ATOMIC PHYSICS

UNIT – I : POSITIVE RAYS

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POSITIVE ! ? Now….!

Attitude….

Optimistic….

NEGATIVE ….. Feel Better ?

Think + ve life is easy…..

- An anode ray (also Positive ray or Canal ray) is a beam of positive ions that is created by certain types of gas-discharge tubes. They were first observed in Crookes tubes during experiments by the German scientist **Eugen Goldstein, in 1886.**

- These **rays** are beams of particles moving in a direction opposite to the "**cathode rays**", which are streams of electrons which move toward the **anode**.
- Goldstein called these **positive rays** "channel **rays**" or "canal **rays**", because they were **produced** by the holes or channels in the cathode.

- When potential difference is applied across the electrodes, electrons (cathode rays) are emitted from the cathode. As they move towards anode, they gain energy. These energetic electrons which collide with the atoms of the gas in the discharge tube, they ionize the atom

- **Positive rays (or) Canal rays**

While conducting experiments on the gas discharge, in 1886, German Physicist, E.Goldstein, discovered that if the cathode used is perforated, luminous streams appeared in the tube behind the cathode. These streams were called as canal rays.

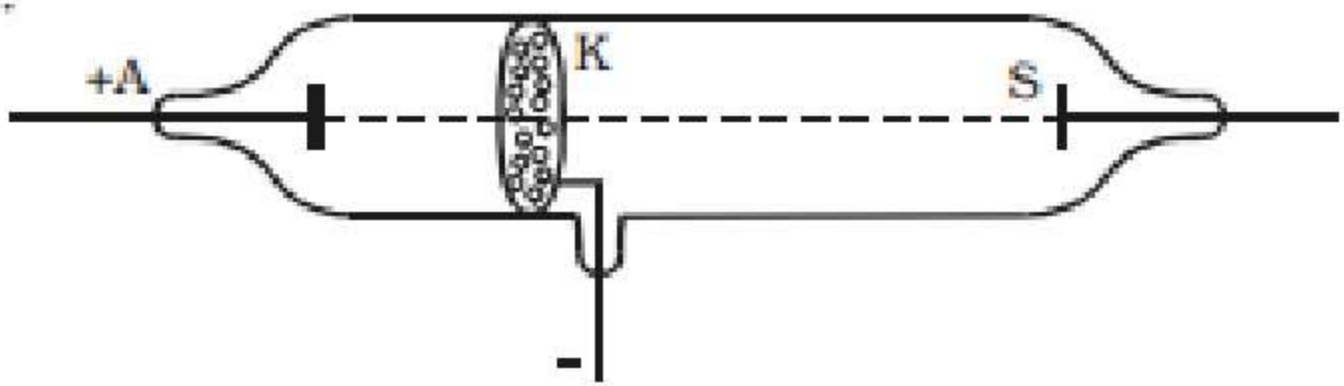
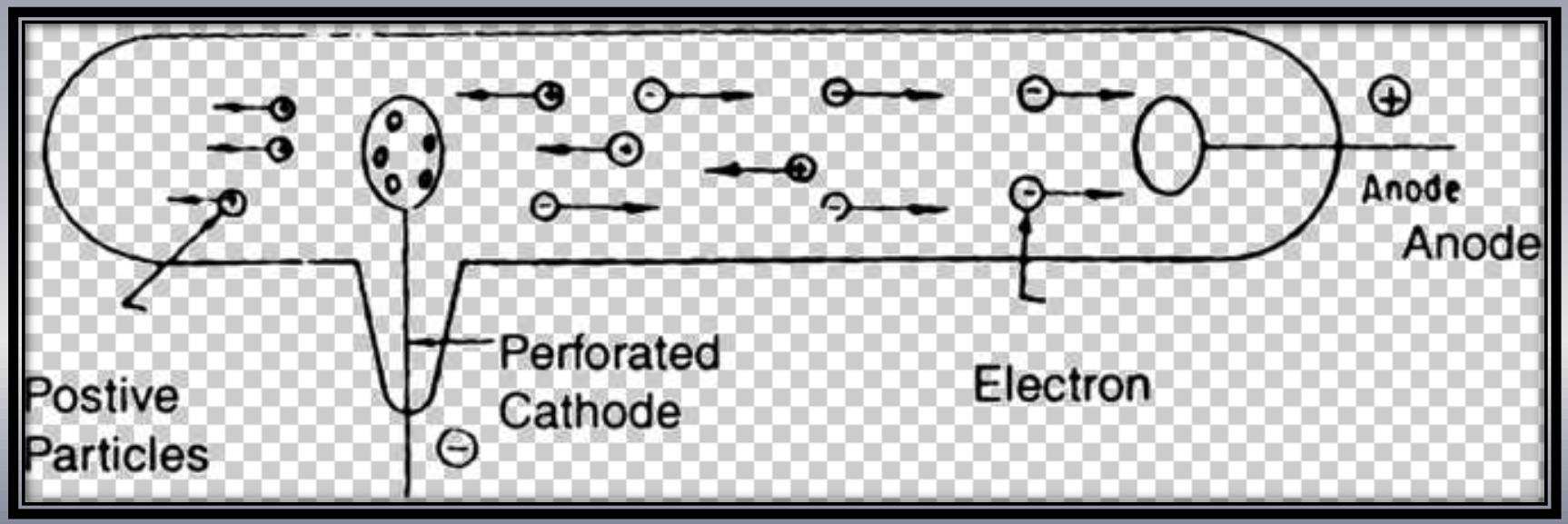
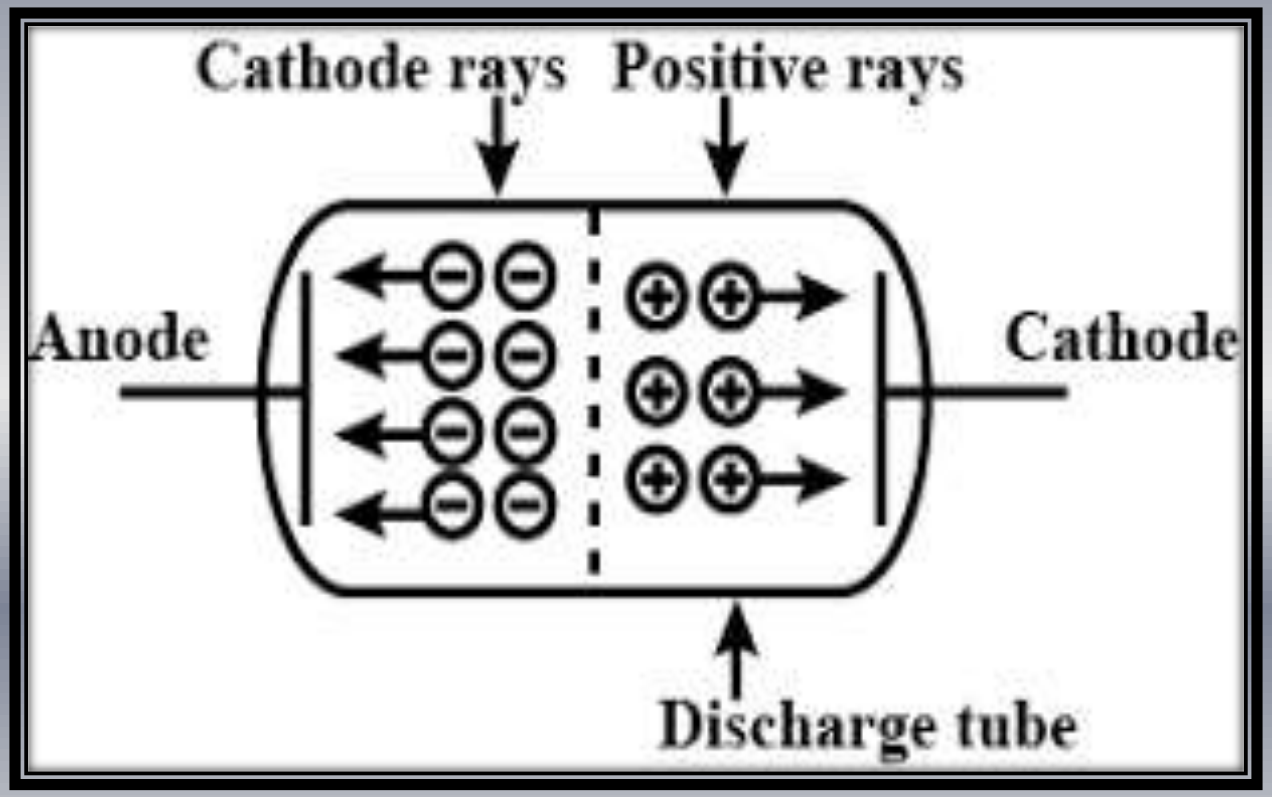


