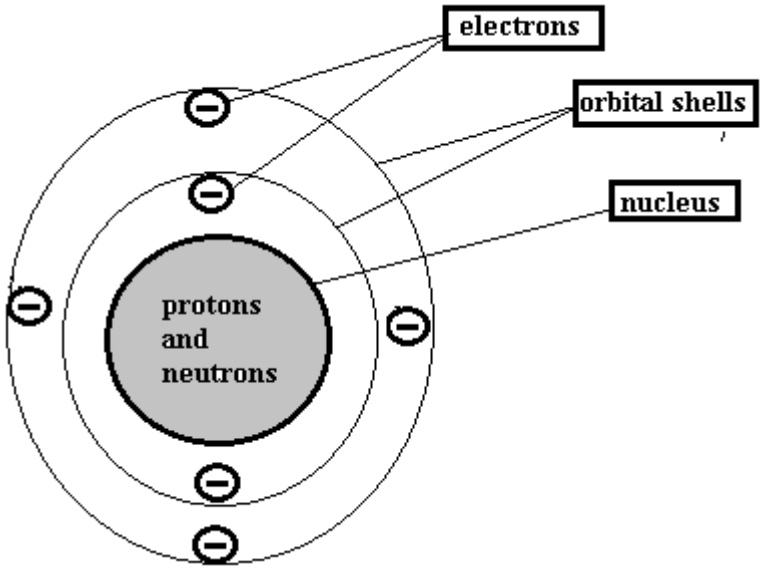
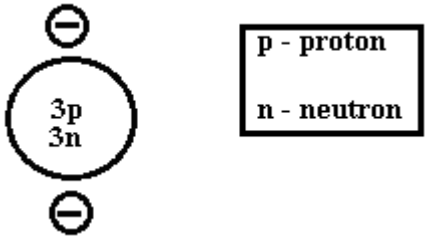
CLASS ACTIVITIES FOR ELECTROSTATICS

1. (a) Where is the nucleus of an atom located?
   (b) Where are the orbital shells of an atom located?
   (c) State the particles and their respective charge found in the nucleus of an atom.
   (d) State the particle and its charge found in the orbit around the nucleus.

2. **Structure of atom.**



The structure of an atom with 2 electrons, 3 protons and 3 neutrons is drawn as



Draw the structure of the following atoms:

   (a) 1 electron, 1 proton and 0 neutron
   (b) 1 electron, 1 proton and 1 neutron
   (c) 2 electrons, 2 proton and 2 protons
   (d) neutral Helium atom

3. The charge on an ion is determined by the number of electrons and protons.
   If the number of **electrons is more than the number of protons** then the charge on the ion is **negative**.
   If the number of **electrons is less than the number of protons** then the charge on the ion is **positive**.
   If the number of **electrons is equal to the number of protons** then the charge on the ion is **zero**. This is known as a neutral atom.

   If an ion has 3 electrons and 2 protons then the charge on the ion is negative one.
   $\Rightarrow 3e + 2p = -3 + +2 = -1$

