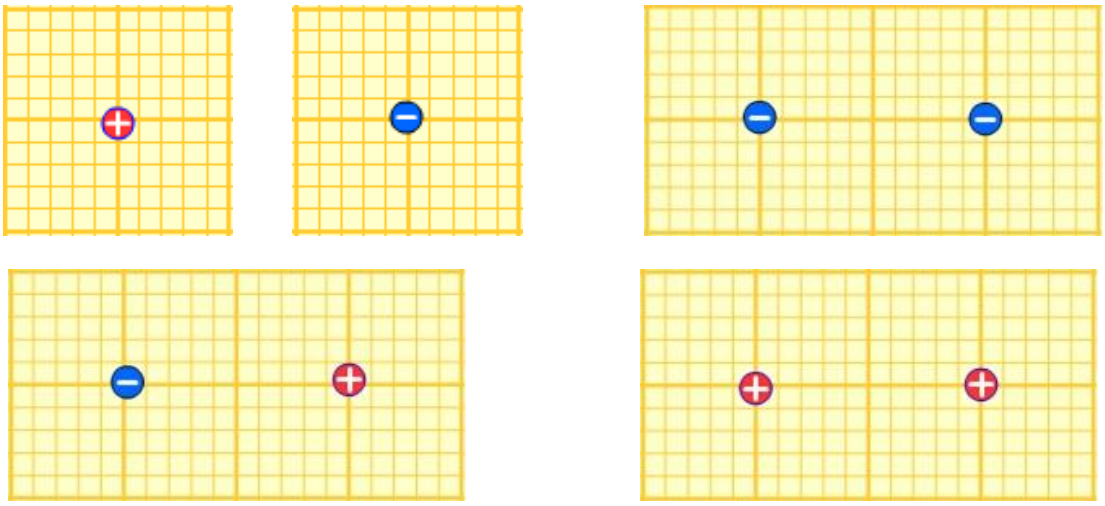
AP PHYSICS 2 LAB: ELECTRIC FIELD & ELECTRIC POTENTIAL	NAME:

PART I – ELECTRIC FIELDS

- Google: "Phet charges and Fields"
- Turn on the grid by clicking on the box next to "grid".
- Click on the box next to "show E-field" to show the electric field.
- Pull the required charges to obtain the arrangements shown below (one at the time)

Q 1. Draw the direction of the electric field for each arrangement shown below.



Q 2. What are the three properties of Electric Field lines?

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-
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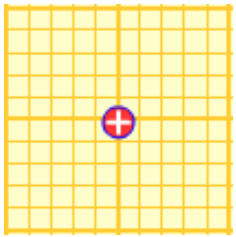
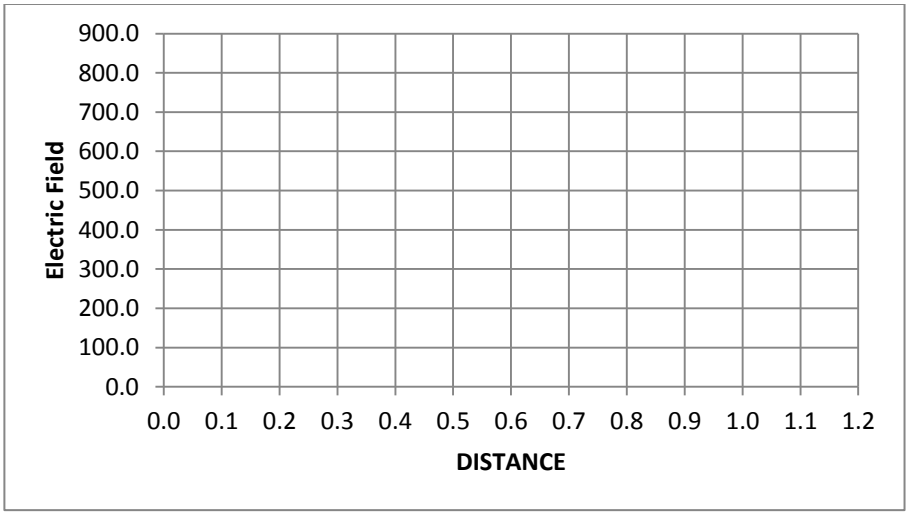
Q 3. Show that the units $\left[\frac{N}{C}\right]=\left[\frac{V}{m}\right]$ are equivalent and both can be used for units of electric field. Remember [V] = [J/C]

Q 4. Complete the chart and the graph below. Use the equipotential sensor:



