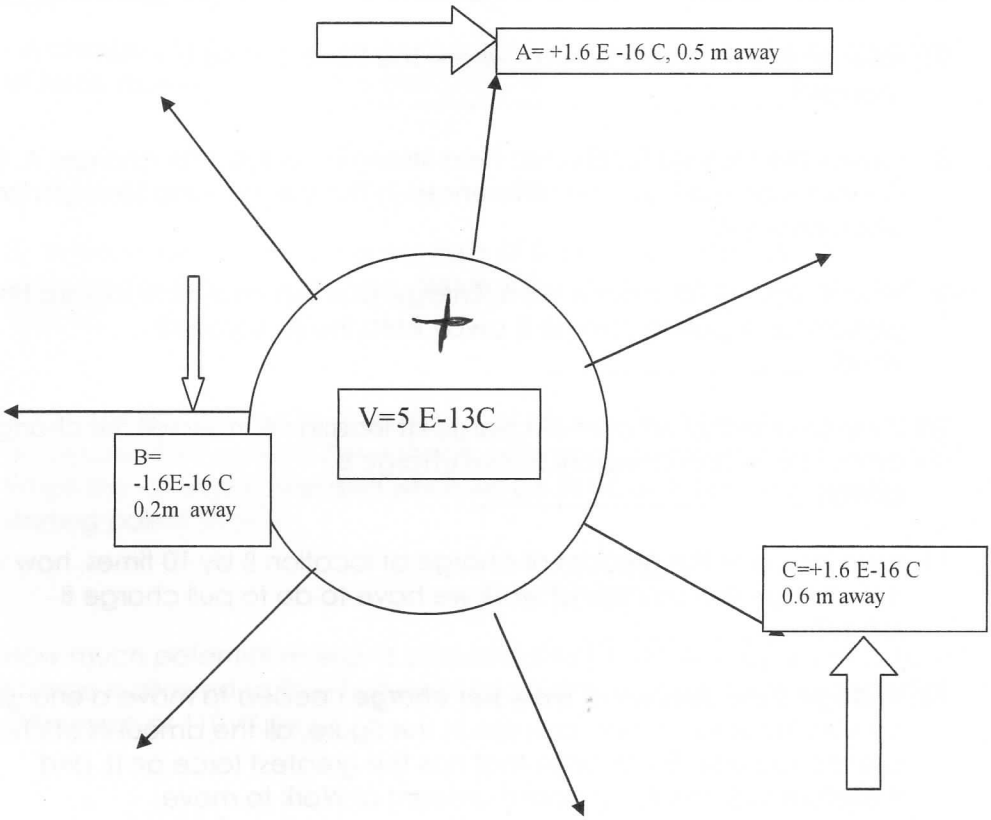
Electric Fields and Voltage

Study the figure below and answer the questions that follow:



Object V is a Van de Graff generator.
Objects A, B, and C are point charges located various distances away from the generator.

1. Which object A, B, or C, has the greatest charge?_____
2. Which object experiences the greatest electrostatic force and Why?
   _____
3. Which direction will charge A move when the generator is turned on? (away/toward)

4. Which direction will charge B move when the generator is turned on? (away, toward)

5. Which charge, A, B or C, will move with the greatest acceleration when the generator is turned on? _____

6. At which location A, B, or C is the Electric Field Strength greater?_____

7. How do the field lines tell you where the Electric Field is greater?_____

8. Here is the formula for Electric Field Strength: **E=F/q.** For charges A, B, and C what is determining the differences in the Electric Field Strength for each charge?

9. Which task will take more Work/Energy, pushing charge A toward the generator or pulling charge B away from the generator? Why?_____

10. If we double the amount of charge at location B, how will this change the amount of work necessary to pull charge B away?_____

11. If we increase the amount of charge at location B by 10 times, how will this change the amount of work we have to do to pull charge B away?_____

12. **Voltage** is the ***amount of work per charge*** needed to move a charge in an electric field. As you can see in the figure, all the amounts of charge are the same so the charge that has the greatest force on it, and therefore requires the greatest amount of Work to move, is_____. Therefore, the _____ between the generator and charge B is greater that it is for charge A or C.

13. For there to be a voltage there must be charge difference. This is what makes the charges want to move. For this reason, voltage is also called _____, **or just** _____.

14. The formula for Voltage is : **V = W/q or V= PE/q.** W stands for Work and PE stands for Potential Energy. Remember, when you do Work you change Energy and when you release potential energy you get Work. If we do Work against and electric field, (which we must, to keep a charge from moving) we are storing_____energy. When we release a charge in an electric field, we get_____energy and work is performed.

Practice Problems

1. A charge of 2 E -5 C is in an electric field. It is experiencing a 3.5 E -4 N force . What is the magnitude of the electric field at this point?

2. A charge of 6 E-5C is in an electric field of 3.8 N/C. What is the amount of force exerted on the charge?

3. A test charge is in an electric field of 5.2 E -4 N/C strength. It experiences a 5.2 E -8 N force. What is the magnitude of the test charge?

4. If you do 20 J of work to push .005 C of charge from point A to point B in an electric field, what is the voltage difference between points A and B? When the charge is released what will be its KE as it flies back past its starting point?

5. How much potential energy is converted to kinetic energy when 2.0 C of charge is allowed to flow between two points separated by a potential difference of 110V?