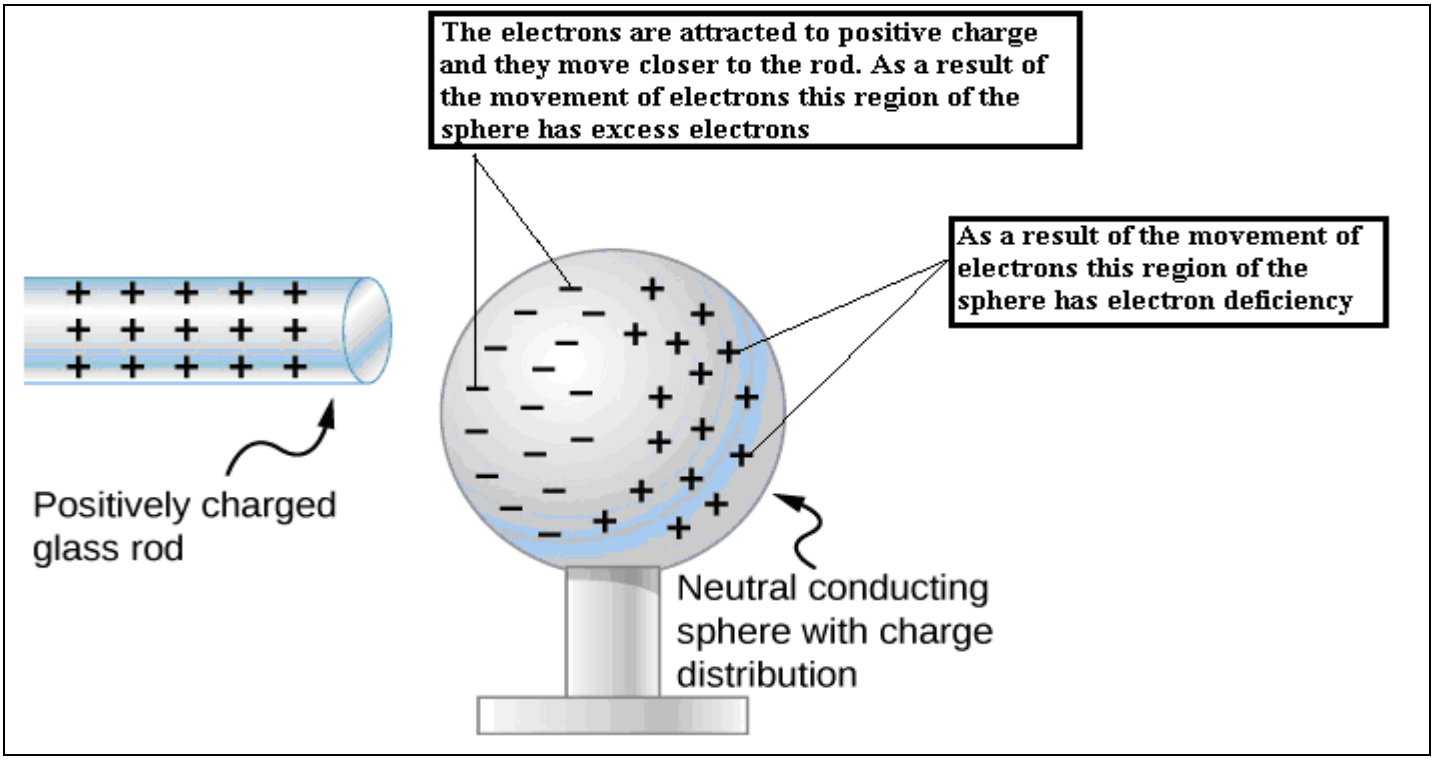
If an ion has 3 electrons and 5 protons then the charge on the ion is positive two.
$\Rightarrow 3e + 5p = -3 + +5 = +2$

State the charge on the following ions:

