

PHY100 — Recitation #3

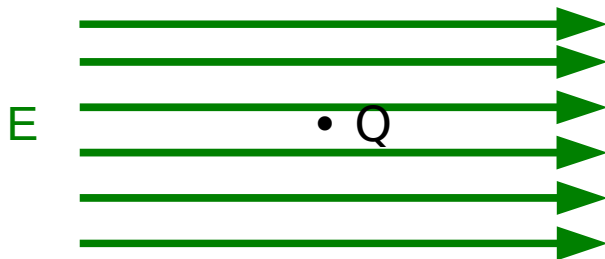
- 1) Red light has a wavelength of 700 nm. Light in vacuum travels at 3×10^8 m/s. What is the frequency of red light? What is the period of the electric and magnetic field oscillations on red light? What is the frequency and period of radio waves with a wavelength of 100 km?
- 2) Every gradeschooler knows that if you mix blue and yellow you get green... Does this mean that 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?

DEFINITIONS:

insulator = material where electric charge will not flow freely (plastic, glass, rubber, etc.)

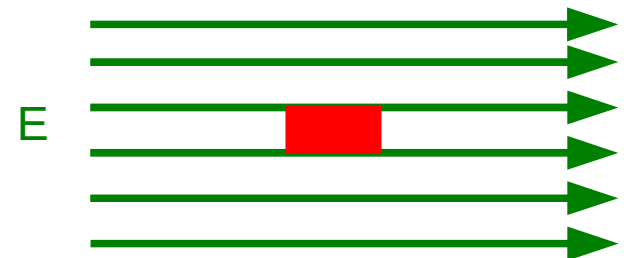
conductor = material where electric charge flows freely (metals)

- 3) Suppose we have a region of uniform electric field:



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

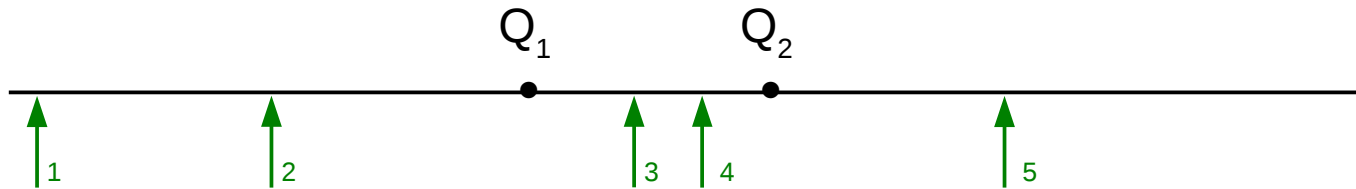
What would happen if a conducting block were placed in this uniform electric field?



4) A charged insulator and an uncharged metal object:

- a) always attract one another
- b) exert no electromagnetic force on one another
- c) always repel one another
- d) may attract or repel, depending on the sign of the insulator's charge

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:



6) Compare the gravitational and electric forces of attraction between the electron and the proton in the Hydrogen atom. How do these forces compare?

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

$$F = G \frac{m_1 m_2}{r^2}$$

$$G = 6.67 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2}; m_e = 9 \times 10^{-31} \text{ kg}; m_p = 1.7 \times 10^{-27} \text{ kg}$$

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

$$k = 9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}; q_1 = q_2 = 1.6 \times 10^{-19} \text{ C}$$

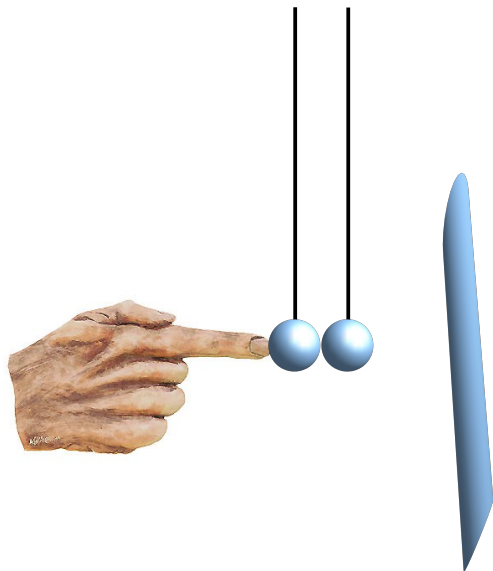
7) Your TA will supply you with two little Aluminum balls attached to threads and a glass rod and an ebonite rod.

a) Charge the glass rod by rubbing it with a silk cloth. And then touch each suspended ball while balls are separated widely.

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

b) Now try the same with ebonite rod (rubbing it against a fur).

c) Now try one ball touched with the glass rod and the other with the ebonite rod.



d) Now touch the balls with your hands and bring them together so that they touch while suspended. Charge the glass rod and bring it close to (but not touching) one of the balls. Have student lightly touch ball on the far side from the rod.

Now separate balls (before moving the rod), but do not let one or both balls hit the rod. They are inclined to be attracted to the rod (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 and that we can make the electric charge flow?