PHYSICS & MATHEMATICS FORMULA HANDBOOK

A Complete Reference Guide

ABU MUNIRU
YAKUBU ABDULGHAALIB ADINOYI

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INTRODUCTION

I am very happy and excited to welcome you all to this book titled "Mathematics & Physics Formula Handbook: A Complete Reference Guide" I know some of us don't like physics and mathematics as a course or subject, especially because we think of it as a very hard and complicated course or subject. However, it is as simple as ABC when you are familiar with the basic formulas and do a lot of practice. As they say, "practice leads to perfection."

Some students often think physics is not a good course to study in tertiary institutions, but this is a mistake because physics offers a lot of job opportunities, such as Engineering, Data Scientist/Analyst, Medical Physicist, Teaching/Professorship, Computer Programmer/Software Developer, Environmental Scientist, and many more.

For instance, in a physics or mathematics examination, if you were asked to define the term "velocity," it would be very easy for you. However, if you were asked, 'if a car moves a distance of 10m for 10 seconds, what will be the velocity of the car?' This question might be difficult for some students because they don't know the formula.
Another example is when you are asked to calculate the perimeter of a rectangle in a Mathematics examination. This question is straightforward, but if you don't know the formula, it will seem very difficult.

So, I conducted research and created this formula book to make physics and mathematics very simple for determined students. Just as you cannot build a house starting from the rooftop, you cannot understand physics and mathematics without knowing the basic formulas of each.

In conclusion, physics and mathematics are simple science subjects or courses because they are something we see and make use of every day. Physics is life, actually, because everything you were being taught or you came across during studying physics or mathematics is something that you have seen before, e.g., generator, wires, batteries, voltmeter, etc.

So please try to know all these basic formulas in the chapters ahead.

If you have any questions, you can reach out to us on;
Email: graphictechs45@gmail.com
WhatsApp: +234-8075676906

I wish you guys a successful learning experience and adventure.

CHAPTER 1: DIMENSION ANALYSIS

Length = L

Mass = M

Time = T

Electric Current = A

Temperature = K

Amount of Substance = N

Luminous Intensity = II

Velocity = LT^{-1}

Acceleration = LT^{-2}

Force = MLT^{-2}

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

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

Area = L^{2}

Volume = L^{3}

Speed = LT^{-1}

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

Momentum = MLT^{-1}

Impulse = MLT^{-1}

Electric charge = AT

Density = ML^{-3}

Frequency = T^{-1}

Electric Capacitance = $M^{-1}L^{-1}T^{4}A^{2}$

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

Specific Heat = $L^{2}T^{-2}K^{-1}$

Thermal Conductivity = $MLT^{-3}K^{-1}$

Moment of Inertia = ML^{2}

Gravitational Acceleration (g) = LT^{-2}

Simple pendulum $(\mathrm{T} = 2\pi\sqrt{\frac{\mathrm{L}}{\mathrm{g}}})$ = LT^{-2}

Hooke's law (F = ke) = $\mathrm{MT^{-2}L}$

Ohm's law (V= IR) = $ML^{2}T^{-3}A^{-1}$

Albert Einstein equation ($\mathrm{E = mc^{2}}$) = $ML^{2}T^{-2}$

CHAPTER 2: MOTION FORMULAS

This chapter consists of the three (3) equations of motion, velocity, distance, acceleration, kinetic and potential energy, momentum, impulse, bullet and gun, lift or elevator, simple harmonic motion, projectile motion, motion under gravity, friction, sliding, dynamic or kinetic friction. Below are the formulas:

The three (3) equations of motion

i. $v = u + at$

ii. $v^2 = u^2 + 2as$

iii. $s = ut + \frac{1}{2}at^2$

Where;

- v = finial velocity, u = initial velocity, a = acceleration, t = time and s = distance.
- Distance = speed x time
- Speed = $\frac{Distance}{Time}$
- Average Speed = $\frac{total\ distance}{total\ time}$
- Velocity = $\frac{Displacement}{time\ taken}$
- Acceleration = $\frac{\text{Change in velocity}}{time}$

- Kinetic energy = $\frac{1}{2}mv^2$
- Potential energy = mgh
- Momentum = mv
- Impulse = $f = \frac{m(v-u)}{t}$ or $ft = m(v-u)$

Where;

v = finial velocity, u = initial velocity, a = acceleration, t = time, g = acceleration due to gravity, f = force and h = height or distance.

Bullet and gun

- Momentum of bullet = mu, in the forward direction

Where;

m = mass of the bullet, u = velocity of the bullet

- Momentum of the Riffle or gun = MV, in backward direction

Where;

M = mass of the Riffle, V = velocity of the recoil of the Riffle or gun

Therefore, the combined formula is given below

mu = MV

Lift Or Elevator

1. When a lift moves upward with uniform acceleration a, the apparent weight of the body is equal to R minus weight which is equal to the force. $\mathbf{R = m(g + a)}$

2. When a lift moves downward with uniform acceleration a, the weight of the body is equal to weight minus R is equal to the force. $\mathbf{R = m(g - a)}$

3. When a lift is at rest the resultant force is equal to its weight. $\mathbf{R = mg}$

4. When a lift is moving up or down with constant (uniform velocity), the resultant force is also equal to its weight. $\mathbf{R = mg}$

5. When a lift is failing freely, the resultant force becomes zero. Thus, the body inside the lift becomes weightless. $\mathbf{R = m(g-a)}$

Simple Harmonic Motion (S.H.M)

- Acceleration = rw^2
- The acceleration towards the center = $Rw^2 \sin\theta$
- Displacement = y = r sin wt
- S = rθ
- V = rw
- Period = T = 2π\ω **or** T = 1\f
- Frequency = $f = \frac{1}{T}$ (where T is time)
- Simple Pendulum = $T = 2\pi\sqrt{\frac{L}{g}}$

Where;

L is length and g is acceleration due to gravity.

- Simple pendulum = $\frac{T1}{T2} = \frac{L1}{L2}$
- Floating on a liquid = $T = 2\pi\sqrt{\frac{m}{A\rho g}}$

Where; π = pi, m = mass, A = Area, ρ = density and g = acceleration due to gravity

Projectile Motion

- Time of Flight = $T = \frac{2u \sin\theta}{g}$
- Range (R) = $\frac{u^2 sin^2\theta}{g}$
- Maximum Height = H = $\frac{u^2 sin^2\theta}{2g}$
- $H_{max} = \frac{u^2}{2g}$
- $T = \frac{2u}{g}$
- Time of Flight = $T = \frac{\sqrt{2H}}{\sqrt{g}}$
- Time taken to reach H_{max} = $T = \frac{u}{g}$

Where;

u = initial velocity, g = acceleration due to gravity, t = time,and H = height

Motion under gravity

- $V = u + gt$
- $V^2 = u^2 + 2gs$
- $S = ut + \frac{1}{2}gt^2$

Where;

V = velocity, u = initial velocity, t = time, s = distance and g = acceleration due to gravity.

