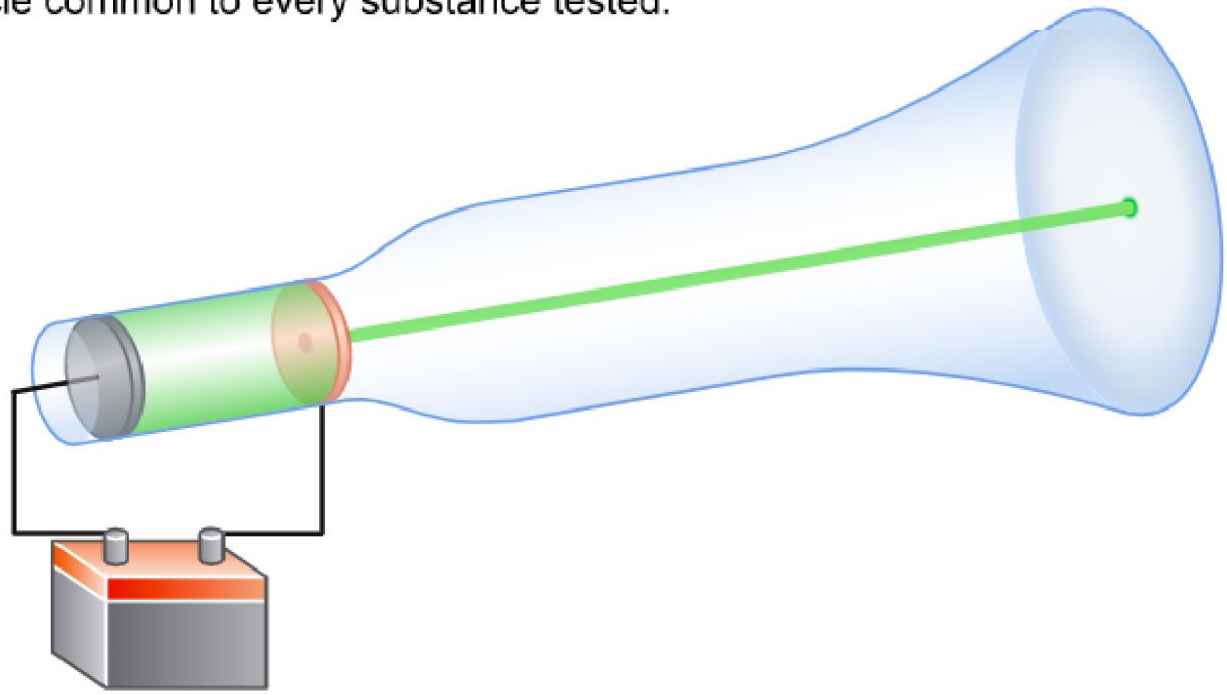
