PHYSICS PRACTICAL SHEET

Date 22 August 2023
Class CE
Roll No. 25
Shift Day
Object of the Experiment (Block Letter)

2023/8/22

Experiment No. 6
Group T
Sub. PHY-102
Set

STUDY OF INTERACTION OF β-PARTICLES WITH MATTER

Apparatus Required:

i) GM counter
ii) Beta-source
iii) Absorber materials
iv) Stopwatch

Theory:

Beta particles are fast moving electrons emitted from the nucleus. They interact with the medium through which they pass. The interaction takes place in the form of scattering and collisions with the nuclei, and the orbital electrons of the intervening medium. The interactions led to the eventual absorption of β-particles due to gradual loss in kinetic energy. An experiment on the absorption of β-particles by medium is effectively performed by counting the numbes of β-particles in a beam at different depths within medium. The number of particles almost falls exponentially until thickness is reached at which beam is entirely stopped. The β-rays are said to be completely absorbed by medium.

In an actual experiment, using GM counter, there is a count due to background activity which is also present, even after all the β-particles have been absorbed by intervening medium. The absorption curve is obtained only after the count rate is corrected in

the backgraund. The maximum range 'R' of given β-radiation can be determined by visual extrapolation of absorption curve to zero count rate. Maximum range 'R' related to maximum β-energy 'E' is given by

$$E = \frac{(R + 0.133)}{0.542}$$

where,
'R' in gm/cm^3 and 'E' is in Mev. The figure shows the graph of count rate against thickness of absorbes. The figure shows graph of ln c vs thickness.

Observations:

Background count rate = $\left(\frac{32+27+34}{3}\right)$ = 31 counts/min

Operating voltage = 600 V
Density of absorbes material = 2.71 gm/cc.

Table:

Nood obs	Plate No	Thickness t (cm)	Surface density $\rho x t$ (gm/cm^2)	Counts/ min	Corrected counts	ln c
1	0	0	0	494	463	6.138
2	1	0.028	0.076	396	365	5.9
3	2	0.056	0.152	274	243	5.493
4	3	0.084	0.228	209	178	5.182
5	4	0.112	0.304	169	138	4.924
6	5	0.140	0.379	153	122	4.804
7	6	0.168	0.456	144	113	4.727
8	7	0.196	0.531	130	99	4.595
9	8	0.224	0.601	119	88	4.477
10	9	0.252	0.683	106	75	4.317
11	10	0.280	0.759	118	87	4.466
12	11	0.308	0.835	105	74	4.304
13	12	0.336	0.911	105	74	4.304
14	13	0.364	0.986	94	63	4.143
15	14	0.392	1.062	107	76	4.331
16	15	0.420	1.138	98	67	4.205

RESULT

From the graph, the extrapolated maximum range (R) = $\rho x t$

$= 2.71 \times 0.42 = 1.138$

Hence, maximum beta energy (E) = $\frac{R + 0.133}{0.542} = \frac{1.138 + 0.133}{0.542}$

