YAKEEN NEET 2.0

2026

Units and Measurements

Physics

Revision 01

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Topics to be covered

1. # Complete Unit and measurment
2. # nu = c a t n
   - ✱ Dimⁿ of RQ
3. # ✱ Principle of Homogenity
   - ✱ Dimⁿ analysis
4. # ↳ applicat / limit
   - Significant sfigit

error
& instrument

Physical quantity

→ Intensity of light
→ Intensity of sound
→ flux
mass

derived

Group of P.Q. Independent of each other are called fundamental

Non physical quantity

You can measure this

Ex - Love,
Bad face
Hate
(Inertia)

(Light)
Sound

PHYSICAL QUANTITY

Fundamental

Group of physical quantity independent upon each other.

↳ length, time, mass

Derived

* Physical quantity which can be express in terms of base or fundamental quantity

Ex - Velocity = $\frac{\text{(length)}}{\text{time}}$

Supplementary

Angle and solid angle

↳ rad

↳ sr rad

Have unit but does not dimen

$R\theta$ = dist^n

(mod × rad) → metre

$$\text{velocity} = \frac{l}{t}$$

$$acc = \frac{v}{t} = \frac{l}{t \times t} = \underline{\underline{LT^{-2}}}$$

PHYSICAL QUANTITY

Powers of fundament PQ.

	Physical quantity	Unit, SI	C.G.S.	Dimension
1.	Mass	Kg	grm	$M^1L^0T^0$
2.	Length	Meter	cm	$L^1M^0T^0$
3.	Time	Sec	sec	$T^1M^0L^0$
4.	Temperature	Kelvin	Kelvin	K^1 or θ^1
5.	Current	Ampere	Biot	A^1
6	Amount of substance	Mole	mole	mol^1
7	Luminous Intensity	Candela	candela	Cd^1

QUESTION

Unit of distance is :

1. Fermimetre $= 10^{-15}$ m
2. Angstrom $= 10^{-10}$ m
3. Parsec
4. Light year
5. All of these

Ans → (5)

Unit of distance

→ S.I → metre
C.G.S → cm
F.P.S → foot

1 AU | light year | Parsec
(↳ unit of dist^{n})

Pashaka → unit of hr, min

Chandrashekhar Limit ⟶ Unit of mass

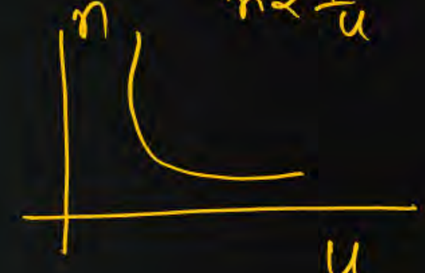
Measurement and Physical Quantity

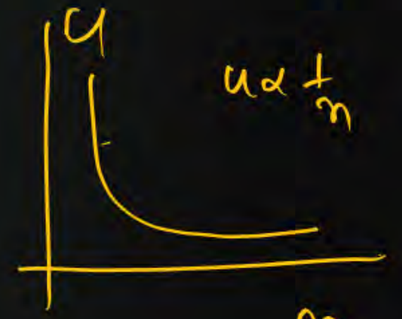
$\Rightarrow n_1 u_1 = n_2 u_2$

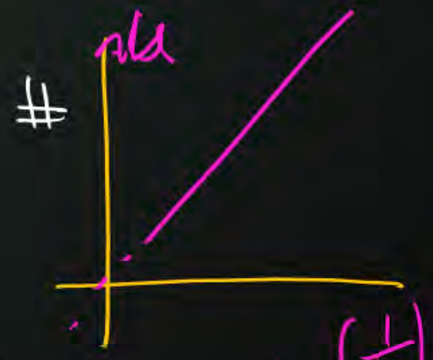
Magnitude, unit

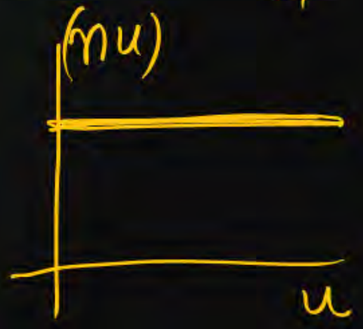
$nu = \text{Constant}$

$n \propto \frac{1}{u}$









← 1m →

$m = 10\,kg = 10^4\,gm$

$\text{Length} = 5\,m = 500\,cm$

(magnitude, unit; magnitude, unit)

$\text{Time} = 10\,sec = 10 \times 1\,sec$

$= 10\left(\frac{1\,min}{60}\right)$

$= \frac{1}{6}\,min$

$1\,min = 60\,sec$

$1\,sec = \frac{1\,min}{60}$

Value of $\boxed{5\ m^3\ \text{Volume}}$ in C.G.S unit ??

Soln $nu = \text{Const}$ for Volume

$n_1 u_1 = n_2 u_2$ ← (S.I, C.G.S)

$5\ m^3 = n_2 \boxed{cm^3}$

$5m^3 = n_2 (10^{-2} m)^3$

$5\cancel{m^3} = n_2 (10^{-6} \cancel{m^3})$

$n_2 = \frac{5}{10^{-6}} = \boxed{5 \times 10^6}$

$(1\ m^3 = (10^{-2} m)^3$

QUESTION

If unit of length becomes double then value of area $5m^2$ in new unit will be :-

In new system

For Area

$$n_1u_1 = n_2u_2$$

$$5m^2 = n_2(m')^2$$

$$5m^2 = n_2(2m)^2$$

$$5m^2 = n_2\,4m^2$$

$$n_2 = \left(\frac{5}{4}\right)$$

QUESTION

Convert 1 Newton into Dyne. ($\frac{gm\,cm}{s^2}$)

S.I → Force; C.G.S → Dyne

$n_1u_1 = n_2u_2$ (for force)

$1\ \frac{kgm}{s^2} = n_2\ \frac{gm-cm}{s^2}$

$10^3\ gm \times 10^2\ cm = n_2\ gm\ cm$

$n_2 = 10^5$

1/1/W

Conver 10J energy into C.G.S unit

$n_1u_1 = n_2u_2$ (S.I, C.G.S)

$10\ \frac{kgm^2}{s^2} = n_2\ \frac{gm\ cm^2}{s^2}$

QUESTION

Convert values of 10 Joule in CGS unit?

QUESTION

If unit of mass becomes double, unit of length becomes half and unit of time becomes $\frac{1}{4}$th then find value of 10 N force in new system of unit.

$$n_1 u_1 = n_2 u_2$$

$$10\ N = n_2\ u_2$$

$$10\ \frac{kg\ m}{s^2} = \frac{n_2\ kg'\ m'}{s'^2}$$

$$10\ \frac{kg\ m}{s^2} = n_2\ \frac{2kg \times \frac{1m}{2}}{\left(\frac{1s}{4}\right)^2}$$

$$\frac{10}{1} = \frac{n_2 \times 1}{8}$$

$$n_2 = \frac{10}{16}$$

QUESTION

If unit of mass becomes double, unit of length becomes half and unit of time becomes $\frac{1}{4}$th then find unit of force.

$nu = (a+n)$ ✗ Not applicable

$$\text{Force} = \frac{kg\, m}{s^2}$$

$$= \frac{2kg \times \frac{1m}{2}}{\left(\frac{1}{4}s\right)^2}$$

$$= \frac{kg\, m}{\frac{1}{16}s^2} = 16\,\frac{kg\, m}{s^2}$$

QUESTION

Unit of length in CGS = 10^2 m = 1 cm

If unit of length 10m and unit of mass is 5 kg and unit of time is 2 sec then, find unit of energy in new system.

$n_u = ?$

$$E = \frac{kg\,m^2}{s^2} = \frac{5\,kg \times (10m)^2}{(2s)^2}$$

$$= \frac{5 \times 100}{4} \left(\frac{kg\,m^2}{s^2}\right)$$

$$E = 125\ kg\,m^2/s^2$$

QUESTION

If unit of length 10m and unit of mass is 5 kg and unit of time is 2 sec then, find value of 10 Joule energy is new system of unit.

$n_1u_1 = n_2u_2$ (for energy)

$10\,\frac{kg\,m^2}{s^2} = n_2\left[\frac{kg'\,m'^2}{s'^2}\right]$

$n_2 = \frac{10}{125}$

Which of the following group can be considered as fundamental group of fundamental P.Q.?

(a) ✗ mass, energy, velocity ($K.E = \frac{1}{2}mv^2$)

(b) Momentum, velocity, mass ($P = mv$)

(c) energy, mass, force ✓✓

(d) Mass, acc^n, Force ✗ ($F = ma$)

(e) None of these ✗

Ans (c)

DIMENSIONAL FORMULA

Dimensional formula of a physical quantity(P) is

$$P = [M^x L^y T^z]$$

Mass → M^1

leg = L^1

Time = T^1

Velocity = $\frac{L}{T} = LT^{-1}$

Acc^n → LT^{-2}

Force = $m \times a = MLT^{-2}$

Work = F x dis = ML^2T^{-2}

energy

Power = $\frac{E}{T} = \frac{ML^2T^{-2}}{T} = ML^2T^{-3}$

$W = \Delta K \cdot E$

M^1

L^1

T^1

LT^{-1}

LT^{-2}

$P = mLT^{-3}$

$E = mL^2T^{-2}$

$P = ML^2T^{-3}$

- **Area** $= L^2$
- **Volume** $=$ Area $\times$ ley $= L^3$
- **Velocity** $\rightarrow LT^{-1}$
- **Acceleration** $= LT^{-2}$
- **Force** MLT^{-2}
- **Energy** ML^2T^{-2}
- **Power** ML^2T^{-3}
- **Momentum** MLT^{-1}
- **Impulse** $= \Delta P = MLT^{-1}$

- **Angular displacement** $(\theta) = M^0L^0T^0$

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

- **Angular velocity** $\rightarrow \omega = \frac{\theta}{T} = T^{-1}$ = Frequency

- **Angular acceleration** $\alpha = \frac{\omega}{T} = T^{-2}$

- * **Angular momentum** $L = r \times p = L(MLT^{-1})$ *

$= ML^2T^{-1}$

- **Moment of Inertia**

$I = MR^2 = ML^2T^0$

- **Torque** $\tau = r \times F = L(MLT^{-2})$

$= ML^2T^{-2}$

Same as work/energy

$I = \frac{Q}{t}$

$\text{charge} = It = A^1 T^1$

- **Linear density** $= \frac{m}{\text{volu}} = m^1 L^{-3}$ (mass)
- **Area density** $= \frac{m}{\text{Area}} = \frac{M}{L^2} = ML^{-2}$
- **Volume density** $= \frac{m}{L^3} = ML^{-3}$
- **Area charge density** $= \frac{Q}{L^2} = \frac{AT}{L^2} = A^1 T^1 L^{-2}$
- **Volume density** $= \frac{Q}{\text{Volu}} = A^1 T^1 L^{-3}$ (Charge)

PHYSICAL QUANTITIES HAVING SAME DIMENSIONAL FORMULA

- Distance, displacement, radius, light year, wavelength, radius of gyration, focal length, parsec, astronomical unit [L]
- Speed, velocity, velocity of light, velocity of sound, terminal velocity, avg. velocity, orbital velocity [LT^{-1}]
- Acceleration, avg acceleration, acceleration due to gravity, intensity of gravitational field, centripetal acceleration [LT^{-2}]
- Impulse, change in momentum [MLT^{-1}]
- Force, weight, tension, thrust, gravitational force, spring force, electrostatic force, magnetic force, normal reaction friction [MLT^{-2}]

Ex. **Determine the dimension of temperature gradient**

Step-1

$$\text{temp. gradient} = \frac{\text{Temperature}}{\text{distance}} = \frac{K^1}{L} = K^1 L^{-1}$$

temp. gradient =

length gradi $= \frac{L}{L} = M^0 L^0 T^0 = 1$

velocity gradiant $= \frac{LT^{-1}}{L} = T^{-1}$ (freq)

Q find dimⁿ of Rate of change in force, $\frac{dF}{dt} = \frac{MLT^{-2}}{T}$

$= MLT^{-3}$

DIMENSION LESS PHYSICAL QUANTITY

- **Angle/ Solid angle/ Strain** $= \frac{\Delta l}{l}$

  Poisson's ratio, refractive index $\mu = \frac{c}{v}$

  Trigonometry formula/ exponential functions, relative permittivity, efficiency, ratio, pure no. specific gravity (Relative density)