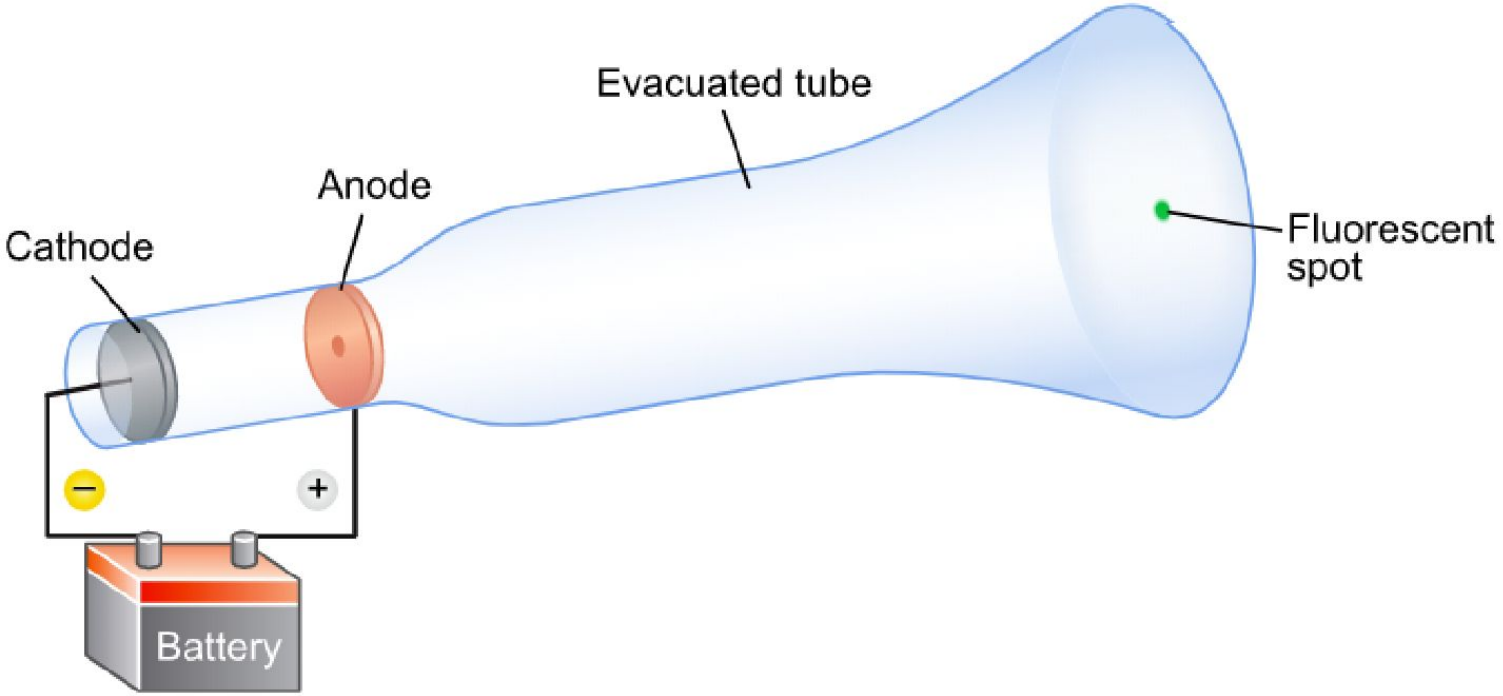
Norton