Fig Production of canal rays.


Anode
Anode
Perforated
Cathode
Postive
Particles
Electron


Cathode rays
Positive rays
Anode
Cathode
Discharge tube

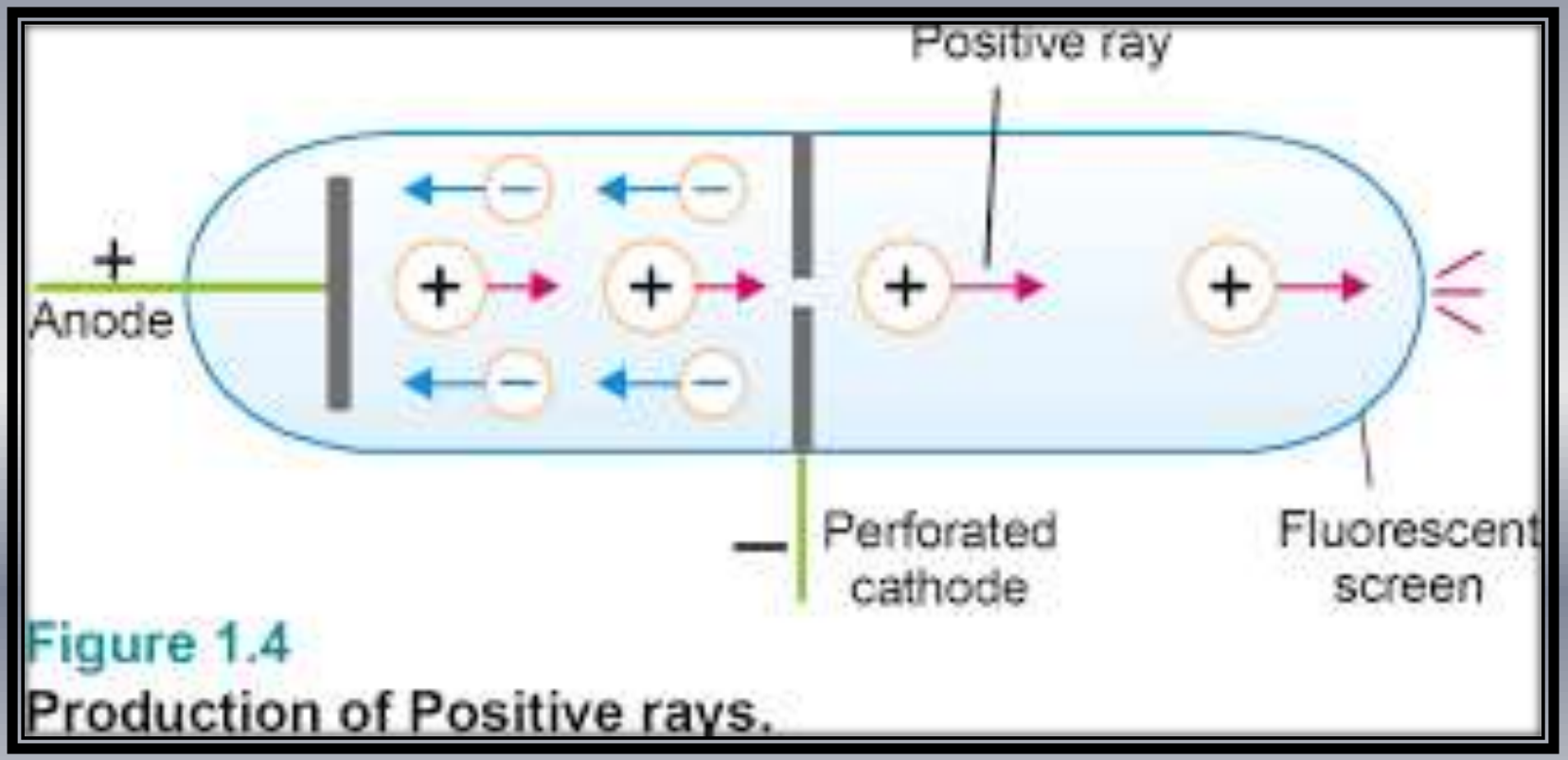
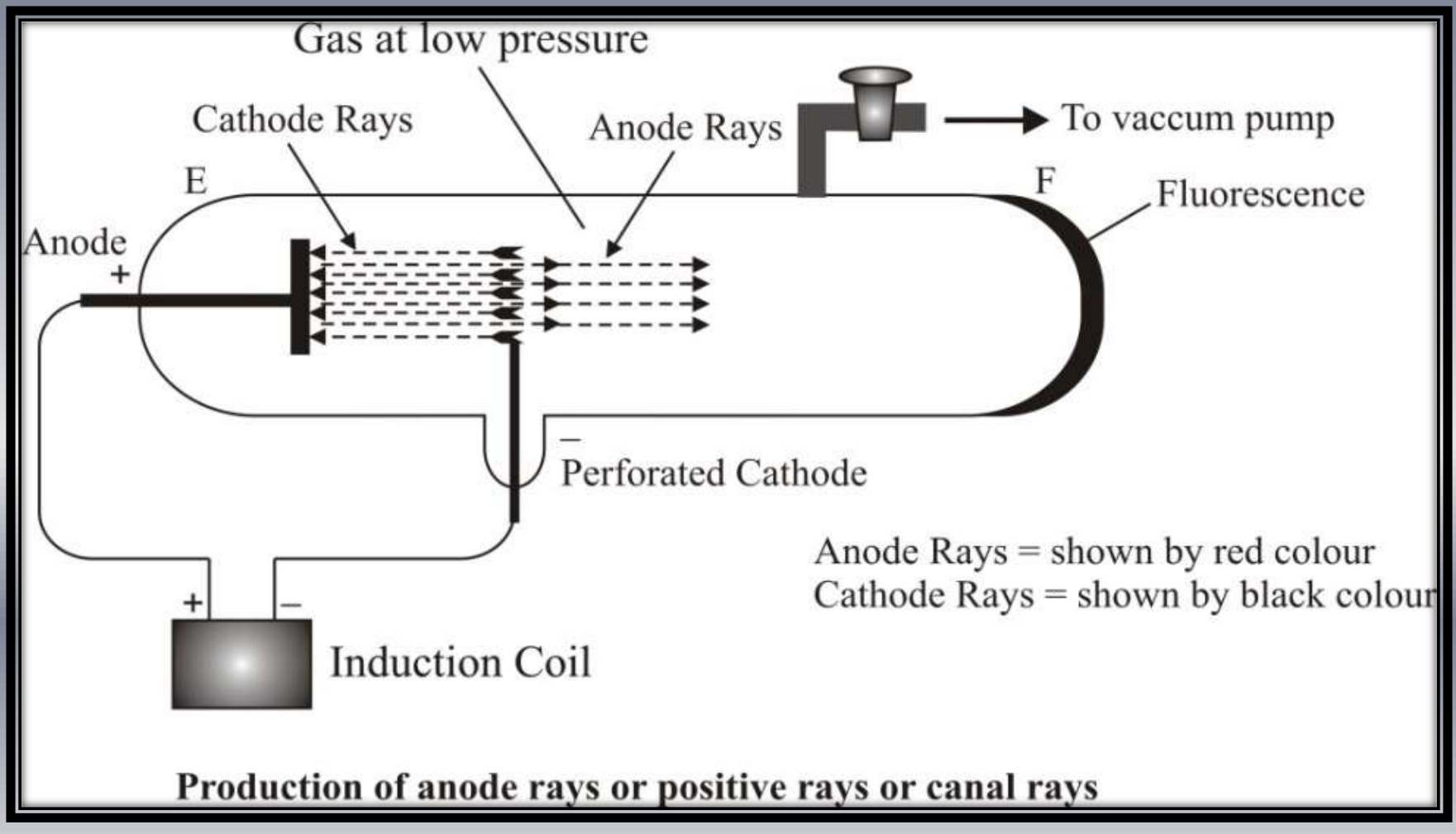