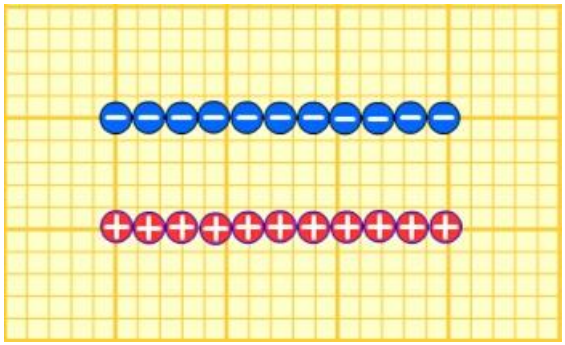
DISTANCE r [m]	ELECTRIC FIELD E [V/m]
0.1	



Q 5. Will the shape of graph change if the charge is negative? EXPLAIN

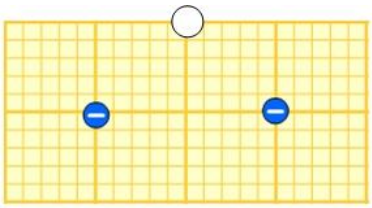
Q 6. What type of relationship do you find between Electric Field and distance? EXPLAIN.

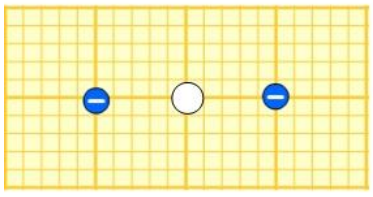
Q 7. **THE CAPACITOR** - Create a capacitor by placing 10 positive charges in a row above 10 negative charges of equal magnitude. Draw the direction of the electric field between the parallel charged plates:

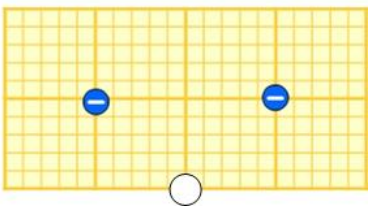


Q 8. Pull the required charges to obtain the arrangements shown below (one at the time). Use the superposition principle and:

- Draw the net electric field at the position of the E-field sensor.
- Write an expression for the net electric field at the position of the E-field sensor (show all your work).
- Find the magnitude and direction of the net electric field at the position of the E-field sensor (click on "show numbers" and verify your answers
- Note all charges are fixed at the grid, and 1 box = 0.1 m.

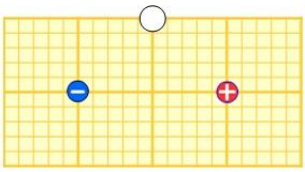


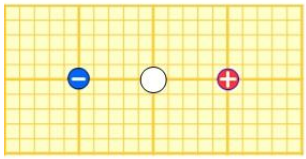


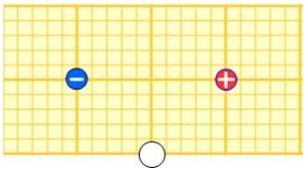


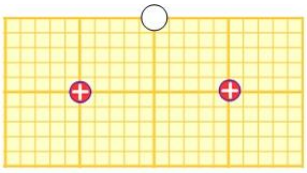
Q 9. Pull the required charges to obtain the arrangements shown below (one at the time). Use the superposition principle and:

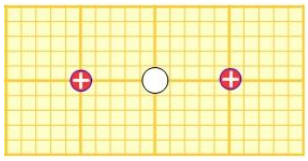
- Draw the net electric field at the position of the E-field sensor
- Write an expression for the net electric field at the position of the E-field sensor (you **don't** have to show all your work)
- Find the magnitude and direction of the net electric field at the position of the E-field sensor.