Cathode Ray

Near the end of the 19th century, J. J. Thomson conducted investigations into the nature of matter. These seminal investigations led Thomson to discover a charged particle common to every substance tested.

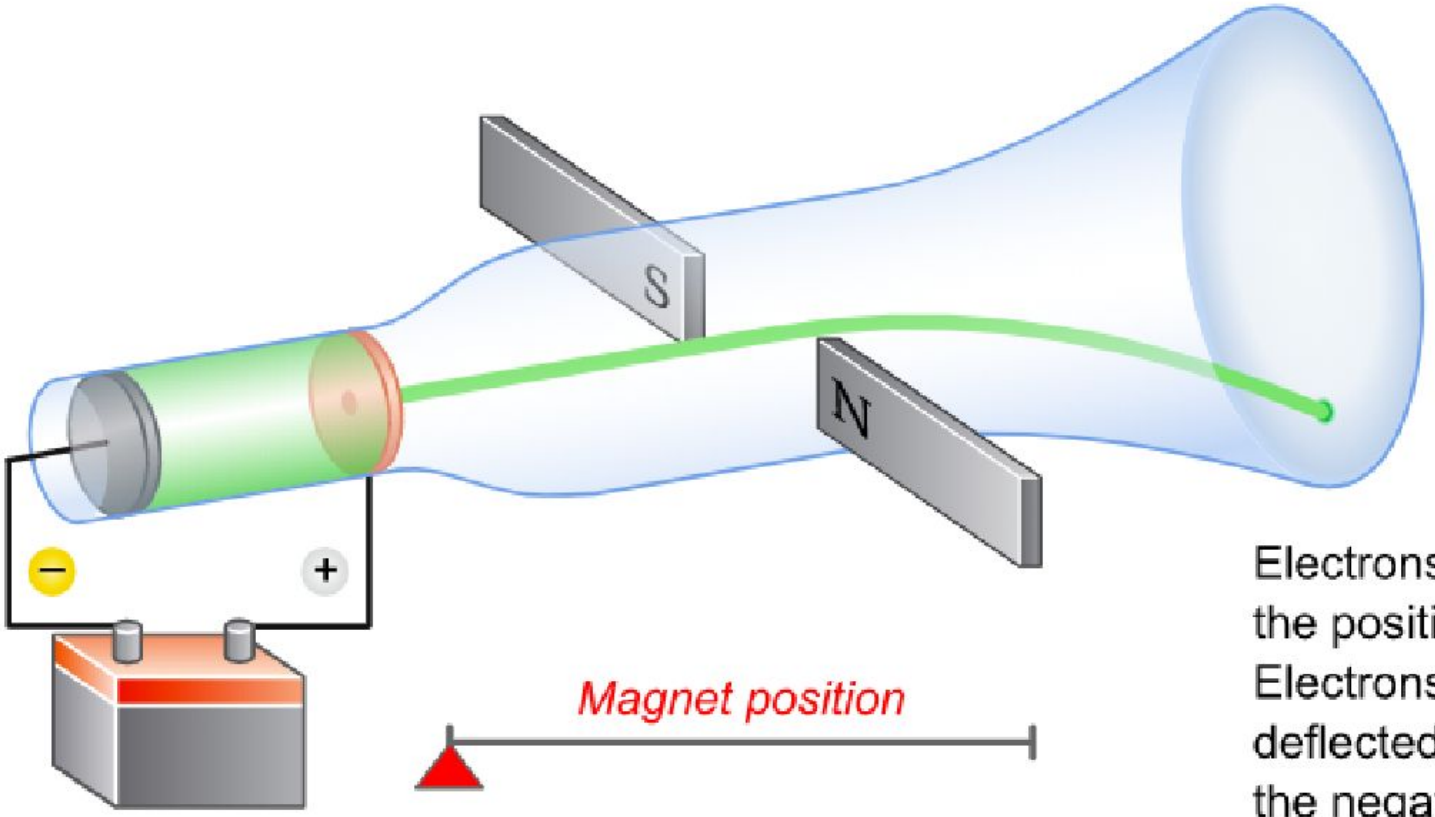


A cathode-ray tube consists of a glass apparatus that contains a partial vacuum.



The electric current generates an energetic beam that travels the length of the tube, starting from the cathode, passing through the hole in the ring-shaped anode, and striking the far end of the tube.