Friction

- $\mu_s = \frac{F_r}{mg}$ or $\frac{F_m}{mg}$
- $F_r = \mu_s.mg$
- $F_m = mg.\sin\theta$
- $R = w = mg.\cos\theta$
- $\mu_s = \frac{mg\sin\theta}{mg\cos\theta} = \tan\theta$

NOTE: The dot means multiplication.

Where;

F_m = moving force

F_r = limiting frictional force

F_n = Forced applied

R = normal reaction between surfaces

W = weight

μ_s = coefficient of static\ stationary

Note: $F_r = F_m$

Sliding, dynamic or kinetic friction

- $\mu_k = \frac{F^1}{R} = \frac{F^1}{mg}$
- $\mu k = \frac{F^1}{mg}$

Where;

F^1 = dynamic friction force

R = normal reaction between surfaces

μ_k = coefficient of kinetic friction

CHAPTER 3: ELECTRICITY FORMULAS

This chapter consists of capacitors, capacitors in series and parallel, electric current, potential difference, voltage, resistance, resistance in series and parallel, Wheatstone bridge, meter bridge, potentiometer, Ohm's law, resistivity, electrical conductivity, electrical energy, electrical power. Below are the formulas:

- Capacitor = $C = \frac{Q}{V}$
- For parallel plate capacitor = $C = \frac{Ae}{d}$
- Capacitor in parallel arrangement = $C_r = C_1 + C_2 + C_3 \ldots\ldots\, C_n$
- Capacitor in series arrangement = $\frac{1}{C_r} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots + \frac{1}{C_n}$
- Energy stored in a capacitor = $\frac{1Q^2}{2\,C}$
- Calculating work done = $\frac{1}{2}CV^2 \text{ or } \frac{1}{2}QV$
- Electric current = Q = It
- Potential Difference = $V = \frac{Work\ done}{Quantity\ of\ charge(Q)}$
- Voltage = V = IR
- Resistance = $R = \frac{V}{I}$

- Wheatstone-bridge = $\frac{R_1}{R_2} = \frac{R_3}{R_4}$
- Meter-bridge = $X = \frac{RL}{100-L}$
- Potentiometer = $\frac{E_1}{L_1} = \frac{E_2}{L_2}$
- Resistance in series = $R_c = R_1 + R_2 + R_3 + ... + R_n$
- Resistance in parallel = $\frac{1}{R_c} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ... + \frac{1}{R_n}$
- Ohm's Law = V= IR

Resistivity

- R = $\frac{\rho L}{A}$
- R = $\frac{\rho L}{\pi r^2}$
- R = $\frac{4\rho L}{4d^2}$
- Electrical conductivity = $k = \frac{1}{RA}$

Electrical Energy

- W = Qv
- W = Ivt
- W = I^2Rt
- W = $\frac{V^2 t}{R}$

Where;

Q = quantity of charge, v = voltage, R = resistance, I = current, t = time and w = workdone.

Electrical Power

- P = $\frac{\text{energy}}{\text{time}} = \frac{Ivt}{t}$
- P = IV
- P = I^2R
- P = $\frac{V^2}{R}$
- Real Power = IV(cosθ)
- Apparent Power = IV
- Real Power = power factor × apparent Power
- E.M.F = IR + Ir **or** I (R + r)
- Lost Voltage (vr) = Ir

Where;

P = power, I = electric current, v = voltage, t = time, R = resistance, E.M.F = electromotive force, IR = external resistance and Ir = internal resistance.

CHAPTER 4: ELASTICITY FORMULAS

- Hooke's Law = $F = Ke$

Where;

F = force, k = constant and e = extension

- Tensile stress = $\frac{\text{force (f)}}{\text{area (A)}}$
- Tensile strain = $\frac{\text{extension (e)}}{\text{original length (L)}}$
- Young Modulus (E) = $\frac{FL}{Ae}$

$$\therefore F = \frac{EAe}{L}$$

- Force-constant (K) = $\frac{F}{e}$
- Workdone = $\frac{1}{2}Ke^2$
- Elastic P.E = W = ½fe
- Velocity = $\frac{1}{2}ke^2 = \frac{1}{2}mv^2$
- Strain = $\frac{\Delta L}{L}$

CHAPTER 5: PRESSURE, DENSITY AND UPTHRUST, AND KINETIC GAS LAW FORMULA.

This chapter consists of pressure, pressure in liquid, density, relative density, pressure law, Boyle's law, Charles's law, and the general gas law.

Pressure

- Pressure = $\frac{\text{force}}{\text{surface area}} = \frac{F}{A}$
- Pressure in Liquid = $\frac{\text{total thrust}}{\text{total area}}$
- P = $\frac{Ah\rho g}{A} = h\rho g$

Where;

H = height, A = Area, p = density, and g = acceleration due to gravity

Density and Upthrust

- Density (ρ) = $\frac{Mass}{Volume}$
- ρ = m\v or m = ρv (S.I unit = kgm^{-3})
- Density of irregular shape = $\frac{\text{Mass of irregular object}}{\text{Volume of water displaced}}$
- Relative Density = $\frac{\text{density of substance}}{\text{density of water}}$

Gas law formula

- Pressure law = $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

Where;

P_1 = initial pressure, T_1 = initial temperature.

P_2 = final pressure, T_2 = final temperature.

- Boyle's law = $P_1V_1 = P_2V_2$

Where;

P_1 = initial pressure, V_1 = initial volume.

P_2 = final pressure, V_2 = final volume.

- Charles' law = $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

Where;

V_1 = initial volume, T_1 = initial temperature.

V_2 = final volume, T_2 = final temperature.

- General gas law = $\frac{P_1V_1}{T_2} = \frac{P_2V_2}{T_2}$

Where;

P_1 = initial pressure, V_1 = initial volume.

P_2 = final pressure, V_2 = final volume.

T_1 = initial temperature, T_2 = final temperature.

CHAPTER 6: WAVES FORMULA

This chapter consists of period, frequency, velocity of wave, speed of sound in air, magnification, distance of a mirror, number of images, focal length, mirror formula, and lens formula.

- Period (T) = $\frac{2\pi}{\omega}$ **or** $\frac{1}{f}$
- Frequency (F) = $\frac{1}{T}$
- V = f λ

Where;

V = velocity, f = frequency and λ = wavelength.

