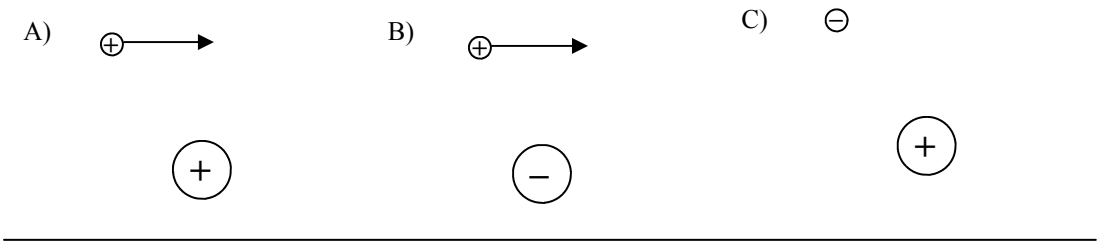
Due Mon., Feb 6

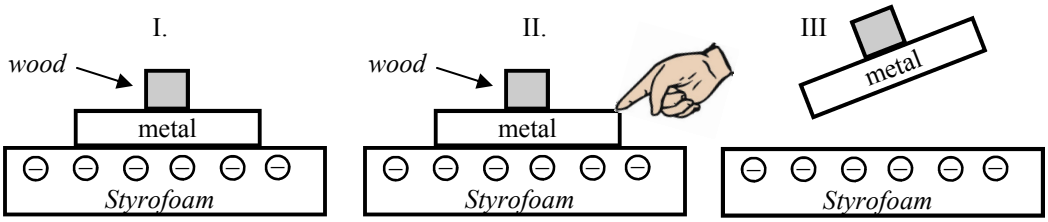
2011-12 PreAP Electrostatics 8

The answers to each problem are given at the right. So, cover up the right side of the page and slide down the cover as you go thru each step. Grading: you will lose points if you just transfer the answer. You must show HOW the answers were calculated. Study this homework. It will help you with retesting for the All or Nothing Quiz.

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

1. Attract or repel:
   A. Proton and an electron? B. Two positive charges. C. Two neutrons?
2. Conductor or Insulator?
   A. Restricts the number of electrons.
   B. Substance with many free electrons in its crystal lattice.
   C. Iron. D. Plastic
3. 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.





4. On the diagram above, the Styrofoam has been made negative by rubbing it with fur.
   A. In the picture I, draw where the negatives are on the metal.
   B. The metal is now charged by _____.
   C. What is the net charge of the metal?
   D. Then you touch the metal while it is still touching the Styrofoam, where do the negatives go?

   E. In picture III, will the metal have a positive or a negative charge?
   F. The metal is now charged by: _____.

   An electron is a negative elemental charge (smallest element [part] of charge [can't be smaller]). 1 e = -1.602×10^{-19}C. A proton has the opposite charge of an electron, but much more massive.
5. What is the charge of 15 electrons?

6. What is the charge of 4 positive elemental charges?

7. A. Given a charge of 4.6μC, how many electrons were gained or lost?

   B. Is this amount of charge possible?

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 +

4. A. Top of the metal
   B. Polarization
   C. Neutral (e's just shifted, but none gained or lost)
   D. To your finger

   E. + (e's went to you)
   F. Induction (the induced charge is always opp.)

5. given e's, so div by e's

$$\frac{15e}{1}\left(\frac{-1.602\times10^{-19}\,C}{1e}\right) = -2.403\times10^{-18}\,C$$

6. (a proton is the + elemental charge) = $+6.408\times10^{-19}$C

7. Given C, div by C.
   μ = E−6, so = 2.87E13 e's

   B. yes. This is 287 and 11 zeros. There's no decimal.

$$F_e = k_c \frac{|q_1 q_2|}{r^2} \qquad E = k_c \frac{q_1}{r^2} \qquad PE = k_c \frac{q_1 q_2}{r} \qquad V = k_c \frac{q_1}{r}$$

8. Given a charge of 7.209×10^{-19}C.
   A. How many elemental charges were gained or lost?

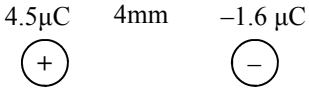
   B. Is this charge possible?

8. Elem charge is p or e's
   A. Div by Coulombs
   = 4.5 e's

   B. No—can't have part of and e or proton.

Part II: Electric Forces and Fields.

9. What is the force on the −1.6μC charge below?



9. Need direction, too.
μ =$\times10^{-6}$
mm =$\times10^{-3}$m
Magnitude = 4050N
direction: left (attract)

10. A point in space has an electric field magnitude of 1.5 N/C.
    A. What is the electric field strength if a 3 C charge is placed at that same point?

    B. What is the force on the 3 C charge?

10.
A. Same. It's about the position: not what's there: 1.5 N/C

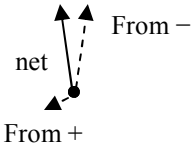
B. (1.5N/C)(3C) = 4.5 N

11. Electric fields point the direction a _____ charge would move.

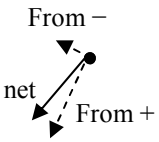
11. + charge

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.

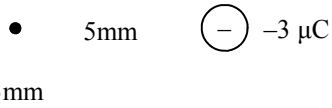
12 for I:



12 for II:

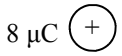


13. A. Calculate the electric field at the point due to the 8 μC charge and draw the direction.



13A: 8×10^{9} N/C
up (away from a +)

B. Calculate the electric field at the point due to the −3μC charge.

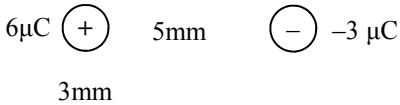


13B. 1.08×10^{9} N/C
right (toward a −)

C. Calculate the net electric field at the point.

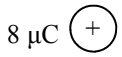
13C. Pyth theor + $\tan^{-1}$
Mag = 8.07×10^{9} N/C
Direc = 82.3º (Quadr 1)

D. A 6μC 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 6μC charge.



E. You have N/C and C, calculate N
8.07×10^{9} N/C(6μC) = 48420N at 82.3º