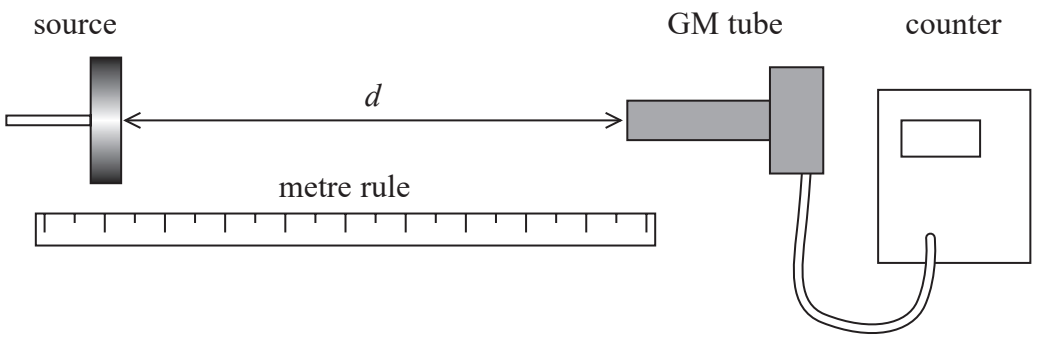
10 A student investigated the way in which gamma radiation spreads out from a source. He placed a cobalt-60 source in a source holder and set up a Geiger-Müller (GM) tube a short distance *d* away. He connected the GM tube to a counter as shown.

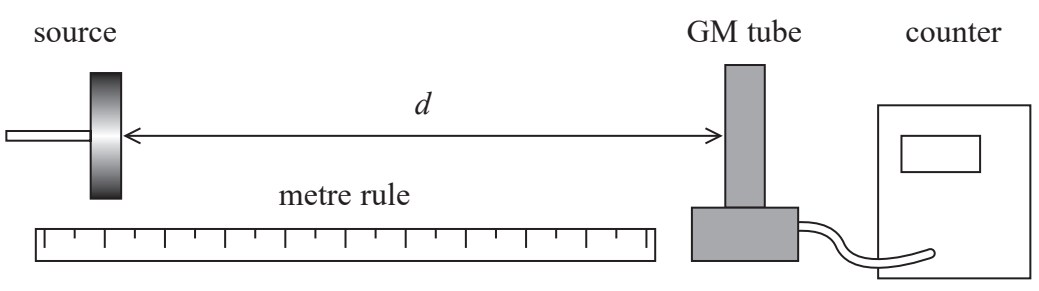


The student recorded the count for 2 minutes.

(a) Describe how to determine the corrected count rate from the source.

(2)

(b) His teacher turned the GM tube through 90° so that the side of the tube faced the source as shown below.



(i) Explain why this arrangement could lead to more accurate data.

(2)

(ii) Explain another modification to the experimental method which would improve the accuracy of the data.

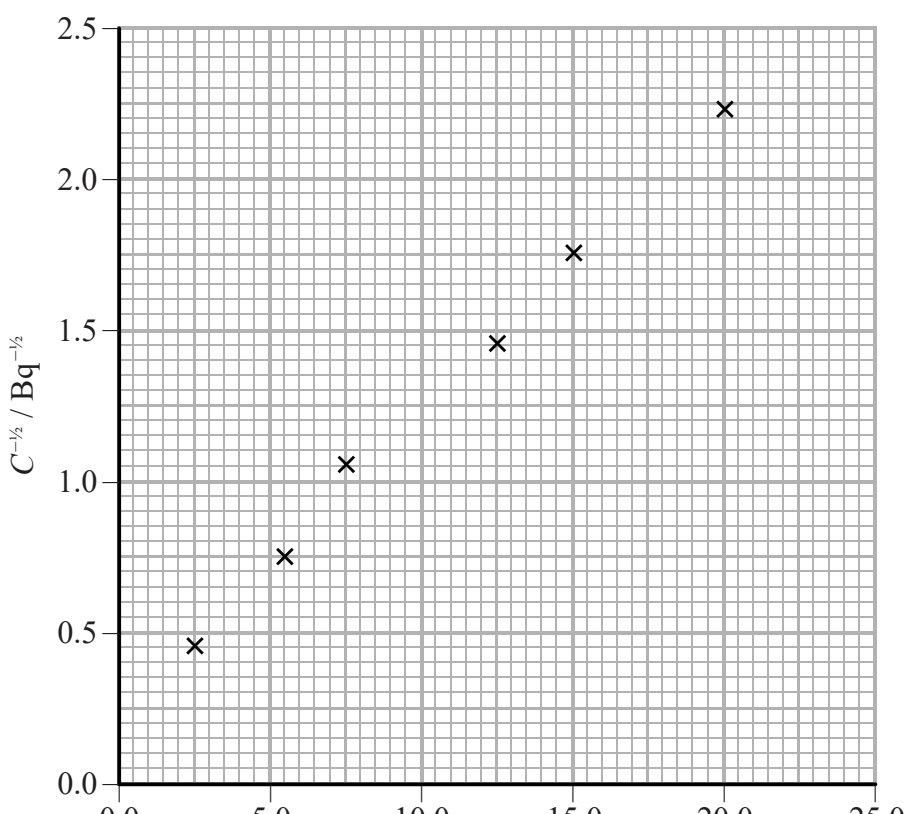
(2)

(c) The variation in the intensity of gamma radiation with distance from a point source should obey an inverse square law. If this is the case, then the count rate *C* should vary with *d* according to the equation

$$C = \frac{K}{4\pi d^2}$$

where *K* is a constant.

The student plotted $\frac{1}{\sqrt{C}}$ against *d* and obtained the following graph.



(i) Draw a line of best fit on the graph.

(ii) The student concluded that the graph was consistent with the gamma radiation intensity obeying an inverse square law.

Discuss the extent to which the data obtained supports the student's conclusion.

(4)

(d) It is suggested that the investigation into the way in which gamma radiation spreads out from a source, using the apparatus as shown in (b), could be carried out successfully using a radium-226 source.

Radium-226 emits α, β and γ radiation.

Justify this suggestion.

(2)

(Total for Question 10 = 13 marks)