$\sin\theta = \frac{P}{H}$

e^x

time

$\mu_r = \left(\frac{\mu_m}{\mu_0}\right)$

$\varepsilon_r = \frac{\varepsilon_m}{\varepsilon_0}$

$F = G\frac{m^2}{r^2}$

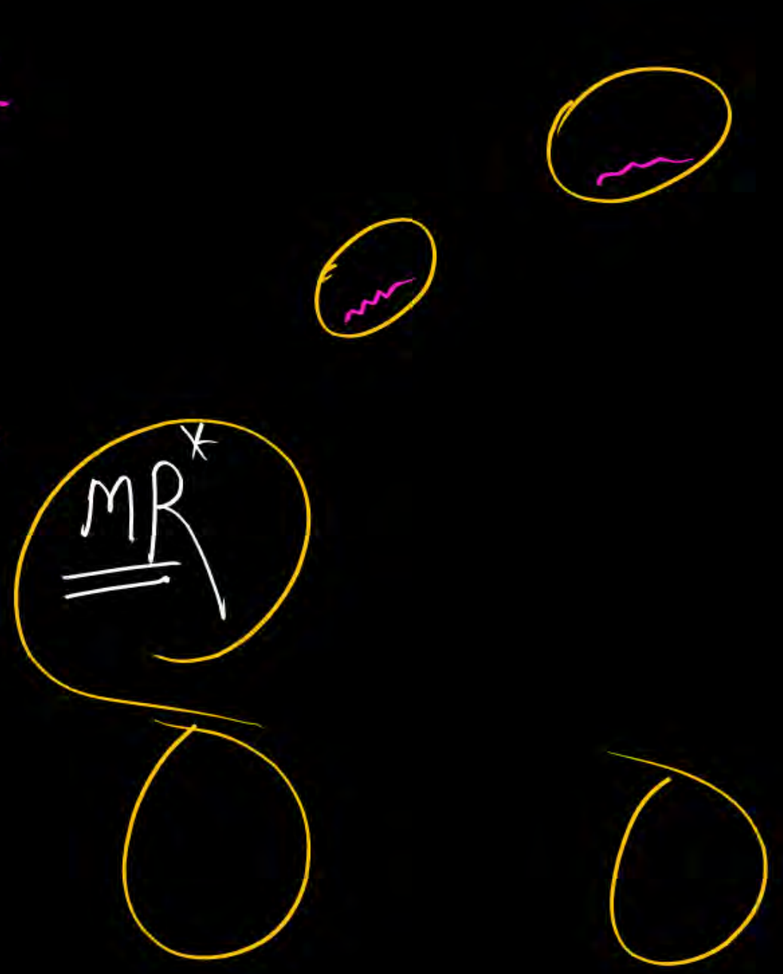
$E = hf$

$H = E = I^2 R t$

$E = \frac{Q^2}{2C}$

$\frac{1}{2} C I^2 = E$

$L = \frac{E}{Ir}$



$E = \frac{3}{2} k_B T$

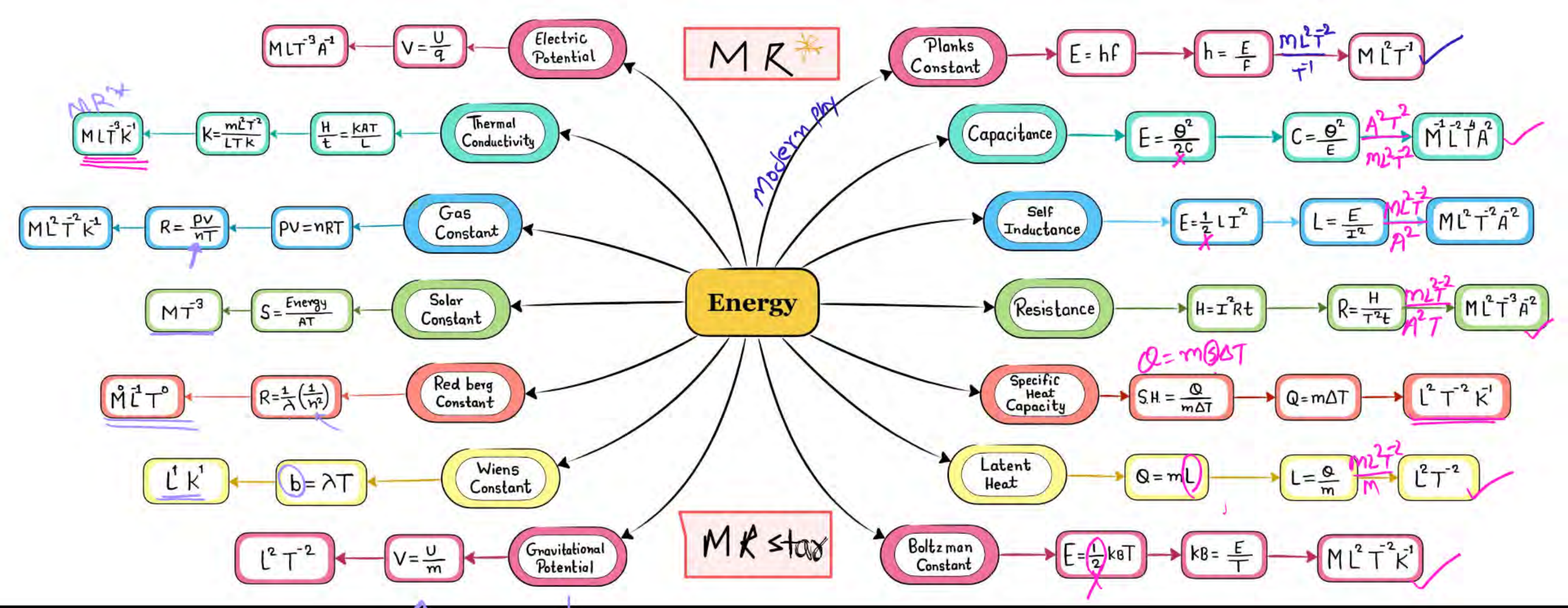
$k_B = \frac{E}{T e m}$

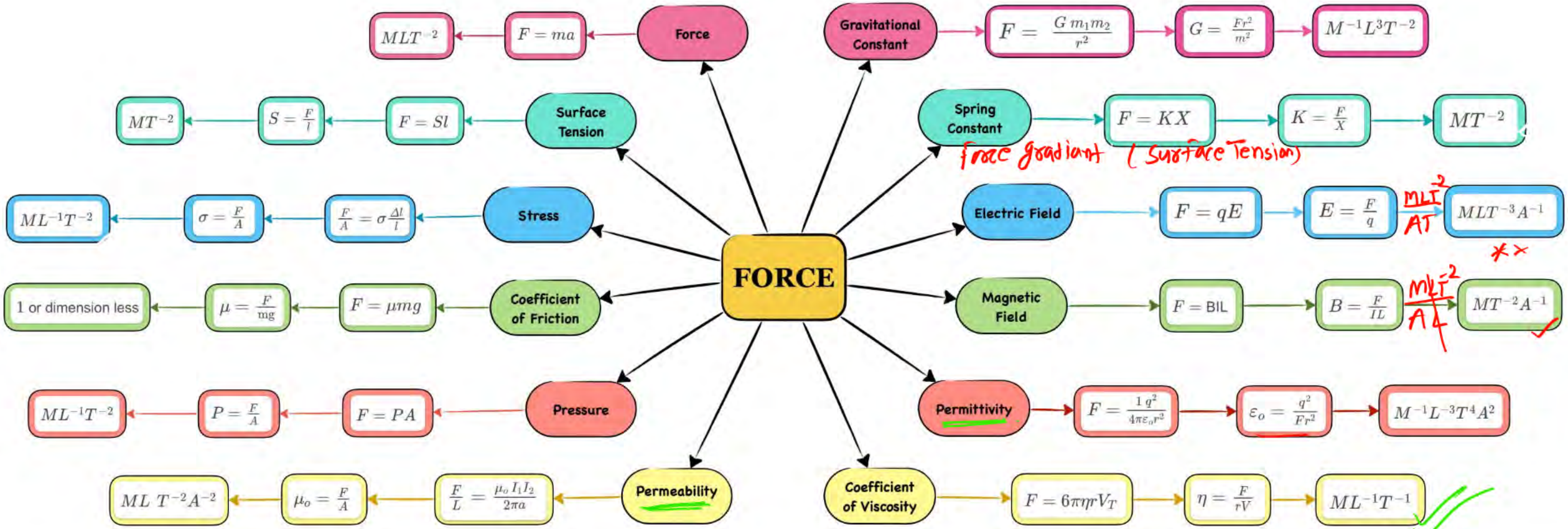
$\delta = \frac{F}{l}$

$F = A x$

$F = \eta \gamma v$

$\eta = \frac{F}{\gamma v}$


Energy
MR
Modern phy
MR stab
Electric Potential
V = U/q
MLT⁻³A⁻¹
Thermal Conductivity
H/t = KAT/L
K = mL²T⁻²/LTK
MLT⁻³K⁻¹
Gas Constant
PV = nRT
R = PV/nT
ML²T⁻²K⁻¹
Solar Constant
S = Energy/AT
MT⁻³
Red berg Constant
R = 1/λ (1/n²)
M⁰L⁻¹T⁰
Wiens Constant
b = λT
L¹K¹
Gravitational Potential
V = U/m
L²T⁻²
V = ML²T⁻²/M
Planks Constant
E = hf
h = E/f
ML²T⁻²/T⁻¹
ML²T⁻¹
Capacitance
E = Q²/2C
C = Q²/E
A²T²/ML²T⁻²
M⁻¹L⁻²T⁴A²
Self Inductance
E = ½LI²
L = E/I²
ML²T⁻²/A²
ML²T⁻²A⁻²
Resistance
H = I²Rt
R = H/T²t
ML²T⁻²/A²T
ML²T⁻³A⁻²
Specific Heat Capacity
Q = mSΔT
S.H. = Q/mΔT
Q = mΔT
L²T⁻²K⁻¹
Latent Heat
Q = mL
L = Q/m
ML²T⁻²/M
L²T⁻²
Boltz man Constant
E = ½kBT
kB = E/T
ML²T⁻²K⁻¹



$$P = \frac{F}{A} = \frac{MLT^{-2}}{L^2} = ML^{-1}T^{-2}$$

$$\frac{F}{l} = \frac{\mu_0 I^2}{2\pi a}$$

$$\mu_0 = \frac{F}{I^2} = MLT^{-2}A^{-2}$$

$$F = G\frac{m^2}{L^2}$$

$$G = \frac{FL^2}{m^2} = \frac{MLT^{-2} \times L^2}{m^2} = M^{-1}L^3T^{-2}$$

$$F = 6\pi\eta r V_T$$

$$\eta = \frac{F}{rv} = \frac{MLT^{-2}T^{-1}}{L \cdot LT^{-1}} = ML^{-1}T^{-1}$$

QUESTION

Which does not have same unit as other :-

1. watt - sec ✓
2. kilowatt – hour ✓
3. eV ✓
4. Joule - sec ✗

(*) Power → watt ✓

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

E = watt-sec ✓

Ans. 4

QUESTION

Which of the following group of physical quantity can be considered as a group of fundamental physical quantity.

1. Force, mass, time
2. Mass, force, acceleration
3. Velocity, momentum, mass
4. Velocity, time, displacement
5. None of the above

QUESTION

Which of the following is a characteristic of unit?

1. The unit must be universally accepted
2. It must be invariable and well defined
3. It must be of suitable size and easily available
4. All the above

CHARGE

- **Electric Potential →** $V = \frac{U}{q}$

- **Gravitational Potential →** $V = \frac{U}{m}$

- Gradient → Change per unit length
- Velocity gradient $= \frac{LT^{-1}}{L} = T$
- Temperature gradient
- Length gradient
- Time gradient $\frac{T}{L} = TL^{-1}$

Thermal Conductivity

$$\frac{dH}{dt} = \frac{K A \Delta T}{L}$$

$$K = \frac{H}{t} \frac{L}{A K}$$

$$= \frac{m L^2 T^{-2} \times L}{T L^2 K}$$

$$= m L T^{-3} K^{-1}$$

- **Magnetic Flux :** $\phi = B \cdot A$

$F = BIL$

- **Electric Flux :** $\phi = E \cdot A$

MR*

$$\text{Resistance} = R = WL = \frac{1}{WC}$$

Inductive Resist $= WL = \Omega$

Capacitive Resist $= \left(\frac{1}{WC}\right)\Omega$

$R = WL = \frac{1}{WC}$

$\omega = \frac{R}{L}$

$f = T^{-1} = \frac{R}{L}$

$T = \left(\frac{L}{R}\right)$

$R = \frac{1}{\omega C}$

$\frac{1}{\omega} = CR$

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

$WL = \frac{1}{WC}$

$\omega^2 = \frac{1}{LC}$

$\omega = \frac{1}{\sqrt{LC}} = f$

$T = \sqrt{LC}$

DIMENSION LESS PHYSICAL QUANTITY

- Angle/ Solid angle/ Strain

  Poisson's ratio, refractive index

  Trigonometry formula/ exponential functions, relative permittivity, efficiency, ratio, pure no. specific gravity

QUESTION

The dimension of (mutual inductance) is: [JEE Main 2022]

Self Induced

$E = \frac{1}{2} L I^2$

$L = \frac{E}{I^2}$

$= \frac{M^2 T^2 A^{-2}}{}$

1. $[ML^2 T^{-2} A^{-1}]$
2. $[ML^2 T^{-3} A^{-1}]$
3. $[ML^2 T^{-2} A^{-2}]$
4. $[ML^2 T^{-3} A^{-2}]$

QUESTION

If L, C and R are the self inductance, capacitance and resistance respectively, which of the following does not have the dimension of time? [JEE Main 2022]

1. RC
2. L/R
3. $\sqrt{LC}$
4. L/C

Ans (4)

Ex $R = \omega L = \frac{1}{\omega C}$

$R = \frac{1}{\omega C}$

$RC = \frac{1}{\omega} = T$

$\omega^2 = \frac{1}{LC}$

$\omega = \frac{1}{\sqrt{LC}}$

$T = \sqrt{LC}$

$\frac{1}{\omega} = \frac{L}{R}$

QUESTION

Match List-I with List-II: [JEE Main-2023]

List-I		List-II	
A.	Planck's constant (h)	I.	$[M^1 L^2 T^{-2}]$
B.	Stopping potential (Vs)	II.	$[M^1 L^1 T^{-1}]$
C.	Work function (ϕ)	III.	$[M^1 L^2 T^{-1}]$
D.	Momentum (p)	IV.	$[M^1 L^2 T^{-3} A^{-1}]$

1. A-III, B-I, C-II, D-IV
2. A-III, B-IV, C-I, D-II
3. A-II, B-IV, C-III, D-I
4. A-I, B-III, C-IV, D-II

QUESTION

Match List-I with List-II:

Choose the correct answer from the options given below: **[JEE Main 2023]**

	List-I		List-II
A.	Young's Modulus (Y)	I.	[M L^{-1} T^{-1}]
B.	Co-efficient of Viscosity (η)	II.	[M L^{2} T^{-1}]
C.	Planck's Constant (h)	III.	[M L^{-1} T^{-2}]
D.	Work Function (ϕ)	IV.	[M L^{2} T^{-2}]

1. A-II, B-III, C-IV, D-I
2. A-III, B-I, C-II, D-IV
3. A-I, B-III, C-IV, D-II
4. A-I, B-II, C-III, D-IV

Hooks law

Stress = $\frac{F}{A}$ Strain

↓ dim.

QUESTION

If L, C and R are the self inductance, capacitance and resistance respectively, which of the following does not have the dimension of time? **[JEE Main 2022]**

1. RC
2. L/R
3. $\sqrt{LC}$
4. L/C

- **Dimension of electric resistance** (2007)

$H = I^2 R t$

- **Self-Induction** $E = \frac{1}{2} L I^2$ (1989)

- **Permeability** $\frac{F}{l} = \frac{\mu_0 I^2}{2\pi a}$ (1991)

QUESTION

Match List-I with List-II:

Choose the correct answer from the options given below: **[JEE Main 2023]**

	List-I		List-II
A.	Angular momentum	I.	$[ML^2 T^{-2}]$
B.	Torque	II.	$[ML^{-2} T^{-2}]$
C.	Stress	III.	$[ML^2 T^{-1}]$
D.	Pressure gradient	IV.	$[ML^{-1} T^{-2}]$

1. A-I, B-IV, C-III, D-II
2. A-III, B-I, C-IV, D-II
3. A-II, B-III, C-IV, D-I
4. A-IV, B-II, C-I, D-III

QUESTION

Match List-I with List-II:

Choose the correct answer from the options given below: **[JEE Main 2022]**

List-I		List-II	
A.	Torque	I.	Nms^{-1}
B.	Stress	II.	$J\,kg^{-1}$
C.	Latent Heat	III.	Nm
D.	Power	IV.	Nm^{-2}

1. A-III, B-II, C-I, D-IV
2. A-III, B-IV, C-II, D-I
3. A-IV, B-I, C-III, D-II
4. A-II, B-III, C-I, D-IV

- **Magnetic field/Magnetic flux** **(1999)**

$F = qvB$

- **Coefficient of viscosity**

$F = 6\pi\eta r v$

QUESTION

If the dimensions of a physical quantity are given by $M^a L^b T^c$, then the physical quantity will be (2009)

1. velocity if $a = 1, b = 0, c = -1$
2. acceleration if $a = 1, b = 0, c = -2$
3. force if $a = 0, b = -1, c = -2$
4. pressure if $a = 1, b = -1, c = -2$

$M^a L^b T^c$

$V = M^1 L^0 T^{-1}$

LT^{-1}

QUESTION

True / False.