Figure 1.4
Production of Positive rays.



Production of anode rays or positive rays or canal rays

- The discharge tube designed by Goldstein is shown in Fig. The tube contains an anode (A), a perforated cathode (K) and a fluorescent screen (S). At a pressure of about 1mm of mercury, a luminous stream of particles were observed behind the cathode proceeding in a direction opposite to that of the cathode rays. Goldstein, called them as canal rays

- Since they pass through and emerge from the holes, in the cathode in straight lines, opposite to the direction of the cathode rays. From the nature of the deflection produced, by a magnetic field or electric field, these rays were found to be positively charged particles. Hence, canal rays are most commonly known as positive rays.

- The beam of **rays** which travel in a direction away from **anode** towards **cathode** when gas is taken in a discharge tube is subjected to the action of high voltage under low pressure is known as **canal rays**

- **Canal rays** are positively charged radiations that can pass through perforated cathode plate. These **rays** consist of positively charged particles known as Protons

Properties of canal rays

i) They are the streams of positive ions of the gas enclosed in the discharge tube. The mass of each ion is nearly equal to the mass of the atom.

ii) They are deflected by electric and magnetic fields.

iii) They travel in straight lines.

iv) The velocity of canal rays is much smaller than the velocity of cathode rays.

v) They affect photographic plates.

