EQUIPOTENTIAL SURFACES COMPUTER LAB ACTIVITY

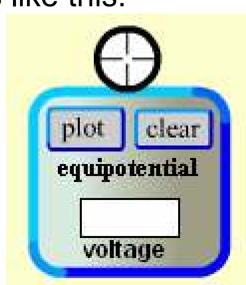
Name:__________________________

Remember that an equipotential surface is the set of all points around a group of charges that are at the same potential. Hese surfaces allow us to calculate the amount of work needed to move a charge from one spot to another. The amount of work needed to move a charge q through a potential difference ΔV is given by:

$$W=q\Delta V$$

The purpose of today's activity is to make you familiar with the shape and appearance of these equipotential surfaces and their replationship to the electric field.

1. After you have logged on to the computer, go to the resources page of the website and click the button labeled "Potential Surfaces and Electric Fields Activity" and save it to the desktop. Open the program from the desktop and maximize the screen. You will see an area for grabbing charges that can be placed in the area on the screen, a green box that allows you to change certain aspects of the area, and a movable tool that looks like this:



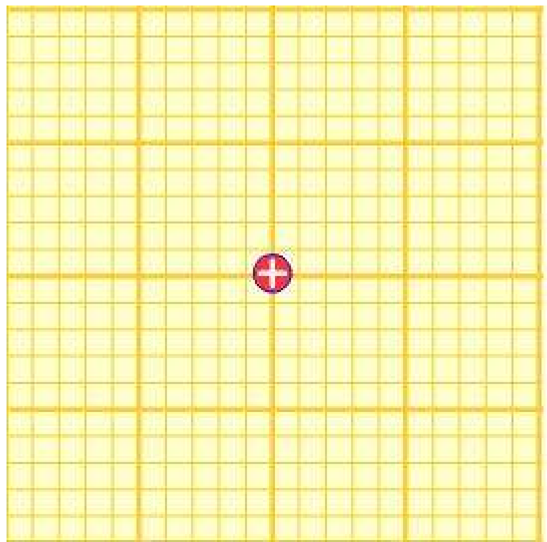
   It is used to find the value of the potential at any point in space and plot the lines of equipotential in the area. The circle at the top changes color to reflect the relative magnitude and polarity of the potential at the point in the cross hairs. You will be using this tool to plot the potential lines.

2. Check the box in the green window labeled "Grid." Notice that the major lines of the grid are at intervals of 1 meter. In the same window check the box labeled "Show E-Field." Once a charge is placed in the test area, you will see arrows that represent the electric field due to the charge.
3. Place one of the positive charges in the center of the test area. Notice the electric field? Move the charge around a note what the field does. Answer the following:
   a. How does the program show the direction of the electric field at any point?

b. How does the program show the magnitude of the electric field at any point?

c. Where is the electric field strongest?

d. In the diagram below, draw the electric field of a positive point charge:



4. Move the equipotential tool around the test area and note the color change of the circle.

a. How is it related to the voltage measured in the field?

b. Where is the voltage the highest?

Use the tool to plot equipotential lines at 1m intervals from the charge. Fill in the table below:

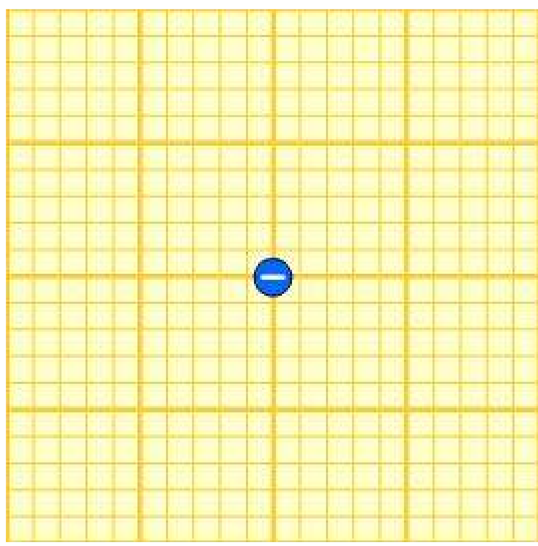
Distance (m)	Voltage (V)
1	
2	
3	
4	
5	
6	

Create a graph of the data and attach the graph to your lab. Does the voltage due to a point charge vary directly or inversely with distance from the charge?

In the diagram from number three, draw in the equipotential lines around your charge.

