AIM OF THE EXPERIMENT:-

To observe discrete energy levels of an atom and hence to determine the first excitation potential of an atom by using Frank-Hertz experimental kit.

APPARATUS REQUIRED:-

Frank-Hertz experimental kit with a (vaccum tube) filled with some inert gas vapour.

THEORY:-

It was known from Bohr's postulates that internal energies of an atom are quantized. This can be proved directly by the experiment.

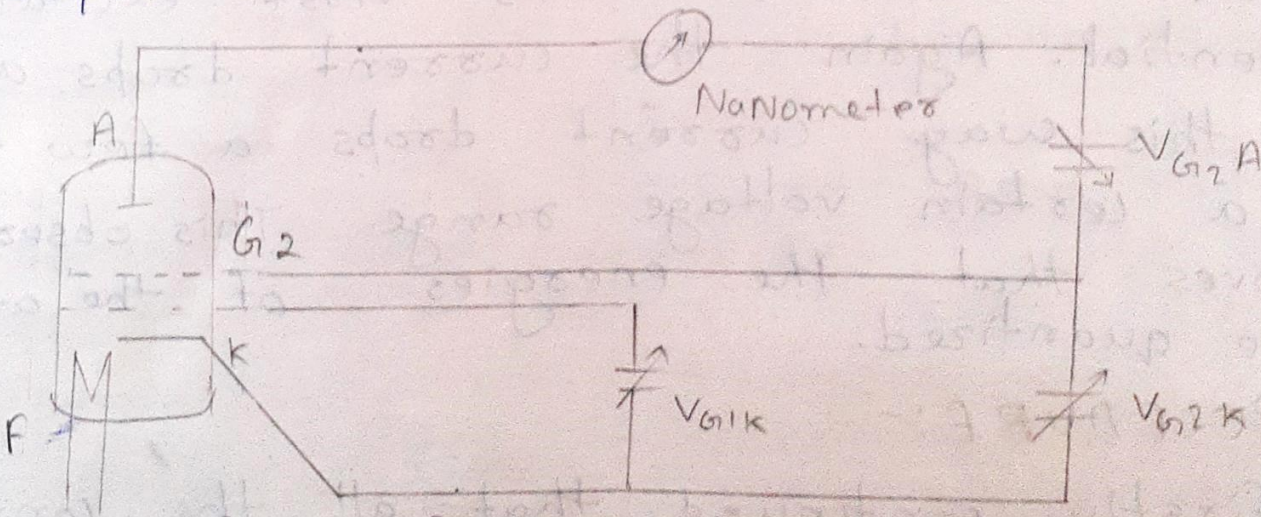


Fig:-1- Frank-Hertz Experiment kit.

In the step-up for experiment there is a electrode filled with argon vapour. Electrons emitted by the heat filaments f are

accelerated by the potential V_{G2K} (applied between cathode and grid G_2). Initially some electrons reach the anode. Provided that their kinetic energy is sufficient to overcome the retarding potential V_{G1K} (applied between cathode K and grid G1). So, in the beginning it is seen that anode current increase with increase of voltage V_{GK}. But as the voltage increase further, the energy of the electron reaches the threshold to excite the atom to its 1st excited state and then the voltage V_{G2K} is increased further. Again the current starts to increase and when the voltage V_{G2K} reaches to a value twice that of its first excitation potential. Again the current drops abruptly. In this way current drops a few times in a certain voltage range. This observation proves that the energies of the atom are quantized.

