ELECTROSTATICS FORMULA-1

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 X 10^{-19} C
2	Electrostatic force constant	$1/(4\pi\epsilon_0)$	value : 9 x 10^9 Nm^2C^{-2}
3	Permittivity	ϵ_0	8.85 x 10^{-12} $C^2N^{-1}m^{-2}$
4	Coulumb's Law	$F = q_1q_2/4\pi\varepsilon_0 r^2$	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	$K = \varepsilon/\varepsilon_0 = \varepsilon_r$	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	$E = Q/(4\pi\varepsilon_0 r^2)$	Direction of E is along r.
9	Electric Field due to dipole on a point on axial line	$E = 2P/(4\pi\varepsilon_0 r^3)$	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	$E = P/(4\pi\varepsilon_0 r^3)$	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 $\vec{P}$	$E = P\sqrt{(3\cos^2\theta+1)}/4\pi\varepsilon_0 r^3$	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 thenjj	$\tan\alpha = \frac{1}{2}\tan\theta$	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	$qr/4\pi\varepsilon_0(r^2+a^2)^{3/2}$	
13	Torque on a dipole kept in Electric Field	τ = PESinθ or $\boldsymbol{\tau} = \boldsymbol{P} \times \boldsymbol{E}$	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- Cosθ)	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 ^{0}	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	$\phi_E = \oint [E.ds] = q/\varepsilon_0$	Flux linked to a closed surface is q/ε_0 times the charge enclosed in it.

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20	Field due to infinite long straight charged conductor	$\lambda/2\pi\epsilon_0 r$	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	$E = q/(4\pi\varepsilon_0 r^2)$	q is charge on shell, r distance from centre.
25	Electric field on the surface of spherical shell.	$E = q/(4\pi\varepsilon_0 R^2)$	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 .	$E = r\rho/3\epsilon$	r is radius of sphere, ρ is volumetric charge density, is permittivity of medium
28	Potential due to charge Q at distance r	$V = Q/(4\pi\varepsilon_0 r)$	Potential is characteristic of that location
29	Potential Energy with charge q kept at a point with potential V	$U = qV = Qq/(4\pi\varepsilon_0 r)$	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	$U = q_1q_2/(4\pi\varepsilon_0 r)$	
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	$V = P/(4\pi\varepsilon_0 r^2)$	P is dipole momentum, r is distance from centre of dipole
35	Electric Potential due to dipole on a point on equitorial line	Zero	
36	Electric Potential due to dipole at any general point,	$V = P\cos\theta / 4\pi\varepsilon_0 (r^2 - a^2\cos^2\theta)$	P is dipole momentum, r is distance from centre of dipole, a is half length of dipole, 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	$4\pi\varepsilon_0 R$	R is radius of the sphere
39	Capacitance of a parallal plate capacitor	$\varepsilon_0 kA/d$	A is area of each plate, d is distance between them, k is dilectric constant of the medium between plates.
40	Dielectric Constant	$k = C / C_0$	Cis capacitance with medium within plates, and C_0 is capacitance in free space.

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41	Capacitance of a spherical capacitor.	$C = 4\pi\varepsilon_0 r_a r_b/(r_a-r_b)$	r_a and r_b are radius of internal and external spherical shells
42	Equivalent capacitance for Capacitors in parallal	$C = c_1 + c_2 + c_3....$	Cis equivalent capacitance, c_1, c_2 are capacitnce of the capacitors joint together.
43	Equivalent capacitance for Capacitors in series	$1/C = 1/c_1 + 1/c_2 + 1/c_3...$	
44	Charge, capacitance, Potential Difference	$C = q/V$	q ischarge on the plate of capacitor and V is Potential Difference between the plates.
45	Energy stored in capacitor	$½cv^2$, $½qv$, $½q^2/c$	q is charge, c is capacitance, v is Pot. Difference
46	Common Potential	$V=C_1V_1+C_2V_2)/C_1+C_2$	
47	Energy loss in connecting	$\frac{1}{2}\frac{C_1C_2}{C^1+C_2}(V1\text{-}V2)^2$	c_1 at v_1 is connected to c_2 at v_2
48	C with dielectric slab inserted	$\varepsilon_0 kA/d\text{-}t(1\text{-}1/k)$	t is thickness of dielectric slab of constant k,
49	C with metal plate inserted	$\varepsilon_0 kA/(d\text{-}t)$	t is thickness of metal plate inserted,
50	Force of attraction between plates	$½q^2/\varepsilon_0 A$, $½\varepsilon_0 E^2 A$	q is charge on plate, A is area, E Elect. Field.