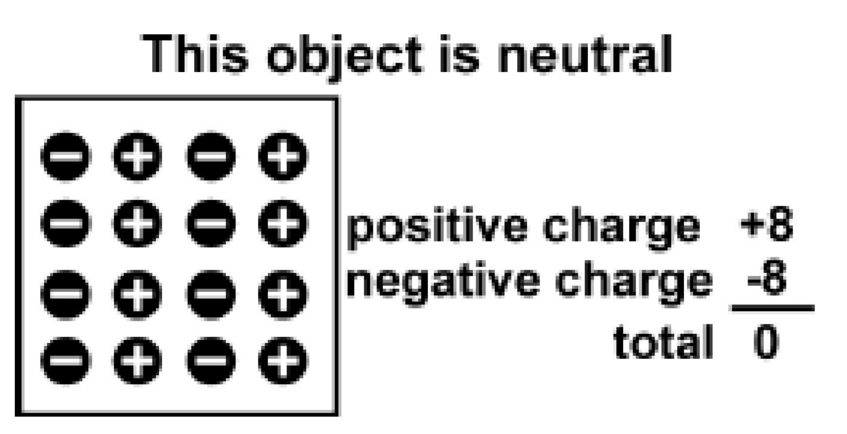
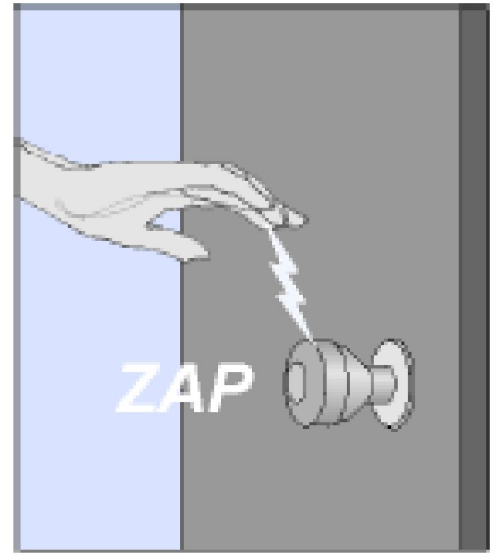
Electric Charge

- All ordinary matter contains both positive and negative charge.
- You do not usually notice the charge because most matter contains the exact same number of positive and negative charges.
- An object is electrically neutral when it has equal amounts of both types of charge.



Electric Charge

- Objects can lose or gain electric charges.
- The net charge is also sometimes called excess charge because a charged object has an excess of either positive or negative charges.
- A tiny imbalance in either positive or negative charge on an object is the cause of static electricity.
- Electric charge is a property of tiny particles in atoms.
- The unit of electric charge is the coulomb (C).
- A quantity of charge should always be identified with a positive or a negative sign.



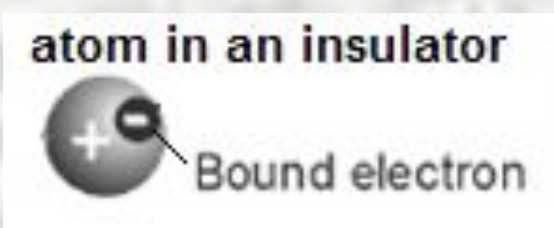
Static electricity

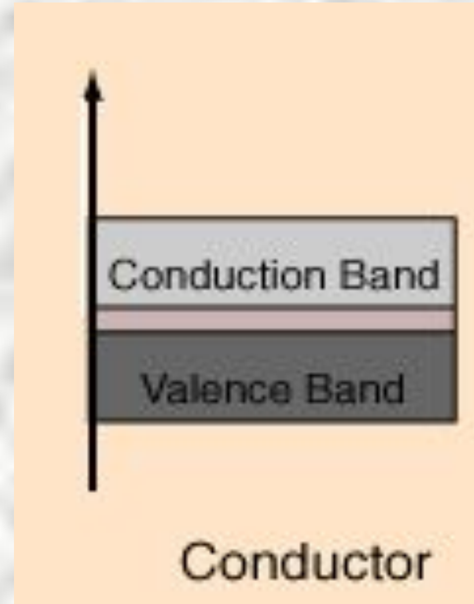
	Mass (kg)	Charge (coulombs)
Electron	9.109×10^{-31}	-1.602×10^{-19}
Proton	1.673×10^{-27}	$+1.602 \times 10^{-19}$
Neutron	1.675×10^{-27}	0