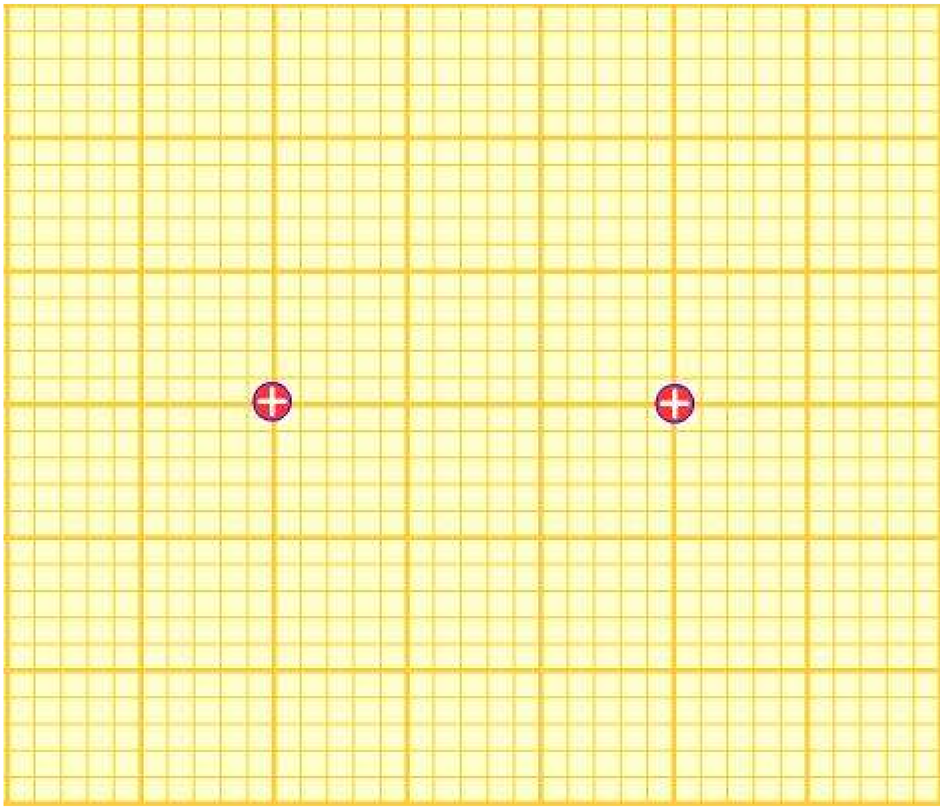
c. How is the electric field oriented relative to the equipotential lines?

5. Clear the test area. Place a negative charge in the test area. On the diagram below, draw in the electric field lines and equipotential lines for a negative charge:

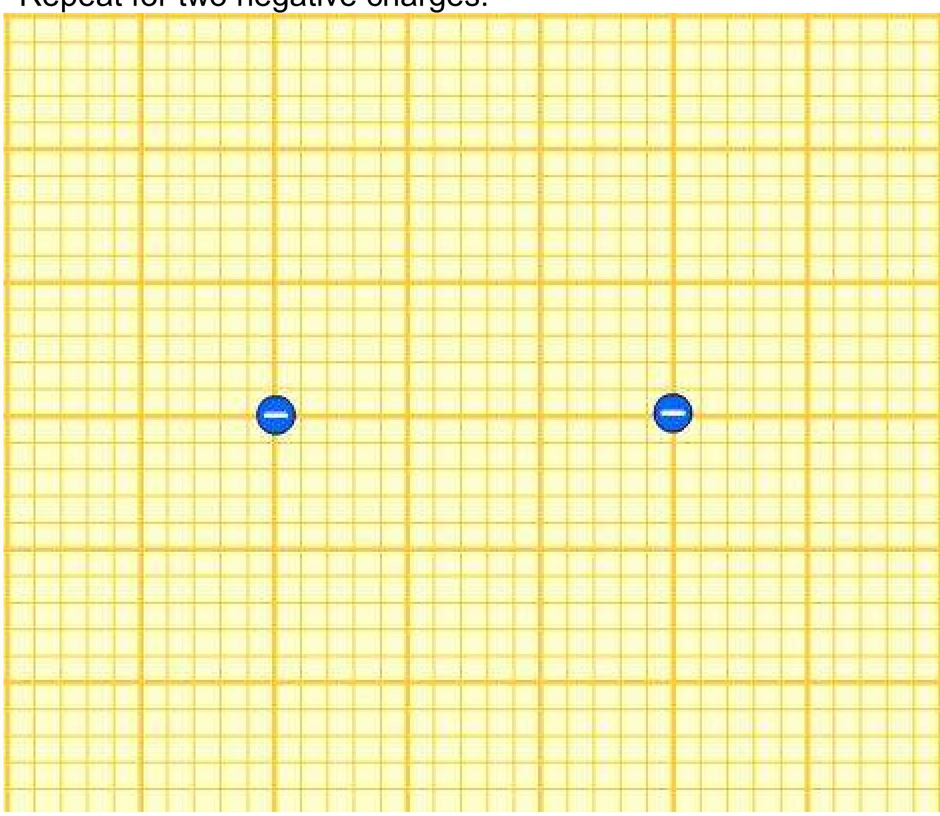


a. How are the field lines oriented relative to the equipotential lines?