A unitless physical quantity may have dimension → false

(A unitless P.Q must be dimensionless → True)

A dimensionless physical quantity may be unitless → True

Coeffju of Tone, Angle →

A physical quantity have unit must have dimension → false

Ex - Angle

A physical quantity have dimension may have unit → fals

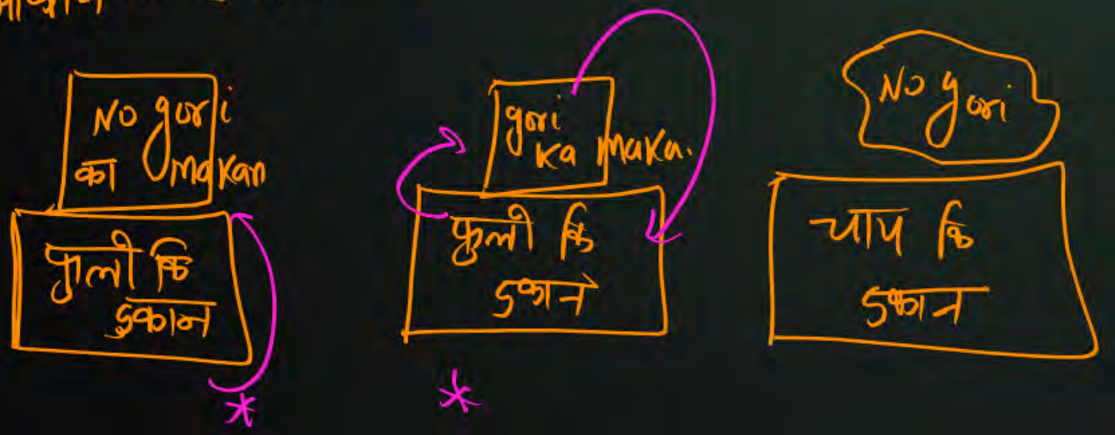
* Strain → unitless / dimnless

PLANE AND SOLID ANGLE

Dimension जोरी का मकान	..... May have dimⁿ	..... ↳ Must be dimⁿ less.	A P. Q. does not have dimension	A. P Q. have dimension
Unit फुली कि दुकान	A P.Q. have unit	A P.Q. does not have unit	..... may have unit	..... Must have unit

Angle

जोरी का मकान → 1 मकान ✓



DIMENSIONLESS PHYSICAL QUANTITY

Angle, solid angle, coefficient of friction

Refractive index, Poisson ratio, strain, current gain, voltage gain, efficiency, relative permittivity, relative density

Any trigonometric ratio = $\sin\theta$, $\cos\theta$, $\tan\theta$

Principle of Homogenity → You can add / subtract, equate, or compair any two P.Q which have same dimn.

Ex

✗ $5m - 4kg = 1se$

$6kg - 2se$ ✗

$4kg > 3m$ ✗

$4kg - 3kg = 1g$ ✓

mass + accn ✗

force + veloci ✗

mass × velo = p ✓

$A = B + C - D$

not ✗ $A = B = C = D$ ✓

QUESTION

If A and B are different physical quantity, having different dimension then wrong option will be?

1. $A + B$ (wrong)

$\frac{A+B}{A}$ ✗

2. A/B ✓

3. $A - B^2$ (correct) ✓

4. $AB + A$

Ex A = Area
B = length

5. AB ✓

A = energy = ML^2T^{-2}
B = molar = T^0

QUESTION

Position of any object is given as $y = at + bt^2$ where t is time then, find dimension of a and b?

MR*

Posit^n

$Y = at = bt^2$

$a = \frac{Y}{t} = \frac{L}{T} = LT^{-1}$

$Y = bt^2$

$L = bT^2$

$b = LT^{-2}$

QUESTION

$F = 2E$

$E = \frac{F}{2}$ N/C

Electric field in a certain region is given by $\vec{E} = \left(\frac{A}{x^2}\hat{i} + \frac{B}{y^3}\hat{j}\right)$. The SI unit of A and B are:

[JEE Main 2023]

1. $Nm^3\ C^{-1}; Nm^2\ C^{-1}$
2. $Nm^2\ C^{-1}; Nm^3\ C^{-1}$
3. $Nm^3\ C; Nm^2\ C$
4. $Nm^2\ C; Nm^3\ C$

$E = \frac{A}{x^2}\hat{i} + \frac{B}{y^3}\hat{j}$

$E = \frac{A}{x^2} = \frac{B}{y^3}$

$A = Ex^2$

$= \frac{N}{C}m^2$

$B = Ey^3$

$= \frac{N.m^3}{C}$

Logarithmic fun
Exponetical fu
Trigonometric funct

dimn less !

$\sin\theta$

dim = (1)

$\rightarrow M^0 L^0 T^0 = 1$

$Y = A \sin\theta$

$\rightarrow Y = A$

$Y = B e^{(x)}$

dimn → $ax = 1$

$\rightarrow Y = B$

QUESTION

The time dependence of a physical quantity p is given by $p = p_0 \exp(-at^2)$, where a is a constant and t is the time. The constant a (1993)

1. is dimensionless
2. has dimensions $[T^{-2}]$
3. has dimensions $[T^2]$
4. has dimensions of p

$P = P_0 \exp(-at^2)$

$P = P_0 \Rightarrow at^2 = 1$

$a = \frac{1}{t^2} = T^{-2}$

Dimension in diffrentiation

$$\frac{dy}{dx} = \frac{y}{x}$$

$$\# \quad \frac{dy}{dt} = \frac{y}{t}$$

$$\# \quad \frac{d^2y}{dx^2} = \left(\frac{y}{x^2}\right)$$

$$\frac{d^3y}{dt^3} = \frac{y}{t^3}$$

y = force & x = energy

then find $\frac{dy}{dx}$

Sol^n $\quad \frac{dy}{dx} = \frac{y}{x} = \frac{mLT^{-2}}{ml^2T^{-2}}$

$$= \frac{L}{L^2}$$

$$\Rightarrow L^{-1}$$

Dimension of Integral term

$$\int y\,dx = yx$$

QUESTION

Assertion: If x and y are the distances along x and y axes respectively then the dimensions of $\frac{d^3y}{dx^3}$ is $M^0 L^{-2} T^0$.

Reason: Dimensions of $\int_a^b y\,dx$ is $M^0L^2T^0$.

1. If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
2. If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
3. If Assertion is True but the Reason is False.
4. If both Assertion & Reason are false.

QUESTION

Unit vectors are unitless

Assertion: The unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$ have units of distance and dimensions $[M^0 L^1 T^0]$

Reason: The product of a scalar and a vector is a new scalar.

1. If both Assertion & Reason are True & the Reason is a correct explanation of the Assertion.
2. If both Assertion & Reason are True but Reason is not a correct explanation of the Assertion.
3. If Assertion is True but the Reason is False.
4. If both Assertion & Reason are false.

QUESTION

Different physical quantity can have same dimension? → Yes

Work = F × d ✓

Torque

QUESTION

Two quantity have same dimension, can be same physical quantity.

No

PHYSICAL QUANTITY

1. **Dimensionless; Constant** → π / e
   (No dimn; fixed)

2. **Dimensional; Constant** → Universal gravitation cstn, Boltzmann cstn, Planck's cstn; gmp
   (Have Dimn)

3. **Dimensionless; Variable** → strain
   (No dimn)

4. **Dimensional; Variable**
   → velocity

→ { dimensionless; dimensional (Have dimn) }

Constant
Variable

QUESTION

Which of the following is a dimensional constant? (1995)

1. Relative density
2. Gravitational constant
3. Refractive index
4. Poisson's ratio.

QUESTION

On the basis of dimension, decide which of the following relation for displacement of a particle is not correct [NCERT] (Examplar)

1. $y = a \sin\left(\frac{2\pi t}{T}\right)$ ✓

$S = vt$

2. $y = a \sin\left(\frac{vt}{\lambda}\right)$ ✓

3. $y = \sqrt{2}a \sin\left(\frac{2\pi t}{T}\right) \cos\left(\frac{2\pi x}{\lambda}\right)$

4. ✗ $y = \frac{x}{t} \sin(\lambda t)$

λt → dimⁿ less

Ans → (4)

QUESTION

If force $F = A\sqrt{x} + Bt$, then find dimension of A and B.

Soln

$$F = A\sqrt{x} = Bt$$

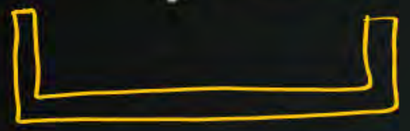
$$A = \frac{F}{\sqrt{x}} = \frac{MLT^{-2}}{L^{1/2}}$$

$$Bt = F$$

$$B = \frac{F}{t} = \frac{MLT^{-2}}{T} = MLT^{-3}$$

QUESTION

Velocity $V = \frac{\alpha}{\beta} e^{-\alpha t}$ then find dimension of α and β.



$V = \frac{\alpha}{\beta}$

$\beta = \frac{\alpha}{V}$

$= \frac{T^{-1}}{LT^{-1}}$

$\beta = L^{-1}$

$\alpha t = 1$

$\alpha = \frac{1}{T} = T^{-1}$

QUESTION

$\int \frac{dx}{\sqrt{2ax-x^2}} = b$; find dimension of a and b of x are different

$$\int \frac{dx}{\sqrt{2ax - x^2}} = b$$

$$\int \frac{\sqrt{x}}{\sqrt{x^2}} = b$$

$\frac{x^{1/2}}{x} = b$

$b = m^0 L^0 T^0$

$2ax = x^2$

$a = \frac{x^2}{x} = L$

QUESTION

If y = Force and x = velocity then find dimension of $\frac{dy}{dx}$.

$= \frac{Y}{x} = \frac{F}{V}$

QUESTION

Momentum of object is given as $P = \alpha t[1 - \beta e^{\gamma x}]$ then, find dimension of α, β and γ. Where t is time x is position.

$$P = \alpha t\left(1 - \beta e^{\gamma x}\right)$$

$$P = \alpha t - \alpha t \beta e^{\gamma x}$$

$$P = \alpha t = \alpha t \beta e^{\gamma x}$$

$$\alpha = \frac{P}{t} = \frac{mLT^{-1}}{T}$$

$$\alpha = mLT^{-2}$$

$$\alpha t = \alpha t \beta$$

$$\beta = 1$$

$$\gamma x = 1$$

$$\gamma = \frac{1}{x} = L^{-1}$$

If force acting on object is directly proportional to square of velocity then find dimⁿ of Proportional Constⁿ.

Solⁿ

$$F \propto V^2$$

$$F = K V^2$$

$$K = \frac{F}{V^2} = \frac{MLT^{-2}}{L^2T^{-2}}$$

$$= M L^{-1}$$

$$U = \frac{\alpha x}{\beta t - x^2}$$

U = Potential energy

x = distn

t = time

α & β → din.

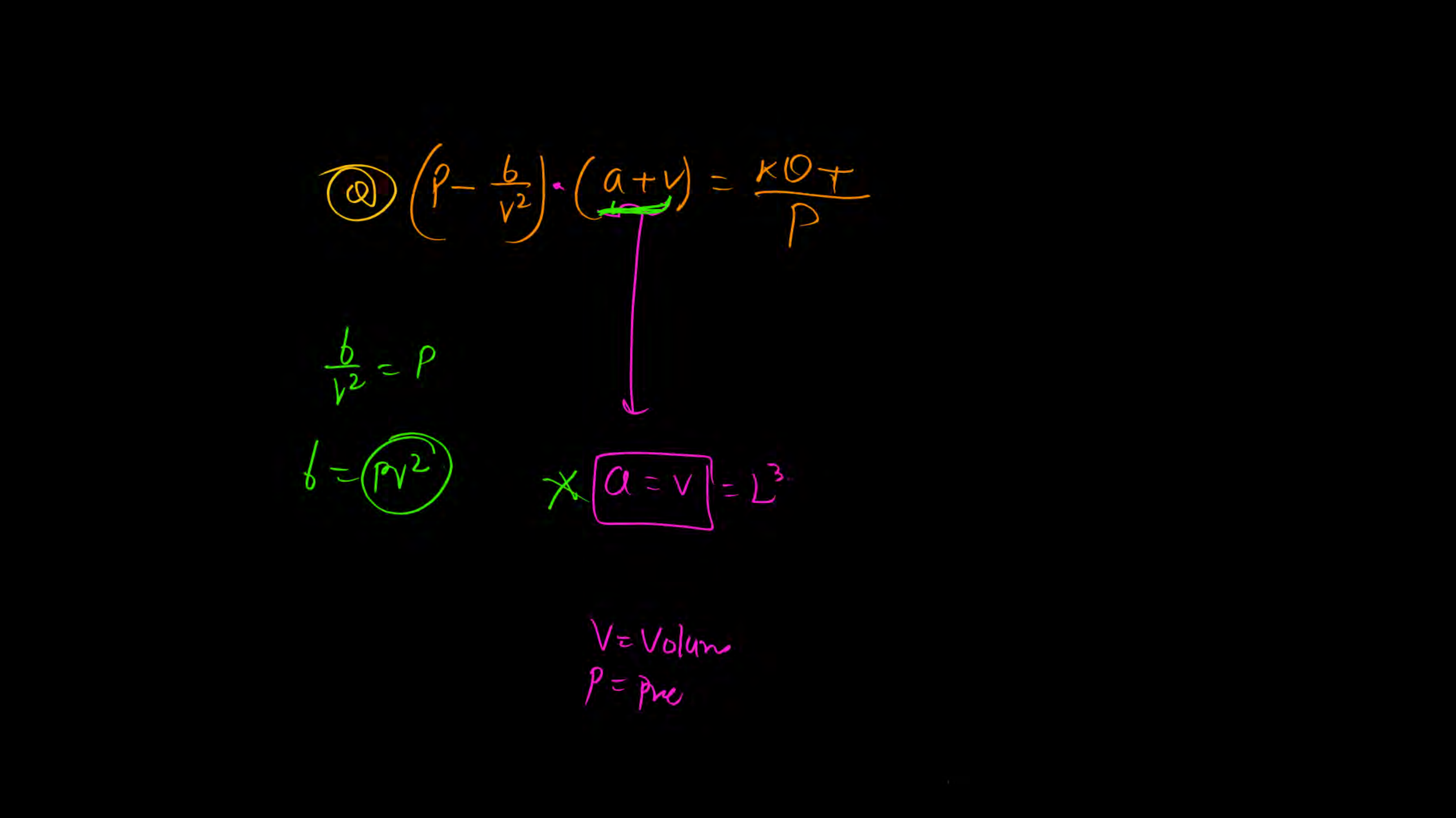
Sol^n

$$\beta t = x^2$$

$$\# \quad \beta = \frac{x^2}{t} = L^2 T^{-1}$$

$$U = \frac{\alpha x}{x^2}$$

$$\alpha = Ux$$


(a) $\left(P - \frac{b}{V^2}\right) \cdot (a+V) = \frac{KOT}{P}$
$\frac{b}{V^2} = P$
$b = PV^2$
$* \boxed{a = V} = L^3$
V = Volum
P = Pre

energy density = Pressure = stress = Young modulus

= Modulus of rigidity

= Bulk Modulus

$= \frac{1}{2} \gamma \times (\text{strain})^2$

$= \frac{1}{2} \varepsilon_0 E^2$

$= \frac{1}{2} \frac{V^2}{\text{vol.}}$

$$Y = A \sin(\alpha t) \cos\left(\frac{\beta}{x}\right)$$

find dim of $\alpha/\beta = ??$

$$\alpha t = \beta/x$$

$$\frac{\alpha}{\beta} = \frac{1}{tx} = L^{-1}T^{-1}$$

APPLICATION OF DIMENSIONAL ANALYSIS

$T \propto (l, g)$

1. If time period of simple pendulum depends on length of pendulum and acceleration due to gravity then derive formula of time in terms of l and g using dimensional analysis.

