

Tesla = $\frac{weber}{m^2}$

* Magnetic flux :-

(चुंबकीय प्रवाह)

Magnetic flux (ϕ) = $BA\cos\theta$

$B \rightarrow$ Magnetic field

$A \rightarrow$ area

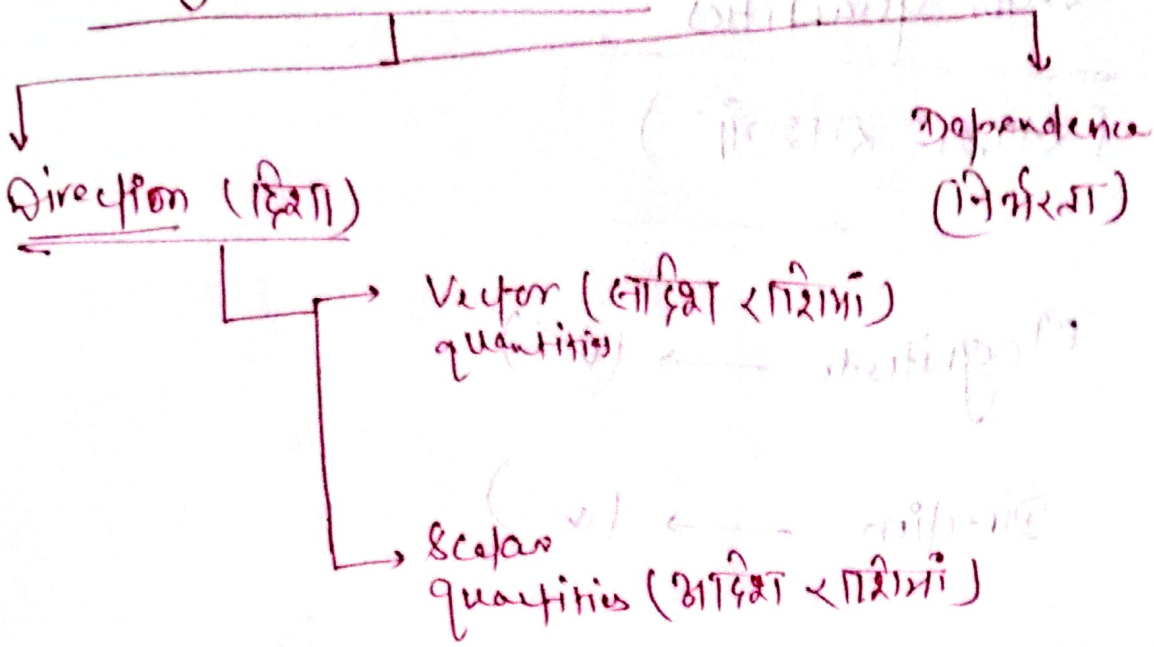
B = Tesla = $\frac{\text{Weber}}{m^2}$

$\phi = BA$

= $\frac{\text{Weber}}{m^2} \times m^2$

= Weber

✱ Physical quantities



✱ Scalar quantities

Magnitude – (✓)

Direction — (✗)

Ex :-

Mass, Time, Temperature, Area (क्षेत्रफल), Distance (दूरी)
Volume (आयतन), Speed (चाल),
Density (घनत्व), Work (कार्य), Power (शक्ति),
Energy (ऊर्जा), Electric current (विद्युत धारा),
Pressure (दाब), Electric Potential (विद्युत विभव),
charge (आवेश) etc.

⊛ Vector quantities

(सदिश राशियाँ)

Magnitude ⟶ (✓)

Direction ⟶ (✓)

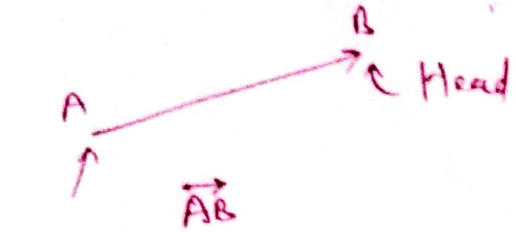
Ex:-

Displacement (विस्थापन), Velocity (वेग),
Acceleration (त्वरण), Force (बल),
Momentum (संवेग), Weight (भार),
Impulse (आवेग), ~~Electrifield~~
Electric field (विद्युत क्षेत्र), Torque (बल-आघूर्ण),
Angular velocity (कोणीय वेग),
Angular Momentum (कोणीय संवेग),
Magnetic field (चुम्बकीय क्षेत्र) etc.