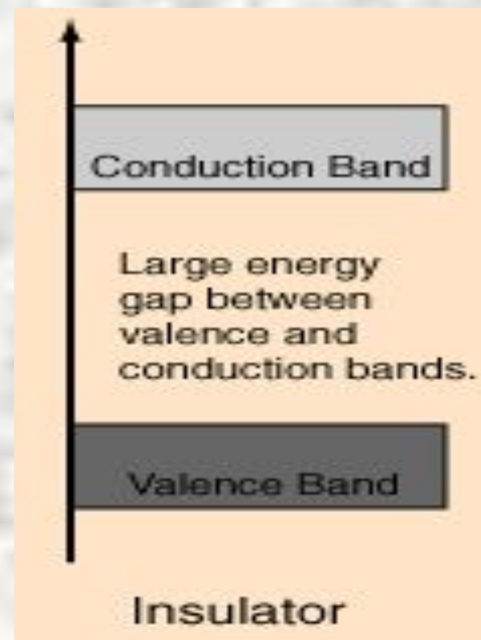
Conductors and insulators

- All materials contain electrons.
- The electrons are what carry the current in a conductor.

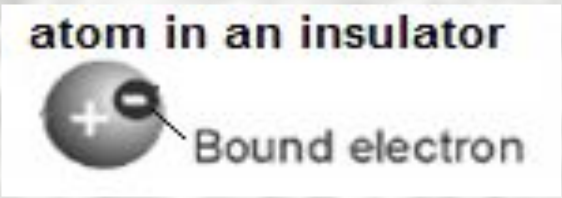
- The el are not free to move– und inside atoms.