2. If length and acceleration taken as fundamental physical quantity then express dimension of time in terms of them.

3. In new system of unit of length is 2 m and unit of acceleration is 8 m/s^2 then find unit of time in new system.

$n_4 = 6+n$

Not applicable ✗

$T \propto \left(\frac{l}{g}\right)$ $\Rightarrow T = l^{1/2} g^{-1/2} = \left(\frac{l}{g}\right)^{1/2} = \left(\frac{2m}{8\,m/s^2}\right)^{1/2} = \left(\frac{1}{4}\right)^{1/2} = \frac{1}{2}\,s$

Sol^n is same for all three

APPLICATION OF DIMENSIONAL ANALYSIS

1. If time period of simple pendulum depends on length of pendulum and acceleration due to gravity then derive formula of time in terms of l and g using dimensional analysis.

$T \propto l^x$ — (I)

$T \propto g^y$ — (II)

dimn analysis

$T = l^x g^y$

$M^0L^0T^1 = (L^1)^x (LT^{-2})^y$

$M^0L^0T^1 = L^x \; L^y T^{-2y}$

$M^0L^0T^1 = L^{x+y} \; T^{-2y}$

Compair Powr of (l)

$x + y = 0$

$x = -y$ — (I)

$-2y = 1$

$y = -\frac{1}{2}$

$x = -y + \frac{1}{2}$

$\boxed{T = (K)\, l^x g^y = l^{\frac{1}{2}} g^{-\frac{1}{2}}}$

K = dimless

QUESTION

If force (F), acceleration (a) and time t is used as a fundamental P.Q. then find dimension of length in terms of them :-

1. $F^0 a^1 T^2$
2. $F a^2 T^2$
3. $F a^2 T^0$
4. $F^0 a T$

$$L = \{F^x a^y t^z\}$$

$$M^0 L^1 T^0 = (MLT^{-2})^x (LT^{-2})^y (T)^z$$

$$M^0 L^1 T^0 = M^x L^{x+y} T^{-2x-2y+z}$$

$x = 0$	$x + y = 1$	$-2x - 2y + z = 0$
	$y = 1$	$0 - 2 \times 1 + z = 0$
		$z = 2$

$$L = f^0 a^1 t^2$$

Fat

l | F | a | t

$$a = \frac{v}{t} = \frac{l}{t^2}$$

$$l = a t^2 F^0$$

QUESTION

If force, acceleration and time are basic fundamental P.Q. then find dimension of energy.

1. $F^2 A^{-1} T$
2. $F A T^2$
3. $F A T^{-2}$
4. $F A^{-1} T$

F / a / t (fun)

$E = F^x a^y t^z = F^1 a^1 t^2$

$M L^2 T^{-2} = (M L T^{-2})^x (L T^{-2})^y T^z$

$M L^2 T^{-2} = M^x L^{x+y} T^{-2x-2y+z}$

$x = 1$

$x + y = 2$

$y = 1$

$-2 = -2x - 2y + z$

$-2 = -4 + 2$

$z = 4 - 2 = 2$

mR^x

$E = \frac{FQ}{t^2} \times t^2$

$F^1 a^1 T^2$

QUESTION

Plank's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length? [NEET 2016]

1. $\frac{\sqrt{hG}}{c^{3/2}}$

$h \to ML^2T^{-1}$
$G = M^{-1}L^3T^{-2}$
$C = LT^{-1}$

2. $\frac{\sqrt{hG}}{c^{5/2}}$

3. $\sqrt{\frac{hc}{G}}$

$M^0L^1T^0 = \sqrt{hG} = \sqrt{L^2L^3}$

$\Rightarrow \frac{\sqrt{hG}}{C^{5/2}} = \frac{L^{5/2}}{L^{5/2}} = L^1$

4. $\frac{\sqrt{Gc}}{h^{3/2}}$

मजदूरी

$L = h^x G^y C^z$

$M^0L^1T^0 = (ML^2T^{-1})^x (M^{-1}L^3T^{-2})^y (LT^{-1})^z$

$M^0L^1T^0 = M^{x-y} L^{2x+3y+z} T^{-x-2y-z}$

$x - y = 0$
$x = y = \frac{1}{2}$

$2x + 3y + z = 1$
$5x + z = 1$
$-3x - z = 0$
$2x = 1$
$x = 1/2$

$-x - 2y - z = 0$
$-3x - z = 0$
$z = -3x$
$z = -3/2$

QUESTION

$f = 6\pi \eta r v_T$

$\eta = \frac{MLT^{-2}}{L \cdot LT^{-1}} = ML^{-1}T^{-1}$

If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$ where η, ρ, r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by

1. 1, 1, 1
2. 1, -1, -1
3. -1, -1, 1
4. -1, -1, -1

$v = \eta^x \rho^y r^z$

$LT^{-1} = (ML^{-1}T^{-1})^x (ML^{-3})^y (L)^z$

$LT^{-1} = M^{x+y} L^{-x-3y+z} T^{-x}$

$M^0 LT^{-1} = (\eta \rho r^2)$

QUESTION

The frequency of vibrations f of a mass m suspended from a spring of spring constant K is given by a relation of type $f = cm^x K^y$, where c is a dimensionless constant. The values of x and y are:

1. $x = \frac{1}{2}, y = \frac{1}{2}$
2. $x = \frac{-1}{2}, y = \frac{-1}{2}$
3. $x = \frac{1}{2}, y = \frac{-1}{2}$
4. $x = \frac{-1}{2}, y = \frac{1}{2}$

$T^{-1} = m^x K^y$

$T^{-1} = m^x (mT^{-2})^y$

$M^0 L^0 T^{-1} = m^{x+y} T^{-2y}$

$-2y = -1$

$y = \frac{1}{2}$

QUESTION

If energy E, velocity V and time T are taken as fundamental units, the dimensional formula for surface tension is

1. $[E\ V^{-2}\ T^{-2}]$
2. $[E^{-2}\ V\ T^{-2}]$
3. $[E^{-2}\ V\ T^{-2}]$
4. $[E^{-2}\ V^{-2}\ T^{2}]$

$$S = \frac{F}{L}$$

$$S = \frac{F \times l}{l \times l} = \frac{E/T^2}{l^2} = \frac{E}{V^2 T^2}$$

QUESTION

A physical quantity of the dimensions of length that can be formed out of c, G and $\frac{e^2}{4\pi\varepsilon_0}$ is [c is velocity of light, G is universal constant of gravitation and θ is charge]

1. $\frac{1}{c^2}\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

2. $c^2\left[G\frac{e^2}{4\pi\varepsilon_0}\right]^{1/2}$

3. $\frac{1}{c^2}\left[\frac{e^2}{G4\pi\varepsilon_0}\right]^{1/2}$

4. $\frac{1}{c}G\frac{e^2}{4\pi\varepsilon_0}$

$$\begin{cases} c = LT^{-1} \\ G = M^{-1}L^3T^{-2} \\ \frac{e^2}{4\pi\varepsilon_0} = ML^3T^{-2} \end{cases}$$

$$F = \frac{e^2}{4\pi\varepsilon_0 r^2} \quad (\text{force b/w two charge})$$

$$\frac{e^2}{4\pi\varepsilon_0} = Fr^2 = ML^3T^{-2}$$

$$M^1L^1T^1 = c^2\left(G\frac{e^2}{4\pi\varepsilon_0}\right) = L^6L^2$$

QUESTION

In equation $y = x^2 \cos^2 2\pi(\beta\gamma/\alpha)$ then units of x, α, β and m, s^{-1} and (ms^{-1}) respectively. The units of y and γ are

1. m^2, ms^{-2}
2. m, ms^{-1}
3. m^2, m^{-1}
4. m, ms^{-2}

$y = x^2$

$y = m^2$

$\frac{\beta\gamma}{\alpha} = 1$

$\gamma = \frac{\alpha}{\beta} = \frac{s^{-1}}{ms^{-1}} = m^{-1}$

QUESTION

The number of particles crossing per unit area perpendicular to Z axis per unit time is given by $N = -D\frac{(N_2 - N_1)}{(Z_2 - Z_1)}$, where N_2 and N_1 are the number of particles per unit volume at Z_2 and Z_1 respectively. What is the dimensional formula for D?

[redacted]

$$N = D\frac{N_2}{Z_2}$$

$$D = \frac{NZ_2}{N_2} = \frac{L^3 \times L}{\text{Area}} = \frac{L^4}{L^2} = L^2$$

QUESTION

Plank's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length? [NEET 2016]

1 $\frac{\sqrt{hG}}{c^{3/2}}$

2 $\frac{\sqrt{hG}}{c^{5/2}}$

3 $\sqrt{\frac{hc}{G}}$

4 $\frac{\sqrt{Gc}}{h^{3/2}}$

QUESTION

If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$ where η, ρ, r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by

1. 1, 1, 1
2. 1, –1, –1
3. –1, –1, 1
4. –1, –1, –1

QUESTION

If force F, area A and density D are taken as the fundamental units, the representation of Young's modulus 'Y' will be:

1. $[F^{-1} A^{-1} D^{-1}]$
2. $[F A^{-2} D^{2}]$
3. $[F A^{-1} D]$
4. $[F A^{-1} D^{0}]$ ✓

F/A/D

$$Y = \frac{F}{A} = F^{1} A^{-1} D^{0}$$

QUESTION

The speed of light C, gravitational constant G and plant constant h are taken as fundamental P.Q then the dimension of time in the new system of unit

1. $G^{+1/2} h^{1/2} c^{-5/2}$
2. $G^{-1/2} h^{1/2} c^{-1/2}$
3. $G^{-1/2} h^{1/2} c^{-3/2}$
4. $G^{-1/2} h^{1/2} c^{1/2}$

$= \frac{G^{1/2} h^{1/2}}{c^{5/2}}$

$C = LT^{-1}$

$G = M^{-1}L^{3}T^{-2}$

$h = ML^{2}T^{-1}$

$M^{0}L^{0}T = \frac{(Gh)^{1/2}}{c^{5/2}} = \sqrt{L^{3}L^{2}} = \frac{L^{5/2}}{(L^{1}T^{-1})^{5/2}}$

QUESTION

Let P represent radiation pressure, c represent speed of light and I represent radiation energy striking a unit area per second, then $P^x/^y c^z$ will be dimensionless for

Hlw

1. $x = 0, y = z$
2. $x = y = z$
3. $x = z = -y$
4. $x = y = -z$

LIMITATION OF DIMENSIONAL ANALYSIS

$T = 2\pi\sqrt{\frac{L}{g}}$

(1) It is not use to derive dimensionless proportional constant.

(2) It can not derive dimensionless function, like sinθ, cosθ, tanθ e^x etc.

(3) If physical quantity depends upon two P.Q. of same dimⁿ

$Y = A\sin(\omega t)$

(4) It can not derive formula which have '+' and '–' term

Ex : $S = ut + \frac{1}{2}at^2$

$S = ut + \frac{1}{2}at^2$

$l = E^x \omega^y I^z$

(5) We equate the power of M, L and T. So, it only work when quantity depends only on three physical quantity.

Ex : If force depends upon energy, velocity, time work.

$F = E^x V^y t^z \omega^p$

QUESTION

Which of the following equation can be derived dimensionally

1. $s = vt - \frac{1}{2}at^2$

2. $v^2 = u^2 - 2as$

3. $h = \frac{\omega^2 r^2}{2g}$

4. $v = \frac{d}{t}$

QUESTION

Which of the following equation can not be derived dimensionally

1. $F = 6\pi r\eta$
2. $\theta = \omega t$
3. $\frac{d\theta}{dt} = \rho A v$
4. $P = \rho g h$

Ans → 1

Physically	Physically wrong	Physically may be correct	Physically wrong the dim'?	Physically Correct
Dimensionally	If eqn is dim'ly wrong (Not conv.) What about physically	dim'ly Correct	may be dim'n Correct	Must be dim'n Correct

$S = ut^2$ ✓

$K.E = \frac{3}{2}mv^2$ ✓

$S = ut^2$ ✗

$S_{n^{th}} = u + \frac{a}{2}(2n-1)$

dim'n Correct

$$S_{n^{th}\,sec} = S_{n\text{-}sec} - S_{(n-1)\,sec}$$

$$S = ut + \frac{1}{2}at^2$$

Find dis in 1-sec (0 to 1s)

dim Conc $\longleftarrow$ $\left(S = u + \frac{1}{2}a\right)$ Ans

ROUNDING OFF

- Dimensionally correct equation must be (physically) correct. → false/wrong
- Dimensionally incorrect must be physically correct. → false
- Physically incorrect equation may be dimensionally correct. → True
- Physically correct may be dimensionally correct. → wrong

↑ must be dim' correct

SIGNIFICANT FIGURES (DIGITS)

- All the certain digits and the one uncertain digit are called the significant digits.

Ex. : 2404

Significant digit indicate precision in the measurement.

- Choice of charge in different unit does not effect the significant digit.

Rule to find significant digit :

Significant digit = all certain + (one uncertain)

1. All non-zero are significant. 2463 Kg → 4
2. all zero between non-zero are significant. 403701 Kg → 6
3. The trailing zero without decimal point is insignificant. → 4080 Kg → (3)
4. After decimal place all zero are significant 2.4003 → 5, 24.03 → 4, 360.0 → 4 →
5. If number is less than one, the zero on the left of the 1st non-zero digit are insignificant.

   Ex. : 0.004870 → 4
6. The exact number are infinite significant digit.