(*) Vector :-

(*) Representation of a vector :-

(सदिश का निरूपण)



Tail

Direction → Tail to Head

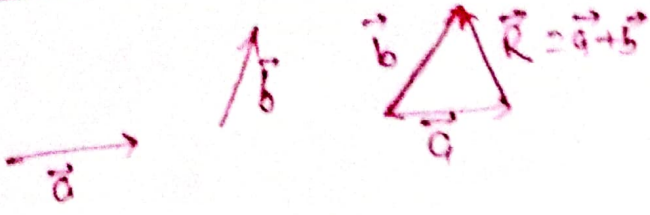
$\vec{a}$ → vector a

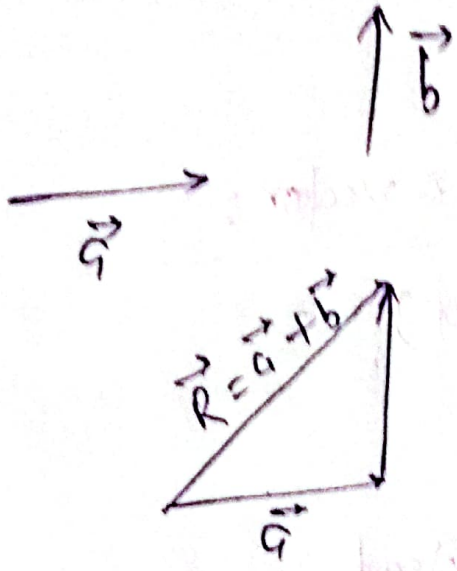
$|\vec{a}|$ → Magnitude of vector a

(परिमाण)

(*) Addition of vector :-

(*) Law of triangle (त्रिभुज के नियम)

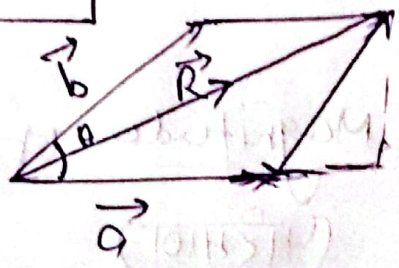




* Law of Parallelogram (समांतर चतुर्भुज का नियम)

$$R = \sqrt{a^2 + b^2 + 2ab\cos\theta}$$

($\theta \rightarrow \vec{a}$ तथा $\vec{b}$ के बीच का कोण)



Resultant → ~~परिणाम~~ परिणाम

(परिणाम)

$$-1 \leq \cos\theta \leq 1$$

(*) If $\theta = 0°$

$$R = \sqrt{a^2 + b^2 + 2ab\cos\theta}$$

$$= \sqrt{a^2 + b^2 + 2ab\cos(0)}$$

$$= \sqrt{a^2 + b^2 + 2ab}$$

$$= \sqrt{(a+b)^2}$$

$$\boxed{R = a + b}$$

(*) If $\theta = 90°$

$$R = \sqrt{a^2 + b^2 + 2ab\cos(90°)}$$

$$R = \sqrt{a^2 + b^2}$$

$$\boxed{R = \sqrt{a^2 + b^2}}$$

(*) If $\theta = 180°$

$$R = \sqrt{a^2 + b^2 + 2ab\cos(180°)}$$

$$R = \sqrt{a^2 + b^2 + 2ab(-1)}$$

$$R = \sqrt{a^2 + b^2 - 2ab}$$

$$R = \sqrt{(a-b)^2} = a - b$$

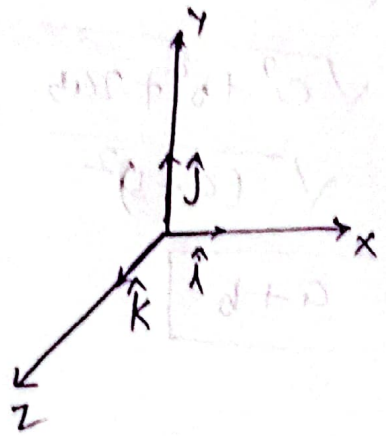
$$\boxed{R = a - b}$$

✱ Unit Vector :-

(एकांकसदिश)

