

Physics 100 - Fall 2007 - Recitation 3

- ① Red light has a wavelength of 700 nm.
Light in a vacuum travels at 3×10^8 m/s.
What is the frequency of red light?
What is the period of the electric and magnetic field oscillations in red light?
What is the frequency and period of radio waves with a wavelength of 100 km?

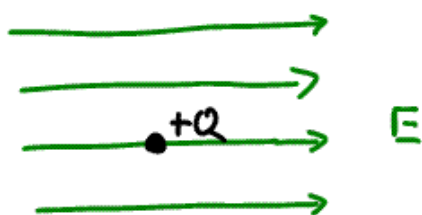
- ② Every gradeschooler knows that if you mix yellow with blue you can get green ...

Does this mean if I shoot a beam of yellow light ($\lambda = 550$ nm) into a beam of blue light ($\lambda = 450$ nm) that I get a beam of green light ($\lambda = 500$ nm)?
Why or why not?

③ insulator \equiv material where electric charge will
NOT flow freely
(Rubber, Plastic, glass, etc)

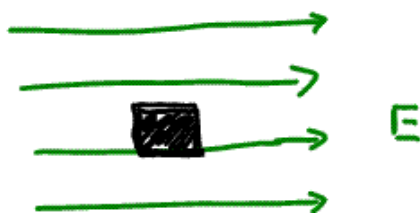
conductor \equiv material where electric charge flows
freely (metals)

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?



④ A charged insulator and an uncharged metal object

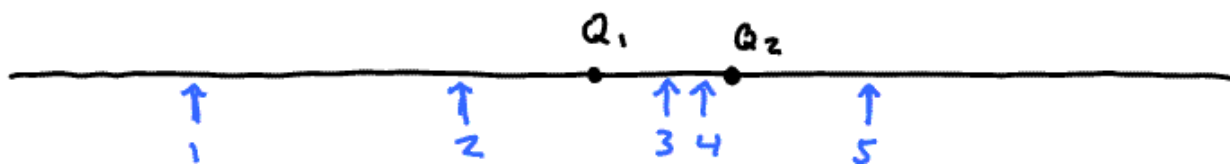
(a) always repel one another.

(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.

⑤ 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

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

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

$$q_2 = q_1 = 1.6 \times 10^{-19} \text{ Coulombs}$$

unit of charge
in MKS
system
is
Coulombs

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Your TA will supply you with two little Aluminium foil balls attached to threads

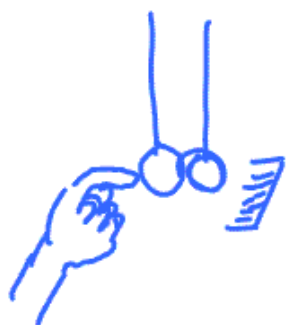
Feel free to use other sources
of Static Charge

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?