5 Pen → infin

QUESTION

State the number of significant figures in the following:

(i) $0.007\ m^2$ → 1

(ii) $2.64 \times 10^{24}\ kg$ → 3

(iii) $0.2370\ g.cm^{-3}$ → 4

(iv) $6.320\ J$ → 4

(v) $6.032\ Nm^{-2}$ → 4

(vi) $0.0006032\ m^2$

4

QUESTION

The number of significant figures in 3.04×10^{23} is :

1. 2
2. 3
3. 23
4. 25

QUESTION

The number of significant figures in 0.01020 is :

1. 1
2. 2
3. 3
4. 4

QUESTION

The number of significant figures in (i) 0.03800 and (ii) 90.00 is :

4 4

QUESTION

Given P = 0.0030 m, Q = 2.40 m and R = 3000 m, the number of significant figures in P, Q, R are respectively :

1. 1, 2, 1
2. 2, 3, 1
3. 4, 2, 1
4. 4, 2, 4

QUESTION

The respective number of significant digit in the number 24.304, 0.00380, 4.3×10^{-7} are receptivity.

- **Addition or Subtraction**
  - Final result is written in minimum decimal places.

$$\begin{array}{r} 4.35\,m \\ 6.1\,m \\ \hline 10.45\,m \end{array} \rightarrow 10.4\,m \checkmark$$

- **Multiplication or Division**
  - Final result written in minimum significant figure.

QUESTION

Add these three length :-

$l_1 = 0.307$ m, 0.52 m and 0.4 m

1. 1.22 m
2. 1.2 m
3. 1.3 m
4. 1.7 m

0.307
0.52
0.4
1.227

1.23

1.2

1.358 → 1.36

1.354 → 1.35

1.3545 = 1.36
1.3445 → 1.34

ROUNDING OFF

- If digit to be removed is less than 5 then there is no change in parimary number.
- If digit to be removed is greater than 5 then there previous number increases by 1.
- If digit is 5, then previous number remains same if even and increase by 1 then if odd.

QUESTION

Taking into account of significant digit. What is the value of

9.99 m – 0.0099 m.

[NEET-2020]

1. 9.98 m
2. 9.890 m
3. 9.9 m
4. 9.9801 m

9.99 m
− 0.0099 m

QUESTION

The area of rectangle of length 55.3 m and breadth 25 m. [NEET-2022]

1. 1382

Area = 55.3 × 25

2. 1382.5

3. 14×10^2

4. 138×10^1

QUESTION

If A = 2.413 and B = 1.2 then find A + B.

$$\begin{array}{r} 2.413 \\ +\ 1.2 \\ \hline 3.613 \end{array}$$

3.6

Ans

QUESTION

$\frac{1.5}{1.5}$ is equal to

1. 1
2. 1.0
3. 1.00
4. 1.000

QUESTION

Taking into account of the significant figures, what is the value of 9.99 m – 0.0099 m? [NEET 2020]

1. 9.9801 m
2. 9.98 m
3. 9.980 m
4. 9.9 m

QUESTION

Find round off value of $x = 3.750$ up to digit.

1. 3.7
2. 3.8 ✓
3. 3.5
4. 3

$x = 3.750$

3.75 (5)

3.8

Accuracy → How close the measured value to the True value

Precision → Measure value upto large decimal places ✓

If True value is Not given then most precise is most accurate

QUESTION

If true value of length is 6.57 m then which of the following reading is most accurate [redacted]

True

1. 6.52 m
   6.57 m
   0.05
2. 6.61 m (most accurate)
   6.57
   0.04
3. 6.513 m
4. 6.68 m

ABSOLUTE ERROR

#Absolute error

- **Different between measured value and true value.** → NO ✗

(#) Magnitude of difference between Measured and true value is absolute error.

$$\Delta x = |x_T - x_M|$$

$$\Delta x = |x_m - x_T|$$

↳ unit same as P.Q. जिसका ही Error calculate करें

Four measures value is given as x_1, x_2, x_3 & x_4

$$x_{mean} = \left\{\frac{x_1 + x_2 + x_3 + x_4}{4}\right\} = x_{Av} = x_{True}$$

$$\Delta x_1 = |x_T - x_1| \quad \Delta x_3 = |x_T - x_3|$$

$$\Delta x_2 = |x_T - x_2| \quad \Delta x_4 = |x_T - x_4|$$

$$|\Delta x|_{av} = \frac{\Delta x_1 + \Delta x_2 + \dots}{4}$$

ABSOLUTE ERROR

Ramlal → $\Delta x_1 = 1\ m$ → $l_1 = 5m$

absolute error can't tell accuracy of measures

$\frac{\Delta x}{x_T}$ = Relative error

$\frac{\Delta x}{x_T} \times 100$ = % error

Both are unitless

Kallu → $\Delta x_2 = 1\ Km$ → $l_2 = 6400\ Km$

QUESTION

If measured length of rod is l_1, l_2, l_3, l_4 and l_5 we can calculate true value by taking average of measured value.

$l_{True} = \frac{l_1 + l_2 + l_3 + l_4 + l_5}{5}$

$\Delta l_1 = |l_T - l_1|$

$\Delta l_2 = |l_T - l_2|$

$\Delta l_3 = |l_T - l_3|$

$\Delta l_4 = |l_T - l_4|$

$\Delta l_5 = |l_T - l_5|$

$\Delta l_{mean\ abs} = \frac{\Delta l_1 + \Delta l_2 + \Delta l_3 + \Delta l_4 + \Delta l_5}{5}$

$\frac{\Delta l_{mean\ abs.}}{l_{mean}} \times 100 = \%\ error$

QUESTION

If measured length of rod are $\overline{4.42\text{m}}$, $\overline{4.43\text{m}}$, $\overline{4.44\text{m}}$, $\overline{4.45\text{m}}$, $\overline{4.46\text{m}}$ then find

(i) True length of rod $\rightarrow$ $l_{mean} =$

(ii) Absolute error $= \dfrac{\Delta l_1 + \Delta l_2 + \Delta l_3 + \Delta l_4 + \Delta l_5}{5}$

(iii) Percentage error

H/W

QUESTION

Δx x

If absolute error and actual value of a number are 5, 15 respectively then relative error is

1. 1/3

$$\frac{\Delta x}{x} = \frac{5}{15} = \frac{1}{3}$$

2. 3/2

3. 3

4. 100/3

QUESTION

In a series of successive measurements in an experiment, the readings of the period of oscillation of a simple pendulum were round to be 2.63s, 2.56s, 2.42s, 2.71s and 2.80s. Calculate

(i) The mean value of the period of oscillation

(ii) The absolute error in each measurement

(iii) The mean absolute error

(iv) The relative error

(v) The percentage error.

T_1 T_2 T_3 T_4 T_5

$$T_{mn} = \frac{T_1 + T_2 + T_3 + T_4 + T_5}{5} =$$

$$= \frac{\Delta T_{mean}}{T_m}$$

$$\frac{\Delta T_m}{T_m} \times 100 \qquad \Delta T_i = |T_m - T_i|$$

2.63
2.56
2.42
2.71
2.80

2

Q.

$\Rightarrow$ $l_m = 4.6\ m$ ← True ✗

$\Delta l = 0.1\ m$

$l = 4.63\ m$

$\Delta l = 0.01\ m$

$m = 5.369\ gm$

$\Delta m = 0.001\ gm$

$l = 3.637\ mm$

$\Delta l = 0.001\ mm$

QUESTION

If mass of object is measured 5.4 grm then find % error in the measurement of mass. [IIT]

$M_T = 5.4\ gm$

$\Delta m = 0.1\ gm$

$\frac{\Delta m}{m} \times 100 = \left(\frac{0.1}{5.4} \times 100\right)$ Ans.

Two measure mass

m_1 / m_2

$m_{Avg} = \frac{m_1 + m_2}{2} = m_T$

$\Delta m_1 = |m_T - m_1|$

$\Delta m_2 = |m_T - m_2|$

$(\Delta m)_{Abs} = \frac{\Delta m_1 + \Delta m_2}{2}$

ERROR PROPAGATION IN MATHEMATIC FORMULA

Two physical quantity having true value A and B and absolute error in A & B are ΔA and ΔB.

$Z = A + B$

diff^n of Z w.r.t

$\frac{\Delta Z}{\Delta t} = \frac{\Delta A}{\Delta t} + \frac{\Delta B}{\Delta t}$

$\Delta Z = \Delta A + \Delta B$ —①

$\left\{\frac{\Delta Z}{Z}\right\} = \left(\frac{\Delta A + \Delta B}{A+B}\right)$

$Z = A - B$

$\Delta Z = \Delta A + \Delta B$

relative error in 'z'

$\left(\frac{\Delta Z}{Z}\right) = \frac{\Delta A + \Delta B}{A-B}$

$\left(\frac{\Delta Z}{Z}\right) \times 100 = \left[\frac{\Delta A + \Delta B}{A-B} \times 100\right]$

$Z = A \cdot B$

$\Delta Z = \Delta A B + \Delta B A$ *

divided by Z both sides

$\left(\frac{\Delta Z}{Z}\right) = \frac{B\Delta A + A\Delta B}{A \cdot B}$

$\frac{\Delta Z}{Z} = \left(\frac{\Delta A}{A}\right) + \left(\frac{\Delta B}{B}\right)$ *

$\Delta Z = Z\left(\frac{\Delta A}{A} + \frac{\Delta B}{B}\right)$

$Z = \frac{A}{B}$

$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$

$\frac{\Delta Z}{Z} \times 100 = \left(\frac{\Delta A}{A} + \frac{\Delta B}{B}\right) \times 100$

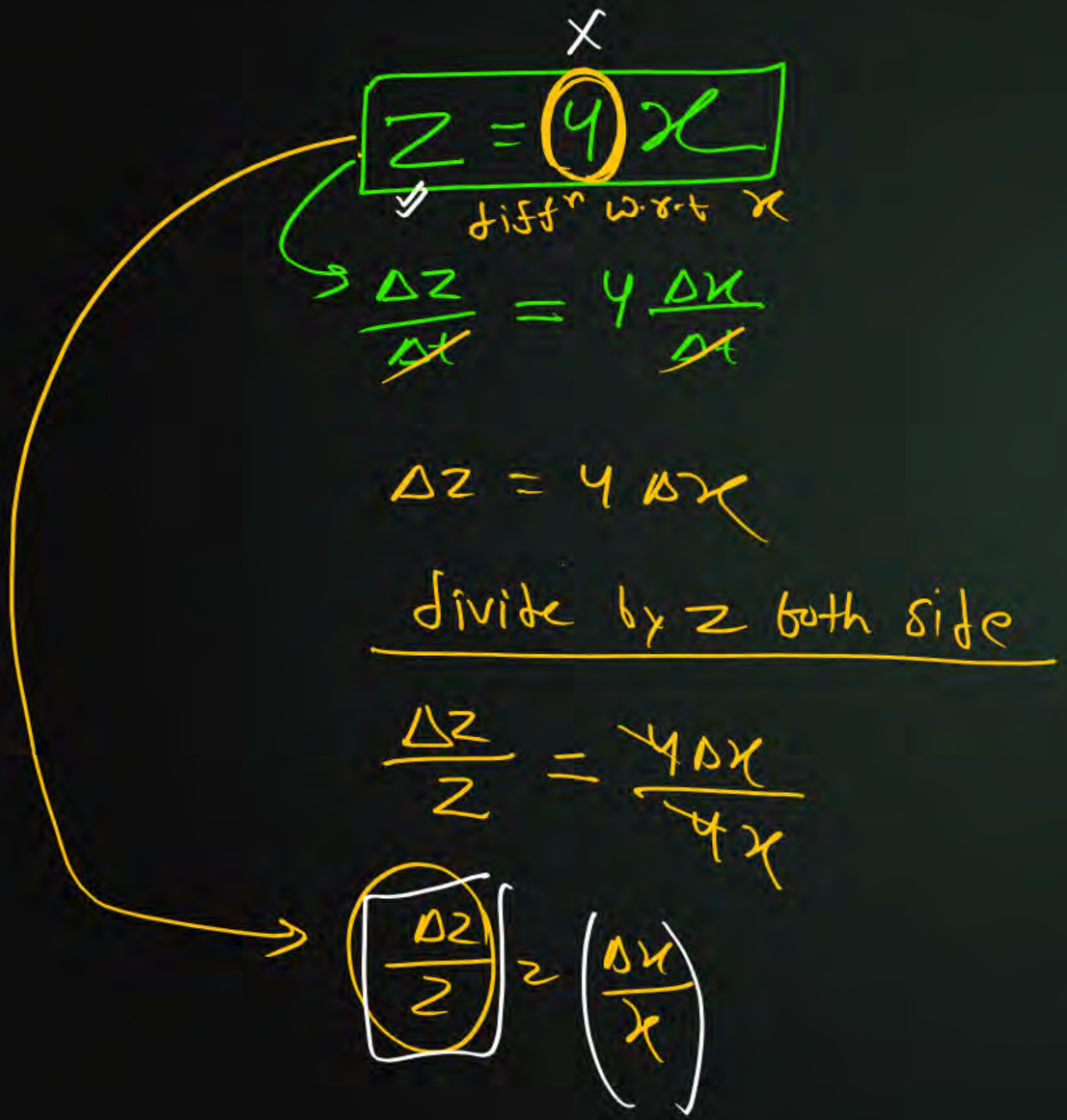
$Z = A + B$

$\Delta Z = \Delta A + \Delta B$ ✓

$\frac{\Delta Z}{Z} = \frac{\Delta A + \Delta D}{A + B}$ ✓

$\frac{\Delta Z}{Z} = \frac{\Delta A}{A} + \frac{\Delta B}{B}$ ✗

If constant is multiplied with the function



$$z = x^2$$

$$\frac{\Delta z}{z} = 2\,\frac{\Delta x}{x}$$

$z = x + y$

$\frac{\Delta z}{z} = \frac{\Delta x}{x} + \frac{\Delta y}{y}$ ✗

$\Delta z = \Delta x + \Delta y$

$\frac{\Delta z}{z} = \frac{\Delta x + \Delta y}{x + y}$ ← dibagi

$z = x - y$

$\Delta z = \Delta x + \Delta y$

$\frac{\Delta z}{z} = \frac{\Delta x + \Delta y}{x - y}$

$$z = 3x^2$$

$$\left(\frac{\Delta z}{z}\right) = 2\frac{\Delta x}{x}$$ ✓

$$Z = \frac{3 A^2 \sqrt{B}}{C D^3}$$

$$\frac{\Delta Z}{Z} = \left(2\frac{\Delta A}{A}\right) + \left(\frac{1}{2}\frac{\Delta B}{B}\right) + \left(\frac{\Delta C}{C}\right) + 3\frac{\Delta D}{D}$$

$$\frac{\Delta Z}{Z} \times 100 = 2\frac{\Delta A}{A} \times 100 + \frac{1}{2}\frac{\Delta B}{B} \times 100 + \frac{\Delta C}{C} \times 100 + \frac{3\Delta D}{D} \times 100$$ ✓

QUESTION

If $l_1 = (10 \pm 2)$ cm and $l_2 = (20 \pm 1)$ cm. Find $l = l_1 + l_2$ with error.