- Speed of sound in air (V) = $\frac{\lambda}{T}$
- Speed of sound in air = $V = \frac{2x}{t}$
- Magnification (M) = $\frac{\textbf{image height}\ (D_I)}{\textbf{object height}\ (D_o)} = \frac{\textbf{image distance}\ (H_I)}{\textbf{object distance}\ (D_o)}$
- Distance of a mirror (D) = V + U
- Number of images (n) = $\frac{360°}{\theta - 1}$
- Angle of Deviation = D = 2g
- Focal length = $\frac{\text{radius of curvature}}{2}$ $\boldsymbol{or}$ $\frac{r}{2}$

Mirror formulae

- $\frac{1}{V} + \frac{1}{U} = \frac{1}{F}$
- $\frac{1}{V} + \frac{1}{U} = \frac{2}{r}$
- $M = \frac{V}{F-1}$
- $M = \frac{2V}{r-1}$

Where;

U = distance or height of object, V = distance or height of image, f = focal length, r = radius and M = magnification.

Lens formula

- $\frac{1}{V} + \frac{1}{U} = \frac{1}{F}$
- $\frac{u}{f} - \frac{1}{m} = 1$
- $\frac{v}{f} - m = 1$

Where;

U = distance or height of object, V = distance or height of image, f = focal length, and M = magnification.

CHAPTER 7: MACHINE FORMULAS

- Mechanical advantage = $\frac{load}{effort} = force\,ratio$
- Velocity ratio = $\frac{effort}{load}$
- Velocity ratio = $\frac{X}{Y}$
- Efficiency = $\frac{\text{Mechanical advantage (M.A)}}{\text{Velocity ratio (V.R)}}$ x 100
- The Velocity ratio (V.R) of a screw = $\frac{2\pi a}{\rho}$ (a = radius)
- V.R = $\frac{1}{sin\theta}$ x $\frac{\text{length of plane}}{\text{height}}$
- Velocity Ratio of a Gear = $\text{V.R} = \frac{x}{y}$

Where;

x = the number of teeth in the driven wheel, y = the number of teeth in the driving wheel

- Coefficient of friction between two bodies = $\mu = \frac{F}{R}$

Where;

F = limiting friction, R = Normal reaction, μ = coefficient of friction

Lever formulae

- M.A = $\frac{load}{effort}$
- V.R = $\frac{effort\ arm}{load\ arm}$

- Lever = $\frac{load}{effort} = \frac{effort\ arm}{load\ arm}$

CHAPTER 8: FORCE FIELD

- F = $\frac{GMm}{R^2}$
- Gravitational potential = $V = \frac{-GM}{R}$
- V = $V = \frac{\sqrt{2GM}}{R}$
- G = $\frac{GM}{R^2}$
- Escape velocity = $V = \sqrt{2gR}$
- F = $\frac{GM_1M_2}{r^2}$
- F = mg
- Magnetic force = $F = BeV.\sin\theta$

Where;

e is charge of electron, V is the velocity and B is the magnetic field.

- Force on wire = F = BIL

  F = $BIL.\sin\theta$

CHAPTER 9: SURFACE TENSION, HUMIDITY, WEATHER, AND TEMPERATURE CONVERSION.

Surface tension

- Surface tension(T) = $\frac{F}{L}$ or $\frac{F}{d}$ (Nm^{-1})
- Coefficient of surface tension = $T = \frac{rh\rho g}{2}$
- Viscosity = $\eta = \frac{Force}{Area}$ x Velocity gradient

Humidity and Weather

- Relative humidity (R.H) = $\frac{M_1}{M_2} X \frac{100}{1}$

Where;

M_1 = Mass of water vapor, M_2 = Mass of the statured vapor.

Temperature conversion

- From ^{0}C to ^{0}F = $\left(\frac{^0C}{1} x \frac{5}{9}\right) + 32$
- From ^{0}C to K = ^{0}C + 273K
- From K to ^{0}C = ^{0}C - 273K

CHAPTER 10: HEAT (THERMAL ENERGY)

This chapter consists of thermal conductivity, temperature gradient, linear expansivity of a solid, area and volume (cubic) expansivity of a solid, expansivity of a liquid, apparent expansivity, resistance thermometer, specific heat capacity of material, heat capacity, quantity of heat, specific heat capacity of a solid by electrical method, specific heat capacity of a liquid by electrical method, and specific latent heat.

- Thermal Conductivity (Q) = $\frac{KA[\theta_2 - \theta_1]}{\Delta x}$ (S.I unit $= wm^{-1}k^{-1}$)

Where;

K = coefficient of thermal conductivity

A = cross-sectional area

t = time

$\theta_1 - \theta_2$ = change in temperature

Δx = change in length

- Temperature Gradient = $\frac{\theta_1 - \theta_2}{\Delta x}$ (S.I unit = $^0Cm^{-1}$)

Linear Expansivity of a Solid

- $\alpha = \frac{l_2 - l_1}{l_1(\theta_2 - \theta_1)}$ (S.I unit = K^{-1})

Where;

α = linear Expansivity of a Solid

l_1 = initial length

l_2 = final length

θ_1 = initial temperature

θ_2 = final temperature

Increase in Length

- $l_1 - l_2 = \alpha l_1 \theta$

Final Length

- $l_2 = l_1 (1 + \alpha\theta)$

Area and Volume (cubic) Expansivity of a Solid

AREA

- $\beta = \frac{A_2 - A_1}{A_1(\theta_2 - \theta_1)}$
- $A_2 = A_1 (1 + \beta\theta)$

Where;

$\beta = 2\alpha$

β = area expansivity of solid

A_1 = Initial area

A_2 = final area

θ_1 = initial temperature

θ_2 = final temperature

VOLUME

- $\gamma = 3\alpha$
- $\gamma = \frac{V_2 - V_1}{V_1(\theta_2 - \theta_1)}$
- $V_2 = V_1 (1 + \gamma\theta)$

Area Easy Formula

- $2\alpha = \frac{A_2 - A_1}{A_1(\theta_2 - \theta_1)}$

Volume Easy Formula

- $3\alpha = \frac{V_2 - V_1}{V_1(\theta_2 - \theta_1)}$

Expansivity of a Liquid

Real Expansivity

- $\gamma_r = \gamma_a + \gamma$

Where;

γr = real Expansivity

γ_a = apparent Expansivity

γ = Cubic Expansivity of the material

Apparent expansivity

- $\gamma_a = \frac{V_2 - V_1}{V_1(\theta_2 - \theta_1)}$

To Find V_2

- $V_2 - V_1 = \gamma a V_1 (\theta_2 - \theta_1)$

Heat energy: measurement of temperature

- $\theta = \frac{P_\theta - P_o}{P_{100} - P_o} \times \frac{100}{1}$

Where;

P_o = pressure at θ^0c

P_{100} = pressure at 100^0c

P_θ = pressure at θ

Resistance Thermometer

- $0^0c = \frac{R_\theta - R_o}{R_{100} - R_o} x \frac{100}{1}$

Where;