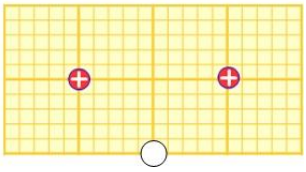






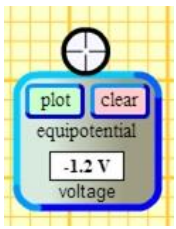




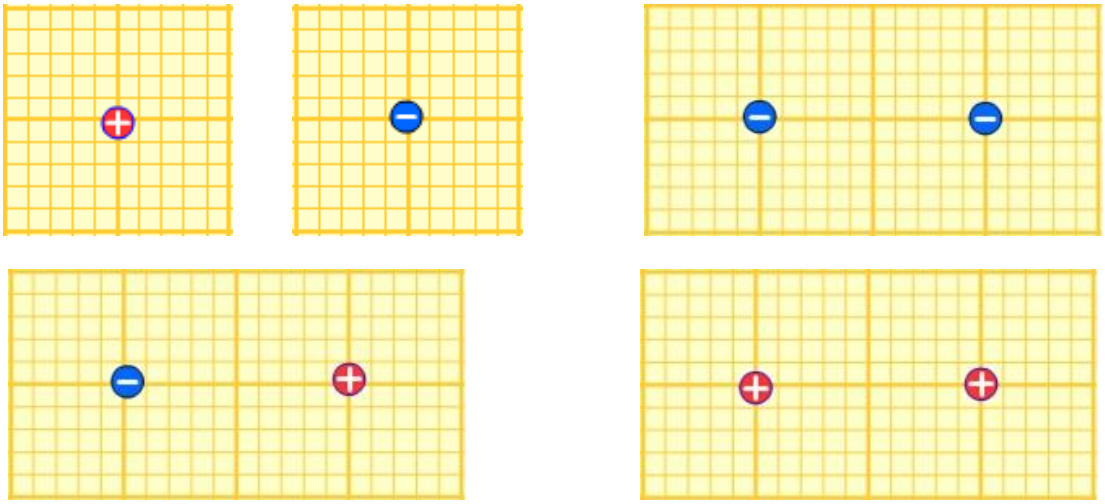


PART II – ELECTRIC POTENTIAL

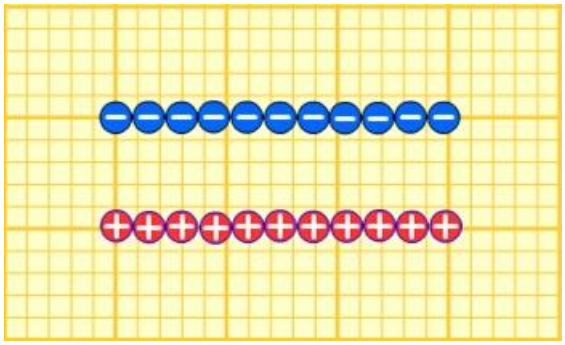
- Pull the required charges to obtain the arrangements shown below (one at the time)
- Bring the equipotential sensor close to the charge and click plot.
- Move the equipotential sensor away from the charge (just a little bit) and click plot.
- Repeat the process until you have 5 equipotential lines for each charge.



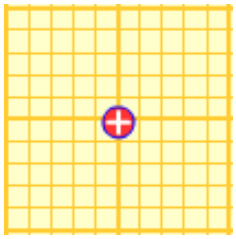
Q 10. Draw equipotential lines for each arrangement shown below.



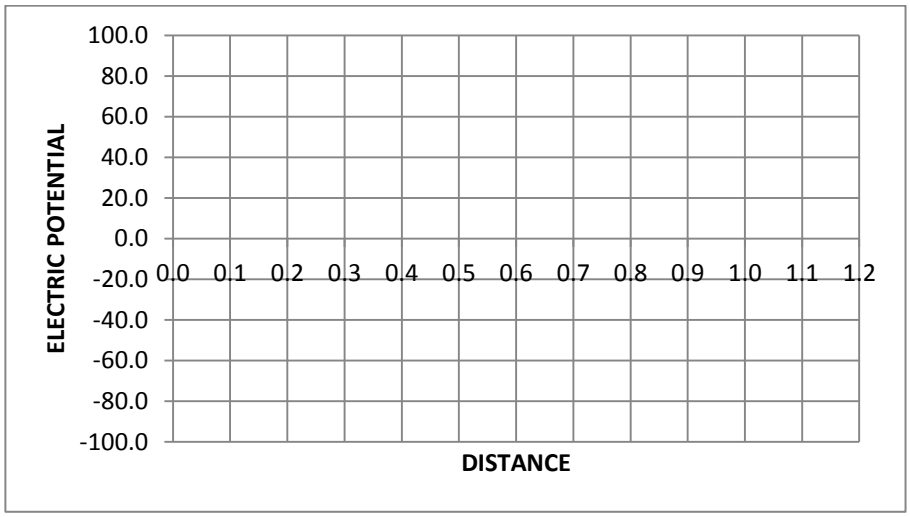
Q 11. **THE CAPACITOR** - Create a capacitor by placing 10 positive charges in a row above 10 negative charges of equal magnitude. Draw equipotential lines around the parallel charged plates:



Q 12. Complete the chart and the graph below. Use the equipotential sensor:



DISTANCE r [m]	ELECTRIC POTENTIAL V [m]
0.1	



Q 13. What type of relationship do you find between Electric Potential and distance? Explain.