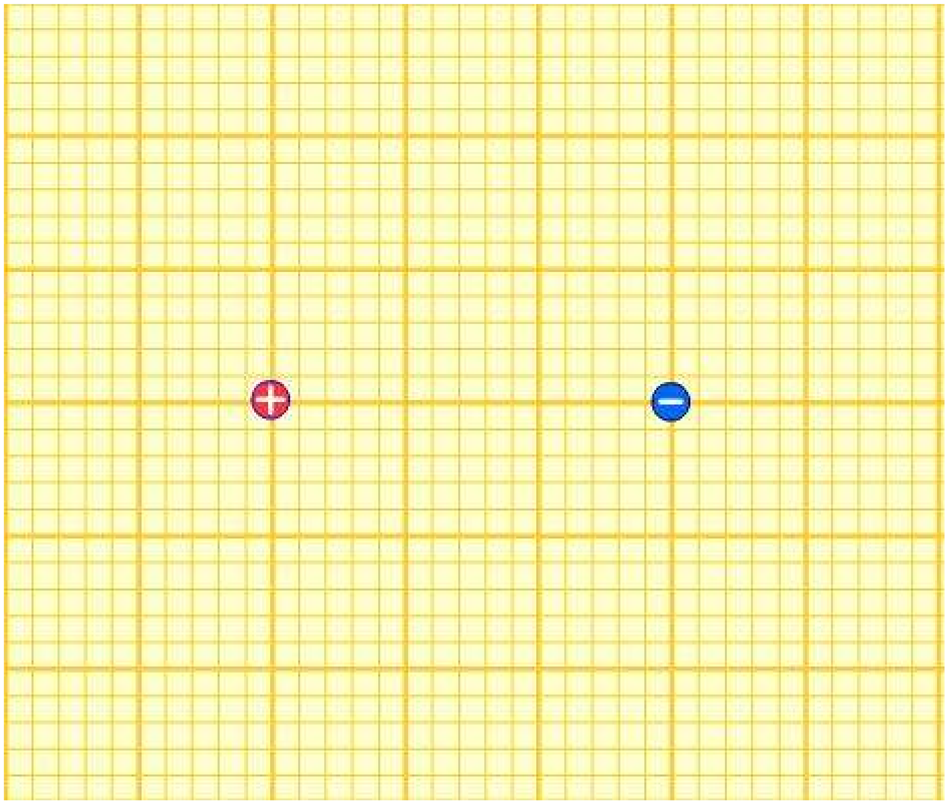
6. Clear the test area. Place two positive charges a distance of 3 m apart in the test area. Use the diagram below to draw in the field and equipotential lines:



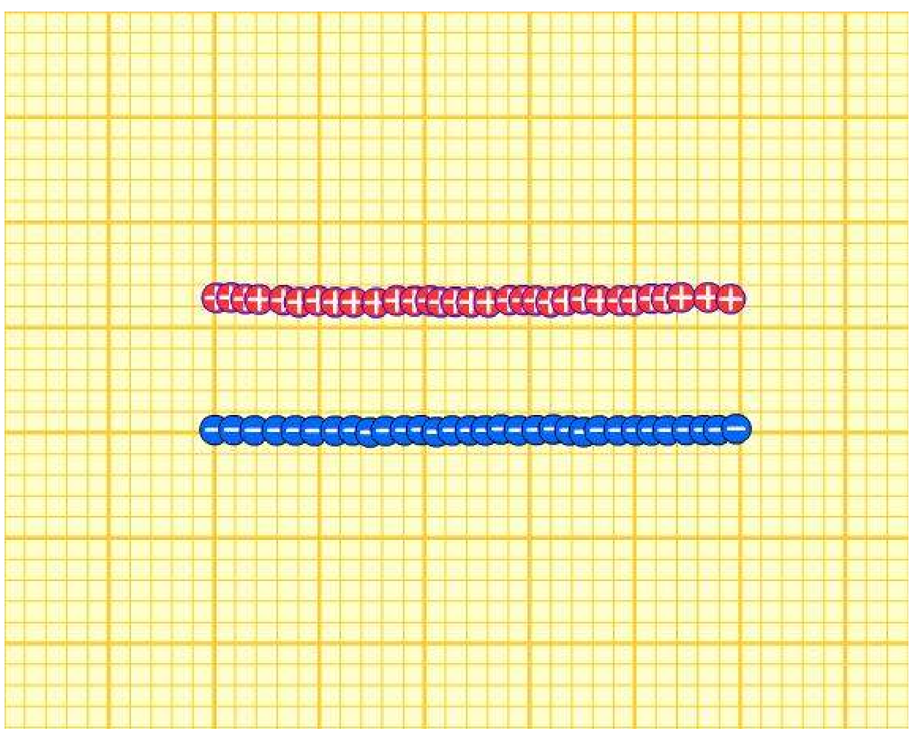
7. Repeat for two negative charges:



8. Repeat for a positive and a negative charge. This configuration is what is called a "dipole."



9. Repeat for a double line of oppositely polarized charges. This will take a little time to set up:



10. What does the electric field of the previous configuration resemble?

11. For all the configurations, the following should be true statements. Circle the boldfaced choice that will make each one true.

The electric field points in the direction of **increasing / decreasing** voltage.

A positive charge released in an electric field will spontaneously move **with / against** field lines.

A positive charge released in an electric field will spontaneously move from regions of **high / low** potential to regions of **high / low** potential.

A negative charge released in an electric field will spontaneously move **with / against** field lines.

A negative charge released in an electric field will spontaneously move from regions of **high / low** potential to regions of **high / low** potential.