R_o = resistance of the platinum 0^0c (ice point)

R_{100} = resistance of the platinum coil at 100^0c (steam point)

R_θ = resistance of the platinum coil at temperature of θ^0c

Specific Heat Capacity of Material

- Q = Mc[$\theta_2 - \theta_1$]
- C = $\frac{Q}{m}(\theta_2 - \theta_1)$

Where;

Q = quantity of heat required in joules

M = mass of substances heated

C = specific heat capacity ($jkg^{-1}k^{-1}$)

The Heat Capacity (c)

- C = mc

Where;

C = heat capacity

m = mass of the substance

c = specific heat capacity of the substance

Quantity of heat or heat capacity

- Q = mc($\theta_2 - \theta_1$)

Specific heat capacity of a Solid by electrical method

- C = $\frac{Ivt}{m(\theta_2 - \theta_1)}$ (S.I unit = $jkg^{-1}k^{-1}$)

Specific Heat Capacity of a Liquid by Electrical method

- C = Ivt – mc cc (θ2 – θ1)\m1 (θ2 – θ1)

Where;

M1 = know mass of a liquid

mc = mass of the calorimeter

cc = specific Heat Capacity of calorimeter

Mct (for liquid) = Ivt (for heater)

Specific Latent Heat

- I = $\frac{Q}{M}$

Where;

Q = quantity of Heat in joules

m = mass of substance in kg

I = specific latent heat

WHEN A SOLID MELTS

- Ivt = ml

Where;

I = electric current

V = voltage

t = time

m = mass

l = length

MATHHEMATICS SECTION

MATHEMATICS FORMULAS SECTION

CHAPTER 11: LAW OF INDICES AND LOGARITHM

Law of indices

a) $a^m \times a^n = a^{m+n}$

b) $\frac{a^m}{a^n} = a^{m-n}$

c) $(a^m)^n = a^{mn}$

d) $a^0 = 1$

e) $a^{-n} = \frac{1}{a^n}$

f) $\sqrt[n]{a^m} = a^{m/n}$

g) $(ab)^m = a^m x\, b^m$

h) $(\frac{a}{b})^m = \frac{a^m}{b^m}$

i) If $a^m = b^m$ $(m \neq 0)$, then a = b.

j) If $a^m = a^n$ then m = n.

Laws of Logarithm

a) If $a^x = M$ then $\log_a M = X$

b) $\log_a 1 = 0$

c) $\log_a a = 1$

d) $a^{\log_a m} = M$

e) $\log_a MN = \log_a M + \log_a N$

f) $\log_a \left(\frac{M}{N}\right) = \log_a M - \log_a N$

g) $\log_a M^n = n\log_a M$

CHAPTER 12: MENSURATION, AREAS, PERIMETER, VOLUME, AND LATITUDE AND LONGITUDE FORMULAS.

This chapter covers mensuration, including formulas for areas, perimeter, volume, as well as latitude and longitude

- Square = L^2
- Rectangle = L × B
- Triangle = ½bh
- Parallelogram = Base × Height
- Rhombus = ½(product of the diagonal)
- Trapezium = ½h(a + b)
- The area of a circle = πr^2
- Area of a sector = $\frac{\theta}{360°}$ x $\pi r^2\ cm^2$
- Area of circle = πr^2
- Circumference of a circle = $2\pi r$
- Perimeter of square = 4S
- Perimeter of a rectangle = 2(x + y)
- Perimeter of a rhombus = 4x

- Perimeter of a triangle = (a + b + c)
- Area of a trapezium = $\frac{1}{2}(x + y)h$

Where;

x and y are two parallel sides and h is the height.

- Perimeter of a trapezium = (p + y + q + x)
- Calculate the length of the arc = $\theta/360° \times 2\pi r$
- Perimeter of a sector = $2r + \theta/360° \times 2\pi r$
- Perimeter of a sector = 2r + L
- Area of a segment = Area of a sector – area of a triangle = $\frac{\theta}{360°} \times \pi r^2 - \frac{1}{2}r^2\sin\theta$
- Area of a sector = $\theta/360° \times \pi r^2$
- Surface area of a cone = πrl
- Area of a cube = $6x^2$
- Total surface area of a cuboid = 2(xy + yz + xz)
- The formula for the volume of a sphere = $V = 4/3\pi r^3$
- Surface Area of a Sphere $A = 4\pi r^2$

Cylinder formula

- Curved surface area = $2\pi rh$
- Curved surface area with one end closed = $2\pi rh + \pi r^2$
- Curved surface area with two ends closed = $2\pi r(h + r)$

Cone formula

- Curved surface area = πrl
- Total surface area = $\pi rl + \pi r^2$
- Volume of a cube = S^3
- Volume of a cylinder = $\pi r^2 h$
- Volume of a cuboid = xyz
- Volume of a pyramid = $\frac{1}{3}\text{Base area} \times \text{height}$
- Volume of a cone = $\frac{1}{3}\pi r^2 h$

Latitude and longitude

- Radius of the earth = 6,370 km or 6,400km
- Circumference of the parallel = $2\pi r$
- The length of the arc = $\frac{\theta}{360^\circ}$ x $2\pi r$ or $\frac{\theta}{360^\circ}$ x $2\pi R cos\theta$
- Speed = $\frac{Distance}{Time} = \frac{D}{T}$

CHAPTER 13: BUSINESS MATHEMATICS

Profit and loss formula

- Profit = S.P – C.P (where; S.P is selling price and C.P is cost price)
- Loss = C.P – S.P
- Profit % = $\frac{Profit}{C.P} x \frac{100}{1}$
- Loss % = $\frac{loss}{C.P} x \frac{100}{1}$
- Selling price = $\frac{\text{C.P } (100 + \text{profit\%})}{100}$
- Selling price = $\frac{\text{C.P } (100 + \text{loss\%})}{100}$
- Cost price = $\frac{100 \times \text{S.P}}{100 + \text{profit\%}}$
- Cost price = $\frac{100 \times \text{S.P}}{100 - \text{loss\%}}$
- Selling price = market price – discount
- Selling price = price after discount + value added tax.

Simple interest

- I = $\frac{PRT}{100}$ (where; p = principal, R = rate, T = time and I or S.I = simple intrest)
- Amount (A) = P + I

Compound interest

- $C.L = P[(\frac{I + R}{100})^{n-1}]$

where;

p = principal, R = rate, T = time, n = time and C.L = compound interrest.

- Amount (A) = P $(I + R\backslash 100)^{n}$

CHAPTER 14: EQUATIONS AND PERCENTAGE ERROR.