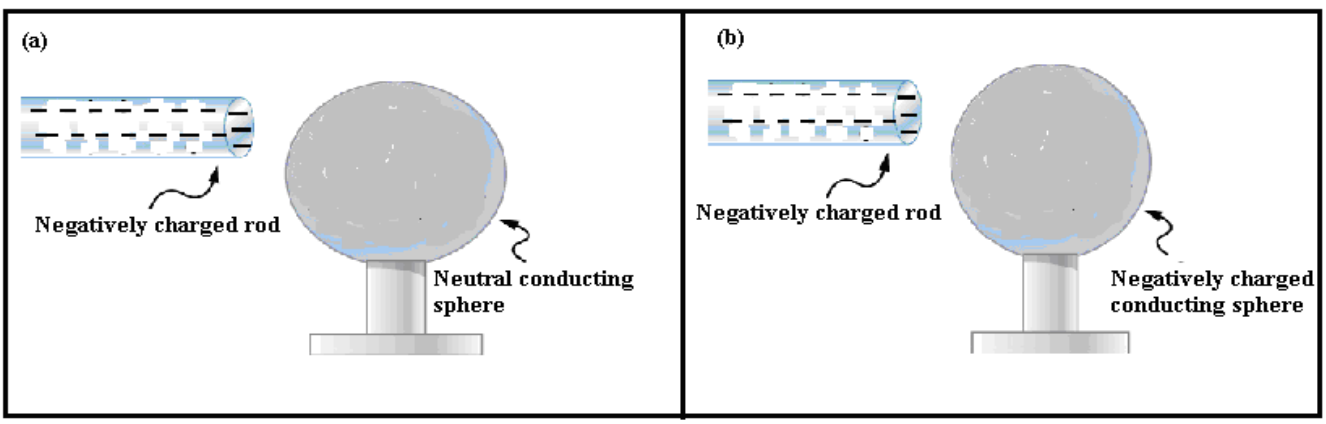
(a) 2 electrons, 1 proton and 0 neutron
(b) 1 electron, 2 protons and 1 neutron
(c) 2 electrons, 2 proton and 2 protons
(d) 7 electrons, 9 protons and 9 neutrons

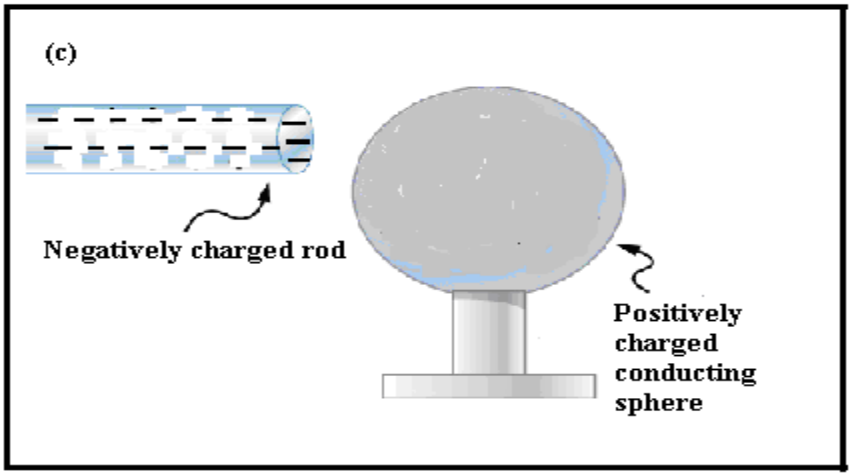
4. (a) State the unit and symbol of charge.
(b) State the properties of charge.
(c) Name two conductor and two insulators.

5. **Charge distribution**



Draw the charge distribution on the metallic sphere.



