

To Verify the Inverse Square Law for Gamma Radiation

Date

Source used. Type 8a Cup Source
Radium - 226

Geiger Muller tube with decade counter.

Background level measured in cpm :-
19, 17, 18, 19, 22

Average background count 19 cpm

x/cm	CPM	CPM	CPM	CPM	C/cpm	$C^{-\frac{1}{2}}/cpm^{-\frac{1}{2}}$
	1	2	3	Average		
5.0	437	449	482	456	437	0.048
7.5	272	286	296	285	266	0.061
11.8	153	158	145	152	133	0.087
15.0	109	99	114	107	88	0.106
18.5	75	70	74	73	54	0.136
21.0	74	69	80	74	55	0.134

↓ average
C = corrected count rate in cpm

A straight line fits the four points where x is smallest. It also 'bisects' the other two points.

'Error' bars are needed to see if a straight line fits all the data within the uncertainties of the measurements.

δ used here to mean 'uncertainty in'

$$\delta C = \frac{1}{2}(\text{range of repeat readings})$$

$$C_{\max} = C \pm \delta C$$

$$\text{'Error' bars found from } \frac{1}{\sqrt{C_{\max}}} - \frac{1}{\sqrt{C}}$$

x/cm $\pm 0.1\text{cm}$	$C^{-1/2}$ $\text{cpm}^{-1/2}$	δC cpm	C_{\max} cpm	$C_{\max}^{-1/2}$ $\text{cpm}^{-1/2}$	$\delta(C^{-1/2})$ $\text{cpm}^{-1/2}$
5.0	0.048	22.5	460	0.047	0.001
7.5	0.061	12.0	278	0.060	0.001
11.8	0.087	6.5	140	0.085	0.002
15.0	0.106	7.5	96	0.102	0.004
18.5	0.136	2.5	57	0.133	0.003
21.0	0.134	5.5	61	0.128	0.006

The line of best fit passes through 5 of the 6 data points with the uncertainty of the measurements.

Looking at the graph, the inverse square law is verified for small ranges up to 16.0 cm. At greater distances the background count variations may play a part in the data being so far from the line of best fit.

Further analysis could be done to include uncertainty in the background count and/or the investigation could be reproduced taking more data.