

**Physics 9**  
**Homework Set 1**  
**Electrostatics**

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1. **What is the repulsive force between two charged objects that are 0.20 [m] apart and have equal charges of  $-34.3$  [nC]? The metric prefix “n” means “nano” or  $\times 10^{-9}$  (billionth).**
  
2. **Red blood cells often can be charged. Two red blood cells are separated by 1.50 [m] and have an attractive electrostatic force of 0.985 [N] between them. If one of the red blood cells has a charge of  $+8.59 \times 10^{-6}$  [C], what is the sign and magnitude of the second charge,  $Q$ ?**
  
3. **What is the electrical force between two electrons that are placed 1 [m] apart? The charge of an electron is  $-1.60 \times 10^{-19}$  [C].**
  
4. **What is the gravitational force between two electrons that are placed 1 [m] part? Recall Newton’s Universal Law of Gravitational  $F = Gm_1m_2/r^2$ .  $G = 6.67 \times 10^{-11}$  [ $\text{Nm}^2/\text{kg}^2$ ] and the mass of an electron is  $9.11 \times 10^{-31}$  [kg]. How many times greater is the electrical force than the gravitational force acting on the electrons?**
  
5. **A particle that has the same mass as an electron, but opposite charge is called a positron. Many different types of this “antimatter” were in existence right after the big bang, although very few currently exist in the known universe. Where the antimatter is now is a current topic of research. Antimatter can be created at particle accelerators such as the LHC in Geneva, Switzerland to study their properties. In one such experiment, it was found an electrical force of  $2 \times 10^{-24}$  [N] acted between two positrons. How far apart were these positrons?**

## **Qualitative Problems**

**Short answer (in a complete sentence) or a fully labeled graph  
(Given, Find, Solution NOT required)**

6. **Who coined the terms “positive” and “negative” charge?**
  
7. **What was Coulomb’s contribution to the study of electrical forces?**
  
8. **Two pieces of charged scotch tape are brought close to one another. They are observed to ATTRACT one another. Draw a picture of this situation and show charge distribution on each tape that causes this attraction.**
  
9. **Two pieces of charged scotch tape are brought close to one another. They are observed to REPEL on another. Draw a picture of this situation and show charge distribution on each tape that causes this attraction.**
  
10. **As two charged objects are brought closer to one another, how and why will the magnitude of the force between them change? Include a reference to Coulomb’s Law in your explanation.**

## HW Set 1 Answers

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1.  $2.65 \times 10^{-4}$  [N]
2.  $-2.87 \times 10^{-5}$  [C]
3.  $2.3 \times 10^{-28}$  [N]
- 4a.  $5.54 \times 10^{-71}$  [N]
- 4b. The electrical force is  $4.16 \times 10^{42}$  times greater than the gravitational force!
5. 0.0107 [m]
- 6-10. Will discuss in class