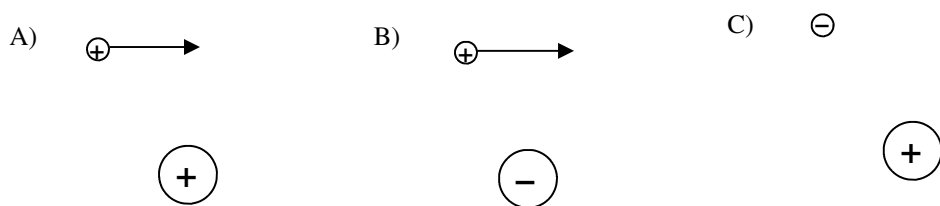


# PreAP Electrostatics 8

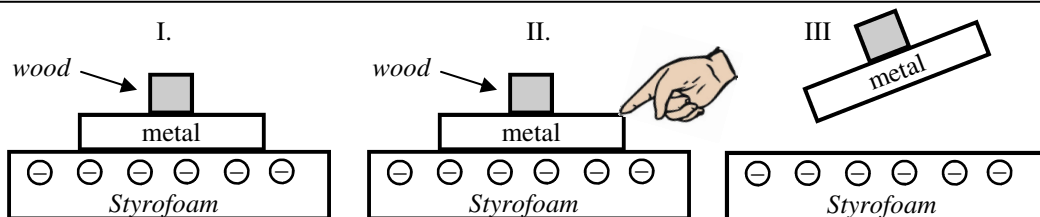
This homework is a review homework to ensure you remember about charge, electric fields and forces. Since answers are given you must show me the work to get the answers.

**Part I: Charge:** Opposite attract, etc; Conductors vs. Insulators; Only electrons move in solids; charge is quantized.

- Attract or repel:
  - Proton and an electron?
  - Two positive charges.
  - Two neutrons?
- Conductor or Insulator?
  - Restricts the number of electrons.
  - Substance with many free electrons in its crystal lattice.
  - Iron.
  - Plastic
- In the following situations a small charge is near a larger charge. An arrow shows the smaller charge moving before hand. No arrow means the smaller charge is originally at rest. In each situation, draw the path of the smaller charge. Don't outthink this.



1. A. Attract B. R C. N/A (neutrons are neutral)
2. A. Ins  
B. Cond.  
C. Cond (many solids have regular geometric shapes, like crystals.)  
D. Ins.
3. A. Repels, so curves up and to the right  
B. Attract, so down and to the right.  
C. attract, so straight toward the +



- On the diagram above, the Styrofoam has been made negative by rubbing it with fur.
  - In the picture I, draw where the negatives are on the metal.
  - The metal is now charged by \_\_\_\_\_.
  - What is the net charge of the metal?
  - Then you touch the metal while it is still touching the Styrofoam, where do the negatives go?
- In picture III, will the metal have a positive or a negative charge?
- The metal is now charged by: \_\_\_\_\_.

- Top of the metal
- Polarization
- Neutral (e's just shifted, but none gained or lost)
- To your finger
- + (e's went to you)
- Induction (the induced charge is always opp.)

An electron is a negative elemental charge (smallest element [part] of charge [can't be smaller]).  
 $1 e = -1.602 \times 10^{-19} C$ . A proton has the opposite charge of an electron, but much more massive.

- What is the charge of 15 electrons?
- What is the charge of 4 positive elemental charges?
- A. Given a charge of  $4.6 \mu C$ , how many electrons were gained or lost?  
  
B. Is this amount of charge possible?

- given e's, so div by e's  

$$\frac{15e}{1} \left( \frac{-1.602 \times 10^{-19} C}{1e} \right)$$

$$= -2.403 \times 10^{-18} C$$
- (a proton is the + elemental charge) =
- Given C, div by C.  
 $\mu = E-6$ , so =  $2.87E13$  e's  
 B. yes. This is 287 and 11 zeros. There's no decimal.

$$F_e = k_c \frac{|q_1 q_2|}{r^2}$$

$$E = k_c \frac{q_1}{r^2}$$

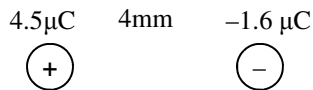
$$PE = k_c \frac{q_1 q_2}{r}$$

$$V = k_c \frac{q_1}{r}$$

8. Given a charge of  $7.209 \times 10^{-19} \text{C}$ .  
 A. How many elemental charges were gained or lost?  
 B. Is this charge possible?

8. Elem charge is p or e's  
 A. Div by Coulombs  
 =  $4.5 \text{ e's}$   
 B. No—can't have part of  
 and e or proton.

9. What is the force on the  $-1.6 \mu\text{C}$  charge below?



9. Need direction, too.  
 $\mu = \times 10^{-6}$   
 $\text{mm} = \times 10^{-3} \text{m}$   
 Magnitude =  $4050 \text{N}$   
 direction: left (attract)

10. A point in space has an electric field magnitude of  $1.5 \text{ N/C}$ .  
 A. What is the electric field strength if a  $3 \text{ C}$  charge is placed at that same point?  
 B. What is the force on the  $3 \text{ C}$  charge?

10.  
 A. Same. It's about the  
 position: not what's there:  
 $1.5 \text{ N/C}$

11. Electric fields point the direction a \_\_\_\_\_ charge would move.

- B.  $(1.5 \text{N/C})(3 \text{C}) = 4.5 \text{ N}$   
 11. + charge

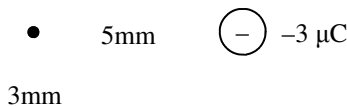
12. A. At points I and II used dotted lines to show the electric fields due to each charge. These are Crazy's path.  
 B. Use a solid line to show the net electric field. This is Lazy.



- 12 for I: Use +q to find E's dir.

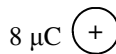
- 12 for II:

13. A. Calculate the electric field at the point due to the  $8 \mu\text{C}$  charge and draw the direction.



- 13A:  $8 \times 10^9 \text{ N/C}$   
 up (away from a +)

- B. Calculate the electric field at the point due to the  $-3 \mu\text{C}$  charge.



- 13B.  $1.08 \times 10^9 \text{ N/C}$   
 right (toward a -)

- C. Calculate the net electric field at the point.

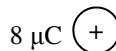
- 13C. Pyth theor +  $\tan^{-1}$   
 Mag =  $8.07 \times 10^9 \text{ N/C}$   
 Direc =  $82.3^\circ$  (Quadr 1)

- D. A  $6 \mu\text{C}$  charge is placed at that point. How has the electric field at that point changed?



- D. No change: it's about the  
 position: not what's there.

- E. Calculate the force on the  $6 \mu\text{C}$  charge.



- E. You have  $\text{N/C}$  and  $\text{C}$ ,  
 calculate  $\text{N}$   
 $8.07 \times 10^9 \text{ N/C}(6 \mu\text{C}) = 48420 \text{N}$   
 at  $82.3^\circ$