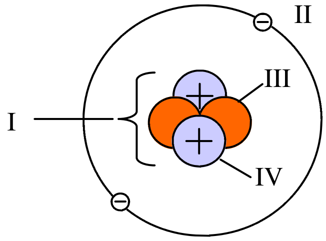
PreAP Electrostatics 1



1) From the diagram at the left.

A. ___ A proton | C. ____ * A neutron
B. ___ An electron | D. ____ The nucleus

2) * Which of the subatomic particles in the atom is easily removed?

3) So, when charges move it is almost always the ____________ that are moving.

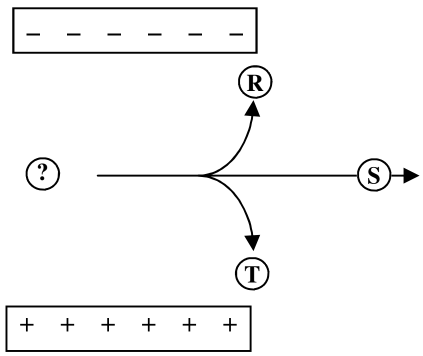
4) Opposites attract and like charges repel.
   A) Two protons will:
   B) Two electrons will:
   C) An electron and a proton will:

5) For each of the pairs of charges, will they attract or repel each other:

A) (+) (+) Attract or Repel?

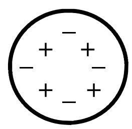
B) (–) (+) Attract or Repel?

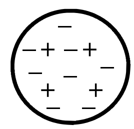
C) (–) (–) Attract or Repel?

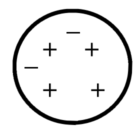


6) A particle is shot between the charged plates of a capacitor. The path the particle will take depends on its charge. Determine the charge for each path.
   A. * Path R: B. Path S: C. Path T:

7) For the three spheres shown below, count up the number of +s and – and decide if the net charge of the sphere is positive (+), negative (–), or neutral (0).

A) ____ 

B) * ___ 

C) ____ 

8) For the next four examples decide the net charge of the object.

D) ____ An object with 2 protons and 4 electrons

E) ____ An object with 18 protons and 16 electrons

F) ____ * An object that loses electrons.

G) ____ An object that gains electrons.

9) A piece of rabbit fur is rubbed against a rubber rod. The rubber rod becomes negative. Did the rubber rod gain or lose electrons?

10) * So, how do objects become positive?

11) How do objects become negative?

We know (from the homework "PreAP Circuits 5") that 1 electron (e) = -1.6×10^{-19} C and 1 proton = $+1.6\times10^{-19}$ C.
Therefore: $\left(\dfrac{1e}{-1.6\times10^{-19}C}\right)$ OR $\left(\dfrac{-1.6\times10^{-19}C}{1e}\right)$ *Again, use the units. If you need coulombs, put coulombs on top, etc.*

12) * Calculate the charge of 14 electrons.

13) * Remembering that μ means: "$\times10^{-6}$", how many electrons is 1.36μC?

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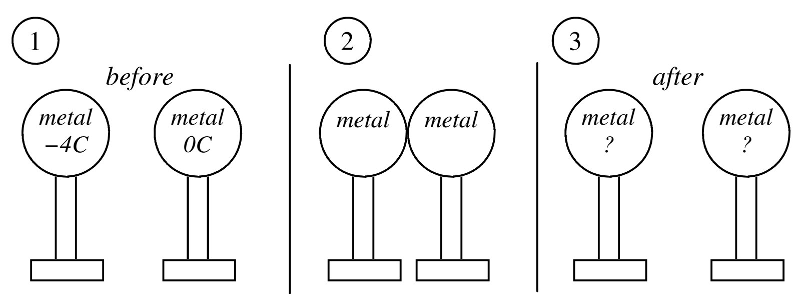
14) A metal sphere has a charge of –4C. It is touched to another metal sphere that is neutral to begin with.
   A. Are the spheres conductors or insulators?
   B. Will they allow electrons to flow?
   C. Will the electrons attract or repel each other?
   So the electrons will spread apart as far as possible.
   D. * What will be the charge of the right sphere afterwards?



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The new equation at the right looks a lot like the gravity equation. Both of them are field forces and are $1/r^2$ laws: known as inverse-square laws. Please note the absolute value symbol on top. This equation gives you the MAGNITUDE (size) of the electric force. You decide on the direction (attract; repel; left; right; 34°; etc.) by looking at the situation. Also, remember that in your calculate 4×10^{12} is 4E12 and that there are 1000mm in a m. ***ALSO: r can never be negative.***

Coulomb's Law

Charge 1 (*in Coulombs*)

Charge 2 (*in C*)

Electric Force Magnitude (*in N*)

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

Distance between the two charges (*in m*)

Coulomb's Constant $= 9\times10^9\ \mathrm{Nm^2/C^2}$

15) * Calculate the force between a 4 μC charge and a 8 μC charge that are 3.2 mm apart. (*Be sure to say "attract" or "repel".)*

16) Calculate the force between a 1.2 μC charge and a –4.8 μC charge that are 2.5 mm apart.

17) Let's remember how proportionality works. In the following table calculate the electric force for each of the situations. This is for comparison, so you don't need to fully calculate your answers, so leave "k_C" in your answer.

Situation	q_1 =	q_2 =	r =	F_e = (keep k_C in the equation)
1. control	1	1	1	$F_e = k_C \frac{q_1 q_2}{r^2} = k_C \frac{1(1)}{1^2} = k_C \frac{1}{1} = 1k_C$
2. double the charge	2	1	1	
3. half the charge	1	0.5	1	
4. double the distance	1	1	2	
5. half the distance	1	1	.5	

18) How does the electric force change?
   A. * If one of the charges is doubled?
   B. * If the distance is tripled?
   C. If one of the charges is 1/3rd as big?
   D. If the distance is halved?

1C) Neutron is III 2) electrons (they are not bound in the nucleus by the strong nuclear force)
6A) + 7B) – 8F) +
10) by losing electrons
12) -2.24×10^{-18} C 13) -8.5×10^{12} e. The neg means you lost electrons, which you already knew since the object was pos.
14D) –2C
15A) ×2 15B) 1/9 the force
16) = 2.81×10^4 N repelling (in your calculator should look like this: 9E9*4E-6*8E-6/3.2E-3^2)
18A) q is on top, so doubling q doubles F
18B) r is squared and on the bottom, so tripling r makes (1/9)F