$$\hat{a} = \frac{\vec{a}}{|\vec{a}|}$$

$$\vec{a} = \hat{a}|\vec{a}|$$



$\vec{a} = 3\hat{i} + 8\hat{j} + 5\hat{k}$

x - direction $\longrightarrow \hat{i}$

y - " $\longrightarrow \hat{j}$

z - " $\longrightarrow \hat{k}$

$$|\vec{a}| = \sqrt{(3)^2+(8)^2+(5)^2}$$

$$= \sqrt{9+64+25}$$

$$= \sqrt{98}$$ Ans

$\vec{a} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$

$\vec{b} = b_x\hat{i} + b_y\hat{j} + b_z\hat{k}$

$$\vec{a}+\vec{b} = (a_x+b_x)\hat{i} + (a_y+b_y)\hat{j} + (a_z+b_z)\hat{k}$$

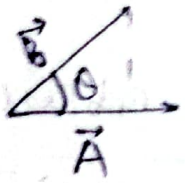
✳ Multiplication of Vector (सदिश का गुणनफल)

✳ Dot Product (or) Scalar Product :-

$\vec{a} \cdot \vec{b} = c$ ← Scalar
Vector Vector

(Same dir^n):

$$\boxed{\vec{A} \cdot \vec{B} = AB\cos\theta}$$



Ex:-

Work done = Force . disp.

$W = \vec{F} \cdot \vec{S}$

✳ Scalar Product of unit vector

$\hat{i} \cdot \hat{i} = 1 \cdot 1 \cos(0^\circ) = 1$

$\hat{j} \cdot \hat{j} = 1$

$\hat{k} \cdot \hat{k} = 1$

$\hat{i} \cdot \hat{j} = 1 \cdot 1 \cos(90^\circ)$

$= 1 \cdot 1 \times 0$

$= 0$

$\hat{j} \cdot \hat{k} = 0$

$\hat{i} \cdot \hat{k} = 0$

$$\vec{a} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$$

$$\vec{b} = b_x\hat{i} + b_y\hat{j} + b_z\hat{k}$$

$$\vec{a}\cdot\vec{b} = a_xb_x + a_yb_y + a_zb_z$$

$$\vec{a}\cdot\vec{b} = ab\cos\theta$$

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|}$$

* Cross Product (or) Vector Product :-

$\vec{a} \times \vec{b} = \vec{c}$

↑ Vector ↑ Vector ↑ Vector

$\vec{a} \times \vec{b} = ab\sin\theta\, \hat{n}$

$|\vec{a} \times \vec{b}| = ab\sin\theta$

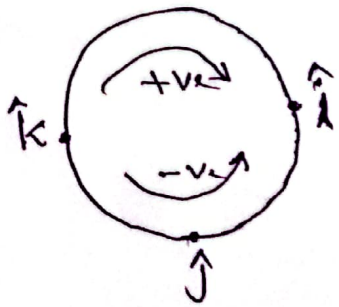
$$\sin\theta = \frac{|\vec{a} \times \vec{b}|}{ab}$$

* Vector Product of unit vector :-

$\hat{i} \times \hat{i} = 1 \cdot 1 \cdot \sin(0)\, \hat{n} = 0$

$\hat{j} \times \hat{j} = 0$

$\hat{k} \times \hat{k} = 0$



$\hat{i} \times \hat{j} = \hat{k}$

$\hat{j} \times \hat{k} = \hat{i}$

$\hat{k} \times \hat{i} = \hat{j}$

$\hat{j} \times \hat{i} = -\hat{k}$

$\hat{k} \times \hat{j} = -\hat{i}$

$\hat{i} \times \hat{k} = -\hat{j}$