Chapter 24 : Electric Force and Electric Field

* Coulomb's Law:
a force exists between charged particles

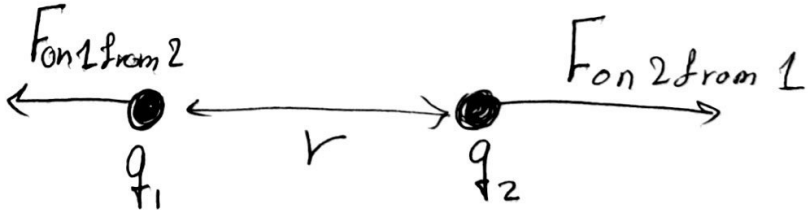
$$|F_{1on2}| = |F_{2on1}| = k\frac{|q_1 q_2|}{r^2}$$

$k = \frac{1}{4\pi\varepsilon_0} \approx 9\times10^9 \frac{N m^2}{C^2}$ "the permittivity of free space" (ε_0)
$= 8.854\times10^{-12}$ F/m

r : the distance separating the charges

q_1, q_2 : the charges magnitude

* If 2 charges have opposite signs, the force is attractive, and repulsive if they have the same sign



→ The two forces are equal in size, but point in opposite directions "Newton's third Law"
"Vector"

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Superposition of Electric Forces

- the net force on an object is the net vector sum of the forces from all the direction

see example: 24.1, 2, 3

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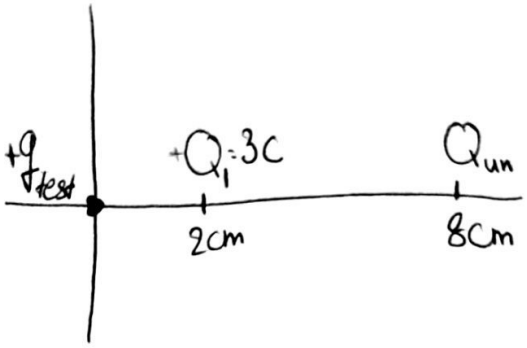

what is the magnitude of Q_{un} ?! if the net force on $q_{test} = 0$?!

Q_{un} should be negative

$$F_1 = F_{un}$$

$$\frac{kqQ}{(2)^2 \times 10^{-4}} = \frac{kqQ_{un}}{(8)^2 \times 10^{-4}}$$

$$\frac{3}{4} = \frac{Q_{un}}{64}$$

$$\boxed{Q_{un} = 48\ C}$$

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The electric field:

is a way of describing how a configuration of charges affects the surrounding space

$$E = \frac{F}{q} = \frac{N}{C}$$

- it's defined in terms of magnitude and direction of the electric force per unit charge

- So, it's a measure of how much force a 1C charge would experience.

→ The electric field due to a point charge

$$E = \frac{F}{q} \longleftarrow F = \frac{kqQ}{r^2}$$

$$E = \frac{kQ}{r^2}$$

→ The direction of the field is the same as the direction that the force would be on a positive charge - radially outward from the source charge if it's positive, towards the source charge if it's negative

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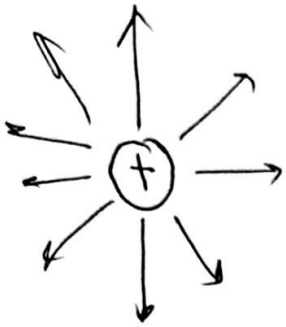
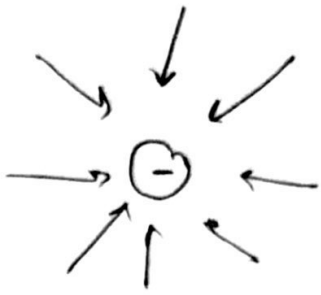
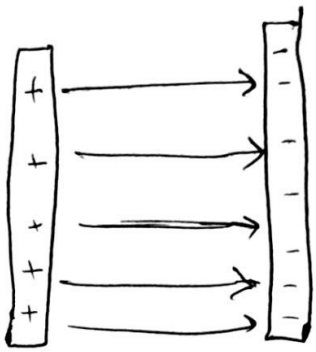
Electric Field Diagrams



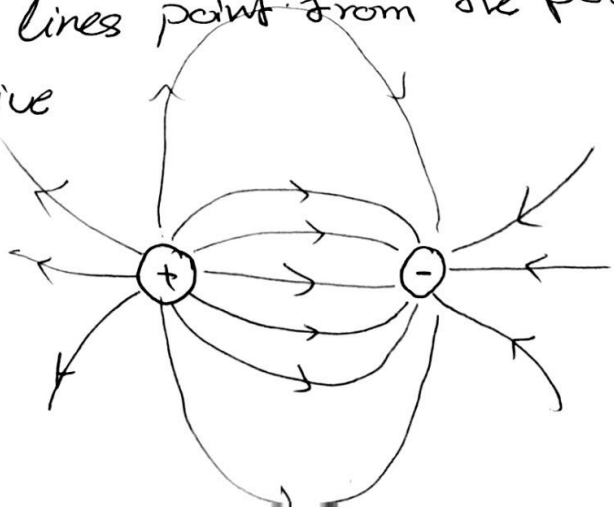




- uniform electric field can be generated by having parallel plates carying a uniform charge distribution, with one plate have positive charge, and another negative charge.

- electric dipole field: can be created by equal magnitude positive and negative charges seperated by some distance.

- The field lines point from the positive to the negative



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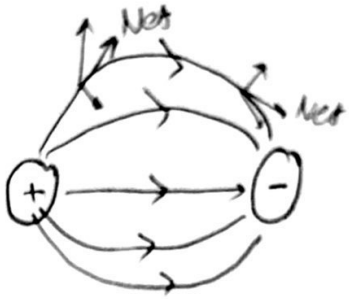
Superposition of electric field:

- The electric field at any point in space can be found by a vector sum of the fields at that point due to all charges present



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