Important Formulae X Science

Ls-1 Laws of motion:

Like parallel forces $F_{net} = F_1 + F_2$

Unlike parallel forces $F_{net} = F_1 - F_2$

Torque $\tau = F \times S$

Principle of moments = $F_1 \times d_1 = F_2 \times d_2$

Force $F = ma$ m = mass, a = acceleration

$1 N = 1 kg\,ms^{-2}$; $= 1 kgf = 1 kg \times 9.8\,ms^{-2}$

$1\,dyne = 1\,g\,cm\,s^{-2}$; $1 N = 10^5\,dyne$

Impulse (J) = $F \times t$ = Force × time

Law of conservation of momentum

$m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$

By Newton's law of gravitation

Force $F = \frac{GMm}{r^2}$ $G = 6.67 \times 10^{-11}\,Nm^2kg^{-2}$

Acceleration due to gravity

$g = \frac{GM}{R^2}$ | M - Mass, R - Radius

weight $w = mg$

Apparent weight

(i) when lift is moving upwards

$R = m(g+a)$ [R → apparent wt of the person] a = acceleration

ii) when lift is moving downwards

$R = m(g-a)$ m → mass of the person

iii) when lift is at rest

$R = mg$ g → acceleration

iv) when lift is falling down freely

$R = 0$

Lesson-2 Optics:

$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$ $\mu = \frac{C_a}{C_m}$

C_a - speed of light in air or Vaccum

C_m - speed of light in medium

Amount of scattering $= S \propto \frac{1}{\lambda^4}$

This is also called Rayleigh scattering law

Lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

v → distance of image

u → distance of object

$m = \frac{h'}{h} = \frac{h_i}{h_o} = \frac{\text{height of the image}}{\text{height of the object}}$

Magnification $(m) = \frac{v}{u} = \frac{\text{distance of the image}}{\text{distance of the object}}$

Power of a lens $P = \frac{1}{f}$

Lens Maker's formula:

$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

μ - refractive index

R_1, R_2 — Radii of curvature of two faces of the lens.

Focal length of required concave lens for myopia $f = \frac{xy}{x-y}$

Focal length of required convex lens for hypermetropia $f = \frac{dD}{d-D}$

Magnification for simple microscope

$M = 1 + \frac{D}{f}$ D → Least distance of distinct vision from the lens of the eye.

Magnification for Compound microscope

$M = \left[\frac{u}{v}\left(1 - \frac{D}{f_e}\right)\right]$ (or) $M = \left(\frac{v}{f_o} - 1\right)\left(1 + \frac{D}{f_e}\right)$

Astronomical telescope:

$M = \frac{f_o}{f_e}$ f_o → focal length of objective lens, f_e → focal length of eye lens

Lesson-3 Thermal Physics:

Relation between Celsius and kelvin

$K = C + 273$

Fahrenheit to kelvin

$K = (F - 32)\,5/9 + 273$

Coefficient of linear expansion

$\alpha_L = \frac{\Delta L}{L_0 \Delta T}$

ΔL - change in length (Final length - original length)

L_0 - original length

ΔT - change in temperature (Final temperature - Initial temperature)

Co-efficient of areal expansion (or) superficial expansion $\alpha_A = \frac{\Delta A}{A_0 \Delta T}$

$\Delta A \rightarrow$ change in area (Final area - Initial area)

$A_0 \rightarrow$ original area

$\Delta T \rightarrow$ change in temperature (Final temperature - initial temperature)

Co-efficient of cubical expansion

$\alpha_V = \frac{\Delta V}{V_0 \Delta T}$

$\Delta V \rightarrow$ change in volume (Final volume - initial volume)

$V_0 \rightarrow$ original volume

$\Delta T \rightarrow$ change in temperature (Final temperature - initial temperature)

Boyle's law = $P \propto \frac{1}{V}$ $PV = \text{constant}$

Charles law = $V \propto T$ (or) $\frac{V}{T} = \text{constant}$

Avagadro's law = $V \propto n$ (or) $\frac{V}{n} = \text{constant}$

$n \Rightarrow$ no: of atoms or molecules

Ideal gas equation: $PV = RT$

Lesson - 4 Electricity

Ohm's law $V = IR$ $R = \frac{V}{I}$ Unit = ohm (Ω)

Resistivity $\rho = \frac{RA}{L}$ Unit: ohm-metre (Ωm)

Conductance $= \frac{1}{R}$ Unit: ohm^{-1} (mho)

Conductivity: $\sigma = \frac{1}{\rho} = \frac{1}{\text{resistivity}}$

Unit: $\Omega^{-1} m^{-1}$ (or) $mhom^{-1}$

Resistance in series $R_S = R_1 + R_2$

If 'n' resistors connected in series

$R_S = nR$

Resistance in Parallel:

$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Joule's law: $H = I^2Rt$ (or) $H = VIt$