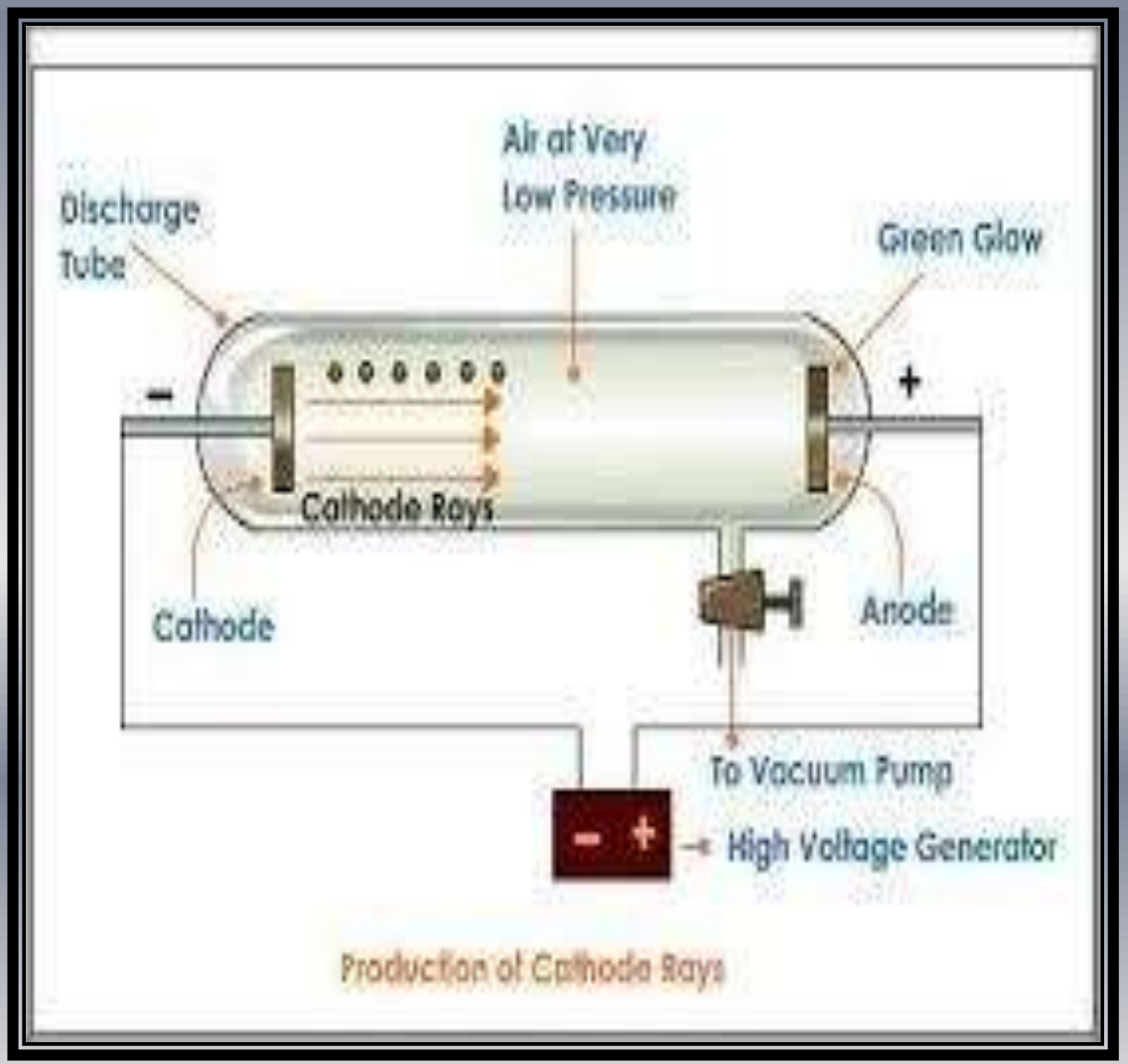
vi) These rays can produce fluorescence.