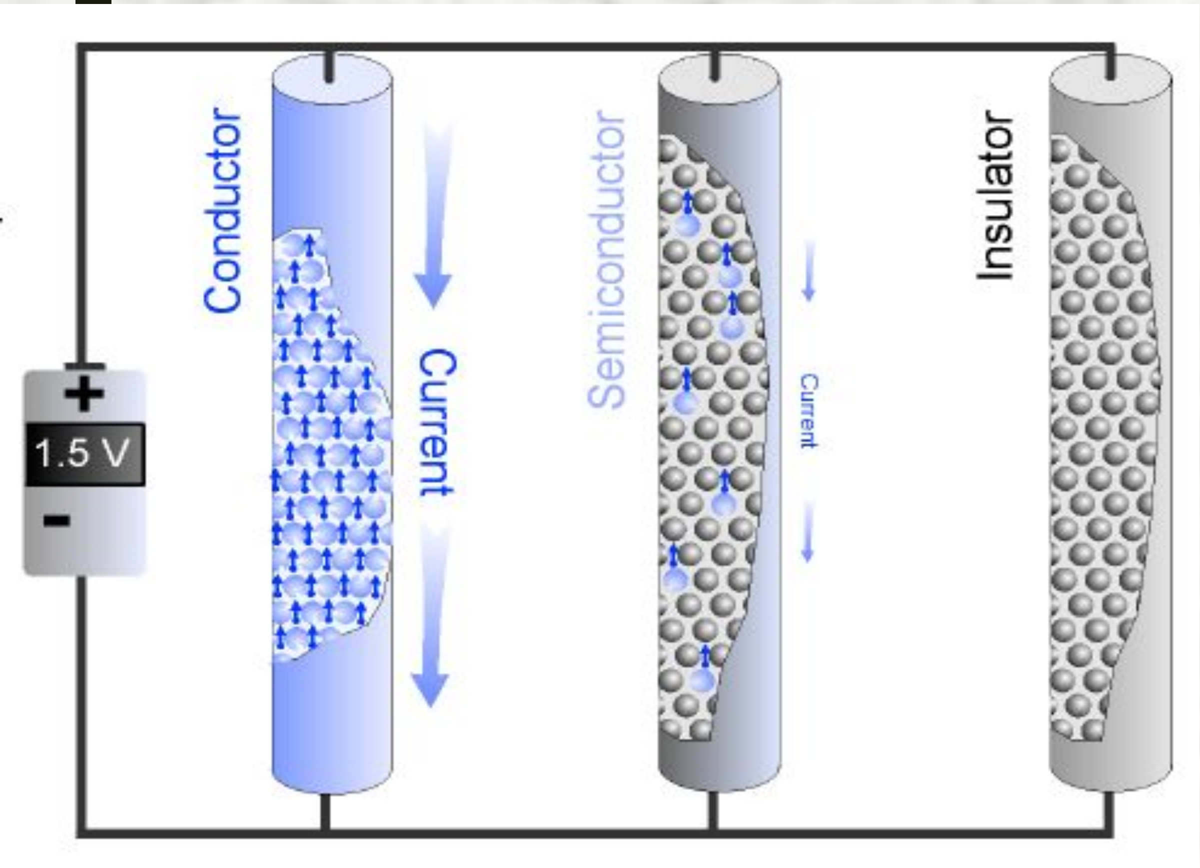


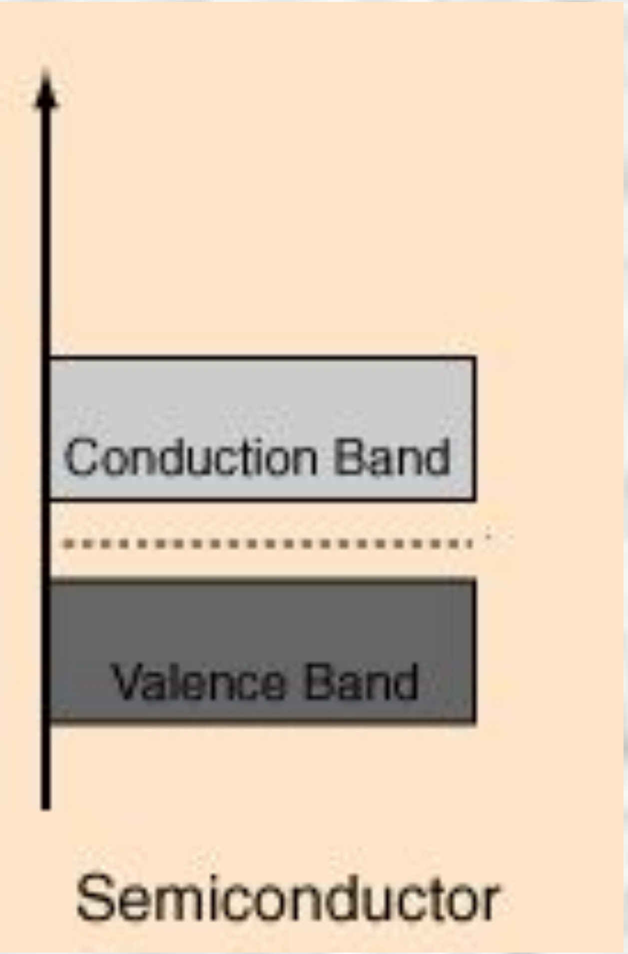




A semiconductor has a few free electrons and atoms with bound electrons that act as insulators.







Coulomb's Law

Coulomb's law relates the force between two ingle charges separated by a distance.

orce (F) depends on charge (q)

