A Cathode Ray Tube

Source of Electrical Potential

(–)

(+)

Metal Plate

Gas-filled glass tube

Metal plate

Background Information

Cathode Rays

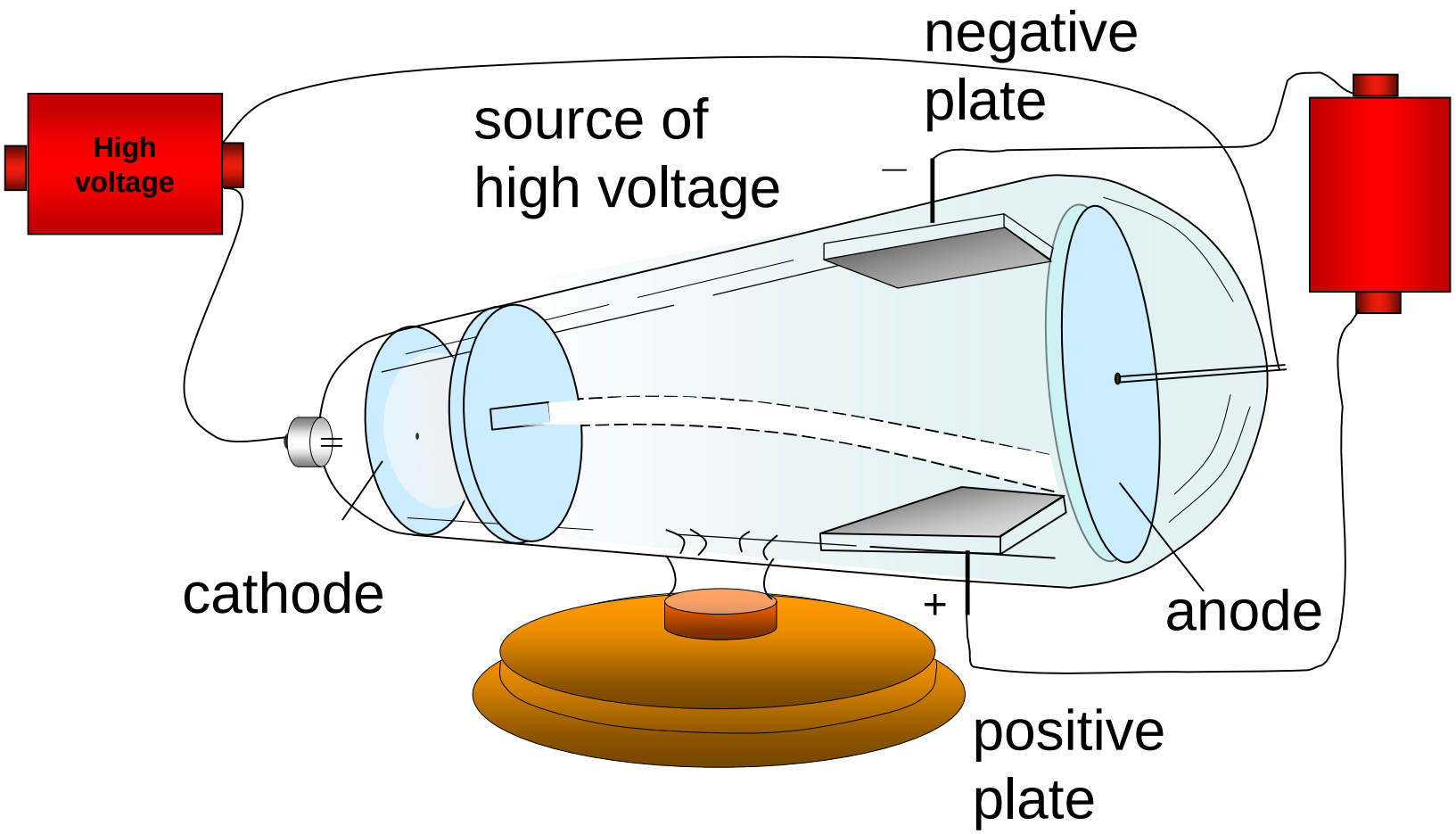
- Form when high voltage is applied across electrodes in a partially evacuated tube.
- Originate at the cathode (negative electrode) and move to the anode (positive electrode)
- Carry energy and can do work
- Travel in straight lines in the absence of an external field

Cathode Ray Experiment

1897 Experimentation

- Using a cathode ray tube, Thomson was able to deflect cathode rays with an electrical field.
- The rays bent towards the positive pole, indicating that they are negatively charged.

The Effect of an Electric Field on Cathode Rays



Dorin, Demmin, Gabel, Chemistry The Study of Matter , 3rd Edition, 1990, page 117

Conclusions

- He compared the value with the mass/ charge ratio for the lightest charged particle.
- By comparison, Thomson estimated that the *cathode ray particle* weighed 1/1000 as much as hydrogen, the lightest atom.
- He concluded that *atoms do contain subatomic particles* - atoms are divisible into smaller particles.
- This conclusion contradicted Dalton's postulate and was not widely accepted by fellow physicists and chemists of his day.
- Since any electrode material produces an identical ray, cathode ray particles are present in all types of matter - a universal negatively charged subatomic particle later named the electron

Thomson Model of the Atom

- J.J. Thomson discovered the electron and knew that electrons could be emitted from matter (1897).
- William Thomson proposed that atoms consist of small, negative electrons embedded in a massive, positive sphere.
- The electrons were like currants in a plum pudding.
- This is called the ‘plum pudding’ model of the atom.