$= 2.345$ MeV

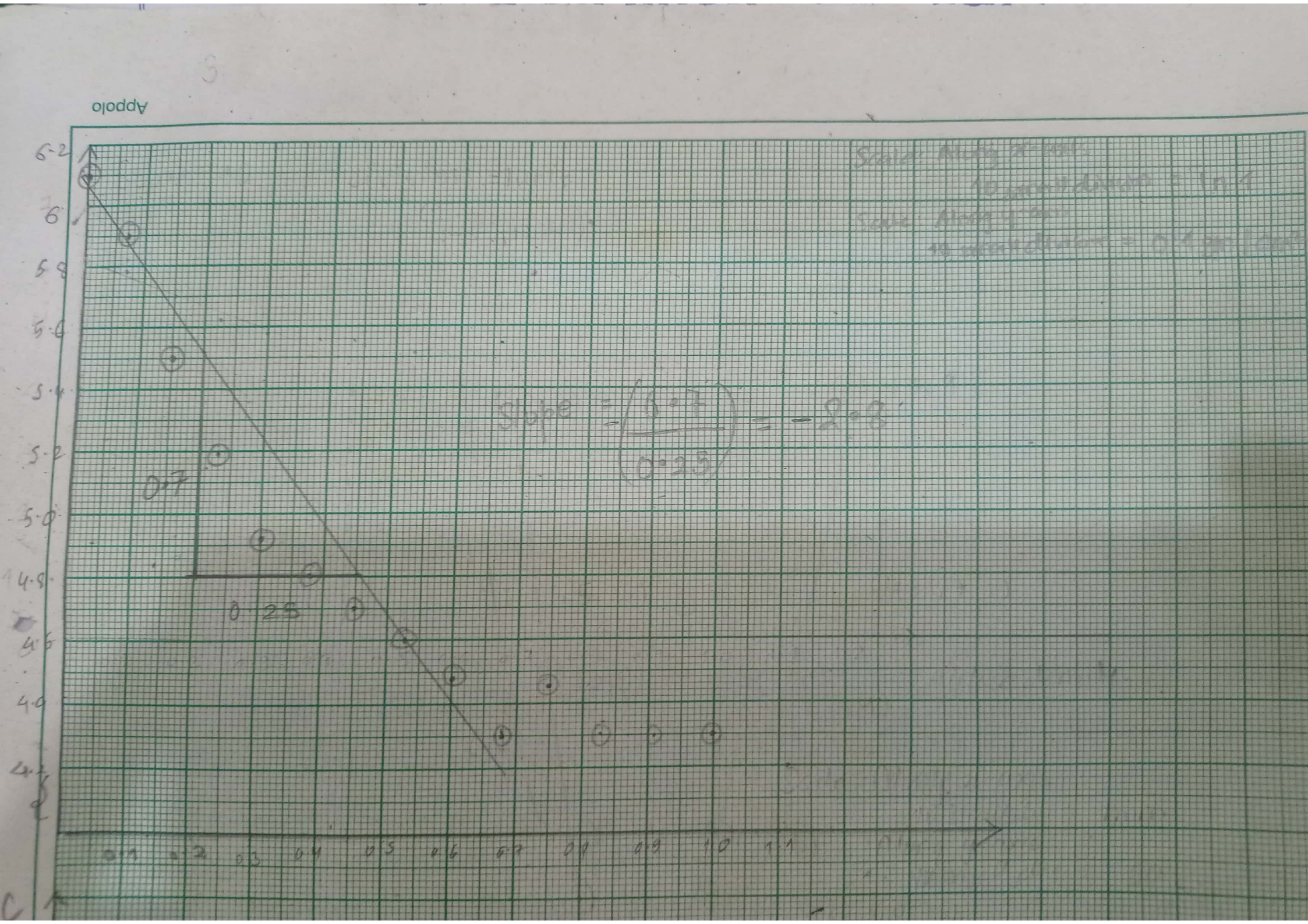
From the extrapolated medium,

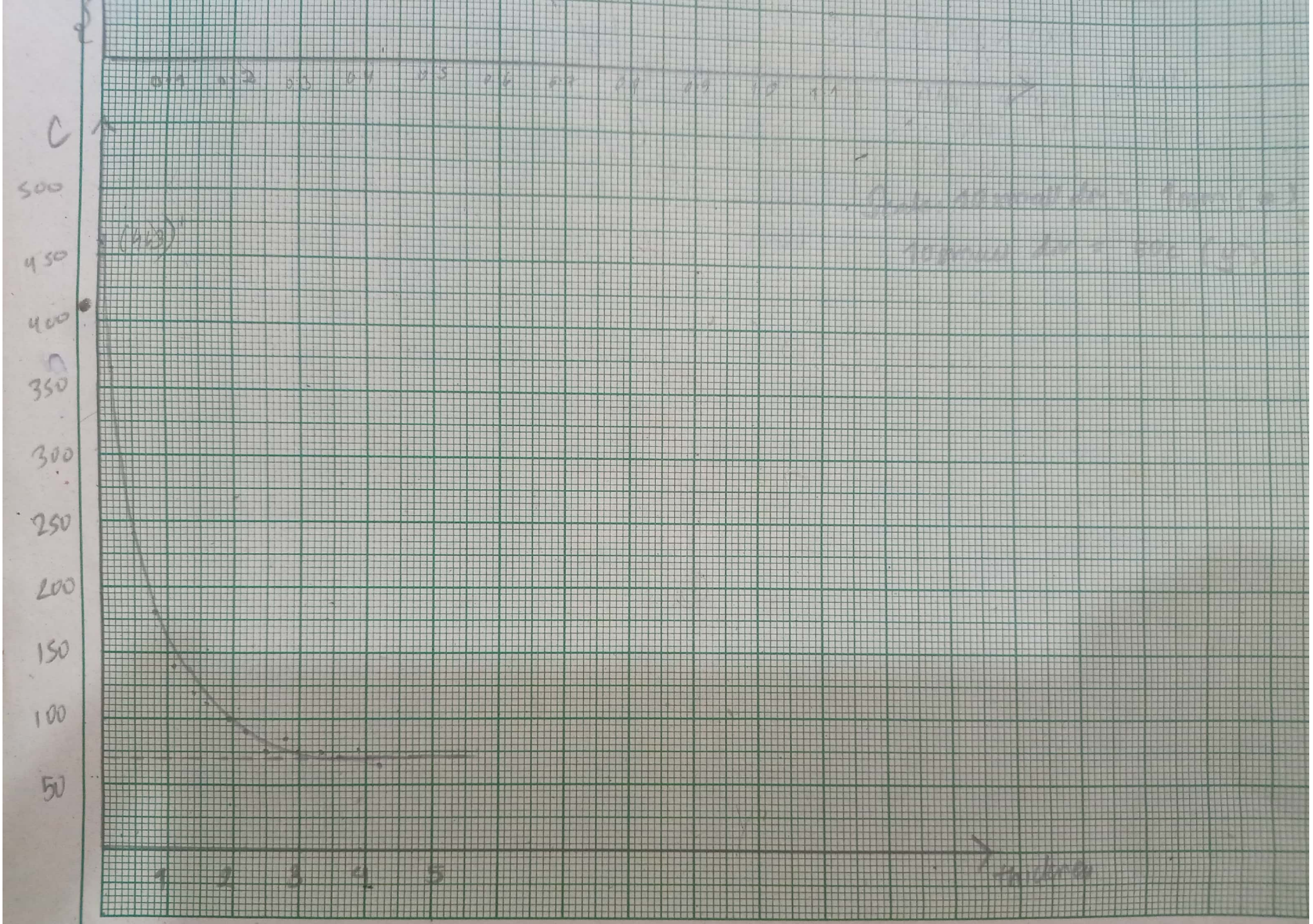
maximum range (R) = ~~thickness~~ y-intercept / Slope (m) = 6.138 / −2.8 = 2.192

Hence,

maximum beta energy (E) = (R + 0.133) / 0.542 = (2.192 + 0.133) / 0.542

= 4.28 MeV


Slope = -(0.7 / 0.25) = -2.8
0.7
0.25


C
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