Physics Basic Formulas

Force (Newton's 2nd Law)

Formula

$$F = ma$$

F ⟶ Net Force

m ⟶ mass

a ⟶ acceleration

Velocity (v)

Formula

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}}$$

Density (ρ)

Formula

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Drag Force

Formula

$$D = \frac{1}{2} C\rho A v^2$$

- D → Drag Force
- ρ → fluid density
- v → relative velocity
- C → drag coefficient = 0.32
- A → transversal area or cross sectional area

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Gravitational Force (g)

Formula

$$F = \frac{Gm_1m_2}{r^2}$$

- G → Gravitational Constant (6.674×10^{-11} m^3 $kg^{-1}s^{-2}$)
- m_1 → mass of particle 1
- m_2 → mass of particle 2
- r → Distance between m_1 & m_2

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Buoyant Force

Formula

$$Fb = \rho gV = \rho ghA$$

Fb ⟶ Buoyant Force

ρ ⟶ density of liquid

g ⟶ gravitational acceleration

V ⟶ volume of liquid

h ⟶ height of water

A ⟶ surface area

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Momentum

Formula

$$P = mv$$

P ⟶ Momemtum

m ⟶ mass

v ⟶ velocity

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Angular Velocity (ω)

Formula

$$\omega = \frac{\Delta\theta}{t}$$

ω ⟶ Angular Velocity

θ ⟶ angle (angular position)

t ⟶ time

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Escape Velocity

Formula

$$V_{esc} = \sqrt{\frac{2Gm}{r}}$$

V_{esc} → Escape Velocity

G → gravitational constant ($6.67 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$)

m → mass of Earth, moon or any planet

r → radius of Earth, moon or any planet

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Orbital Velocity

Formula

$$V_{orbit} = \sqrt{\frac{Gm}{r}}$$

V_{orbit} → Orbital Velocity

G → gravitational constant ($6.67 \times 10^{-11}\ m^3\ kg^{-1}s^{-2}$)

m → mass of Earth, Moon, or any other Planet

r → distance from the center point of planet

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Dynamic Viscosity

Formula

$$\mu = \tau \frac{y}{u}$$

μ → Dynamic Viscosity

τ → shear stress

y → distance between the layers

u → shear velocity

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Kinematic Viscosity

Formula

$$\nu = \frac{\mu}{\rho}$$

ν ⟶ Kinematic Viscosity

ρ ⟶ fluid density

μ ⟶ dynamic viscosity

Kinetic Energy

Formula

$$KE = \frac{1}{2} mv^2$$

KE ⟶ Kinetic Energy

m ⟶ mass

v ⟶ velocity

Rotational Kinetic Energy

Formula

Rotational Kinetic Energy

$$K = \frac{1}{2} I \omega^2$$

K ⟶ Kinetic Energy

I ⟶ moment of inertia

ω ⟶ angular velocity

Gravitational Potential Energy

Formula

$$PE = mgh$$

PE ⟶ Potential Energy

m ⟶ mass in kilograms

g ⟶ acceleration of gravity

h ⟶ height in meters

Elastic Potential Energy

Formula

$$U = \frac{1}{2}kx^2$$

U ⟶ Potential Energy

k ⟶ elasticity constant

x ⟶ stretch distance of elastic object

Fluid Pressure

Formula

$$P = \rho gh$$

P ⟶ Pressure

ρ ⟶ density of a gas or fluid

g ⟶ acceleration due to gravity (9.80 m/s^2)

h ⟶ height of a column of gas or fluid

Fluid Surface Tension

Formula

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

γ → Surface Tension

F → force

L → length

Surface Charge Density

Formula

$$\sigma = \frac{q}{A}$$

σ → Surface Charge Density

q → total charge

A → surface area

Mach Number (Ma)

Formula

$$Ma = \frac{v}{c}$$

Ma → Mach Number

v → speed or velocity of an object

c → speed or velocity of sound

Reynolds Number (Re)

Formula

$$Re = \frac{\rho v D}{\mu}$$

- Re → Reynold's Number
- ρ → density of the fluid
- v → velocity of the fluid
- D → pipe inside diameter
- μ → dynamic viscosity of the fluid

Gauss Law

Formula

$$\phi_E = Q / \varepsilon_0$$

- ϕ_E → Electric Flux
- Q → total charge enclosed within V
- ε_0 → electric constant

Torque

Formula

$$\tau = r F \sin\theta$$

- τ → Torque
- r → radius
- F → force

Angular Acceleration

Formula

$$\alpha = \frac{\Delta\omega}{\Delta t}$$

α ⟶ Angular Acceleration

$\Delta\omega$ ⟶ change in angular velocity

Δt ⟶ change in time

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Ampere's Law

Formula

Ampere's Law:

$$B = \frac{\mu_0 I}{\Delta L}$$

B ⟶ Magnetic Field Strength

I ⟶ current flow in the closed circuit

ΔL ⟶ radius

μ_0 ⟶ permeability of free space

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Biot Savart's Law

Formula

Biot Savart's Law:

$$\hat{dB} = \frac{\mu_0 I}{4\pi r^2} \hat{dL} \times \hat{1}_r$$

dB ⟶ Magnetic Field Density

μ ⟶ permeability of free space

I ⟶ current

r ⟶ radius

dL ⟶ length of current carrying conductor

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Coulomb's Law

Formula

$$F = \frac{k\,Q_1 Q_2}{r^2}$$

- F → Force between Charges Q_1 & Q_2
- Q_1 → charged particle
- Q_2 → charged particle
- r → distance between center of the charges
- k → constant equals to 8.99×10^9 Nm^2/C^2

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Electric Field

Formula

$$E = \frac{k\,q}{r^2}$$

- E → Electric Field
- k → electric constant
- q → charge
- r → radius

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Induced Voltage

Formula

$$e = N\frac{d\Phi}{dt}$$

- e → Induced Voltage
- N → number of turns in coil
- Φ → magnetic flux
- t → time in seconds

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Resistivity & Conductivity

Formula

Resistivity:

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

- ρ → Resistivity
- R → resistance
- A → area of cross-section
- l → length of material

Conductivity:

$$C = \frac{1}{\rho}$$

- C → Conductance
- ρ → Resistivity

Resonant Frequency

Formula

$$f = \frac{1}{2\pi\sqrt{LC}}$$

- f → Resonant Frenquency
- L → inductance
- C → capacitance

Magnetic Force Charge

Formula

$$F = q\,v\,B\sin\theta$$

F ⟶ Magnetic Force

q ⟶ charge

v ⟶ velocity of charge

B ⟶ magnetic field

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Refraction

Formula

$$n = \frac{\sin i}{\sin r}$$

n ⟶ Refraction

i ⟶ angle of incident

r ⟶ angle of refraction

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