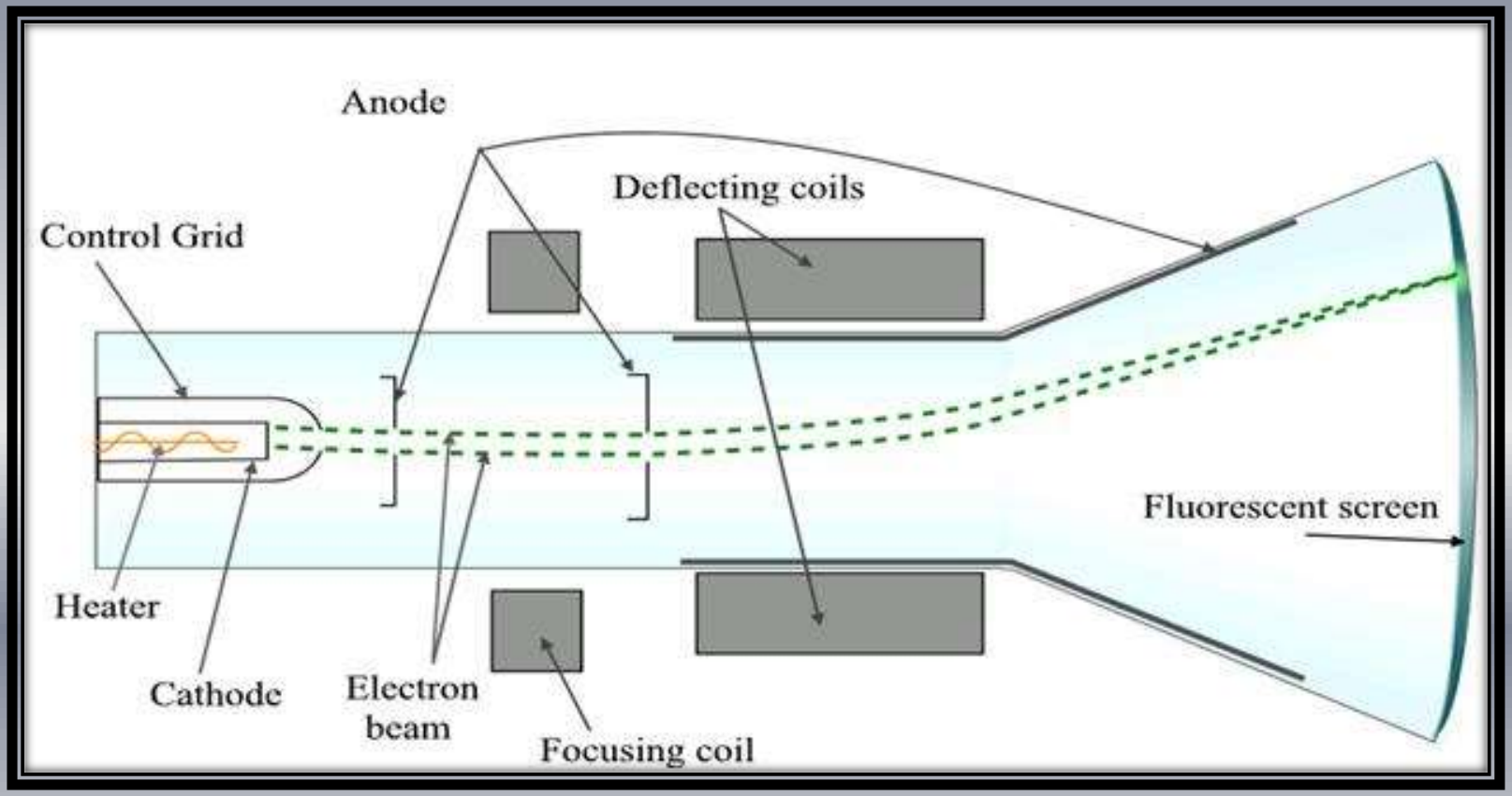
vii) They ionize the gas through which they pass.

viii) They are capable of producing physical and chemical changes.

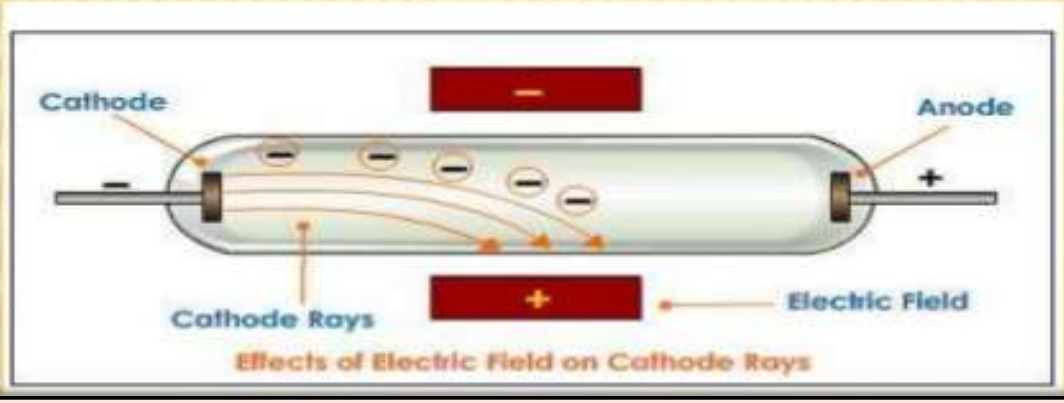
ix) They can penetrate thin metal foils

x) They Produce mechanical effect


Air at Very
Low Pressure
Discharge
Tube
Green Glow
−
+
Cathode Rays
Cathode
Anode
To Vacuum Pump
− +
High Voltage Generator
Production of Cathode Rays


Anode
Deflecting coils
Control Grid
Fluorescent screen
Heater
Cathode
Electron beam
Focusing coil

- J. J. Thomson's cathode ray tube experiments led to a very important scientific discovery, the electron. In this lesson learn what a cathode ray tube is, and how J. J. Thomson made his discovery.