$l = l_1 + l_2$

$\frac{\Delta l}{l} = \frac{\Delta l_1}{l_1} + \frac{\Delta l_2}{l_2}$

$l = l_1 + l_2$

$\Delta l = \Delta l_1 + \Delta l_2$

$\Delta l = 2 + 1 = 3$

$l = 10 + 20 = 30$

$l_{fu} = (30 \pm 3)$ cm

$\frac{\Delta l}{l} = \frac{3}{30}$

$\frac{\Delta l}{l} \times 100 = \frac{3}{30} \times 100$

QUESTION

Value of $A = (10 \pm 0.1)$ m and $B = (20 \pm 0.5)$ m then find:

(i) $x = B + A$ (ii) $y = B \cdot A$

(iii) $z = B - A$ (iv) $m = B/A$

(i) $x = B + A$

$x = 20 + 10 = 30$

$\Delta x = \Delta B + \Delta A$

$\Delta x = 0.5 + 0.1 = 0.6$

$\frac{\Delta x}{x} = \frac{0.6}{30}$

(ii) $Y = B \cdot A = 20 \times 10 = 200$

$\Delta Y = \Delta B \cdot \Delta A$ ✗

$\frac{\Delta Y}{Y} = \frac{\Delta B}{B} + \frac{\Delta A}{A}$

$\frac{\Delta Y}{Y} = \left(\frac{0.5}{20} + \frac{0.1}{10}\right)$

$\Delta Y = 200\left(\frac{0.5}{20} + \frac{0.1}{10}\right)$

(iii) $Z = B - A$

$= 20 - 10$

$Z = 10$

$\Delta Z = \Delta B + \Delta A$

$= 0.5 + 0.1$

$\Delta Z = 0.6$

$Z_{final} = (10 \pm 0.6)$

(iv) $m = \frac{B}{A} = \frac{20}{10} = 2$

$\left(\frac{\Delta m}{m}\right) = \left(\frac{\Delta B}{B} + \frac{\Delta A}{A}\right)$

QUESTION

A public park, in the form of a square, has an area of $(100 \pm 0.2)\ m^2$. The side of park is

1. (10 ± 0.01) m
2. (10 ± 0.1)m
3. (10 ± 0.02) m
4. (10 ± 0.2)m

Area $= (100 \pm 0.2)\ m^2$

$A = l^2$

$l = \sqrt{A} = \sqrt{100} = 10\ m$

$l = A^{1/2}$

$\frac{\Delta l}{l} = \frac{1}{2}\frac{\Delta A}{A}$ $\Rightarrow \Delta l = \frac{l\,\Delta A}{2A} = \frac{10 \times 0.2}{2 \times 100} = \frac{0.1}{10} = 0.01$

$l_{final} = (x \pm \Delta x)\ m$

$l_R = (x \pm \Delta x \pm 2\%)$

QUESTION

If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be:

1. 2%
2. 4%
3. 6%
4. 8%

$$\frac{\Delta r}{r} \times 100 = 2\%$$

$$V = \frac{4}{3}\pi r^3$$

$$\left[100 \times \frac{\Delta V}{V}\right] = 3\left[\frac{\Delta r}{r} \times 100\right]$$

$$= 3 \times 2$$

$$= 6\%$$

QUESTION

In an experiment four quantities a, b, c and d are measured with percentage error 1%, 2%, 3% and 4% respectively. Quantity P is calculate as follows: $P = \frac{a^3 b^2}{cd}$, % error in P is

1. 10%
2. 7%
3. 4%
4. 14%

$$\frac{\Delta P}{P} = \frac{3\Delta a}{a} + \frac{2\Delta b}{b} + \frac{\Delta c}{c} + \frac{\Delta d}{d}$$

$$= 3 + 4 + 3 + 4$$

QUESTION

A physical quantity is represented by $X = [M^a L^b T^{-c}]$. If percentage error in the measurement of M, L and T are $\alpha\%$, $\beta\%$ and $\gamma\%$ respectively, then maximum percentage error in measurement of X should be (Given that α, β and γ are very small)

1. $(\alpha a - \beta b + \gamma c)\%$
2. $(\alpha a + \beta b + \gamma c)\%$
3. $(\alpha a - \beta b - \gamma c)\%$
4. $(\alpha a + \beta b - \gamma c)\%$

$$Q = m^a L^b T^{-c}$$

$$\frac{\Delta Q}{Q} = a\frac{\Delta m}{m} + b\frac{\Delta b}{b} + c\frac{\Delta c}{c}$$

$$= a\alpha + b\beta + c\gamma$$

QUESTION

The radius of a sphere is (5.3 ± 0.1) cm. The percentage error in its volume is

1. $\frac{0.1}{5.3} \times 100$

2. $3 \times \frac{0.1}{5.3} \times 100$

3. $\frac{3}{2} \times \frac{0.1}{5.3} \times 100$

4. $6 \times \frac{0.1}{0.3} \times 100$

$= \frac{0.1}{5.3} \times 100$

QUESTION

A force F is applied on a square area of side L. If the percentage error in the measurement of L is 2% and that in F is 4%, what is the maximum percentage error in pressure?

1. 2%
2. 4%
3. 6%
4. 8%

$$P = \frac{F}{L^2}$$

$$\frac{\Delta P}{P} = \frac{\Delta F}{F} + 2\frac{\Delta L}{L}$$

QUESTION

A rectangular plate has length $(2 + 0.02)$ cm and width (1 ± 0.01) cm. The maximum percentage error in the measurement of its area is

1. 1%
2. 2%
3. 3%
4. 5%

l b

$A = l\,b$

$100 \times \frac{\Delta A}{A} = \left(\frac{\Delta l}{l} + \frac{\Delta b}{b}\right) 100$

$= \left(\frac{0.02}{2} + \frac{0.01}{1}\right) \times 100$

$= (0.01 + 0.01) \times 100$

QUESTION

The acceleration due to gravity is measured on the surface of earth by using a simple pendulum. If α and β are relative errors in the measurement of length and time period respectively, then percentage error in the measurement of acceleration due to gravity is

1. $\left(\alpha + \frac{1}{2}\beta\right)$
2. $(\alpha - 2\beta)$
3. $(2\alpha + \beta) \times 100$
4. $(\alpha + 2\beta) \times 100$

$T = 2\pi\sqrt{\frac{l}{g}}$

$T = \sqrt{\frac{l}{g}}$

$T^2 = \frac{l}{g}$

$g = \frac{l}{T^2}$

$\frac{\Delta g}{g} = \frac{\Delta l}{l} + 2\frac{\Delta T}{T}$

QUESTION

If error in measuring diameter of a circle is 4%, the error in circumference of the circle would be:

1. 2%
2. 8%
3. 4%
4. 1%

$D = 2r$

$S = 2\pi r$

$S = \pi D$

$\text{Error}\left(\frac{\Delta S}{S}\right) = \frac{\Delta D}{D} \times 100$

QUESTION

A wire has a mass (m) (0.3 ± 0.003) g, radius (0.5 ± 0.005) mm and length (6 ± 0.06) cm. The maximum percentage error in the measurement of its density is:

1. 1
2. 2
3. 3
4. 4

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

$$d = \frac{m}{\pi r^2 l}$$

$$\frac{\Delta d}{d} = \frac{\Delta m}{m} + 2\frac{\Delta r}{r} + \frac{\Delta l}{l}$$

QUESTION

A set of defective observation of weights is used by a student to find the mass of an object using a physical balance. A large number of reading will reduce:

1. Random error
2. Systematic error
3. Random as well as systematic error
4. Neither random nor systematic error

Systematic error
- fixed in magn
- Reason is known
- large no of observ
  Can't decrease it

Random error → Reason is not known
- large no. of observ
- Various error

QUESTION

Percentage error in measuring the radius and mass of a solid sphere are 2% & 1% respectively. Then error in measurement of moment of inertia with respect to its diameter is :-

1. 3%
2. 6%
3. 5%
4. 4%

$I = mR^2$

$\frac{\Delta I}{I} = \frac{\Delta m}{m} + \frac{\Delta R}{R} \times 2$

*MR Problem

If A = (6 ± 1) and B = (4 ± 2) m then find Z = 2A + B with absolute error.

ΔA

$Z = 2A + B$

$Z = 2 \times 6 + 4$

$\boxed{Z = 16}$

$\boxed{\Delta Z = 2\Delta A + \Delta B}$

$\Delta Z = 2 \times 1 + 2 = 4$

$\frac{\Delta Z}{Z} = \left(\frac{4}{16}\right)$

$$\rightarrow \frac{d(1/x)}{dx} = -\frac{1}{x^2}$$

$$\frac{d(1/x)}{dt} = \frac{d\,1/x}{dt} \times \frac{dx}{dx}$$

$$= \frac{d\,1/x}{dx} \times \frac{dx}{dt}$$

$$= -\frac{1}{x^2}\frac{dx}{dt}$$

QUESTION

$\frac{d(1/x)}{dx} = -\frac{1}{x^2}$

Two resistance R_1 and R_2 connected in series and parallel combination then percentage error in both combination.

① Series combination

$R_s = R_1 + R_2$

$(\Delta R_s) = \Delta R_1 + \Delta R_2$ — ①

absol

(Relative) $\frac{(\Delta R_s)}{R_s} = \frac{\Delta R_1 + \Delta R_2}{R_1 + R_2}$

$\frac{\Delta x}{x}$

$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$ ✓

$+\frac{1}{R_p^2}\frac{dR_p}{dt} = +\frac{1}{R_1^2}\frac{dR_1}{dt} + \frac{1}{R_2^2}\frac{dR_2}{dt}$

$$\boxed{\frac{dR_p}{R_p^2} = \frac{dR_1}{R_1^2} + \frac{dR_2}{R_2^2}}$$

- $\Delta R_p = R_p^2\left(\frac{dR_1}{R_1^2} + \frac{dR_2}{R_2^2}\right)$
- $\left(\frac{\Delta R_p}{R_p}\right) = R_p\left(\frac{dR_1}{R_1^2} + \frac{dR_2}{R_2^2}\right)$

QUESTION

Two resistance $R_1 = (20\Omega + 2\Omega)$ and $R_2 = (5 \pm 1\Omega)$ are connected in parallel then find % and absolute error.

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2} = \frac{20 \times 5}{25} = 4\Omega$$

$$\frac{\Delta R_{eq}}{R_{eq}} = 4\left(\frac{2}{400} + \frac{1}{25}\right)$$

$$\Delta R_{eq} = R_{eq}^2 \left(\frac{\Delta R_1}{R_1^2} + \frac{\Delta R_2}{R_2^2}\right)$$

$$= 16\left(\frac{2}{400} + \frac{1}{25}\right)$$

$$\Delta R = \left(\frac{32}{400} + \frac{16}{25}\right)$$

QUESTION

If percentage error in the measurement of momentum is 50% then percentage error in K.E.

(✗) error analysis is not valid

Sol: $K.E = \frac{p^2}{2m} \propto p^2$

$\% \text{ change} = \frac{K.E_f - K.E_i}{K.E_i} \times 100 = \frac{\left(\frac{3}{2}p_0\right)^2 - p_0^2}{p_0^2} \times 100 = \left(\frac{9}{4} - 1\right) \times 100 = \frac{5}{4} \times 100$

$= 125\%$

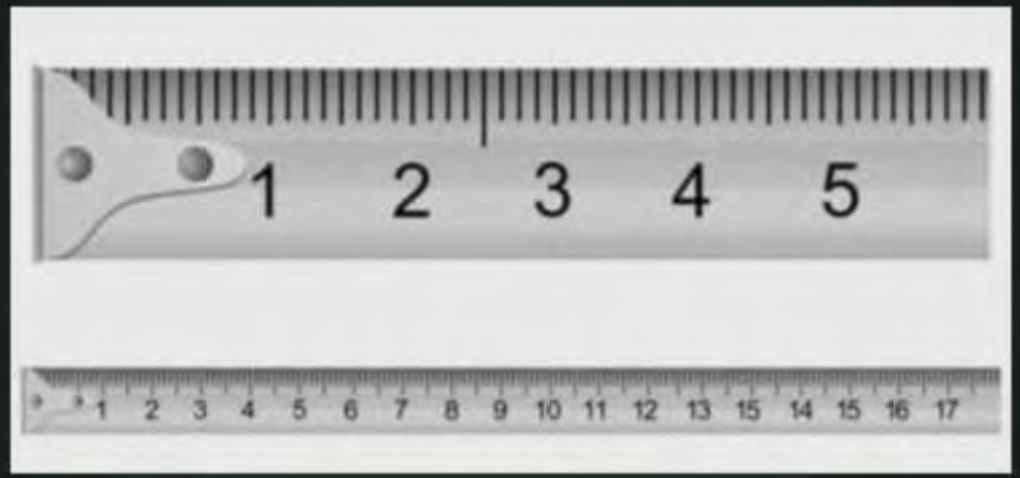
$p_i = p_0 \quad -(1)$

$p_f = 150\% \, p_0 = \frac{150}{100} p_0$

$= \frac{3}{2} p_0$

MEASURING INSTRUMENT

Metre scale :

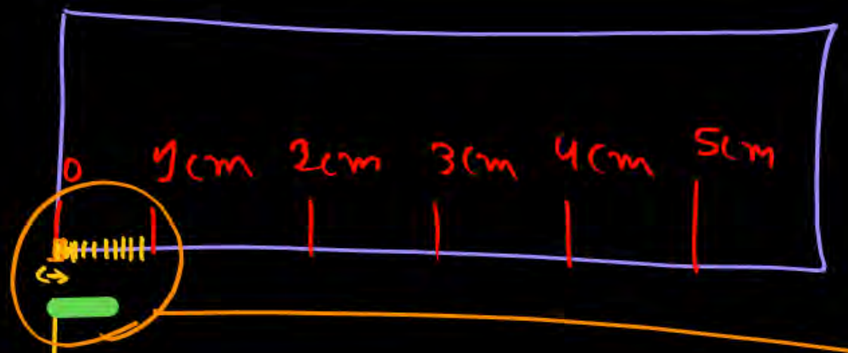


Length of ROD :

Metre Scale

- L.C = max^m error that can be Perfor by instru
- L.C = minimum Reading that can be taken by instrument.