Electric power: $P = VI$ $P = \frac{VIt}{t}$

Unit: (W) (or) volt ampere

$1 kwh = 36 \times 10^5 J$ (or) $3.6 \times 10^6 J$

Electrical energy $E = P \times t = VIt = VQ$ (Unit = Joule)

If 'n' resistors connected in parallel $R_P = R/n$

Electric current $I = \frac{Q}{t}$ Unit: Ampere (or) Cs^{-1}

specific resistance (or) Electrical resistivity

$\rho = \frac{RA}{L}$

Unit = ohm metre

Electrical Potential difference

$V = \frac{W}{Q}$ (or) $W = VQ$

Unit: volt

Electrical Resistance $R = \frac{V}{I}$ Unit (Ω)

L-5 Accoustics

Time period $T = 1/n$ $n \Rightarrow$ Frequency

Frequency $n = 1/T$ $T \rightarrow$ Time period

$c = \nu\lambda$ $\nu = \frac{c}{\lambda}$ $\lambda \rightarrow$ wavelength, $\nu \rightarrow$ Frequency

$I \propto A^2$ $I \Rightarrow$ Intensity, $A \Rightarrow$ Amplitude

$V_T = (V_0 + 0.61T)$

$V_0 \Rightarrow$ Velocity of sound in the gas at 0°c

V_T → velocity of sound at temperature T

$\frac{V_2}{V_1} = \sqrt{\frac{T_2}{T_1}}$

Accoustic Impedance = Density of the medium × speed of sound

Unit: $kgm^{-2}s^{-1}$

Velocity = $\frac{2d}{t}$ = $\frac{\text{distance travelled by sound}}{\text{time taken}}$

source and listener move towards each other $(n') = \left(\frac{V+V_L}{V-V_S}\right)n$

source and listener move away from each other $(n') = \left(\frac{V-V_L}{V+V_S}\right)n$

Listener move towards the stationary source $(n') = \left(\frac{V+V_L}{V}\right)$

Listener move away from the stationary source $(n') = \left(\frac{V-V_L}{V}\right)n$

Source move towards stationary listener $n' = \left(\frac{V}{V-V_S}\right)n$

source move away from stationary listener $(n') = \left(\frac{V}{V+V_S}\right)n$

n' = apparent frequency
n = actual frequency
V_S = velocity of listener
V_S = Velocity of source

Intensity of sound

$I = \frac{W}{A \times t} = \frac{\text{work}}{\text{Area} \times \text{time}}$

Unit = $\frac{\text{work}}{\text{time} \times \text{Area}}$ = Js^{-1}/m^2 = Wm^{-2}

I = $\frac{\text{Power}}{\text{Area}}$ (or) $\frac{E}{t}/A$

wavelength $\lambda = \frac{V}{n}$ V = velocity, n = frequency

Lesson-6 Nuclear Physics

$U^{235}, Pu^{239}, P^{241}$ = fissionable material

$U^{238}, Pu^{240}, Th^{232}$: fertile material

$_2He^4$ = α particle
I^{131} = cure goiter
Fe^{59} = treat anaemia
P^{32} = Cure skin disease
Co^{60}, Au^{79} - Treatment of skin Cancer
Cl^{252} = Detect explosives
Am^{241} = smoke detector
C^{14} = Archaeological research

Components of Nuclear reactor

Control rod = Boron & cadmium
coolant = water, air and liquid sodium
Fuel = uranium
Moderator = graphite, heavy water
Fuel = Uranium

Values:

1 Rd (Rutherford) = 10^6 disintegrations/sec.

1 curie = 3.7×10^{10} disintegration/sec

1 Roentgen = 2.58×10^{-4} C in 1 kg

speed of light $c = 3 \times 10^8 ms^{-1}$

Temperature required for fusion 10^7 to 10^9 K

Energy radiated by sun = 3.8×10^{26} J/s

Energy released in fusion = 200 MeV

α decay: $_{92}U^{238} \rightarrow {}_{90}Th^{234} + {}_{2}He^{4}$

β-decay: $_{15}P^{32} \rightarrow {}_{16}S^{32} + {}_{-1}e^{0}$

Nuclear fission: $_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3\,{}_{0}n^{1} + Q$ (energy)

Nuclear fusion: $_{1}H^{2} + {}_{1}H^{2} \rightarrow {}_{2}He^{4} + Q$ (energy)

Inventions & Discoveries:-

Radioactivity = Henri Becquerel

Radium and Polonium = Marie Curie & F. Joliot

Artificial Radioactivity = Irene Curie & F. Joliot

Radioactive displacement law = Soddy & Fajan

Nuclear fission = Otto Hahn & F. strassman

X-rays = Roentgen

Nucleus (protons) = Rutherford

Uranium = Martin klaproth

Ganasoundari Msc ,B.ed (Physics)
Sri Annai Ranni Convent Hr.Sec School
katterikuppam
Cell:8144940852