Name: ______________________

Class: ______________________

Due Date: ______________________

44 – Electric Field Lines and Parallel Plates

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

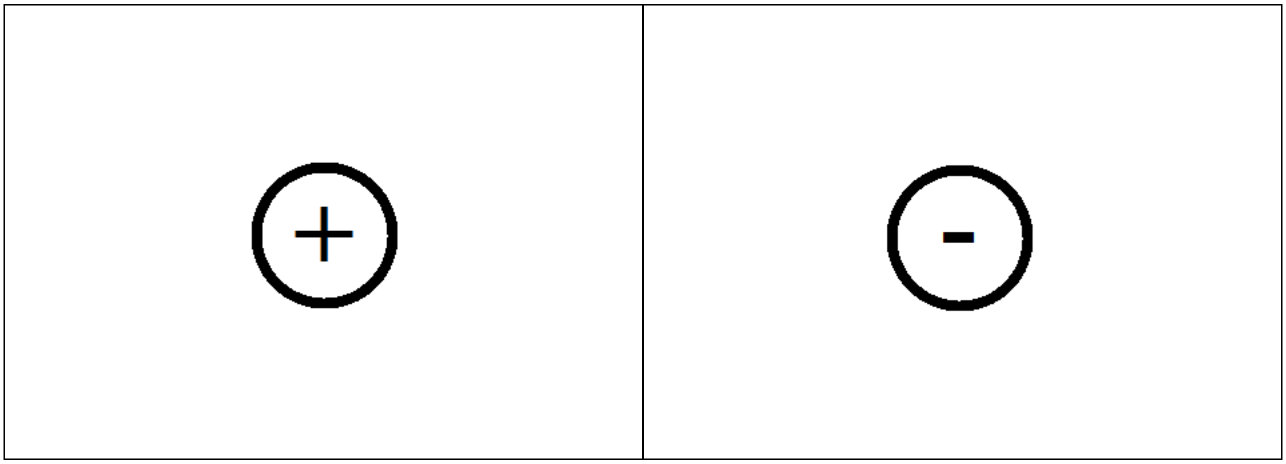
1. : Define *electric potential difference*. Units?

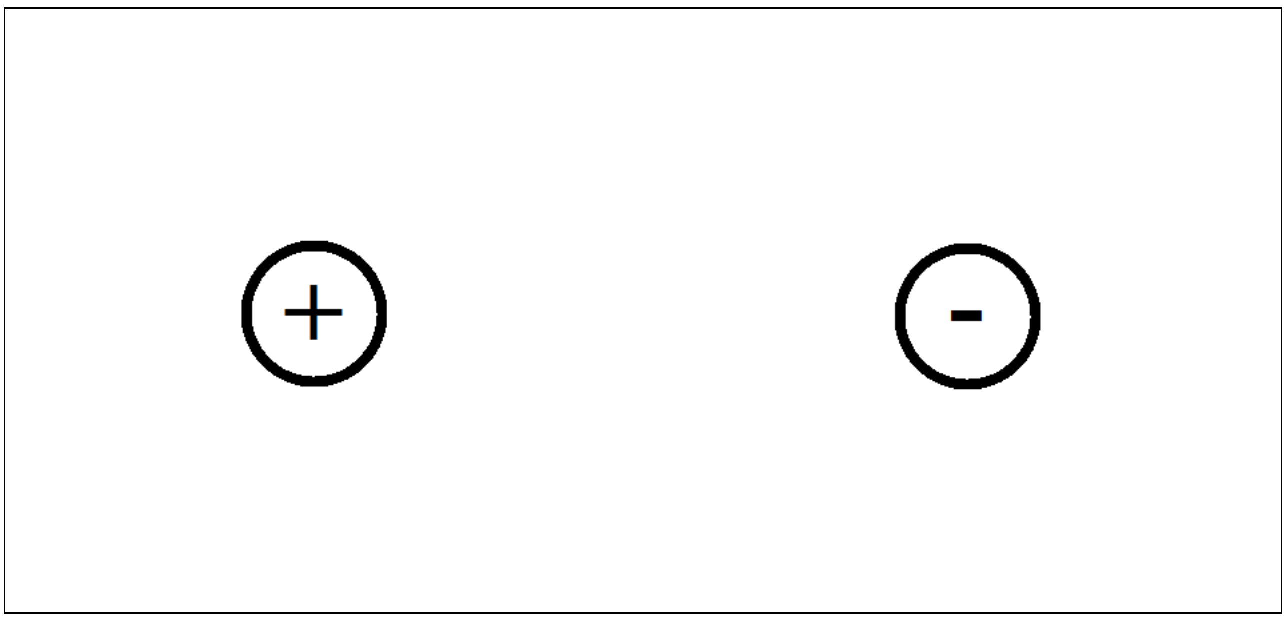
2. C: What are the units and fundamental units of *voltage*?