L.C = 1mm



magnify

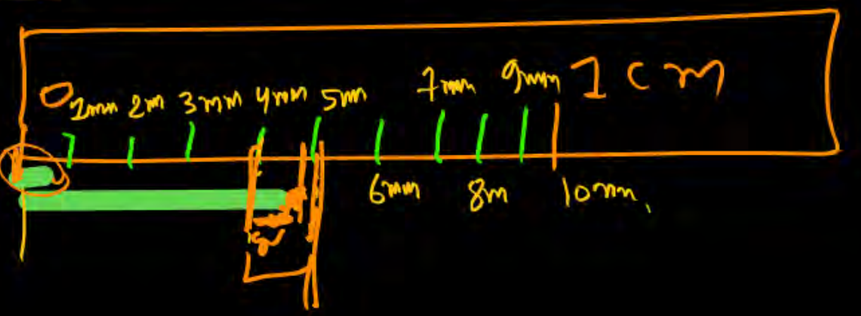
Length of Rod = 4mm ± (L.C)

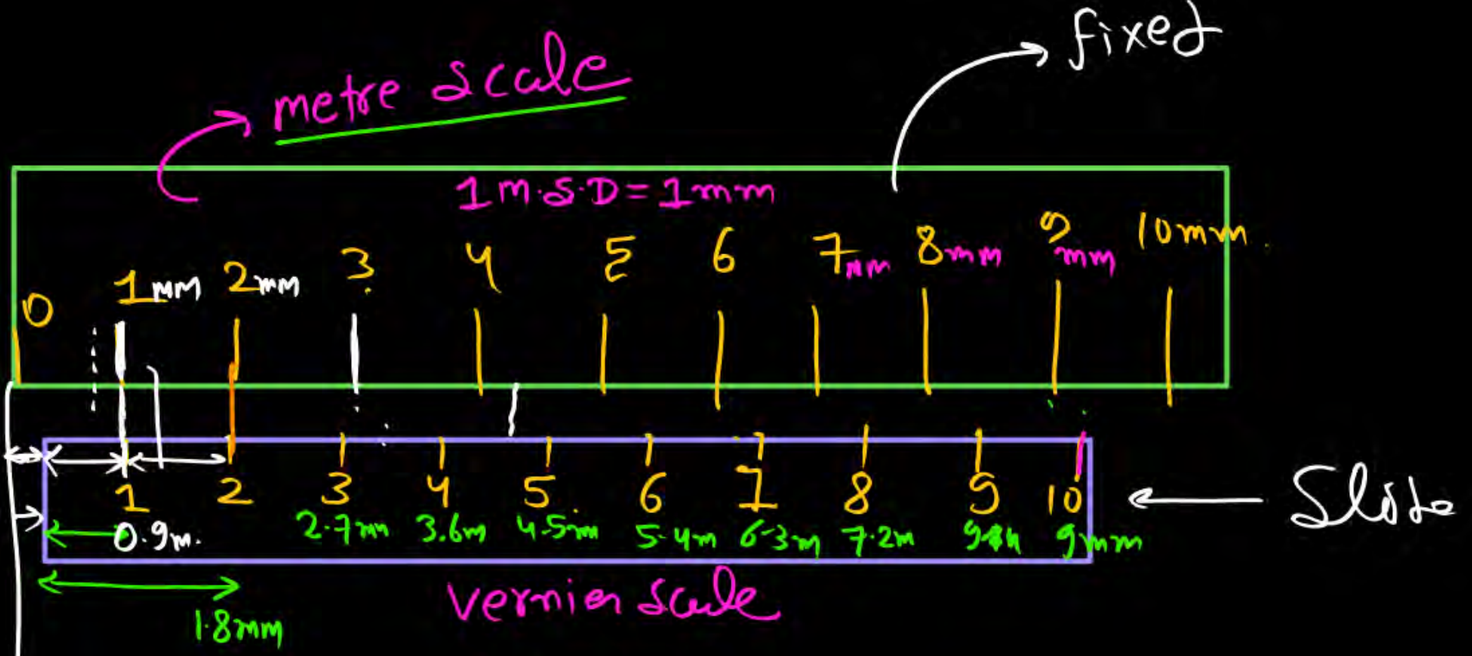
$l_{Rod} = [4mm \pm 1mm]$

→ 1 Main Scale division.

1 cm = 10 mm

* 1 M.S.D = 1mm = 0.1 cm





$$10\ V.S.D = 9\ mm$$

$$1\ V.S.D = \frac{9\ mm}{10}$$

$$= 0.9\ mm$$

0.1 mm

L.C = 1 M.S.D − 1 V.S.D

L.C = 1 MSD − 1 V.SD

MR Radka

MR abt

$$L.C = 1\,M.S.D - 1\,V.S.D$$

$$L.C = 1\,M.S.D - \frac{9\,M.S.D}{10}$$

$$= \frac{1\,M.S.D}{10}$$

$$L.C = \frac{1\,mm}{10} = 0.1\,mm$$

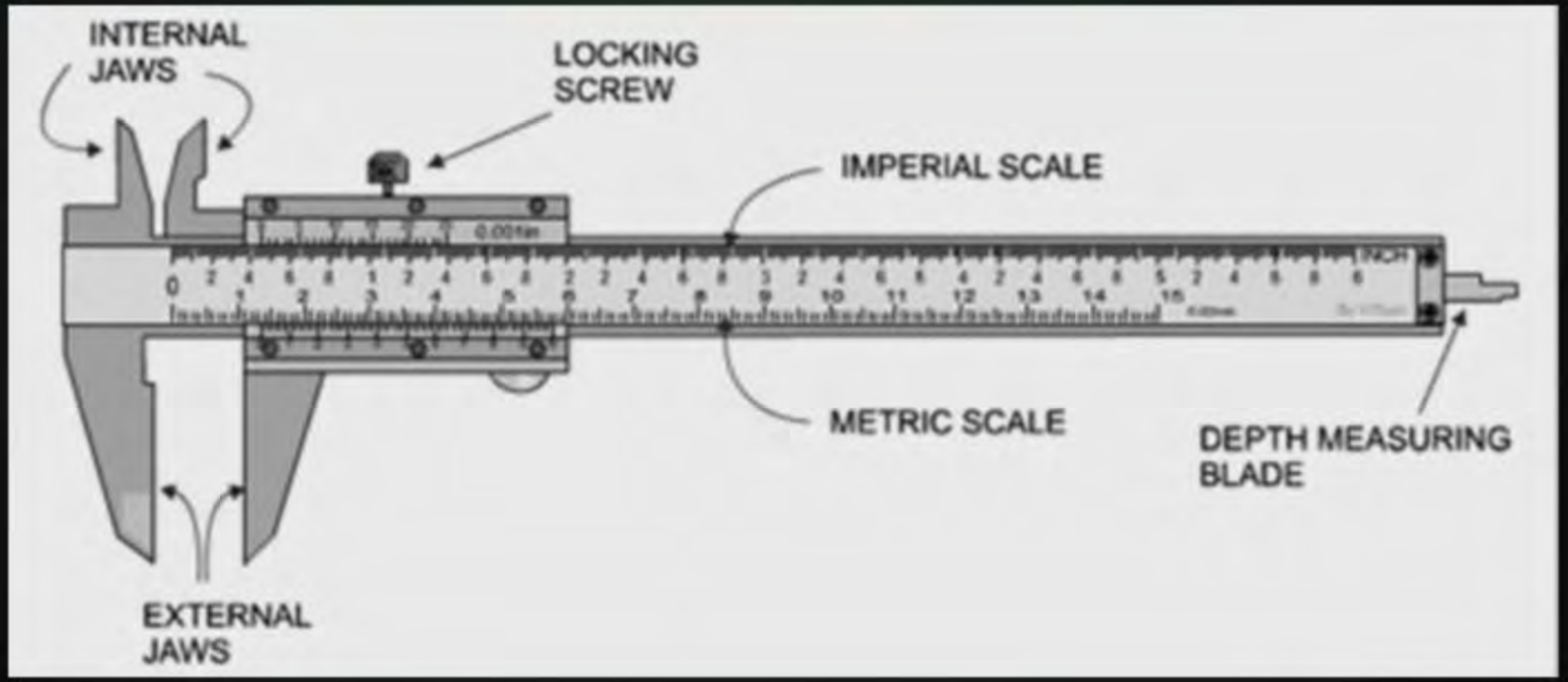
$$9\,M.S.D = 10\,V.S.D$$

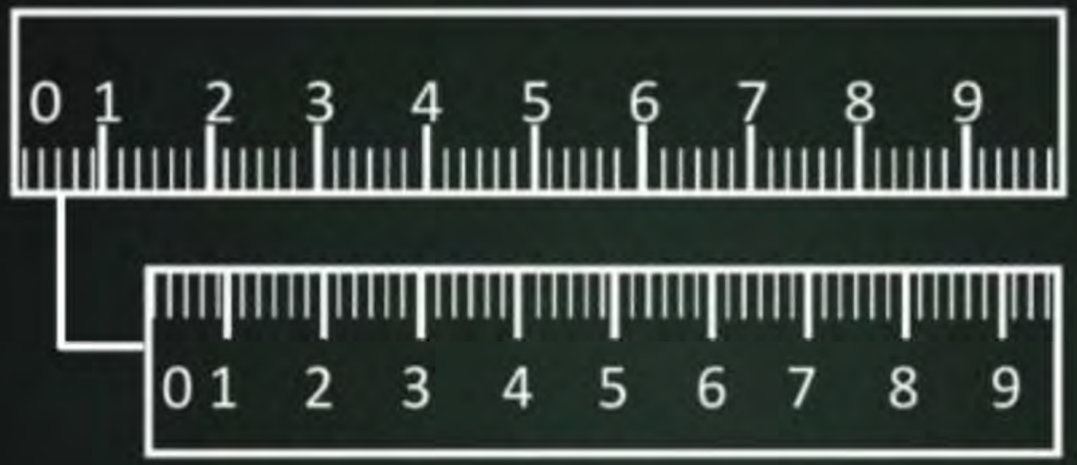
$$\frac{9\,M.S.D}{10} = 1\,V.S.D$$

question ⁊ given

DIMENSIONAL FORMULA

Vernier Callipers





Length of Rod =

QUESTION

Least count of main scale of Vernier caliper is 1 cm and 4 main scale division coinside with 6 Vernier scale division then L.C. of Vernier scale.

$L.C = 1\,M.S.D = 1\,cm$

$4\,MSD = 6\,VSD$

$L.C = 1\,M.SD - 1\,V.SD$

$= 1\,M.S.D - \frac{4}{6}\,M.S.D$

$= \left(1 - \frac{4}{6}\right) 1\,M.SD$

$= \frac{2}{6}(1\,cm) = \frac{1}{3}\,cm$

QUESTION

In a Vernier calliper, one main scale division is x cm and n division of Vernier scale coincide with $(n-1)$ division of the main scale. The least count of the Vernier caliper in cm is :

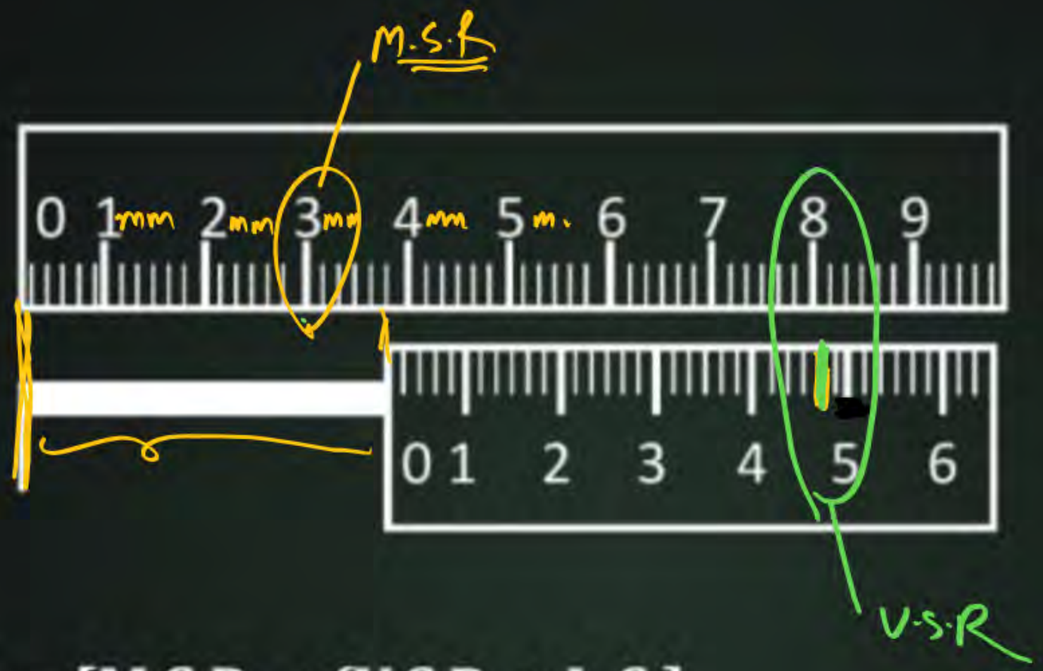
1. $\left(\frac{n-1}{n}\right)x$
2. $\frac{nx}{(n-1)}$
3. $\frac{x}{n}$
4. $\frac{x}{n-1}$

$$\begin{cases} 1\ \text{M.S.D} = x\ \text{cm} \\ n\ (\text{V.S.D}) = n-1\ \text{M.S.D} \end{cases}$$

$$\text{L.C} = 1\ \text{M.S.D} - 1\ \text{V.S.D}$$

$$= 1\ \text{M.S.D} - \frac{n-1}{n}\ \text{M.S.D}$$

$$= \left(\frac{x - x + 1}{n}\right)\ \text{M.S.D} = \frac{1}{n}x\ \text{cm}$$



Length = [M.S.R. + (V.S.R. × L.C.]

$= [3mm + 5 \times 0.1mm]$

$= (3.5mm)$

Main Scale Reading

final answer $= (3.5mm \pm L.C]$

*MR Problem

One cm on the main scale of vernier callipers is divided into ten equal parts. If 20 divisions of vernier scale coincide with 8 small divisions of the main scale. What will be the least count of callipers ?

$1\,cm = 10\ M.S.D$

$1\ M.S.D = \frac{1cm}{10}$

$20\ V.S.D = 8\ M.S.D$

$L.C = 1\ M.S.D - 1\ V.S.D$

$= 1\ M.S.D - \frac{8}{20}\ M.S.D$

$= \frac{12}{20}\left(\frac{1cm}{10}\right)$

*MR Problem

In Vernier calipers 8 M.S.D. is coinside with 10 Vernier scale division then find least count.

$8\,M.S.D = 10\,V.S.D$

$L.C = 1\,M.S.D - 1\,V.S.D$

$1\,M.S.D = 1\,mm$

QUESTION

The main scale of a Vernier callipers has n divisions/cm. n divisions of the Vernier scale coincide with $(n-1)$ divisions of main scale. The least count of the Vernier callipers is

1 $\frac{1}{(n+1)(n-1)}$ cm

2 $\frac{1}{n}$ cm

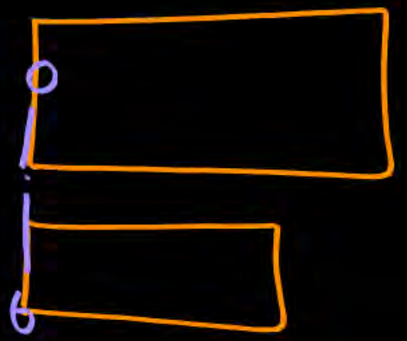
3 $\frac{1}{n^2}$ cm

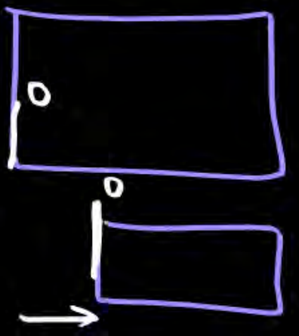
4 $\frac{1}{n(n+1)}$ cm

1 cm = n divis.