Equations

- Quadratic Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Distance Formula: d= $\sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
- Slope Formula: Slope = $\frac{(y_2 - y_1)}{(x_2 - x_1)}$
- Slope Intercept: y = mx+b
- Midpoint Formula: $\frac{(x_1 + x_2)}{2}$, $\frac{(y_1 + y_2)}{2}$
- Pythagorean Theorem: $a^2 + b^2 = c^2$

Percentage error

- Percentage error = $\frac{\text{error}}{\text{measurement}}$ x 100%
- If The True Value is known

Percentage error = $\frac{\text{error}}{true\ value}$ x 100%

CHAPTER 15: TRIGONOMETRY

Basic trigonometric identities

The six (6) trigonometric identities

i. Sine (Sin): = $\frac{\text{opposite}}{\text{hypotenuse}}$

ii. Cosine (Cos) = $\frac{adjacent}{\text{hypotenuse}}$

iii. Tangent (Tan) = $\frac{opposite}{adjacent}$

iv. Cosecant (Cosec) = $\frac{1}{sin}$ **or** $\frac{opposite}{hypotenuse}$

v. Secant (Sec) = $\frac{1}{cos}$ **or** $\frac{adjacent}{hypotenuse}$

vi. Cotangent (cot) = $\frac{1}{tan}$ **or** $\frac{opposite}{adjacent}$

Pythagorean trigonmentric identities

- $a^2 + b^2 = c^2$ .... $**$

By diving through by c^2 will we have

- $\frac{a^2}{c^2} + \frac{b^2}{c^2} = 1$ ....(1)

Recall that $\frac{a^2}{c^2}$ is $cos^2\theta$ and $\frac{b^2}{c^2}$ is $sin^2\theta$

- $cos^2\theta + sin^2\theta = 1$.......(2) (and it is called fundamental identity)
- $cos^2\theta = 1 - sin^2\theta$ ....(3)
- $sin^2\theta = 1 - cos^2\theta$ ....(4)

By dividing equation(2) through by $cos^2\theta$

- $\sec^2\theta = 1 + \tan^2\theta$ ......(5)

By dividing equation(2) through by $sin^2\theta$

- $\text{cosec}^2\theta = \cot^2\theta + 1$ ....(6)

Sun and difference identities

- $\sin(a \pm b) = \text{sinacosb} \pm cosasinb$
- $\cos(a + b) = \text{cosacosb} - \text{sinasinb}$
- $\cos(a - b) = \text{cosacosb} + \text{sinasinb}$
- $\tan(a + b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$
- $\tan(a - b) = \frac{\tan a - \tan b}{1 + \tan a \tan b}$

Double-angle trig identities

- $\sin 2\theta = 2\sin\theta\cos\theta$
- $\cos 2\theta = \cos^2\theta - \sin^2\theta$
- $\cos 2\theta = 2\cos^2\theta - 1$
- $\cos 2\theta = 1 - 2\sin^2\theta$

- $\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$

Sum to product trig identities

- $\sin a + \sin b = 2\sin\left(\frac{a+b}{2}\right)\cos\left(\frac{a-b}{2}\right)$
- $\sin a - \sin b = 2\cos\left(\frac{a+b}{2}\right)\sin\left(\frac{a-b}{2}\right)$
- $\cos a + \cos b = 2\cos\left(\frac{a+b}{2}\right)\cos\left(\frac{a-b}{2}\right)$
- $\cos a - \cos b = -2\sin\left(\frac{a+b}{2}\right)\sin\left(\frac{a-b}{2}\right)$

Product to sum identities

- $2\text{Sin}a\text{Cos}b = \sin(a+b) + \sin(a-b)$
- $2\text{Cos}a\text{Sin}b = \sin(a+b) - \sin(a-b)$
- $2\text{Cos}a\text{Cos}b = \cos(a+b) + \cos(a-b)$
- $2\text{Sin}a\text{Sin}b = \cos(a-b) - \cos(a+b)$

Special angles

- Sin 30^0 = $\frac{1}{2}$
- Cos 30^0 = $\frac{\sqrt{3}}{2}$
- Tan 30^0 = $\frac{1}{\sqrt{3}}$
- Sin 60^0 = $\frac{\sqrt{3}}{2}$
- Cos 60^0 = $\frac{1}{2}$

- Tan $60^0 = \sqrt{3}$

TRIGONOMETRICAL RATIO

1st Quadrant ($0^0 < \theta < 90^0$)

i. Sin θ = + Sin θ

ii. Cos θ = + Cos θ

iii. Tan θ = + Tan θ

2nd Quadrant ($90^0 < \theta < 180^0$)

i. Sin θ = + Sin (180^0 - θ)

ii. Cos θ = - Cos (180^0 - θ)

iii. Tan θ = - Tan (180^0 - θ)

3rd Quadrant ($180^0 < \theta < 270^0$)

i. Sin θ = - Sin (θ – 180^0)

ii. Cos θ = - Cos (θ – 180^0)

iii. Tan θ = + Tan (θ – 180^0)

4th Quadrant ($270^0 < \theta < 360^0$)

i. Sin θ = - Sin (360^0 - θ)

ii. Cos θ = + Cos (360^0 - θ)

iii. Tan θ = - Tan (360^0 - θ)

THE SINE RULE

In any triangle, with angles A, B, C and sides a, b, c opposite these angles

$$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$$

CHAPTER 16: VARIATION, ARITHMETIC PROGRESSION AND GEOMETRIC PROGRESSING.

VARIATION

(i) If x varies directly as y, we write x $\propto$ y or, x = ky where k is a constant of variation.

(ii) If x varies inversely as y, we write $\mathbf{x} \propto \frac{\mathbf{1}}{\mathbf{y}}$ or, $\mathbf{x} = \mathbf{m}\, \boldsymbol{x} \frac{\mathbf{1}}{\mathbf{y}}$ where m is a constant of variation.

(iii) If x $\propto$ y when z is constant and x $\propto$ z when y is constant then x $\propto$ yz when both y and z vary.

Arithmetical Progression (A.P.):

(i) The general form of an A. P. is a, a + d, a + 2d, a + 3d e.t.c where a is the first term and d, the common difference of the A.P.

(ii) The nth term of the above A.P. is given by $T_n = a + (n-1)d$

(iii) The sum of first n terns of the above A.P. is $S_n = {}^n/_2\, [2a + (n-1)\, d]$

(iv) The arithmetic mean between two given numbers a and b is $\frac{(a+b)}{2}$.

Geometrical Progression (G.P.):

(i) The general form of a G.P. is a, ar, ar^2, ar^3 e.t.c where a is the first term and r, the common ratio of the G.P.

(ii) The nth term of the above G.P. is $T_n = ar^{-1}$

(iii) The sum of first n terms of the above G.P. is $S_n = \frac{a(1-r^n)}{1-r}$ when 1 < r.

OR

$S_n = \frac{a(r^n - 1)}{r-1}$ when r > 1 or r < -1.

