

SL. NO.	quantities	FORMULA (RELATIONS)	Electrostatics
1	Quantisation of Elect. Charges (Q) on a body	$Q = n.e$	n is Integral Number, e is charge on electron $1.6 \times 10^{-19} \text{ C}$
2	Electrostatic force constant	$1/(4\pi\epsilon_0)$	value : $9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$
3	Permittivity	ϵ_0	$8.85 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$
4	Coulumb's Law	$F = q_1q_2/4\pi\epsilon_0r^2$	q_1 and q_2 are two charges placed at distance r.
5	Forces on two charges	$F_{12} = - F_{21}$	Direction of F is along r.
6	Dielectric Constant	$K = \epsilon/\epsilon_0 = \epsilon_r$	ϵ is absolute permittivity of medium, ϵ_0 is permittivity of free space, ϵ_r is relative permittivity.
7	Electric Field at a point	$E = F/q$	F is force experienced by the test charge q at a point. E is called field intensity at that point
	Force with respect to field	$F = q.E$	
8	Electric field due to source charge Q at distance r	$E = Q/(4\pi\epsilon_0r^2)$	Direction of E is along r.
9	Electric Field due to dipole on a point on axial line	$E = 2P/(4\pi\epsilon_0r^3)$	P is dipole moment, r is distance from centre of dipole on axial line.
10	Electric Field due to dipole on a point on equitorial line	$E = P/(4\pi\epsilon_0r^3)$	P is dipole moment, r is distance from centre of dipole on equitorial line.
11	Electric Field due to dipole at any general point, at distance r making angle θ with P^-	$E = P\sqrt{1+3\cos^2\theta}/4\pi\epsilon_0r^3$	r is distance of point from midpoint of dipole, θ is angle between direction of r and dipole moment P
	E makes angle α with r then	$\tan \alpha = \frac{1}{2} \tan \theta$	α is angle between resultant field and direction of r, θ is angle between r and P
12	E at any point on the axis of a uniformly charged ring at distance r	$qr/4\pi\epsilon_0(r^2+a^2)^{3/2}$	
13	Torque on a dipole kept in Electric Field	$\tau = PE\sin\theta$ or $\tau = P \times E$	P is dipole moment, E is electric field, Direction of Torque is normal to plain containing P and E
14	Work done for rotating dipole by angle θ	$W = PE(1- \cos\theta)$	P is dipole moment. E is electric field
15	Potential Energy of dipole in equilibrium condition when P is along E.	$U = - PE$	P is dipole moment. E is electric field
16	Potential energy of dipole at 90 degree to E	Zero	
17	Potential energy of dipole at 180°	$U = + PE$	P is dipole moment. E is electric field
18	Electric Flux ϕ_E	$\phi_E = E.S = \int E.ds$	
19	gauss theorem	$\phi_E = \oint [E.ds] = q/\epsilon_0$	Flux linked to a closed surface is q/ϵ_0 times the charge enclosed in it.
20	Field due to infinite long straight charged conductor	$\lambda/2\pi\epsilon_0r$	λ is linear charge density in the conductor, r is the perpendicular distance.
21	Electric field due to infinite plane sheet of charge	$\sigma /2\epsilon_0$	σ is areal charge density. Independent of distance
22	Within two parallal sheets of opposite charges	σ / ϵ_0	Outside, field is zero
23	Within two parallal sheets of similar charges	zero	Outside, field is σ / ϵ_0
24	Electric field due to spherical shell, out side shell	$E = q/(4\pi\epsilon_0r^2)$	q is charge on shell, r distance from centre.

25	Electric field on the surface of spherical shell.	$E = q/(4\pi\epsilon_0 R^2)$	R is radius of shell
26	Electric field inside spherical shell.	Zero	
27	Electric field inside the sphere of charge distributed uniformly all over the volume.	$E = \rho r/3\epsilon$	r is radius of sphere, ρ is volumetric charge density, ϵ is permittivity of medium
28	Potential due to charge Q at distance r	$V = Q/(4\pi\epsilon_0 r)$	Potential is characteristic of that location
29	Potential Energy with charge q kept at a point with potential V	$U = qV = Qq/(4\pi\epsilon_0 r)$	Potential Energy is that of the system containing Q and q.
30	Work done for in moving a charge q through a potential difference of V	$W = q(V_2 - V_1)$	$V = (V_2 - V_1)$
	Energy of system of two charges	$U = q_1 q_2 / (4\pi\epsilon_0 r)$	
31	Relation of E and V	$E = - dv/dr$	dv is potential difference between two points at distance r where r and E are in the same direction.
32	Relation of E and V and θ	$E \cos\theta = - dv/dr$	where θ is angle between dr and E
33	Potential at infinity / in earth	Zero	
34	Electric Potential due to dipole on a point on axial line	$V = P/(4\pi\epsilon_0 r^2)$	P is dipole momentum, r is distance from centre of dipole
35	Electric Potential due to dipole on a point on equatorial line	Zero	
36	Electric Potential due to dipole at any general point,	$V = P \cos\theta / 4\pi\epsilon_0 (r^2 - a^2 \cos^2\theta)$	P is dipole momentum, r is distance from centre of dipole, a is half length of dipole, θ is angle between r and P
37	Work done in moving a charge between two points of an equipotential surface	Zero	
38	Capacitance of a spherical conductor	$4\pi\epsilon_0 R$	R is radius of the sphere
39	Capacitance of a parallel plate capacitor	$\epsilon_0 kA/d$	A is area of each plate, d is distance between them, k is dielectric constant of the medium between plates.
40	Dielectric Constant	$k = C / C_0$	C is capacitance with medium within plates, and C_0 is capacitance in free space.
41	Capacitance of a spherical capacitor.	$C = 4\pi\epsilon_0 r_a r_b / (r_a - r_b)$	r_a and r_b are radius of internal and external spherical shells
42	Equivalent capacitance for Capacitors in parallel	$C = C_1 + C_2 + C_3, \dots$	C is equivalent capacitance, C_1, C_2 are capacitance of the capacitors joined together.
43	Equivalent capacitance for Capacitors in series	$1/C = 1/C_1 + 1/C_2 + 1/C_3 + \dots$	
44	Charge, capacitance, Potential Difference	$C = q/V$	q is charge on the plate of capacitor and V is Potential Difference between the plates.
45	Energy stored in capacitor	$\frac{1}{2} C V^2, \frac{1}{2} q V, \frac{1}{2} q^2 / C$	q is charge, c is capacitance, v is Pot. Difference
46	Common Potential	$V = (C_1 V_1 + C_2 V_2) / (C_1 + C_2)$	
47	Energy loss in connecting	$\frac{1}{2} \frac{C_1 C_2}{C_1 + C_2} (V_1 - V_2)^2$	C_1 at V_1 is connected to C_2 at V_2
48	C with dielectric slab inserted	$\epsilon_0 kA/d - t(1 - 1/k)$	t is thickness of dielectric slab of constant k,
49	C with metal plate inserted	$\epsilon_0 kA/(d - t)$	t is thickness of metal plate inserted,
50	Force of attraction between plates	$\frac{1}{2} q^2 / \epsilon_0 A, \frac{1}{2} \epsilon_0 E^2 A$	q is charge on plate, A is area, E Elect. Field.