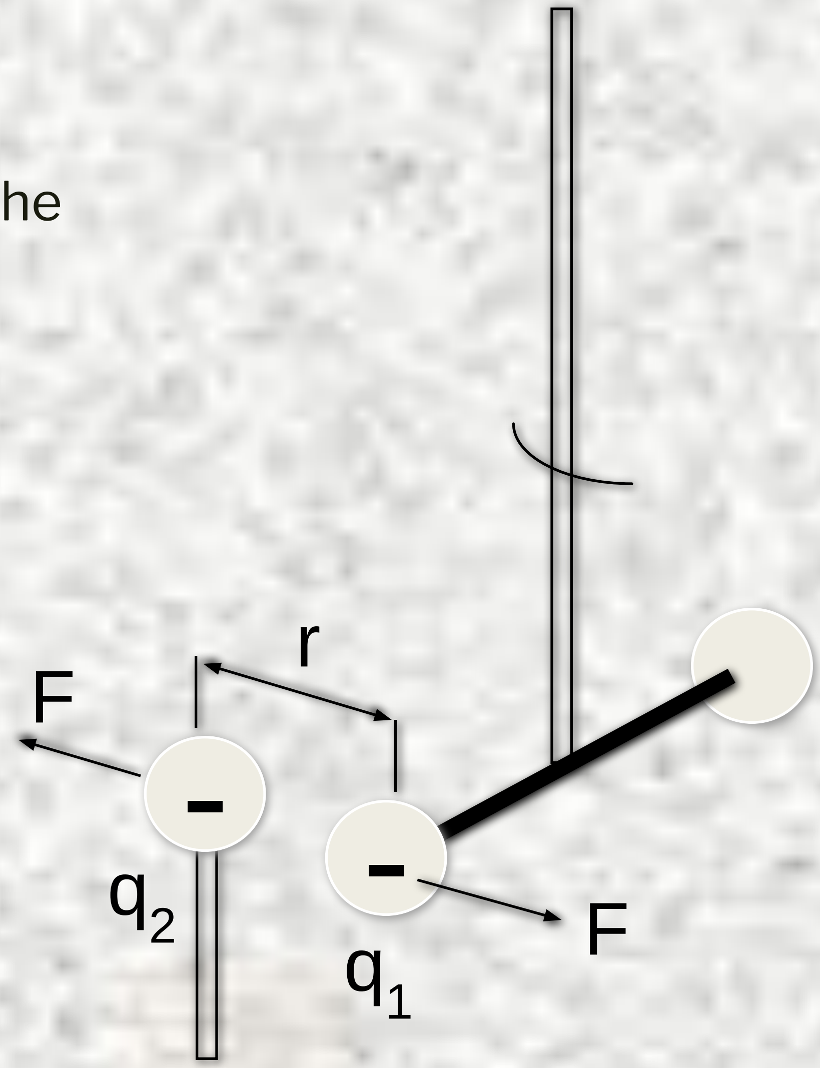
$F \propto q_1 ; F \propto q_2$

orce depends on the inverse square of the istance (r) between the charges

$F \propto 1/r^2$

$F \propto (q_1 q_2)/r^2$

$$\boxed{F = K\frac{q_1 q_2}{r^2}}$$



Coulomb's Law

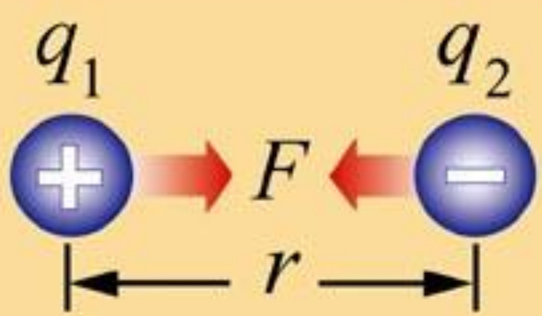
Constant

($9 \times 10^9 N{\cdot}m^2/c^2$)

Charges (C)

Force (N) $$F = K\frac{q_1 q_2}{r^2}$$

Distance (m)



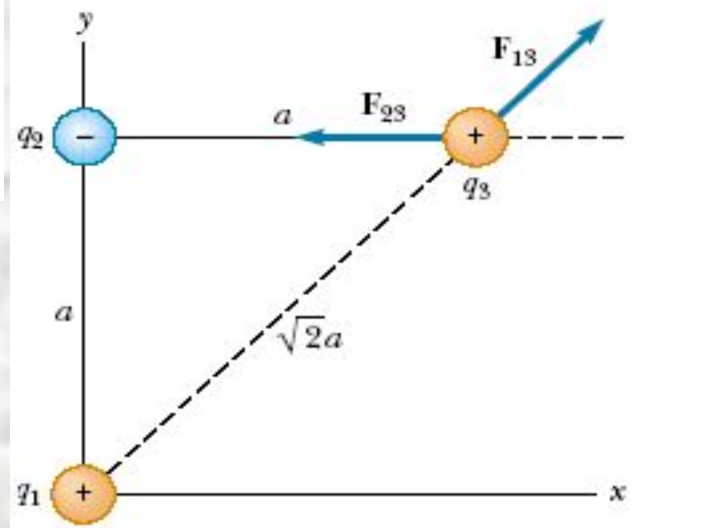
Calculate the Force

Consider three point charges located at the corners of a right triangle as shown in Figure. Find the resultant force exerted on

$q_1 = q_3 = 5.0\ \mu C$, $q_2 = -2.0\ \mu C$, and $a = 0.10$ m.

$$F_{3x} = F_{13x} + F_{23} = 7.9\text{ N} - 9.0\text{ N} = -1.1\text{ N}$$

$$F_{3y} = F_{13y} = 7.9\text{ N}$$



$$\mathbf{F}_3 = \boxed{(-1.1\mathbf{i} + 7.9\mathbf{j})\text{ N}}$$

Find the magnitude and direction of the resultant force $\mathbf{F}_3$.

8.0 N at an angle of 98° with the x axis.