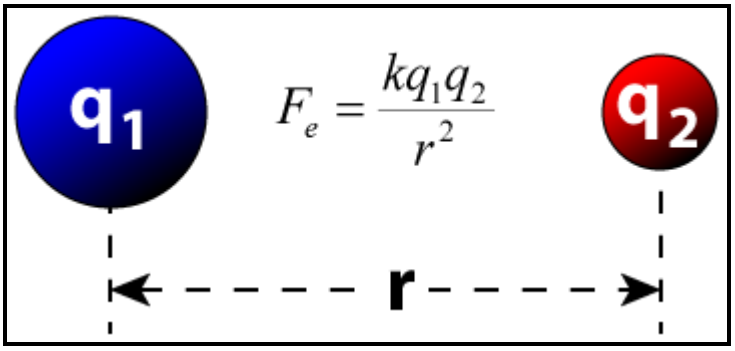


6. With the aid of diagrams show the steps of charging an electroscope

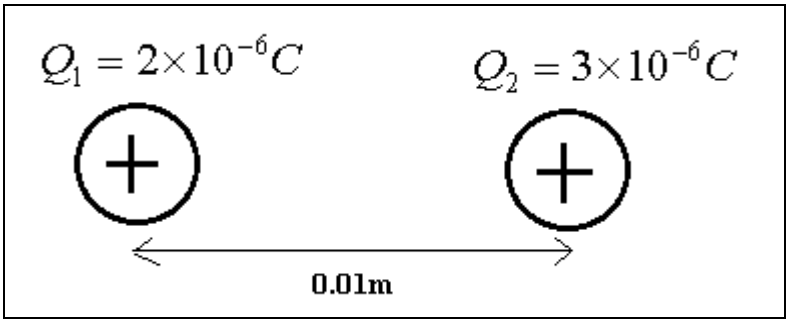
   (a) positively using contact method.
   (b) negatively using induction method.

7. State the material used to make a lightning rod and draw its shape.

8. **Electrostatic force**

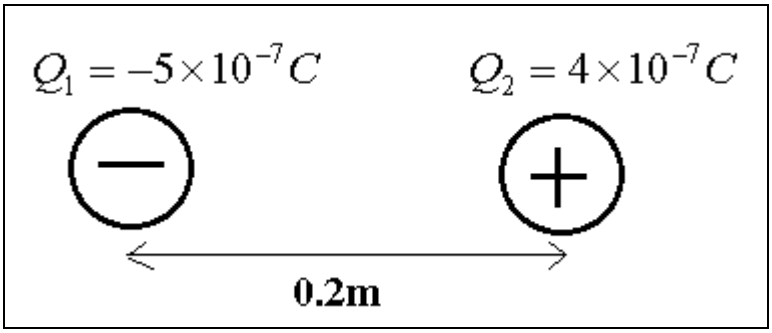


Find the electrostatic force and state whether it is attractive or repulsive force.



$$F = \frac{kQ_1Q_2}{r^2} \Rightarrow F = \frac{(9\times10^9)(2\times10^{-6})(3\times10^{-6})}{(0.01)^2} \Rightarrow \boxed{F = 540N}$$

The force is **repulsive** since both are like charges. (positive force)



$$F = \frac{kQ_1Q_2}{r^2} \Rightarrow F = \frac{(9\times10^9)(-5\times10^{-7})(4\times10^{-7})}{(0.2)^2} \Rightarrow \boxed{F = -0.045N}$$

The force is **attractive** because they are unlike charges. (negative force)

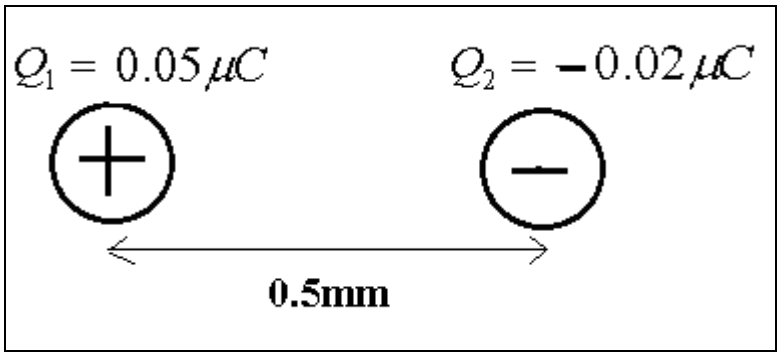
Find the electrostatic force and state whether it is attractive or repulsive force.

(a) $Q_1 = 8\times10^{-6}C$, $Q_2 = 7\times10^{-6}C$ and $r = 0.1m$

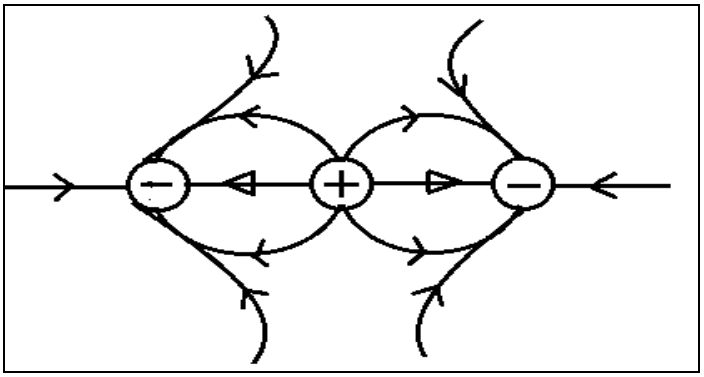
(b) $Q_1 = 200\times10^{-9}C$, $Q_2 = -300\times10^{-9}C$ and $r = 0.05m$