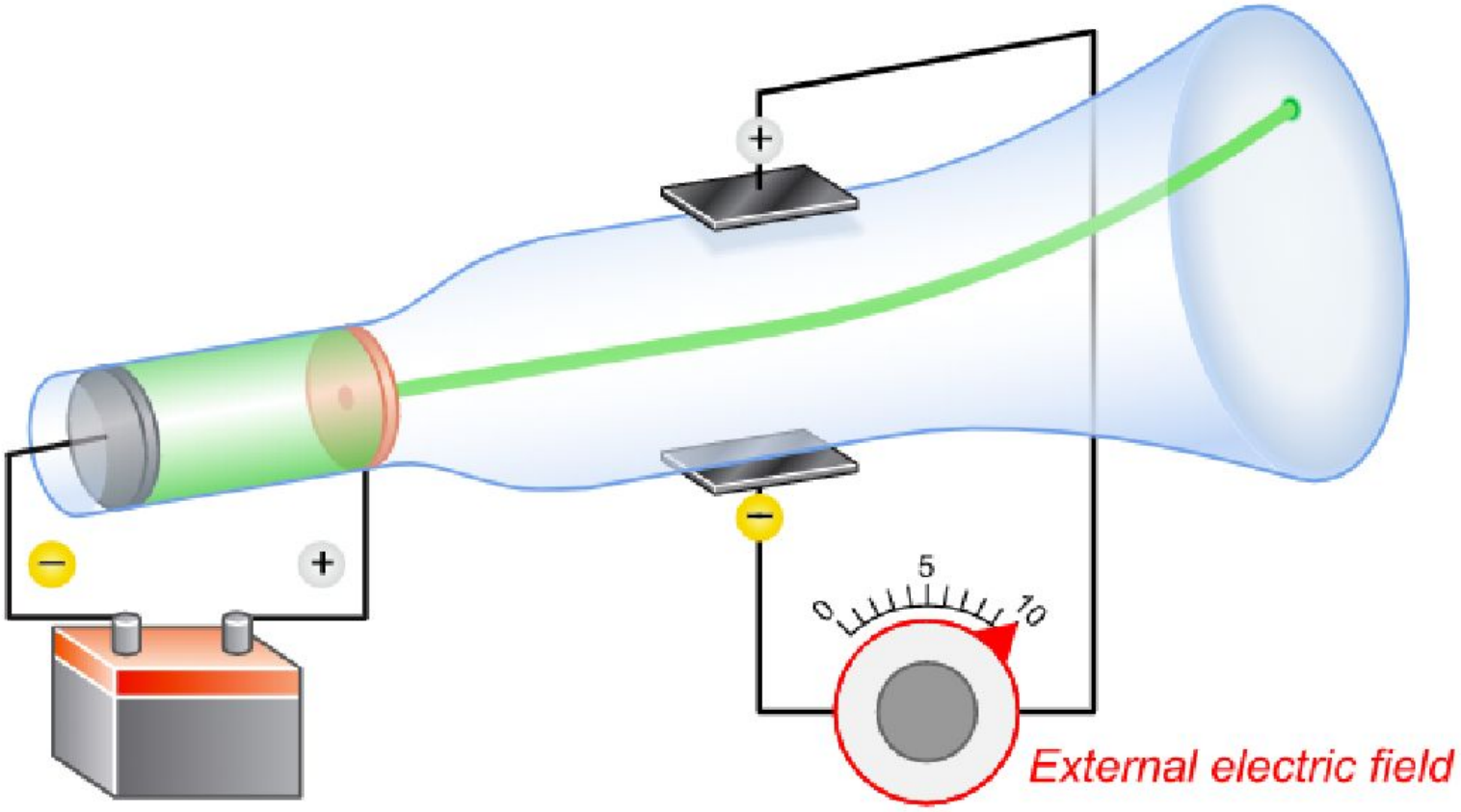
A cathode ray is perturbed by an external magnetic field. This phenomenon established that the cathode ray contains mass.



Electrons are drawn to the positive plate. Electrons are deflected away from the negative plate.