DYNAMICS AND KINEMATICS

$$x = x_0 + v_0 t + \frac{1}{2} a t^2 \quad F_s = -kx$$

$$\vec{F}_{net} = m\vec{a} \quad T = 2\pi\sqrt{\frac{m}{k}}$$

$$\vec{F}_{net} = \frac{d\vec{p}}{dt} \quad T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$f_k = \mu_k N$$

$$f_s \leq \mu_s N$$

$$a_c = \frac{v^2}{r} = \omega^2 r \quad T = 2\pi\sqrt{\frac{I}{mgr}}$$

WORK, ENERGY, POWER, AND MOMENTUM

$$W = \int \vec{F} \cdot d\vec{s} \quad P = \frac{dW}{dt}$$

$$U_s = \frac{1}{2} kx^2 \quad \vec{p} = m\vec{v}$$

$$U_g = mgh \quad F_s = -\frac{dU}{dx}$$

$$KE = \frac{1}{2} m v^2$$

$$\vec{r}_{cm} = \frac{\sum m_i \vec{r}_i}{\sum m_i}, \quad \vec{r}_{cm} = \frac{\int \vec{r} dm}{\int dm}$$

ROTATIONAL MOTION

$$s = r\theta$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$$

$$\vec{\tau} = \vec{r} \times \vec{F}, \quad \vec{\tau} = \frac{d\vec{L}}{dt}$$

$$\vec{L} = \vec{r} \times \vec{p}, \quad \vec{L} = I\vec{\omega}$$

$$I_{rod} = MR^2$$

$$I_{disc} = \frac{1}{2} MR^2$$

$$I_{sphere} = \frac{2}{5} MR^2$$

UNIVERSAL GRAVITATION

$$F = \frac{Gm_1 m_2}{r^2}$$

$$T^2 = \frac{4\pi^2}{GM} r^3$$

$$U_g = -\frac{Gm_1 m_2}{r}$$

MAGNETISM

$$\Phi_B = \int \vec{B} \cdot d\vec{A}$$

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$\vec{F} = i\vec{l} \times \vec{B}$$

$$d\vec{B} = \frac{\mu_0}{4\pi} \frac{i d\vec{s} \times \hat{r}}{r^2}$$

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

MECHANICS OF FLUIDS

$$p = p_0 + \rho gh$$

$$\rho v A = \text{constant}$$

$$p + \frac{1}{2} \rho v^2 + \rho gh = \text{constant}$$

THERMODYNAMICS

$$\Delta L = \alpha L_0 \Delta T \quad W = \int p dV$$

$$Q = mc\Delta T \quad \Delta S = \int \frac{dQ}{T}$$

$$Q = Lm$$

$$pV = nRT = NkT \quad \epsilon \leq 1 - \frac{T_L}{T_H}$$

$$dE = dQ - dW \quad \frac{dQ}{dt} = kA \frac{T_H - T_C}{L}$$

$$e = \frac{W_{out}}{Q_{in}} \quad \frac{Q_C}{W} = \text{COP}$$

ELECTROSTATICS

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \quad \Delta V = -\int \vec{E} \cdot d\vec{s}$$

$$\vec{E} = \frac{\vec{F}}{q} \quad \Phi_E = \int \vec{E} \cdot d\vec{A}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \quad C = \frac{Q}{V}$$

$$U = qV \quad C = \frac{\kappa\epsilon_0 A}{d}$$

$$V = \frac{1}{4\pi\epsilon_0} \frac{q}{r} \quad U = \frac{1}{2} CV^2$$

WAVES

$$v = f\lambda$$

$$y = A \sin(kx - \omega t)$$

$$k = \frac{2\pi}{\lambda}$$

$$v = \sqrt{\frac{T}{\mu}}$$

$$f' = f \frac{v \pm v_p}{v \mp v_s}$$

$$I = \frac{P}{A}$$

$$\beta = (10 \text{ dB}) \log_{10} \frac{I}{I_0}$$

CURRENTS

$$i = \frac{dq}{dt}$$

$$J = n|q|v_d$$

$$E = \rho J$$

$$R = \frac{\rho \ell}{A}$$