(c) $Q_1 = -4nC$, $Q_2 = -5nC$ and $r = 200\mu m$

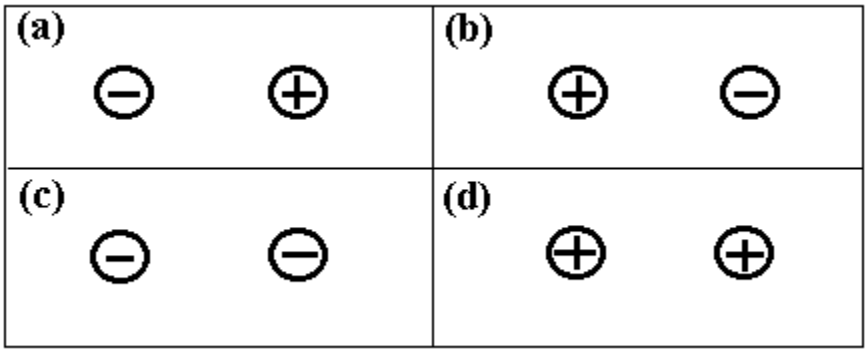
(d)

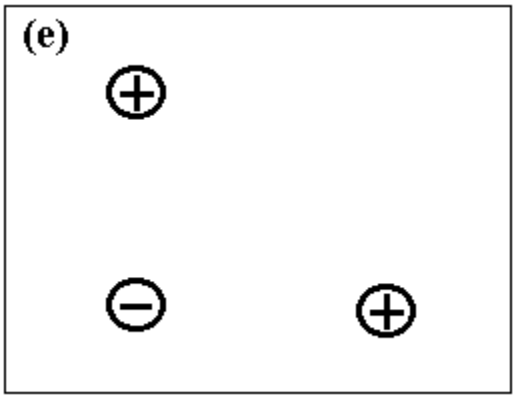


9. **Electric field**

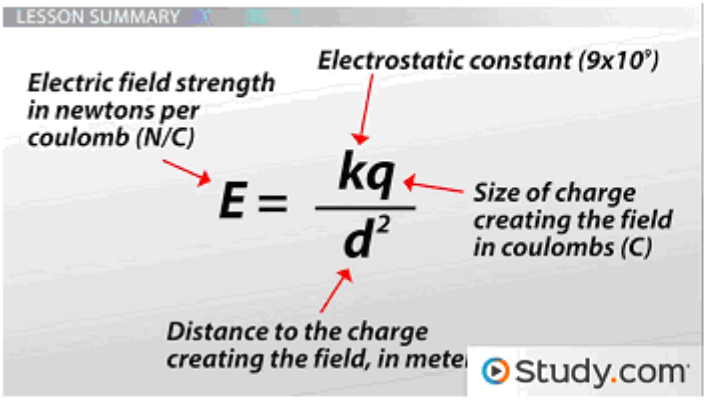


Draw the electric field between and around the point charges.