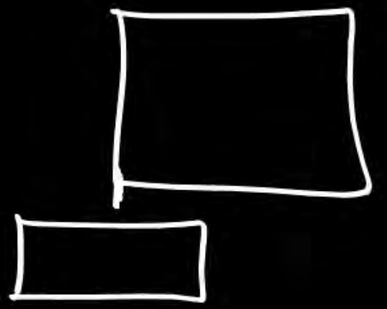
1 M.S.D = $\frac{1\text{ cm}}{n}$

(*) Zero error → always subtracted from reading. With Proper sign.





+ve zero error



-ve zero error

QUESTION

If measured length of Rod is 1.56 cm then instrument used is

(a) metre scale

(b) Vernier calliper

(c) screw gauge

$l = 1.56\,cm$

$= 1.56 \times 10\,mm$

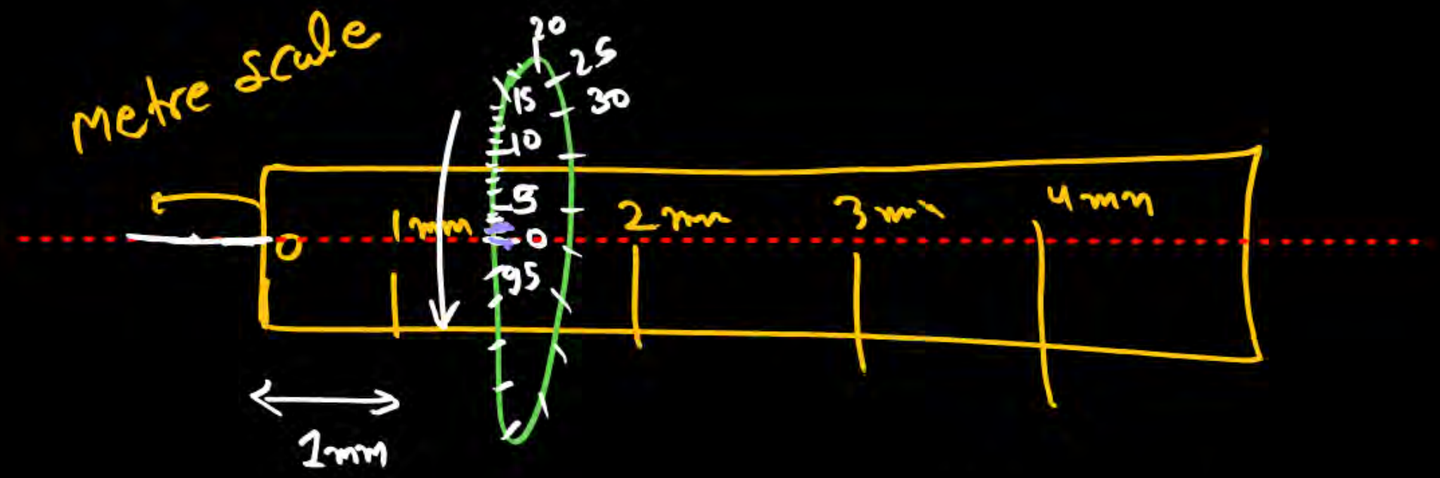
$= 15.6\,mm$

Metre Scale
L.C = 1mm

Vernier calliper
L.C = 0.1mm

Screw gauge
L.C = 0.01mm

Screw gauge



$$L.C = \frac{\text{Pitch}}{\text{No circular division}} = \frac{1mm}{100}$$

$$L.C = 0.01mm$$

$$\text{Real} = \left(M.S.R + \frac{C.S.R}{\times L.C}\right)$$

Distance travelled by circular scale in one Rotⁿ = 1 Pitch

100 division on circular cut = 1mm

1 division cut करेगा $= \frac{1mm}{100} = 0.01mm$

QUESTION

Write down name of measuring instrument for given measurement :

(1) 87.3 mm

(2) 0.831 cm

(3) 6.7 cm

(4) 6.7 mm

(5) 8.53 cm

(6) 8.96 mm

(7) 9.812 cm

1 mm — M.S

0.1 mm — V.C

0.01 mm — S.G

QUESTION

Write down name of measuring instrument for given measurement :

(1) 87.3 mm

(2) 0.831 cm

(3) 6.7 cm

(4) 6.7 mm

(5) 8.53 cm

(6) 8.96 mm

(7) 9.812 cm


0
1
0
5
10


1
2
0
5
10


7
8
0
5
10

QUESTION

Find the zero correction in the given figure.

1. 0.4 mm
2. 0.5 mm
3. –0.5 mm
4. –0.4 mm

QUESTION

One centimeter on the main scale of Vernier calliper is divided into ten equal parts. If 10 divisions of Vernier scale coincide with 8 small divisions of the main scale, the least count of the callipers is:

1. 0.01 cm
2. 0.02 cm
3. 0.05 cm
4. 0.07 cm

SCREW GAUGE

Distance on main scale in 1 Rotation :

$$= \text{Pitch} = 1 \text{ mm}$$

Minimum measurement that can be taken :

$$= \frac{\text{Pitch}}{\text{No.of Circular division}}$$

$$= \frac{\text{M.S.D.}}{\text{No.of circular division}}$$

QUESTION

A screw gauge has least count of 0.01 mm and there are 50 divisions in its circular scale. The pitch of the screw gauge is [NEET-2021]

1. 0.01 mm
2. 0.25 mm
3. 0.5 mm ✓
4. 1.0 mm

$$0.01\,mm = \frac{Pitch}{50}$$

$$Pitch = 50 \times 0.01\,mm$$

$$= \frac{1}{100} \times 50$$

QUESTION

A student measured the diameter of a small steel ball using a screw gauge of least count 0.001 cm. The main scale reading is 5 mm and zero of circular scale division coincides with 25 divisions above the reference level. If screw gauge has a zero error of – 0.004 cm, the correct diameter of the ball is [NEET-2021]

1. 0.521 cm
2. 0.525 cm
3. 0.053 cm
4. 0.529 cm

M.S.R = 5

C.S.R = 25

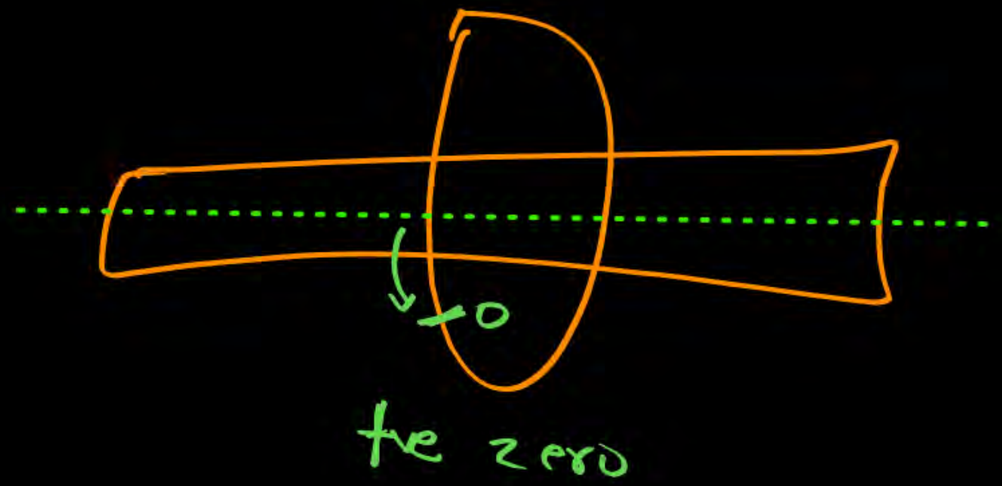
$R = 5\text{mm} + 25 \times 0.01\text{mm}$

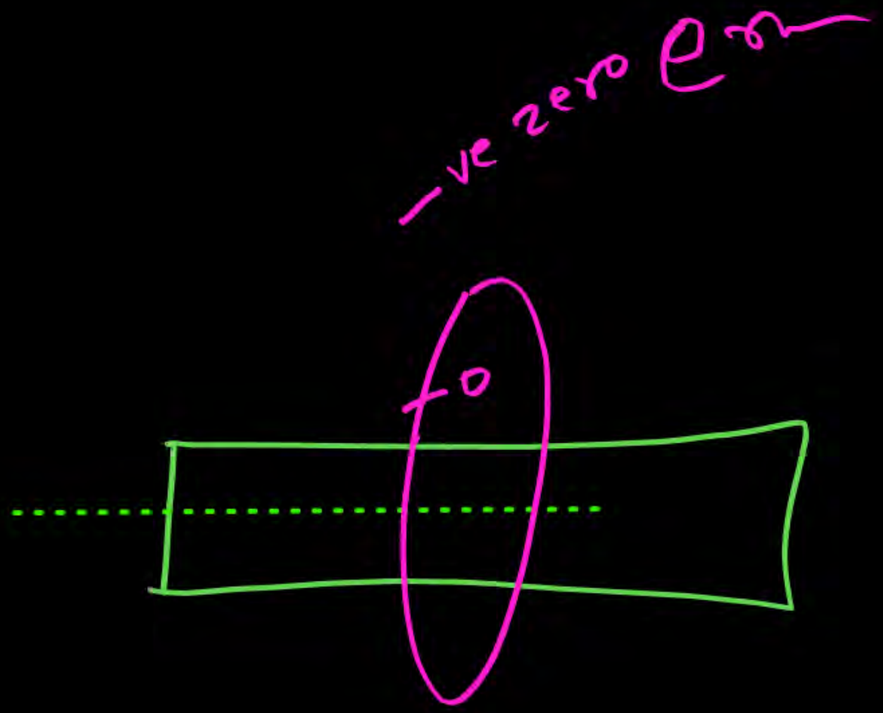
$= 5.25\text{mm}$

$= 0.525\text{cm}$

$= +0.004$

0.529cm


0
the zero


-ve zero
0

QUESTION

Two full turns of the circular scale of gauge cover a distance of 1 mm on scale. The total number of divisions on circular scale is 50. Further, it is found that screw gauge has a zero error of –0.03 mm. While measuring the diameter of a thin wire a student notes the main scale reading of 3 mm and the number of circular scale division in line, with the main scale as 35. The diameter of the wire is

1. 3.32 mm
2. 3.73 mm
3. 3.67 mm
4. 3.38 mm

+ve zero → When zero of circular scale is below the reference level.

–ve zero → When zero of circular scale is above the reference level.

QUESTION

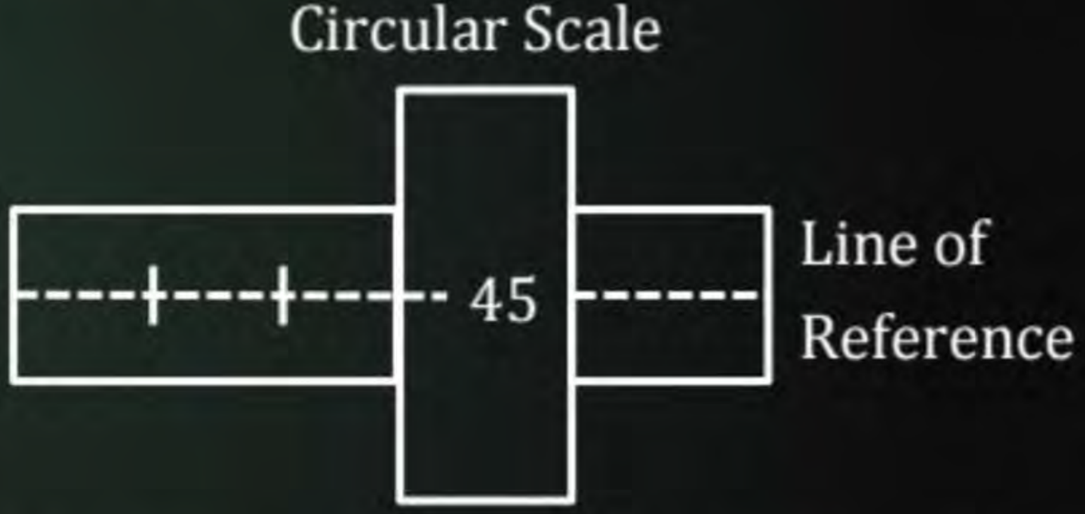
The pitch of a screw gauge is 1 mm and there are 100 division on its circular scale. When nothing is put in between its jaws, the zero of the circular scale lies 4 divisions below the reference line. When a steel wire is placed between the jaws, two main scale divisions are clearly visible and 67 divisions on the circular scale are observed. The diameter of the wire is

1. 2.71 mm
2. 2.67 mm
3. 2.63 mm
4. 2.65 mm

QUESTION

Consider a screw gauge without any zero error. What will be the final reading corresponding to the final state as shown? It is given that the circular head translates P MSD in N rotations. One MSD is equal to 1 mm.

1. $\left(\frac{P}{N}\right)\left(2+\frac{45}{100}\right)$ mm
2. $\left(\frac{N}{P}\right)\left(2+\frac{45}{N}\right)$ mm
3. $P\left(\frac{2}{N}+\frac{45}{100}\right)$ mm
4. $\left(2+\frac{45}{100}\times\frac{P}{N}\right)$ mm



ERROR IN MEASUREMENT

Systematic Error

- Fixed or constant error in magnitude
- Can't decrease by increasing no. of observation

L.C. Error

Random Error

- Irregular or varies in magnitude
- Can be minimize by taking large no. of measurement

Systematic Error

↓

Type

↓

1. Instrumental error + zero error
2. Wrong experimental technique
3. Personal error

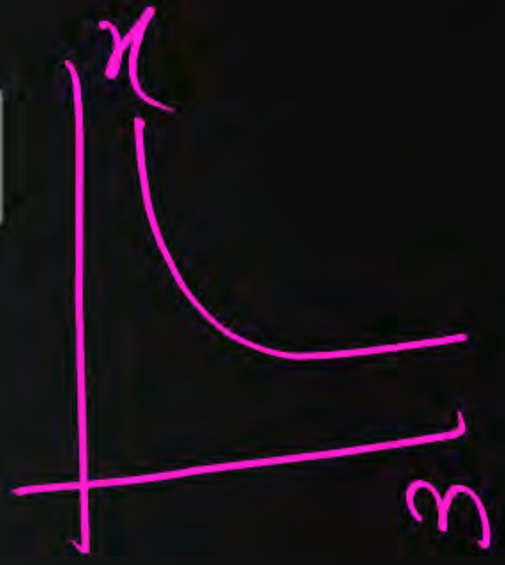
Random Error

↓

Type

↓

Due to random change in pressure temperature



$xn = cst.$

QUESTION

Zero error of an instrument introduces:

1. Systematic errors
2. Random errors
3. Both
4. None

QUESTION

In 5 no of observation random error is 12% then find error is 20 observation?

THANK YOU