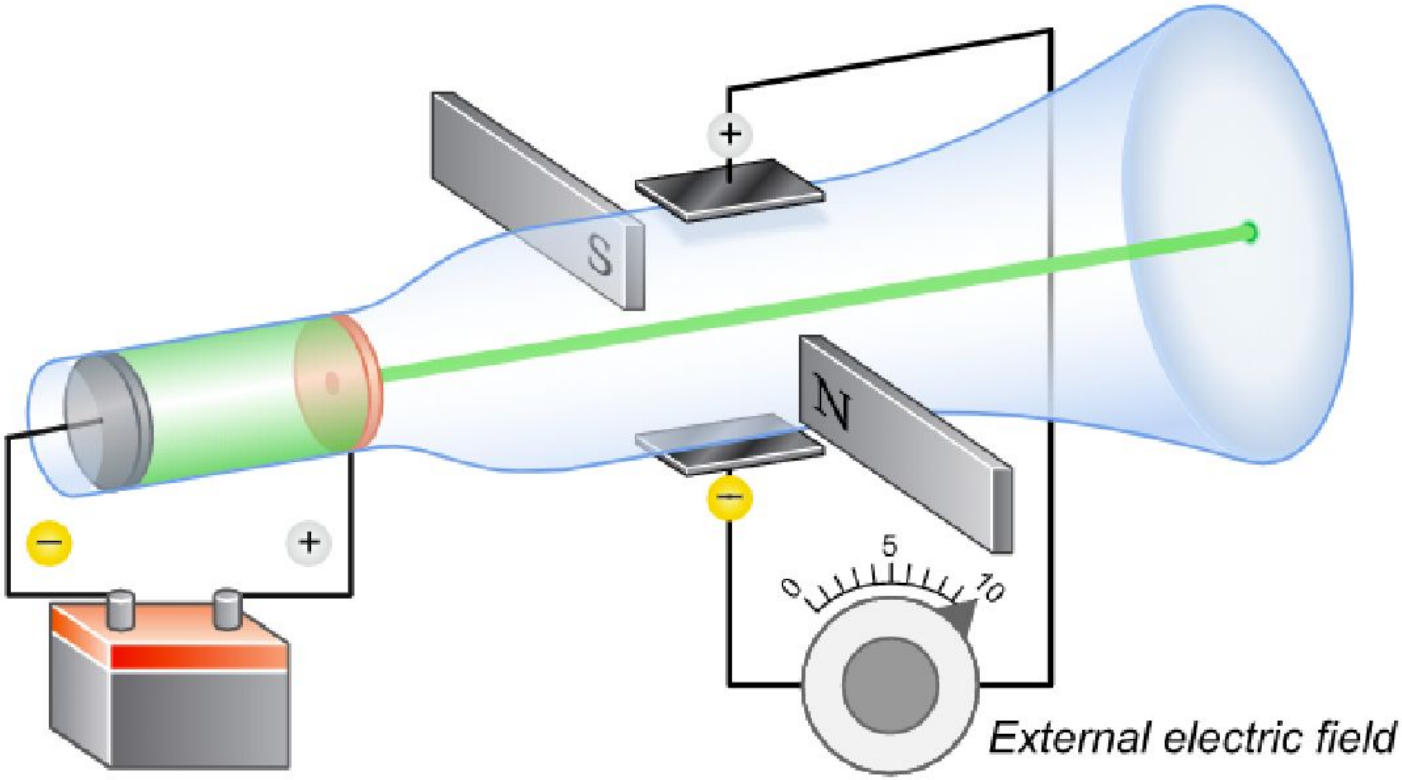
Try it yourself: move the magnets and observe the effect upon the cathode ray.

The path of the cathode ray is also affected by an external electric field. Thomson used that phenomenon to determine that a cathode ray is charged.

