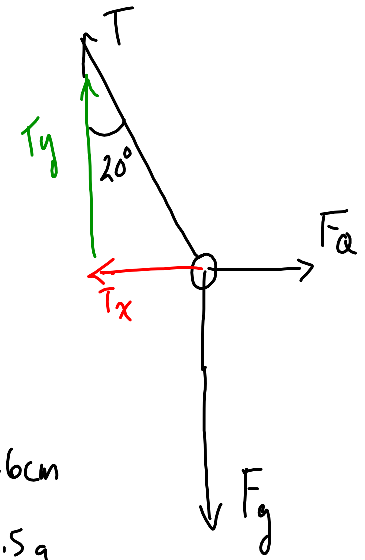
Coulomb's Law + Vectors (pp 640-641)

9.



$r = 2.6cm$

$m = 1.5g$

$q_1 = q_2 = q$

Vertically:

$T_y = F_g$

$T_y = mg$

$T_y = (0.0015kg)(9.8m/s^2)$

$T_y = 0.014715N$

$\tan\theta = \frac{T_x}{T_y}$

$T_x = T_y \tan\theta$

$T_x = (0.014715N)(\tan 20°)$

$T_x = 0.0053558 N$

Horizontally:

$F_Q = T_x = 0.0053558N$

$F_Q = \frac{kq_1q_2}{r^2}$

$F_Q = \frac{kq^2}{r^2}$

$q^2 = \frac{F_Q r^2}{k}$

$q^2 = \frac{(0.0053558N)(0.026m)^2}{(9.0\times10^9 N\cdot m^2/C^2)}$

$q = 2.0\times10^{-8}C$

20 nC

this is the magnitude

$q = \pm 2.0\times10^{-8}C$

§ 14.2 Describing Fields

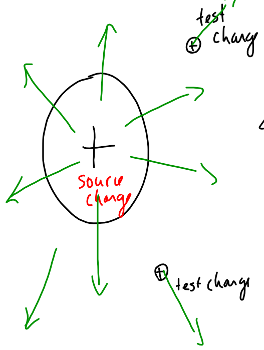
Electric Field Intensity | Strength

All the force vectors make up the field
↓
force per unit mass | charge

The electric field intensity at a point is the quotient of the electric force on a charge and the magnitude of the charge located at that point.

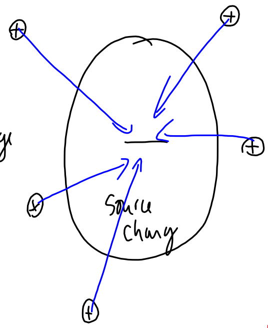
$$\vec{E} = \frac{\vec{F}_Q}{q}$$ Vector!

where $\vec{E}$ is the electric field intensity $\left(\frac{N}{C}\right)$
$\vec{F}_Q$ is the force acting on a positive test charge (N)
q is the charge in the field (C)



← The field is radially outward for a positive source charge.

For a negative source charge the field is directed radially inward.



MP | 645

$q_t = +2.0 \times 10^{-9}$ C
$\vec{F}_Q = 4.0 \times 10^{-9}$ N [W]

a) $\vec{E} = ?$
b) if $q = +9.0 \times 10^{-6}$ C, $\vec{F}_Q = ?$

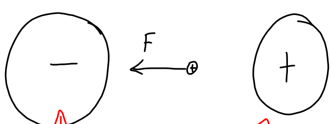
$$\vec{E} = \frac{\vec{F}}{q}$$

$$\vec{E} = \frac{4.0 \times 10^{-9} \text{ N [W]}}{2.0 \times 10^{-9} \text{ C}}$$

direction is OK as long as q is +

$$\vec{E} = 2.0 \frac{N}{C} \text{ [W]}$$

We don't know what is causing the field, we only know that a + charge will experience a force to the West at this location.



b) $\vec{E} = \frac{\vec{F}_Q}{q}$

$\vec{F}_Q = q\vec{E}$

$\vec{F}_Q = (9.0 \times 10^{-6} \text{ C})(2.0 \frac{N}{C} \text{ [W]})$

$\vec{F}_Q = 1.8 \times 10^{-5}$ N [W]

If this is + then the dir is west.

Gravitational Field Intensity:

$$\vec{g} = \frac{\vec{F}_g}{m} \qquad (\vec{F}_g = m\vec{g})$$

* vector (but will always be radially inward)

where $\vec{g}$ is the gravitational field intensity (N/kg)

$\vec{F}_g$ is the force of gravity (N)

m is the mass (kg)

Always attractive

PP/646-647 (electric field intensity)

MP/648 + PP/649 (gravitational field intensity).