Experiment No. 4.

Aim : To determine the ionization potential of mercury used inside a Thyratron tube.

1. Apparatus required: Thyratron tube, variable power supply, ammeter, voltmeter, connecting wires.

2. Theory: **Ionization potential** is defined as the minimum amount of energy required in (ev) electron – volts to just remove an electron from an atom. Here the ionization potential of mercury can be determined by filling the vapours of mercury in a diode or triode tube. The hot cathode has filled triode is known as Thyratron.

In our experiment when a positive potential is applied to the plate and it is increased slowly, plate current also increases slowly. But when plate potential increases beyond a particular value, plate current increases more rapidly. This is because the electrons arriving at the anode gain enough energy to knock out electrons from the atoms of the gas close to anode. These electrons are also attracted by plate and hence causing increase in plate and current. The positive ions so produced neutralize the space charge which further helps in increasing the kinetic energy of thermal electrons. This value of plate potential at which plate current shows large increase is known as ionization potential of the gas (vapours). The circuit connections are shown in Fig.1.

Circuit diagram:

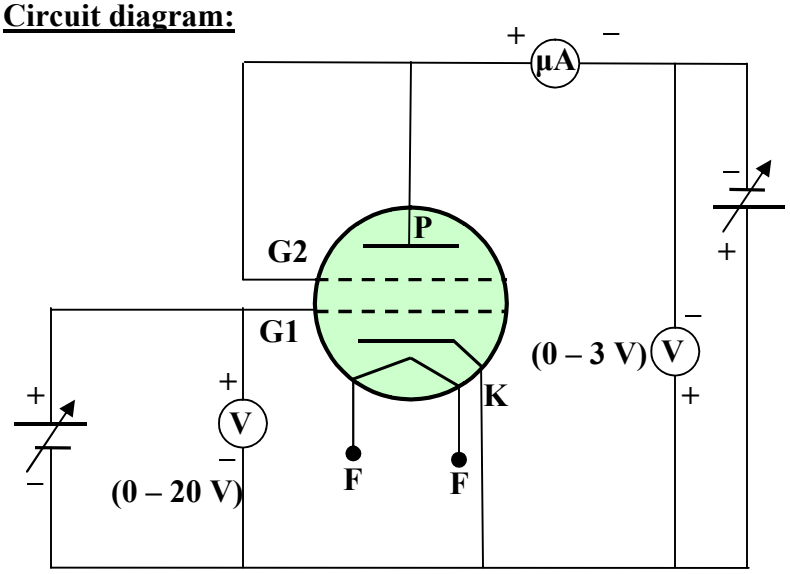
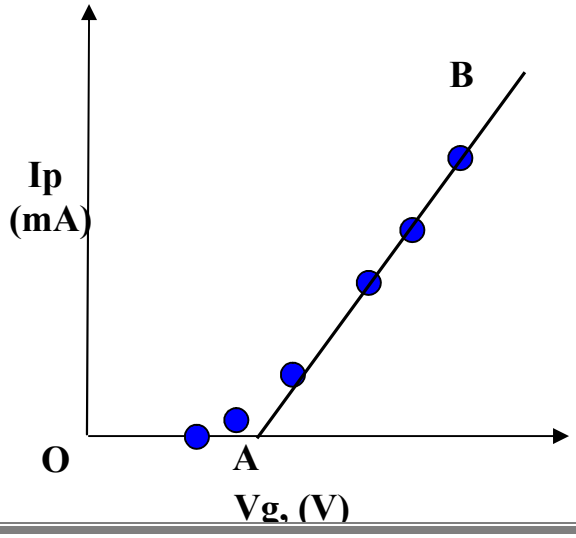


Fig.1

3. Procedure:

I. To find observed ionization potential



(i). Make connections as in Fig.1 and switch on power supply.
(ii). Vary plate voltage, V_g = 1 – 20 V and take reading of plate current, I_p , for each one.
(iii). Draw graph between V_g & I_p.
(vi) Draw a straight line AB between last few points. This line intersects with X-axis at A. OA gives the value of observed ionization potential of mercury.

4.Observations Table:

I. Table to find observed ionization potential

S.NO.	Grid voltage, V	Plate current, μA
1		
2		
3		
4		
5		

5. Result:

The ionization potential of mercury is _____Volts.

6. Precautions:

(i). A gas filled tetrode must be used.
(ii). The connections should be proper before switching on the power supply.

VIVA-VOCE

Q 1. What do you mean by ionisation potential?

Ans. It is the potential required to give an electron just sufficient energy to ionise the atom.

Q 2. **Of what substance are you finding the ionisation potential?**

Ans. Of the gas filled in the thyratron valve.

Q 3. What is gas in the thyratron valve?

Ans. It is inert gas, e.g., Argon. It may be mercury vapour also.

Q 4. What is a thyratron valve?

Ans. It is the commercial name for a thermionic gas filled triode.

Q 5. What is their construction?

Ans. In thyratron, filament is indirectly heated, plate is in the form of the disc and the grid is in the form of a cylinder surrounding the plate.