

## Physics 100 - Spring 2007 - Recitation 3

① Most substances around us are not constructed from single atoms but rather groupings of atoms held together by the sharing of electrons. These groupings of atoms are called "Molecules"

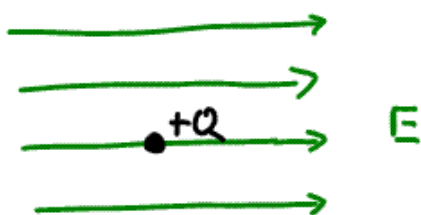
The atomic or molecular spacing in a substance generally increases as you go from solids to liquids to gases. In all states of matter, the atoms/molecules move.

The average speed of a perfume molecule in air is 300 m/s. Nevertheless, the speed with which a scent crosses a room is much less. Why is this?

② insulator  $\equiv$  material where electric charge will  
NOT flow freely  
(Rubber, plastic, glass, etc)

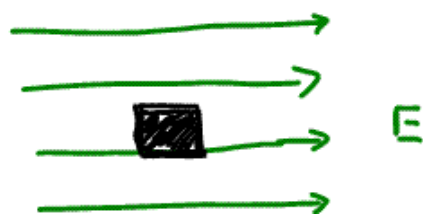
conductor  $\equiv$  material where electric charge flows  
freely (metals)

Suppose we have a region of uniform electric field.



What would happen to a charge +Q placed in  
this electric field and released?

What would happen if a conducting block were  
placed in a uniform electric field?



③ A charged insulator and an uncharged metal object

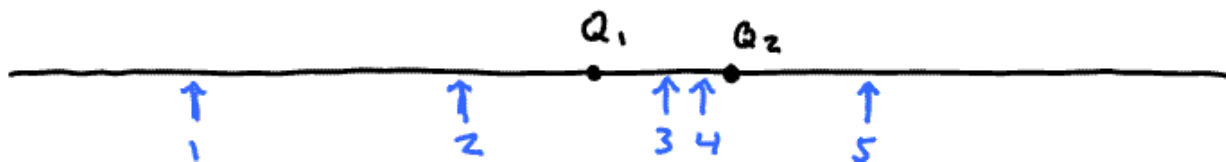
(a) always repel one another.

(b) exert no electromagnetic force on one another.

(c) always attract one another.

(d) may attract or repel, depending on the sign of the charge on the insulator.

④ Charges  $Q_1 = -q$  and  $Q_2 = +4q$  are placed as shown. Of the positions shown by the numbered arrows the one at which the electric field will be approximately zero is



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Calculate the gravitational force of attraction between the proton and the electron in the Hydrogen Atom. Assume the particles are separated by a distance of  $10^{-10}$  m.

Now calculate the electrical force of attraction between the same particles.

How do these forces compare?

How might you decide which force is responsible for holding together the hydrogen atom?

gravitational force

$$F = G \frac{M_1 M_2}{r^2}$$

$$G = 6.67 \times 10^{-11} \frac{(\text{Newton})(\text{meter})^2}{\text{kg}^2}$$

$$m_e = 9 \times 10^{-31} \text{ kg}$$

$$m_p = 1.7 \times 10^{-27} \text{ kg}$$

Electric force

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

$$k = 9 \times 10^9 \frac{(\text{Newton})(\text{meter})^2}{(\text{Coulomb})^2}$$

$$q_e = q_p = 1.6 \times 10^{-19} \text{ Coulombs}$$

unit of charge  
in MKS  
system  
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Your TA will supply you with Two little Aluminium foil balls attached to threads

Feel free to use other sources  
of Static Charge

run a comb  
thru hair  
Touch to each  
Suspended ball  
While balls separated widely.



Bring balls near each other ... NOT touching  
What do you see?

Now touch balls then bring them together  
so that they touch while suspended



Run comb several times thru hair  
and bring it close to ...  
but not touching ... one  
of the balls.

Have student lightly touch ball  
on far side from comb.

Now separate balls (before moving comb),

Do not let one or both balls hit the comb  
(as they are inclined to be attracted to the  
comb ... why?) This is tougher than  
it looks.

Bring balls close together (but not touching)  
What do you observe?

If this latter exercise worked right for you ...  
you should observe the little balls attracting  
each other.

Can you explain these observations?

Do these observations support the idea  
that there are two types of electric  
charge?