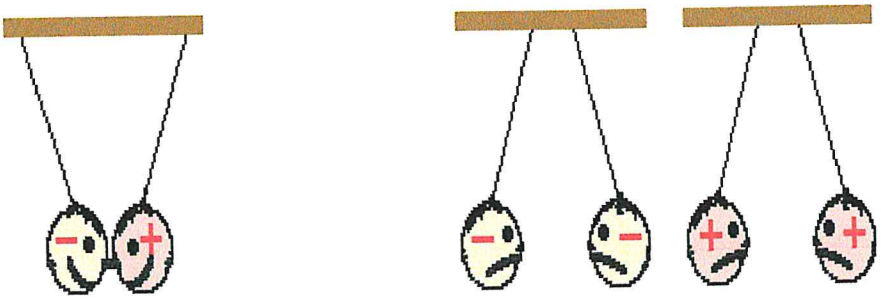
PHYSICS 12

ELECTRIC CHARGE AND ELECTRIC FORCE

In the world of static electricity ...



oppositely-charged objects attract AND objects with like charges repel

Coulomb's Law

= the fundamental law of force between two charged particles. It states that like charges repel one another and opposite charges attract one another.

$$F_e = \frac{k \cdot |q_1||q_2|}{r^2}$$

- Charge can either be positive or negative

k = Coulumb's constant = _____

$|q_1|$ = magnitude of charge one

$|q_2|$ = magnitude of charge two

r = separation distance between the two charges (straight line) **in meters**

F_e = electric force

Units of k : _____

Units of q_1 and q_2: _____

Units of F_e: _____

Electric force is directly proportional to _____

_____

and inversely proportional to _____.

Direction of Electric Force

Electric force is a field force = like gravity, it acts at a distance

Electric force can be either _____ = toward the other charge or it can be

_____ = away from the other charge

Direction of the force is always along a line that connects two charges.

Like charges always _____ each other, while

opposite charges always _____ each other.

- A particle or an object becomes negatively charged when it accepts _____ and contains more _____ than _____.
- A particle or an object becomes positively charged when it loses _____ and the number of _____ is greater than the number of _____.
- Electrically neutral object = object with a balanced number of _____ and _____ .

Law of Conservation of Electric Charge

Electric charge is always conserved. That is, charge is never created or destroyed; instead, negative charge is transferred from one object to another. In other words, one object loses charge while the other gains it.

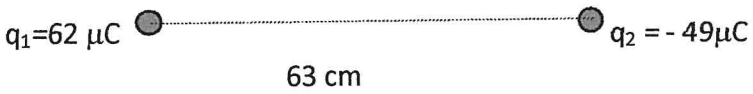
- Electric charge of an isolated system is constant

Electric charge of 1 electron = _____

Electric charge of 1 proton = _____

unit charge = _____

Example: Find the electric force (magnitude and direction) on q_1 due to q_2 if the charges are placed as shown below.



Assignment: textbook p 536 #1-3, p 542#7 – Explain through a diagram.

ELECTRIC FIELD

- Single charge

- Electric dipole. **Electric dipole = two charges of equal magnitude but opposite charge.**

- Two identical charges (magnitude and charge)

  Positive: Negative:

- Electric field between two oppositely charged parallel plates

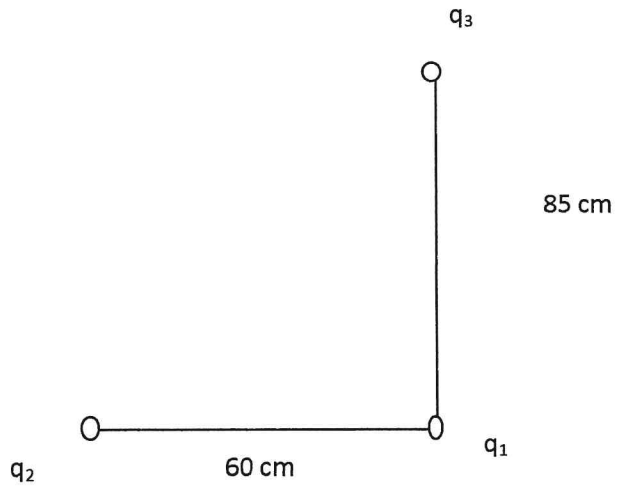
Electric field lines:

Imagine placing a positive unit charge in the vicinity of the given charge; the arrows of the field lines represent the electric force the unit charge would experience.

- Electric field lines are always directed away from the positive charge and towards the negative charge.
- The stronger the charge, the more lines are drawn.
- Keep in mind that electric field is 3D so it is more like a sphere rather than a circle.
- Electric field is stronger where the lines are closer to each other.

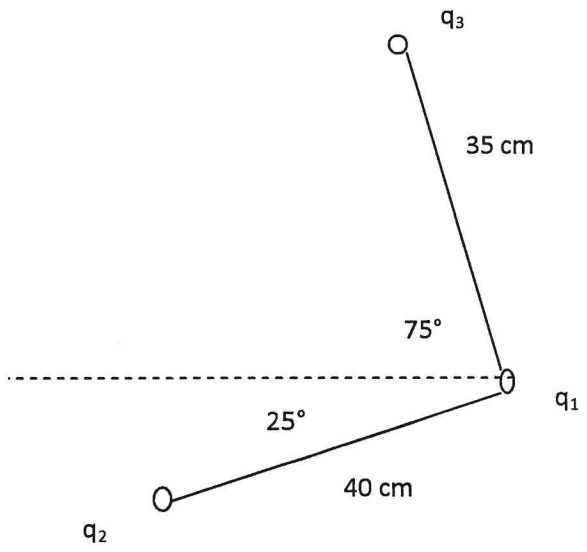
Electric Force - Practice

1. Determine the electric force (magnitude and direction) on a point charge q_1 (-40 μC) due to q_2(+55μC) and q_3 (-85 μC).



2. Determine the electric force (magnitude and direction) on q_2 due to q_1 and q_3.

3. . Determine the electric force (magnitude and direction) on a point charge q_1 (-80 μC) due to q_2(+15μC) and q_3 (-85 μC).



4. Find the charge on q_1 provided that q_1 is 25cm away from q_2 (q_2 =40μC)and experiences repulsive electric force of 465N.

5. Consider point charges of 35μC and -89μC. What is the distance of separation between two point charges if the attractive force experienced by one of the charges is 57N?