Effects of Electric Field on Cathode Rays

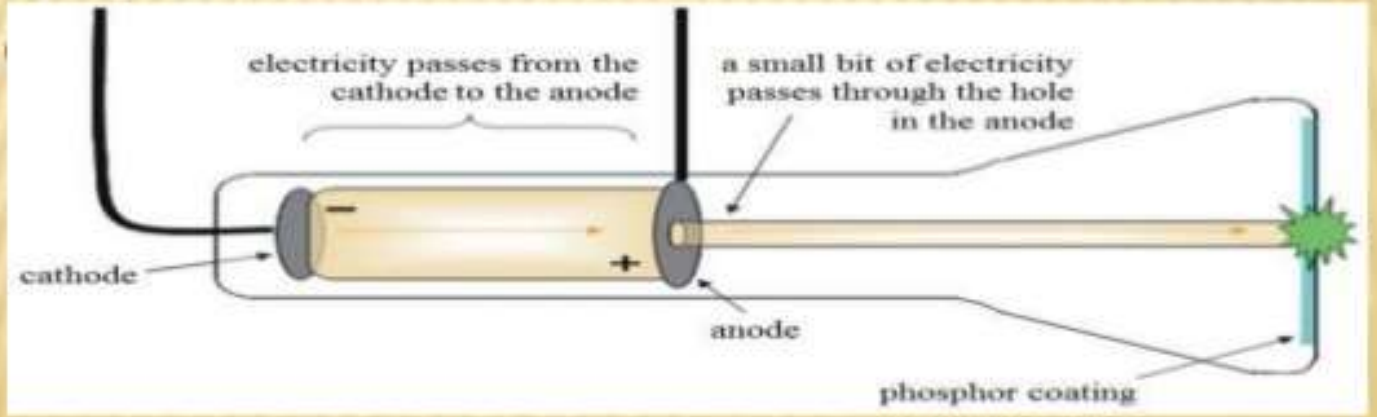
J.J.THOMSON

Cathode Ray Tubes in Your Home

- You might have used a cathode ray tube even if you've never even heard of it until reading this lesson. Before LCD and Plasma TVs became commonplace, most people used bulkier cathode ray tube (CRT) televisions. The CRT in a television is used to display images on your screen. However, cathode ray tubes have been used for more than entertainment. It was cathode ray tubes that allowed the English physicist **J.J. Thomson** to discover the existence of electrons in 1897.

How Cathode Ray Tubes Work

- Before we see how J.J. Thomson used the cathode ray tube to discover the electron, we need to know how a cathode ray tube works. We'll look at a basic CRT like what J.J. Thomson would've used, as seen in the diagram below.



Cathode Ray Tube Diagram

- The CRT consists of several elements starting with a tube that's vacuum sealed to keep air out of it. On one side of the inside of the tube there's a cathode and an anode. The **cathode** is a negatively-charged conductor, and the **anode** is a positively-charged conductor. Electrons, which have a negative charge, flow off the cathode and are attracted towards the anode. A small hole in the anode allows some electrons to pass through it, creating a beam of electrons. On the opposite side of the tube is a coating that glows when struck by the electrons. This allowed J. J. Thomson to see where the electron beam was hitting.
- Of course, before his experiment, we didn't know electrons existed. So no one was calling it an electron beam. Instead, what flowed off the cathode toward the anode were called 'cathode rays.' Hence the name **cathode ray tube**.

Thank You Students