

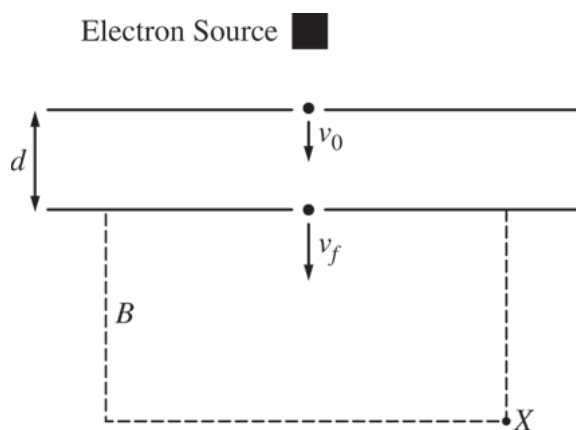
Note: Figure not drawn to scale.

4. (10 points - suggested time 20 minutes)

The apparatus shown in the figure above consists of two oppositely charged parallel conducting plates, each with area $A = 0.25 \text{ m}^2$, separated by a distance $d = 0.010 \text{ m}$. Each plate has a hole at its center through which electrons can pass. High velocity electrons produced by an electron source enter the top plate with speed $v_0 = 5.40 \times 10^6 \text{ m/s}$, take 1.49 ns to travel between the plates, and leave the bottom plate with speed $v_f = 8.02 \times 10^6 \text{ m/s}$.

- Which of the plates, top or bottom, is negatively charged? Support your answer with a reference to the direction of the electric field between the plates.
- Calculate the magnitude of the electric field between the plates.
- Calculate the magnitude of the charge on each plate.

- The electrons leave the bottom plate and enter the region inside the dashed box shown below, which contains a uniform magnetic field of magnitude B that is perpendicular to the page. The electrons then leave the magnetic field at point X .



Note: Figure not drawn to scale.

- On the figure above, sketch the path of the electrons from the bottom plate to point X . Explain why the path has the shape that you sketched.
- Indicate whether the magnetic field is directed into the page or out of the page. Briefly explain your choice.

STOP

END OF EXAM