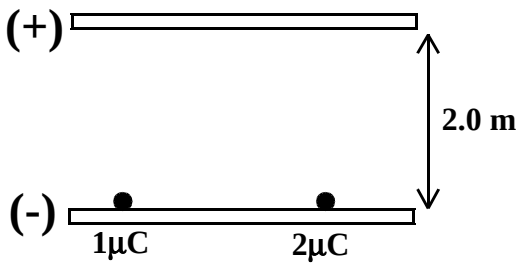
Fields, Potential, and Energy
Worksheet 4

2. Below are two parallel conducting plates, each carrying an equal quantity of excess charge of opposite type. The plates are separated by 2.0 m.



a. Calculate the electrical force acting on each object when it is between the plates. What factors determine the size of this force?

b. Calculate the change in each object's electrical potential energy as a result of being moved from the negative plate to the positive plate. What factors determine the size of this change?

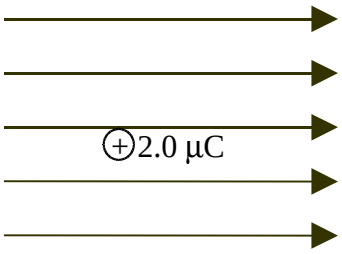
c. What is the difference in electric potential (potential energy per unit charge) between each of pairs of plates? What factors determine the size of this difference?

d. What is the difference in electric potential between the negative plate and a point midway between the plates?

e. How does electrical potential differ from electric potential energy?

3. We learned that the units for electric field were given as $\frac{N}{C}$. It turns out that the electric field strength can also be given in $\frac{V}{m}$. Show how these units, which appear very different, actually describe the same quantity.

5. A region in space has a uniform electric field of strength equal to 400 N/C that points to the right. A +2.0 μC test charge with a mass of 0.1 grams is placed in the field at rest and released.



a. Describe the motion of the charge in the field after it is released.

b. Describe energy changes of the charge/field system as the charge moves in the field.

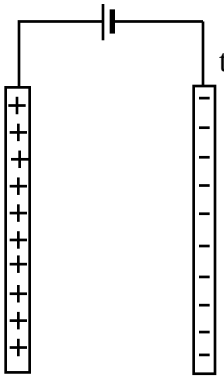
c. What is the magnitude and direction of the electric force on the charge?

d. What is the acceleration of the charge as it moves in the field?

e. After the charge has moved 1.0 meters, how fast will it be moving?

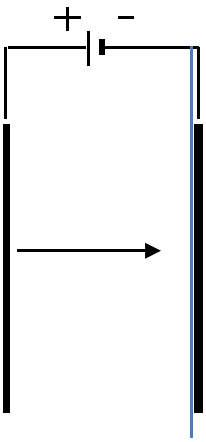
Fields, Potential, and energy Worksheet 5

1. The plates at right are connected to the terminals of a 6 V battery. How does the amount of charge on the plates change (if at all) if the plates are pulled farther apart while remaining connected to the battery? Explain.



Initial

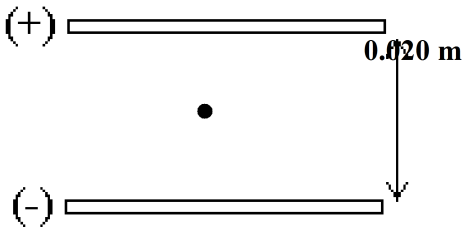
2. An electron is placed midway between two parallel conducting plates that are spaced 3.0 mm apart. The plates are attached to the terminals of a 12.0 V battery.



a. What is the direction and magnitude of the electric field?

b. How much work would be done by moving the electron from the midpoint to the surface of the (-) plate?

3. Robert Millikan determined the charge of an electron by suspending a charged drop of oil between two parallel plates like those shown at right.



a. What forces act on the suspended oil drop? Draw a force diagram that supports your answer.

b. Assuming the mass of the oil drop is 4.0×10^{-15}kg , the potential difference between the plates is 1630 V, and the separation between the plates is 0.020 m, what is the charge on the oil drop?

4. An unknown charged particle (an electron or proton) is placed at point A between two parallel plates. The particle is released from rest and accelerates toward the other plate. The particle emerges through the hole at point B with a speed of 1.4×10^{5} m/s. The potential difference between the two plates is 100V.

a) Is the unknown particle an electron or proton? Justify your answer.

b. Which plate (top or bottom) is positively charged?