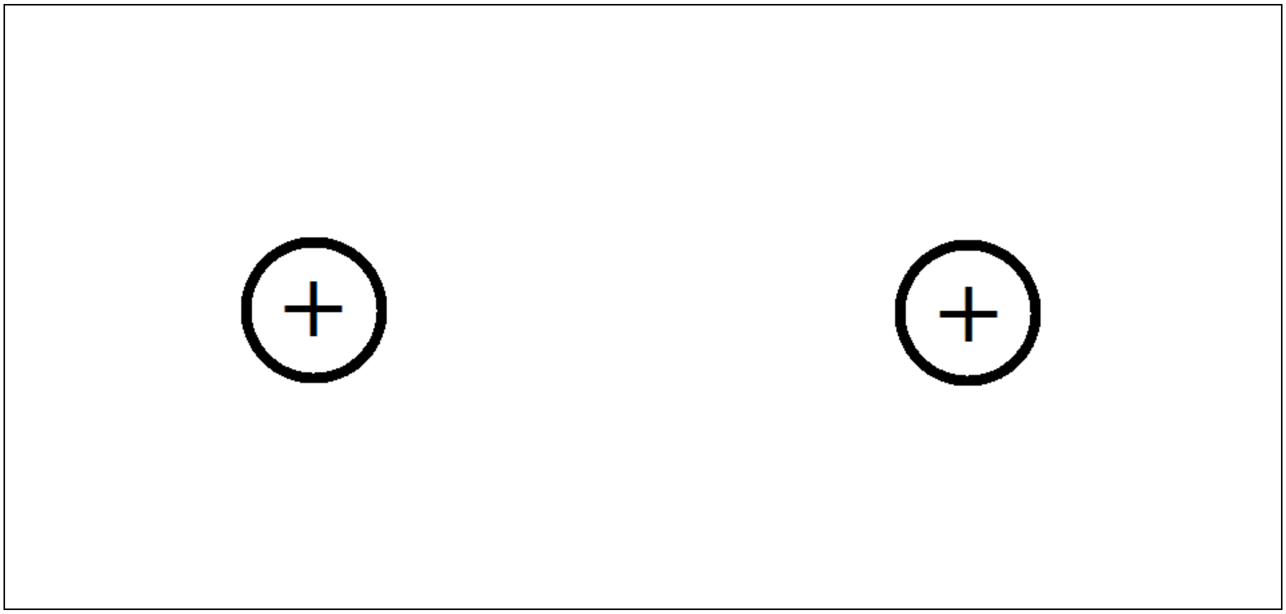
3. C: Define *electron-volt*.

4. C: List some rules for drawing electric field lines.

5. C: **Use a pencil and ruler!** Draw electric field lines for each figure.







6. C: **Use a pencil and ruler!**

   a. Draw charged *parallel plates*.

   b. Draw (and label) six electric field lines between the parallel plates.

   c. If a positive charge is placed between the plates then in which direction will it accelerate?

   d. If a negative charge is placed between the plates then in which direction will it accelerate?

e. Which variable is constant between charged parallel plates?

f. Define each variable for the equation for parallel plates $V = Ed$.

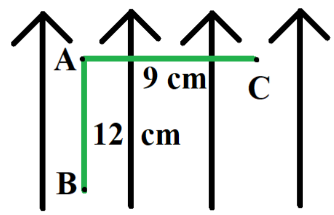
7. E: A charge of 15.0 μC is placed in a uniform electric field which has a field strength of $E = 8.80 \times 10^4 \ \frac{\text{N}}{\text{C}}$.

   a. What will be the magnitude of the electrostatic force acting on this charge?

   b. How much work would be done in moving this charge a distance of 135 cm against the electric field?

   c. What will be the potential difference between these two points?

8. E: A proton is placed at point A in a uniform electric field which has a field strength of $E = 4.50 \times 10^3\ \frac{\text{N}}{\text{C}}$ and which is directed toward the top of the page as shown in the diagram below:



a. What will be the direction of the electrostatic force acting on this proton while at point A?

b. What will be the magnitude of the electrostatic force acting on this proton while at point A?

c. How much work will be done in moving this charge a distance of 12.0 cm against this electric field to point B?

d. How will the electrostatic potential at point B in this field compare with the electrostatic potential at point A?

e. What will be the potential difference between points A and B?

Suppose that this proton is then released and is allowed to accelerate back to point A.

f. What will be the velocity of this proton when it returns to point A?

Suppose that the proton is again at rest at point A.

