Coulombs Law $F_{1 \text{ on } 2} = F_{2 \text{ on } 1} = \frac{K|q_1||q_2|}{r^2}$
The forces are repulsive for two like charges, attractive for two opposite charges.
The net force on a charge is the sum of the forces from all other charges.
The unit of charge is the coulomb (C).
The electrostatic constant is $K = 9.0 \times 10^9\,\mathrm{N \cdot m^2/C^2}$.
Fundamental charges are protons and electrons, with charge $\pm e$, where $e = 1.60 \times 10^{-19}\,\mathrm{C}$.
The amount of charge is $q = (N_p - N_e)e$.
An electric field is identified and measured in terms of the force on a probe charge q: $\vec{E} = \frac{\vec{F}_{onq}}{q}$
The electric field of a point charge is $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}\hat{\vec{r}}$, where permittivity constant $\epsilon_0 = 8.85 \times 10^{-12}\,\mathrm{C^2/(N \cdot m^2)}$
The principle of superposition: $\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \cdots$
A linear charge density $\lambda = \frac{q}{L}$, a surface charge density $\sigma = \frac{q}{A}$
The electric field exerts a force on a charged particle: $\vec{F} = q\vec{E}$
The electric dipole moment is $\vec{p} = (qs, \text{from negative to positive}))$
The electric field exerts a torque on a dipole: $\tau = pE\sin\theta$
Field on axis: $\vec{E} = \frac{1}{4\pi\epsilon_0}\frac{2\vec{p}}{r^3}$
Field in bisecting plane: $\vec{E} = -\frac{1}{4\pi\epsilon_0}\frac{\vec{p}}{r^3}$
Field of an infinite line of charge with linear charge density λ: $\vec{E} = \left(\frac{1}{4\pi\epsilon_0}\frac{2\lambda}{r}, \text{perpendicular to line}\right)$
Field of an infinite plane of charge with surface charge density σ: $\vec{E} = \left(\frac{\sigma}{2\epsilon_0}, \text{perpendicular to plane}\right)$
Field of a sphere of charge is the same as a point charge outside of the sphere.
The electric field inside an ideal capacitor is a uniform electric field: $\vec{E} = \left(\frac{\sigma}{\epsilon_0}, \text{from positive to negative}\right)$
For any closed surface enclosing net charge Q_{in}, the net electric flux through the surface is $\Phi_e = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\epsilon_0}$
Flux is the amount of electric field passing through a surface of area A: $\Phi_e = \vec{E} \cdot \vec{A}$
The electric potential of a point charge q: $V = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$
The principle of superposition: $V = V_1 + V_2 + V_3 + \cdots$
A charged particle has potential energy $U = qV$ at a point where source charges have created an electric potential V.
The electric force is a conservative force, so the mechanical energy is conserved for a charged particle in an electric potential: $K_f + qV_f = K_i + qV_i$ The potential energy of two point charges separated by distance r is $U_{q_1+q_2} = \frac{Kq_1q_2}{r} = \frac{1}{4\pi\epsilon_0}\frac{q_1q_2}{r}$
The potential energy in an electric field of an electric dipole with dipole moment $\vec{p}$ is $U_{dipole} = -pE\cos\theta = -\vec{p}\cdot\vec{E}$
The electric potential of a sphere of charge Q is the same as a point charge if $r \geq R$.
The potential difference between plates of parallel-plate capacitor: $E = \frac{\Delta V_C}{d}$
Electric potential: 1 V = 1 J/C. Electric field: 1 V/m = 1 N/C
V and $\vec{E}$ are related by $\Delta V = V_f - V_i = -\int\limits_{s_i}^{s_f} E_s\,ds$
$E_s = -\frac{dV}{ds}$
The sum of all potential differences around a closed path is zero: $\sum(\Delta V)_i = 0$
The capacitance of two conductors charged to$\pm Q$ is $C = \frac{Q}{\Delta V_C}$
A parallel-plate capacitor has $C = \frac{\epsilon_0 A}{d}$
Filling the space between the plates with a dielectric of dielectric constant k increases the capacitance to $C = kC_0$.
The energy stored in a capacitor is $u_C = \frac{1}{2}C(\Delta V_C)^2$
This energy is stored in the electric field at density $u_E = \frac{1}{2}k\epsilon_0 E^2$
Series capacitors $C_{eq} = \left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots\right)^{-1}$
Parallel capacitors $C_{eq} = C_1 + C_2 + C_3 + \cdots$

Material	**Dielectric** constant k	**Dielectric strength** E_{max} $(10^2)\,V/m$
Vacuum	1	
Air (1 atm)	1.0006	3
Teflon	2.1	60
Polystyrene plastic	2.6	24
Mylar	3.1	7
Paper	3.7	16
Pyrex glass	4.7	14
Pure water (20°C)	80	
Titanium dioxide	110	6
Strontium titanate	300	8