(iv) The geometric mean of two positive numbers a and b is √ (ab) or, -√ (ab).

CHAPTER 17: STATISTICS AND PROBABILITY

STATISTIC

- Mean ($\bar{x}$) = £fx\£f
- Assumed ($\bar{x}$) = A + £fd\£f
- Cumulative Frequency

  |Marks| f | C.F |

- Variance = £f (x - $\bar{x}$)^2\£f
- Standard deviation = √£f (x – $\bar{x}$) ^{2}\£f
- Mean deviation = £f (x - $\bar{x}$)\£f
- Median = L + w (n+1)\ (2 – F_b)\F_m

Where;

L = lower class boundary of medium class

W = width of the class interval

F_b = sum of frequencies before the median class

F_m = frequency of the median class

N = number of observation

PROBABILITY

- P (A) = r\n

Where;

r = number of favorable outcomes

n = total number of outcomes

- Coin = (HH, HT, TH, TT)

Where;

H = head of the coin.

T = tail of the coin.

CHAPTER 18: CALCULUS

Derivative Formulas for Elementary Functions

i. $\frac{d}{dx}(K) = 0$ (constant rule)

ii. $\frac{d}{dx}(Ku) = K\frac{du}{dx}$

iii. $\frac{d}{dx}(u \pm v) = \frac{du}{dx} \pm \frac{dv}{dx}$ (sum and difference rule)

iv. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dv}$ (product rule)

v. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$ (quotient rule)

vi. $\frac{dy}{du}\cdot\frac{du}{dy} = 1$ (chain rule)

vii. $\frac{d}{dx}(x^n) = nx^{n-1}$ (power rule)

viii. $\frac{d}{dx}(e^x) = e^x$ (exponential function)

ix. $\frac{d}{dx}(a^x) = a^x \log a$

x. $\frac{d}{dx}(\log x) = \frac{1}{x}$

xi. $\frac{d}{dx}(\log_a x) = \frac{1}{x}\log_a e$

Differentiation of trigonometric functions

i. $\frac{d}{dx}(\sin x) = \cos x$

ii. $\frac{d}{dx}(\cos x) = -\sin x$

iii. $\frac{d}{dx}(\tan x) = sec^2 x$

iv. $\frac{d}{dx}(\cot x) = -cosec^2 x$

v. $\frac{d}{dx}(\sec x) = \sec x \tan x$

vi. $\frac{d}{dx}(\mathrm{cosec}\, x) = -cosecx\ cotx$

Operation rule on trig functions

vii. $\frac{d}{dx}(\sin u) = \cos u \frac{du}{x}$

viii. $\frac{d}{dx}(\cos u) = -\sin u \frac{du}{dx}$

ix.

$$\frac{d}{dx}(\tan u) = sec^2 u \frac{du}{dx}$$

x. $$\frac{d}{dx}(\cot u) = -cosec^2 u \frac{du}{dx}$$

xi. $$\frac{d}{dx}(\sec u) = \sec u \tan u \frac{du}{dx}$$

xii. $$\frac{d}{dx}(cosecu) = -cosecu\ cot\ u \frac{du}{dx}$$

Differentiation of inverse trig functions

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i. $$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$$

ii. $$\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$$

iii. $$\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$$

iv. $$\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$$

v. $$\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$$

vi. $$\frac{d}{dx}(cosec^{-1} x) = -\frac{1}{x\sqrt{x^2-1}}$$

Differentiation of hyperbolic functions

i. $$\frac{d}{dx}(\sinh x) = \cosh x$$

ii. $$\frac{d}{dx}(\cosh x) = \sinh x$$

iii. $$\frac{d}{dx}(\tanh x) = sec^2 x$$

iv. $$\frac{d}{dx}(\coth x) = -cosec^2 x$$

v. $$\frac{d}{dx}(\text{sech}\, x) = -sechx\ tanhx$$

vi. $$\frac{d}{dx}(cosech\ x) = -cosechx\ cothx$$

Differentiation of inverse hyperbolic functions

i. $$\frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{x^2+1}}$$

ii. $$\frac{d}{dx}(\cosh^{-1} x) = \frac{1}{\sqrt{x^2-1}}$$

iii. $$\frac{d}{dx}\left(\tanh^{-1} x\right) = \frac{1}{1-x^2}$$

iv. $$\frac{d}{dx}\left(\coth^{-1} x\right) = -\frac{1}{1-x^2}$$

v. $$\frac{d}{dx}\left(\text{sech}^{-1} x\right) = -\frac{1}{x\sqrt{1-x^2}}$$

vi. $$\frac{d}{dx}\left(\text{cosech}^{-1} x\right) = -\frac{1}{x\sqrt{1+x^2}}$$

integration Formulas of Elementary Functions

i.
$\int a dx = ax + c$ (constant rule)

ii.

$\int x dx = \frac{x^2}{2} + c$ (variable rule)

iii.
$\int \frac{1}{x} dx = \ln x + c$ (reciprocal rule)

iv.
$\int e^x dx = e^x + c$ (exponential rule)

v.

$\int x^n dx = \frac{x^{n+1}}{n+1} + c$ (power rule)

vi.
$\int cf(x)dx = c\int f(x)dx$ (multiplication by constant)

vii.
$\int (u \pm v)dx = \int udx \pm \int vdx$ (sum and difference rule)

Integral of trigonometric functions

---

i. $\int \sin xdx = -\cos x + c$

ii. $\int \cos xdx = \sin x + c$

iii. $\int \tan xdx = ln|secx| + c$

iv. $\int secx\, dx = ln|tanx + secx| + c$

v. $sin^2xdx = \frac{1}{2}(x - sinx\, cosx) + c$

vi. $\int cos^2xdx = \frac{1}{2}(x + sinx\, cosx) + c$

vii. $\int tan^2xdx = tanx - x + c$

viii. $\int sec^2xdx = tanx + c$

ix. $\int cosec^2xdx = -cot^2x + c$

x. $$\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + c$$

xi. $$\int \frac{1}{\sqrt{1 + x^2}} dx = \tan^{-1} x + c$$

Integration by substitution

$$\frac{dx}{du} \int f(u) du$$

Integration by part

$$\int udv = uv - \int vdu$$

CHAPTER 19: PHYSICS PARAMETERS

M = Mass

L = Length

t = Time

T = Temperature

q = Charge

E = Energy

P = Power

P = Pressure

P = Density

V = Volume

I = Electric Current

R = Resistance

B = Magnetic Field

Φ = Magnetic Flux

f = Frequency

λ = Wavelength

A = Amplitude

T = Period

E = Electric Field

G = Gravitational Constant

c = Speed of Light

N = Avogadro's Number

R = Gas Constant

k = Coulomb's Constant

ε_0= Permittivity of Free Space

μ_0= Permeability of Free Space

G = Universal Gravitational Constant

Amu = Atomic Mass Unit

ω = Angular Velocity

α = Angular Acceleration

Φ = Electric Flux

k = Thermal Conductivity

c = Specific Heat Capacity

R= Thermal Resistance

h = Heat Transfer Coefficient

Iv = Luminous Intensity

E = Illuminance

Φ = Luminous Flux

I = Sound Intensity

SPL = Sound Pressure Level

dB = Decibel

n = Index of Refraction

f = Focal Length

p = Momentum

μ = Friction Coefficient

E = Elasticity

Y = Young's Modulus

G = Shear Modulus

K = Bulk Modulus

ν = Poisson's Ratio

σ = Stress

ε = Strain

P = Resistivity

τ = Torque

Work (W)