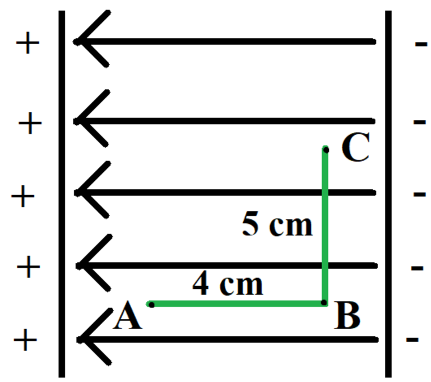
g. How much work would be done in moving this proton from point A to point C?

h. How will the electrostatic potential at point C compare to the electrostatic potential at point A?

i. What will be the potential difference between point C and point B?

j. How much work will have to be done on a proton to move it from point C to point B?

9. E: Two parallel plates are arranged as shown below. The electric field between the plates is uniform and is directed from the positive plate to the negative plate. The electric field strength is $E = 6.00 \times 10^4\ \frac{\mathrm{N}}{\mathrm{C}}$ and the two plates are $d = 6.00\ \mathrm{cm}$ apart. A particle, which has a charge of $q = -0.0150\ \mu\mathrm{C}$, is initially placed at point A.



a. How much work would have to be done to move this particle from point A to point B?

b. What is the potential difference between point A and point B?

c. How much work would have to be done in moving this particle from point A to point C?

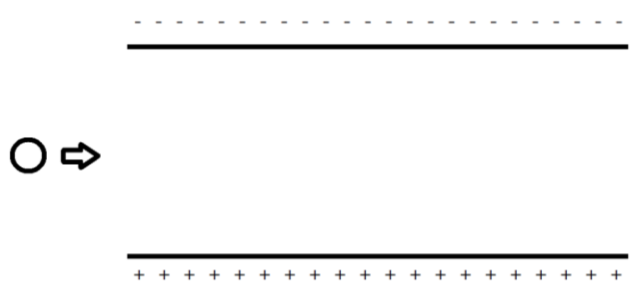
d. What is the potential difference between points B and C?

Suppose that another particle, which has a charge of 2.00 μC, is placed, initially, on the negative plate. This particle is then moved from the negative plate to the positive plate.

e. How much work would be done in moving this particle from the negative plate to the positive plate?

f. What will be the potential difference between these two plates?

10. E: A proton, which has a mass of 1.67×10^{-27} kg and a charge of 1.60×10^{-19} C, is moving with a velocity of $5.60 \times 10^{6}\ \frac{\mathrm{m}}{\mathrm{s}}$ from left to right into a uniform electric field as shown in the figure below. The electric field has a magnitude of $5.60 \times 10^{5}\ \frac{\mathrm{N}}{\mathrm{C}}$ and is directed upward.



a. What will be the direction and magnitude of the gravitational force acting on this proton?

b. What will be the direction and magnitude of the electrostatic force acting on this proton?

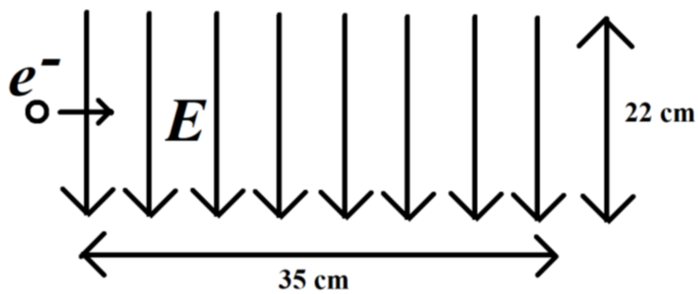
c. What will be the direction and magnitude of the net force acting on the proton?

d. What will be the direction and magnitude of the acceleration of this proton?

e. What will be the velocity of this proton 1.25 microseconds after entering the electric field?

f. What will be the displacement of this proton 1.25 microseconds after entering the electric field?

11. E: An electron, which has a mass of 9.11×10^{-31} kg and a charge of -1.60×10^{-19} C, enters a uniform electric field with a velocity of $5.80 \times 10^{7}\ \frac{\text{m}}{\text{s}}$. The electric field has a magnitude of $2.90 \times 10^{4}\ \frac{\text{N}}{\text{C}}$, is pointing vertically downward and is contained within a limited area. The dimensional limits of the electric field is 35.0 cm horizontally and 22.0 cm vertically. The electron enters the uniform electric field horizontally from the middle of the vertical. The force of gravity also acts on the electron.



a. **Use a pencil!** Sketch the path of this particle through the electric field in the image above.

b. What will be the net force acting on this electron?

c. How long will it take for this electron to pass through this field?

d. Where, exactly, will the electron exit the field?

e. What will be the velocity of the electron as it exits the field?