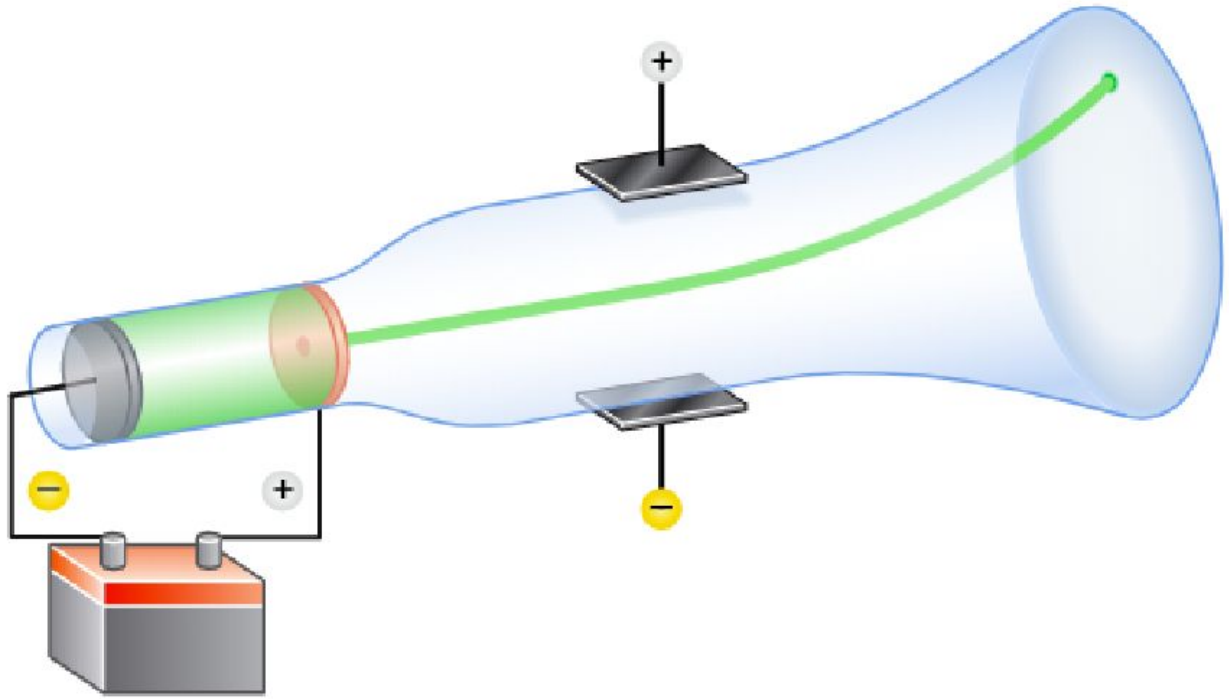


Try it yourself: turn the external electrical field on and off and observe the effect upon the cathode ray.

By studying the magnitude of deflections of cathode rays in different strengths of electric and magnetic fields, Thomson determined the mass-to-charge ratio of the beam particles.



Question 1:

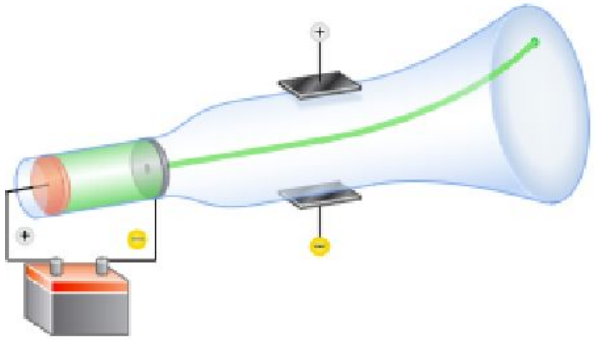


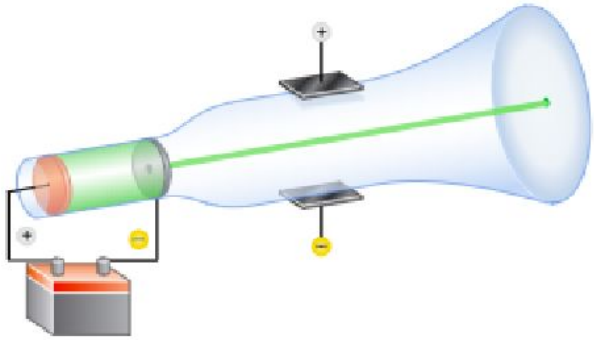
Based on the behavior of the cathode ray in the presence of an external electric field, what can you conclude about the charge of the ray?

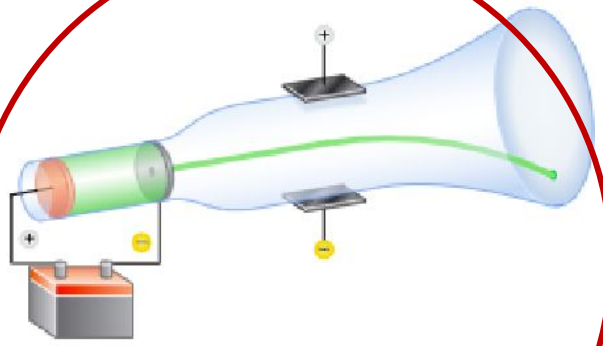
- O the beam is neutral
- O the beam is positively-charged
- O the beam is negatively-charged
- O further experimentation is necessary to determine the charge

Question 2:

Hypothetically, if the cathode emitted a positively-charged ray, what would be the expected behavior of the ray in the presence of an external electric field?







- ○ the beam will curve up
- ○ the beam will be unperturbed
- ○ the beam will curve down
- ○ one must first observe the beam's behavior in the presence of an external magnet before a prediction may be made