I = Rotational Inertia

Fc = Centripetal Force

ac = Centripetal Acceleration

vc = Centripetal Velocity

n = Refractive Index

ω_0= Natural Frequency

Vt = Terminal Velocity

T = Thrust

γ = Heat Capacity Ratio

a = acceleration

C = capacitance

Q = quantity of charge

I = current

E = energy

F = Faraday constant

F = force

F = frequency

G = gravitational force

I = impulse

S = speed

w = work

W = weight

E = young modulus

g = acceleration due to gravity

D = distance

K = Kelvin

U = uniform acceleration

H = height

K = force-constant

A = area

£ = permittivity of medium

d = distance apart

V = voltage

R = external resistance

r = internal resistance

R = resistivity

π = pie

E.M.F = Electromotive force

T = Period

r = displacement

ω = angular speed\velocity

A = amplitude

ρ = liquid of density

π = 3.142

F_m = moving force

F_r = limiting frictional force

F_n = force applied

R = normal reaction between surfaces

μ_s = coefficient of statics\stationary

μ_k = coefficient of kinetic friction

F^1 = dynamic friction force

J = joules

N = Newton

Ω = Ohms

A = Amps

P.d = potential Difference

Kw = kilowatt

kWh = kilowatt hour

Vr = lost Voltage

f(x) = function of x

m = slope of a graph

W = watts

CHAPTER 20: PHYSICS UNITS & CONSTANTS

Meter (m)

Kilogram (kg)

Second (s)

Ampere (A)

Kelvin (K)

Mole (mol)

Candela (cd)

Newton (N)

Joule (J)

Watt (W)

Pascal (Pa)

Hertz (Hz)

Coulomb (C)

Volt (V)

Ohm (Ω)

Farad (F)

Tesla (T)

Weber (Wb)

Henry (H)

Siemens (S)

Lumen (lm)

Lux (lx)

Becquerel (Bq)

Gray (Gy)

Sievert (Sv)

Rad (rad)

Parsec (pc)

Astronomical Unit (AU)

Light-Year (ly)

Gram (g)

Millisecond (ms)

Microsecond (μs)

Microsecond (μs)

Nanometer (nm)

Millimeter (mm)

Centimeter (cm)

Kilometer (km)

Square Meter (m^2)

Cubic Meter (m^3)

Liter (L)

Milliliter (mL)

Kilogram per Cubic Meter (kg/m^3)

Newton-Meter (Nm)

Joule per Second (J/s or Watt)

Pascal-Second (Pa.s)

Newton-Second (Ns)

Joule-Second (J·s or N·m)

Watt per Square Meter (W/m^2)

Joule per Kilogram (J/kg)

Watt per Hertz (W/Hz)

Coulomb per Second (C/s or A)

Joule per Coulomb (J/C or V)

Ampere per Volt (A/V or Ω)

Coulomb per Kilogram (C/kg)

Volt per Meter (V/m)

Ohm Meter (Ω·m)

Farad per Meter (F/m)

Henry per Meter (H/m)

Joule per Mole (J/mol)

Joule per Kelvin (J/K)

Watt per Square Meter-Kelvin ($W/(m^2 \cdot K)$)

Joule per Mole-Kelvin (J/(mol·K))

Pascal per Kelvin (Pa/K)

Watt per Meter-Kelvin (W/(m·K))

Candela per Square Meter (cd/m^2)

Coulomb per Cubic Meter (C/m^3)

Gray per Second (Gy/s)

Sievert per Hour (Sv/h)

Radian (rad)

Degree (°)

Steradian (sr)

Arcsecond (arcsec)

Arcminute (arcmin)

Minute (min)

Hour (h)

Day (d)

Year (yr)

Hertz per Second (Hz/s)

Newton per Meter (N/m)

Newton per Square Meter (N/m^2)

Newton per Coulomb (N/C)

Coulomb per Newton (C/N)

Ampere per Meter (A/m)

Watt per Square Meter-Steradian ($W/(m^2 \cdot sr)$)

Volt per Meter-Steradian (V/(m·sr))

Joule per Cubic Meter (J/m^3)

Coulomb per Cubic Meter-Steradian ($C/(m^3 \cdot sr)$)

Joule per Kilogram-Kelvin (J/(kg·K))

Pascal per Second (Pa/s)

Kilogram per Meter (kg/m)

Kilogram per Second (kg/s)

Newton per Square Meter-Steradian ($N/(m^2 \cdot sr)$)

Watt per Meter-Steradian (W/(m·sr))

Lumen per Watt (lm/W)

Lux per Watt (lx/W)

Kilogram per Cubic Meter-Steradian ($kg/(m^3 \cdot sr)$)

Newton per Meter Squared (N/m^2)

Newton per Meter Cubed (N/m^3)

Pascal per Meter Cubed (Pa/m^3)

Joule per Meter Cubed (J/m^3)

Watt per Meter Cubed (W/m^3)

Watt per Kilogram (W/kg)

Hertz per Volt (Hz/V)

Joule per Ampere (J/A)

Joule per Square Meter (J/m^2)

Joule per Square Meter-Kelvin (J/(m^2·K))

Joule per Kilogram-Kelvin (J/(kg·K))

Watt per Square Meter-Kelvin (W/(m^2·K))

Pascal-Second per Kelvin (Pa·s/K)

Watt per Meter-Kelvin (W/(m·K))

Newton per Coulomb-Meter (N/(C·m))

Tesla Meter Squared (T·m^2)

Volt-Second per Meter (V·s/m)

Joule per Coulomb (J/C)

Joule per Volt (J/V)

Ampere-Hour (A·h)

Watt per Hertz per Square Meter (W/(Hz·m^2))

Joule per Cubic Meter-Steradian (J/(m^3·sr))

Newton per Meter-Second Squared (N/(m·s^2))

Newton-Second per Meter-Second Squared (N·s/(m·s^2))

Watt per Meter-Squared Hertz (W/(m^2·Hz))

Watt per Square Meter-Hertz ($W/(m^2 \cdot Hz)$)

