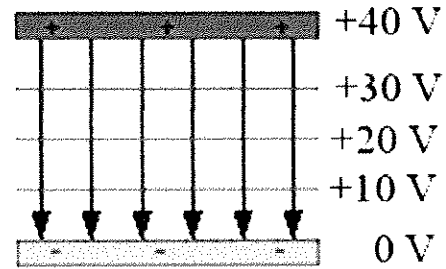
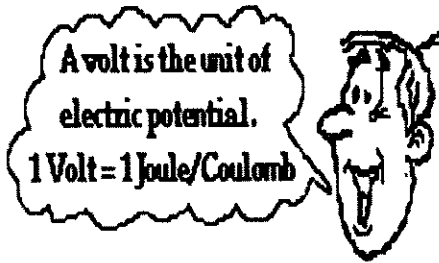


Examples Connecting Electric force and Energy



Field and equipotential
lines between plates

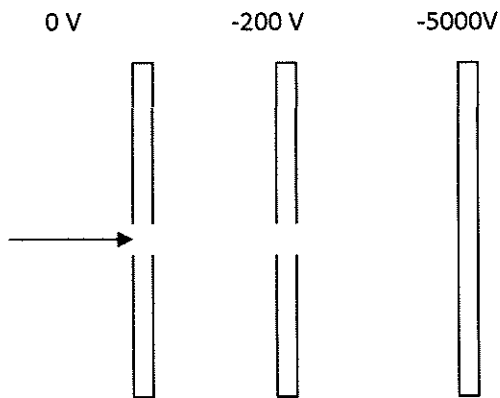
1. Recall that eV is a unit of energy and it is defined as work done by electric force on one electron by moving it through a potential difference equal to exactly 1 V.

$$1\text{eV} = 1.6 \times 10^{-19}\text{J}$$

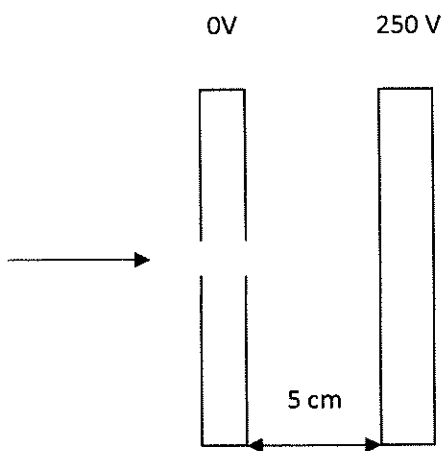
a) Calculate the speed of a proton with 100eV of kinetic energy.

b) What would be the speed of an electron with the same amount of kinetic energy?

2. A proton moving at $5.0 \times 10^5 \text{ m/s}$ enters a series of charged parallel plates as shown below. What is the impact speed on the last plate? **Note: this speed cannot exceed the speed of light in vacuum.**

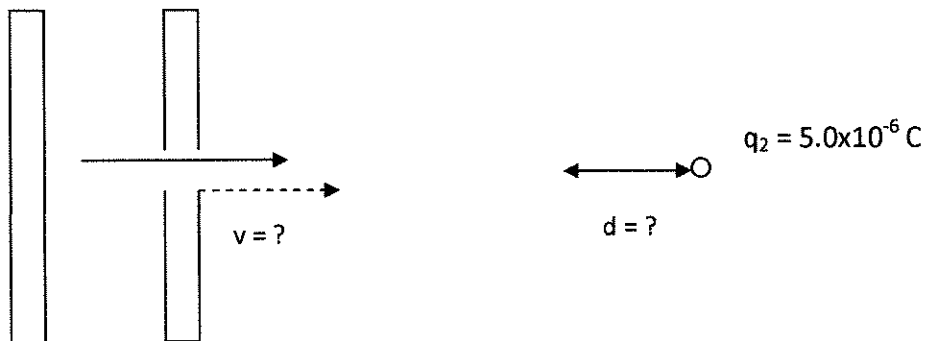


3. An electron moving at $2.5 \times 10^6 \text{ m/s}$ enters a region of electric field between parallel plates by passing through a small hole in the plates as shown. What is the impact speed of the electron on the second plate?



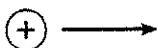
4. A proton is accelerated from rest through a potential difference of $1.2 \times 10^4 \text{ V}$ is directed at a fixed charge of $+5.0 \times 10^{-6} \text{ C}$.


a) What is the speed of the proton as it leaves the last plate?



b) What is the distance of the proton from q_2 when proton stops?

5. Alpha particles with a mass of 6.6×10^{-27} kg and a charge of 3.2×10^{-19} C are fired towards each other from a great distance.

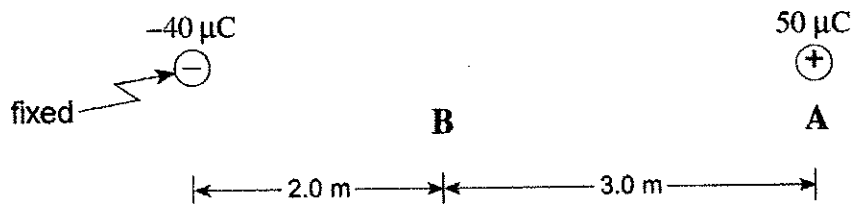
$$m = 6.6 \times 10^{-27} \text{ kg}$$

$$Q = 3.2 \times 10^{-19} \text{ C}$$

$$m = 6.6 \times 10^{-27} \text{ kg}$$

$$Q = 3.2 \times 10^{-19} \text{ C}$$

a) If they each have a speed of 2.5×10^6 m/s to start with, what will be their minimum separation distance?

b) Using energy principles, explain why the particles do not come any closer than this minimum separation distance.

6. A 1.0×10^{-3} kg styrofoam ball carrying $50 \mu\text{C}$ of charge is released from rest from position **A** as shown in the diagram below. ($1 \mu\text{C} = 1 \times 10^{-6} \text{ C}$)



- a) Determine the change in electric potential energy, ΔE_p , of the ball as it moves from position **A** to position **B**.

- b) What is the speed of the ball as it reaches position **B**? ($v_i = 0$ at **A**)