Q 14. Will the shape of graph change if the charge is negative? EXPLAIN

Q 15. Mathematical models [for electric force and electric potential energy use (Q and q)]

ELECTRIC FORCE		ELECTRIC FIELD 1	ELECTRIC FIELD 2
	Divide electric force by "q" →		

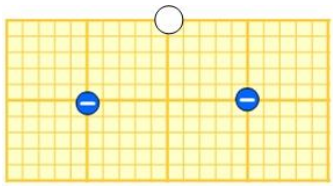
ELECTRIC POTENTIAL ENERGY		ELECTRIC POTENTIAL 1	ELECTRIC POTENTIAL 2
	Divide electric potential energy by "q" →		

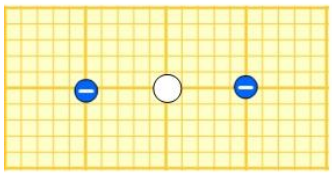
Q 16. Based on the definition of "Electric Field", define "Electric Potential".

Electric field	Electric Potential
A *property of a location in space* that measures the **force per unit charge** that a charged object would feel if placed at that location.	

Q 17. Pull the required charges to obtain the arrangements shown below (one at the time). Use the superposition principle and:

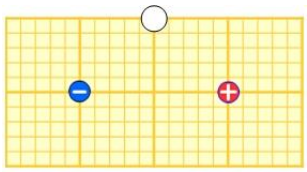
- Draw electric potential lines at the position of the E-field sensor.
- Write an expression for the net electric potential at the position of the E-field sensor (show all your work).
- Find the magnitude of the electric potential at the position of the E-field sensor (compare to the number given by the sensor)
- Note: all charges are fixed at the grid, 1 box = 0.1 m, and ELECTRIC POTENTIAL IS A SCALAR PHYSICAL QUANTITY)

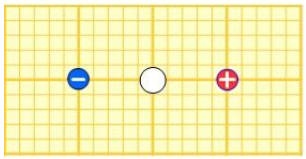


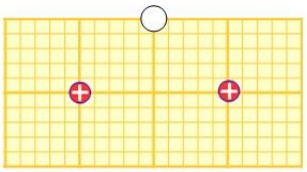


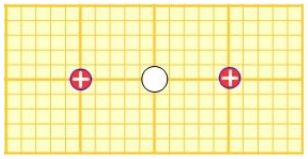
Q 18. Pull the required charges to obtain the arrangements shown below (one at the time). Use the superposition principle and:

- Draw electric potential lines at the position of the E-field sensor.
- Write an expression for the net electric potential at the position of the E-field sensor (You **don't** have to show all your work).
- Find the magnitude of the electric potential at the position of the E-field sensor (compare to the number given by the sensor)

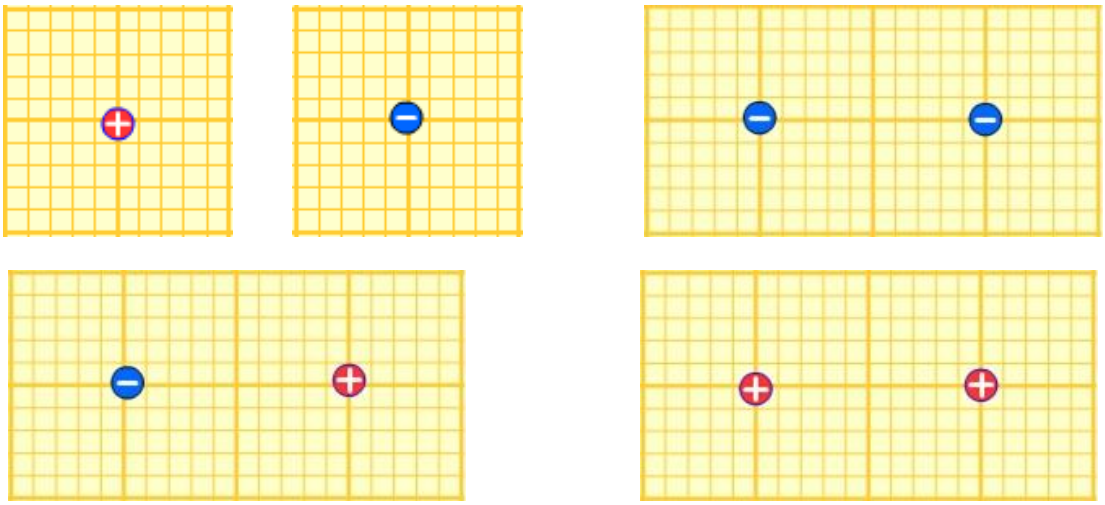








Q 19. Draw the equipotential lines and electric field for each arrangement shown below.



Q 20. How are electric field lines and equipotential lines placed with respect to each other?

Q 21. Can an electric field line begin and end on the same conductor?

Q 22. Why is the surface of a conductor considered to be an equipotential surface?