Watt per Meter-Squared (W/m^2)

Volt per Square Meter (V/m^2)

Ampere per Square Meter (A/m^2)

Tesla Meter ($T \cdot m$)

Coulomb per Volt (C/V)

Ampere per Meter Squared (A/m^2)

Volt per Meter Squared (V/m^2)

Joule per Meter (J/m)

Joule per Second Squared ($J/(s^2)$)

Joule per Meter-Second ($J/(m \cdot s)$)

Pascal-Second per Meter Squared ($Pa \cdot s/m^2$)

Watt per Meter (W/m)

Newton per Square Meter (N/m^2)

Newton per Meter Cubed (N/m^3)

Watt per Meter Squared-Steradian ($W/(m^2 \cdot sr)$)

Volt per Meter-Squared Hertz ($V/(m^2 \cdot Hz)$)

Coulomb per Cubic Meter (C/m^3)

Watt per Meter-Squared Hertz-Steradian ($W/(m^2 \cdot Hz \cdot sr)$)

Joule per Cubic Meter-Hertz ($J/(m^3 \cdot Hz)$)

Joule per Cubic Meter-Steradian ($J/(m^3 \cdot sr$)

Joule per Gram (J/g)

Newton per Millimeter Squared (N/mm^2)

Pascal-Second per Watt ($Pa \cdot s/W$)

Hertz per Newton (Hz/N)

Watt per Millimeter (W/mm)

Newton per Millimeter (N/mm)

Pascal-Second per Kelvin (Pa·s/K)

Pascal-Second per Newton (Pa·s/N)

Fundamental constant in physics

Acceleration due to gravity (g) = $9.98\,\mathrm{m/s^2}$ or $10\,\mathrm{m/s^2}$

Speed of light in a vacuum (c) = $3 \times 10^{8}\ \mathrm{m/s}$

Planck's constant (h) = 6.63×10^{-34} Js

Gravitional constant (G) = $6.67 \times 10^{-11}\ \mathrm{Nm^2/kg^2}$

Charge (e) = 1.60×10^{-19} C

Boltzmann constant (k) = 1.38×10^{-23} J/K

Avogadro's number (N_A) = $6.02 \times 10^{23}\ \mathrm{mol^{-1}}$

Universal gas constant (R) = 8.31 J/mol.K

Faraday constant (F) = $96,485$ C/mol

Vacuum permeability (μ_0) = $4\pi \times 10^{-7}$ Tm/A

Vacuum permittivity (ε_0) = $8.85 \times 10^{-12}\ \mathrm{C^2/Nm^2}$

Rydberg constant (R_∞) = $1.10 \times 10^{7}\mathrm{m^{-1}}$

Fine-structure (α): 0.007297

Electron mass (m_e) = 9.11×10^{-35} kg

Proton mass (m_p) = 1.67×10^{-27} kg

Neutron mass (m_n) = 1.67×10^{-27} kg

Electron charge to mass ration ($\frac{e}{m_e}$) = $-1.76 \text{ x } 10^{11}$ C/kg

Planck length (l_p) = $1.62 \text{ x } 10^{-35}$ m

Planck mass (m_p) = $2.18 \text{ x } 10^{-8}$ kg

Planck time (t_p) = $5.39 \text{ x } 10^{-44}$ s

Stefan Boltzmann constant (σ) = $5.67 \text{ x } 10^{-8}$ $\text{W/m}^2\text{K}^4$

Coulomb constant (K_e) = $8.99 \text{ x } 10^9$ Nm^2/C^2

Atomic mass constant (u) = $1.66 \text{ x } 10^{-27}$ kg

Bohr radius (a_0)= $5.29 \text{ x } 10^{-11}$ kg

Rydberg constant for hydrogen (R_H) = $1.10 \text{ x } 10^7$ m^{-1}

Electron volt (eV) = $1.60 \text{ x } 10^{-19}$ J

Electron magnetic moment (μ_B) = $9.27 \text{ x } 10^{-24}$ J/T

Bohr magneton (μ_B) = $9.27 \text{ x } 10^{-24}$ J/T

Nuclear magneton (μ_N) = $5.05 \text{ x } 10^{-27}$ J/T

Mass of the sun (M_s) = $1.99 \text{ x } 10^{30}$ kg

Solar radius = $6.96 \text{ x } 10^8$ m

Astronomical unit (AU) = $1.50 \text{ x } 10^{11}$ m

Schwarzschild radius (r_s) = 2.95 Km

Universal time constant (τ) = $2.43 \text{ x } 10^{17}$ s

CHAPTER 21: MATHEMATICS PARAMETERS & CONSTANTS

n = Number

x, y, z = Variable

c = Constant (c)

f = Function (f)

E = Equation

∑ = Summation

$\frac{a}{b}$ = Fraction

√ = Square Root

a^n = Exponentiation (a^n)

Log = Logarithm

sin, cos, tan = Trigonometric Functions ()

$\frac{dy}{dx}$ = Derivative

∫ = Integral

lim = Limit

v = Vector

s = Scalar

(·) = Dots Product

(×) = Cross Product

|a| = Modulus

|x| = Absolute Value

$a + bi$ = Complex Number

(r, θ) = Polar Coordinates

(x, y) = Rectangular Coordinates

$ax^2 + bx + c = 0$ ==> Quadratic Equation

$ax + b = 0$ ==> Linear Equation

p = Prime Number

n! = Factorial

nPr = Permutation

nCr = Combination ()

{a, b, c, d} = Set

$A \cup B$ = Union of sets

$A \cap B$ = Intersection of sets

A' = Complement of a set

$A \subseteq B$ = Subset

$A \supseteq B$ = Superset

U = Universal Set

Ø = Empty Set

P = Probability

$\sqrt[3]{}$ = Cube Root

$\sqrt[n]{}$ = nth Root

√ = Radical Sign ()

$y = \sqrt{x}$ ==>Square Root Function

Fundamental constant in mathematics

Pi (π) = 3.14

Euler’s number (e) = 2.71

Goldlen ratio (ϕ) = 1.62

Imaginary unit (i) = $\sqrt{-1}$

Euler-Mascheroni constant (γ) = 0.577

Khinchin's constant (K) = 2.685

Feigenbaum constant (∂)= 4.67

Catalan's constant (G) = 0.92

Theodorus constant ($\sqrt{2}$) = 1.41

Mertens constant (M) = -2.94

Liouville's constant (L) = 0.11

Pi constant in degrees (π) = $180°$

Omega constant (Ω)= 0.57

Mill's constant (A) = 1.31

Plastic number (ρ) = 1.32

Bernstein's constant (B) = 0.28

Laplace limit (L) = 0.66

Levy constant (C) = 0.33

Universal parabolic constant (P) = 2.29