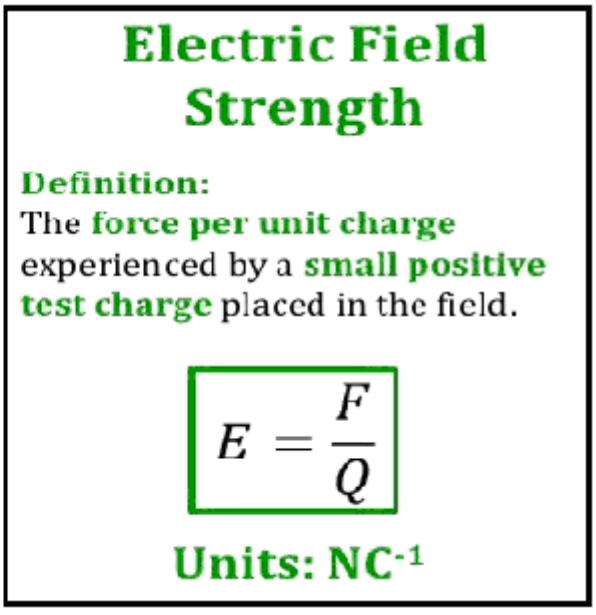




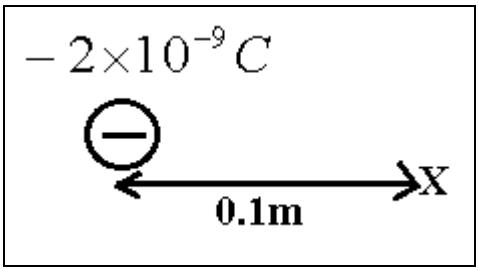
10. **Electric field strength**



d = r = distance

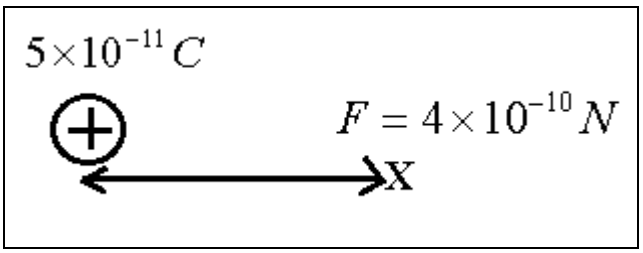


Find the electric field strength at point X due to the charge Q.



$$E=\frac{kQ}{d^2}\Rightarrow E=\frac{(9\times10^9)(-2\times10^{-9})}{(0.1)^2}\Rightarrow \boxed{E=-1800\frac{N}{C}\leftarrow}$$

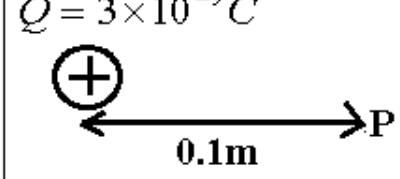
Find the electric field strength at point X due to charge Q if the force experience by a test charge [1C] at point X is $4\times10^{-10}N$



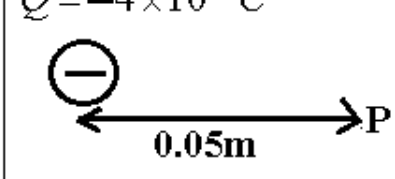
$$E=\frac{F}{Q}\Rightarrow E=\frac{4\times10^{-10}}{5\times10^{-11}}\Rightarrow \boxed{E=8\frac{N}{C}\rightarrow}$$

Find the electric field strength at point P due to charge Q.

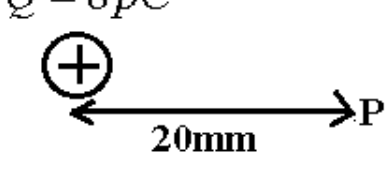
(a)



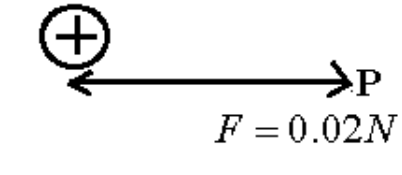
(b)



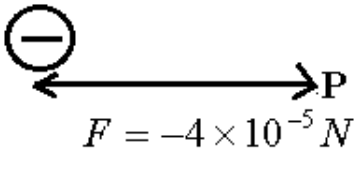
(c)



(d)



(e)



(f)