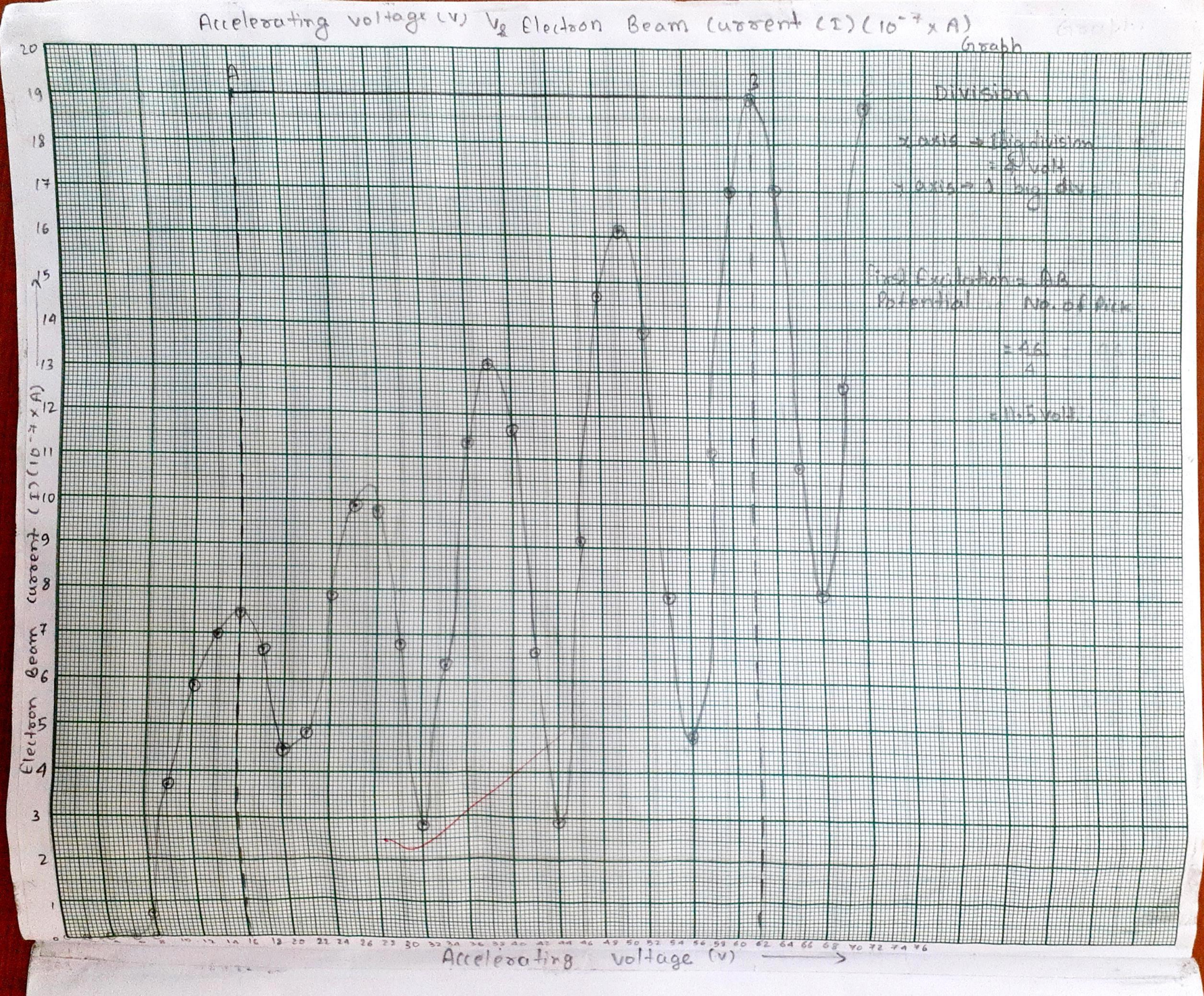
PROCEDURE:-

1. firstly, continued that all the control knobs are in their minimum position.
2. Then turned on the experiment kit. Now, turned on the "manual /auto" switch to

manual mode.

3. Turn on the voltage display selector to V_{G_1K} and adjust the V_{G_1K} control knob to 1.5 V.
4. Select the voltage display of V_{G_1A} and adjust it to 7.5 V.
5. Now change the value of V_{G_2K} is small steps and record the crosspondding current reading.
6. Now draw a graph showing the variation of current as a function of the accelerating voltage.
7. Turn on the manual /auto switch to automode.
8. Connect the Y, G, K sockets to the instrument to the crosspondding ports of the oscilloscope. set the oscilloscope to x-y mode and trigger to external x.
9. Now adjust the shift and gain switch to obtain a clear waveform. Apply the maximum scan range through the instrument.
10. Get the average horizontal distance measured between the peaks. This would give the value of gas obtained first excitation potential in ev.
11. The exiitation of potential can be obtained froow I/V graph.

Accelerating voltage (V) Vs Electron Beam current (I) (10^{-7} x A)



OBSERVATION :-

$V_{G1K} = 1.5\ V, \quad V_{G2A} = 7.5\ V$

Table 1 : for recording of voltage and current.

S.NO.	Accelerating voltage (V_{G2K}) (V)	Electron Beam current (I) ($10^{-7} \times A$)
1.	0	0
2.	2	0
3.	4	0
4.	6	0
5.	8	0.7
6.	10	3.7
7.	12	5.9
8.	14	7.0
9.	16	7.5
10.	18	6.6
11.	20	4.5
12.	22	4.9
13.	24	7.9
14.	26	9.9
15.	28	9.8
16.	30	6.8
17.	32	2.9
18.	34	6.3
19.	36	11.4
20.	38	13.1
21.	40	11.6
22.	42	6.6
23.	44	2.9
24.	46	9.1
25.	48	14.7

26	50	16.1
27.	52	13.9
28	54	7.9
29	56	4.8
30	58	11.2
31	60	17.0
32	62	19.0
33	64	17.0
34	66	10.9
35	68	8.0
36	70	12.7
37	72	18.8

CALCULATIONS :-

First excitation potential = $\frac{AB}{\text{No. of Peak}}$

$= \frac{46}{4} = 11.5$

$\therefore$ first excitation potential = 11.5 V

RESULT :-

Therefore the excitation potential is 11.5 V.

From the experimal curve it is verified that energy levels of an atom are discrete.

22.11.18