OCR
Oxford Cambridge and RSA

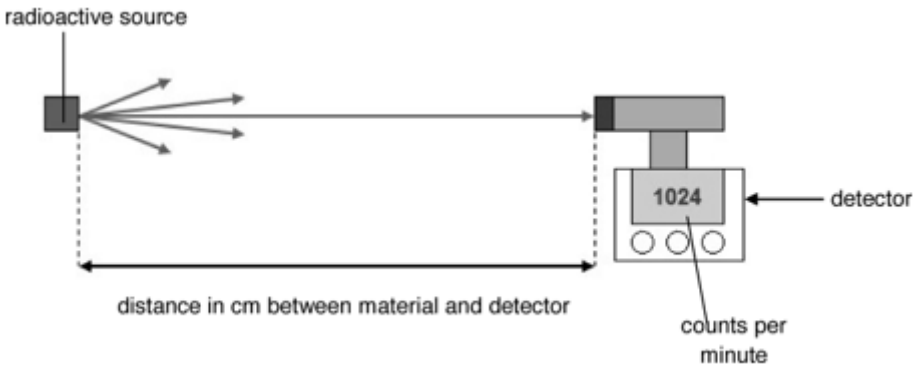
Gateway Science Physics A

J249/02 Physics A P5-P8 and P9 (Foundation Tier)

Question Set 20

20 A student does an experiment with radioactive materials.

- He investigates how the activity of radiation changes with distance.
- In the experiment, the radiation moves from the radioactive source to a detector.
- He measures the counts per minute at the detector.



The table shows the results.

Distance between source and detector (cm)	Count rate (counts per minute)
10	1000
20	240
40	60
80	20

(a) The student could **not** take an accurate reading at 0 cm.

Suggest a reason why.

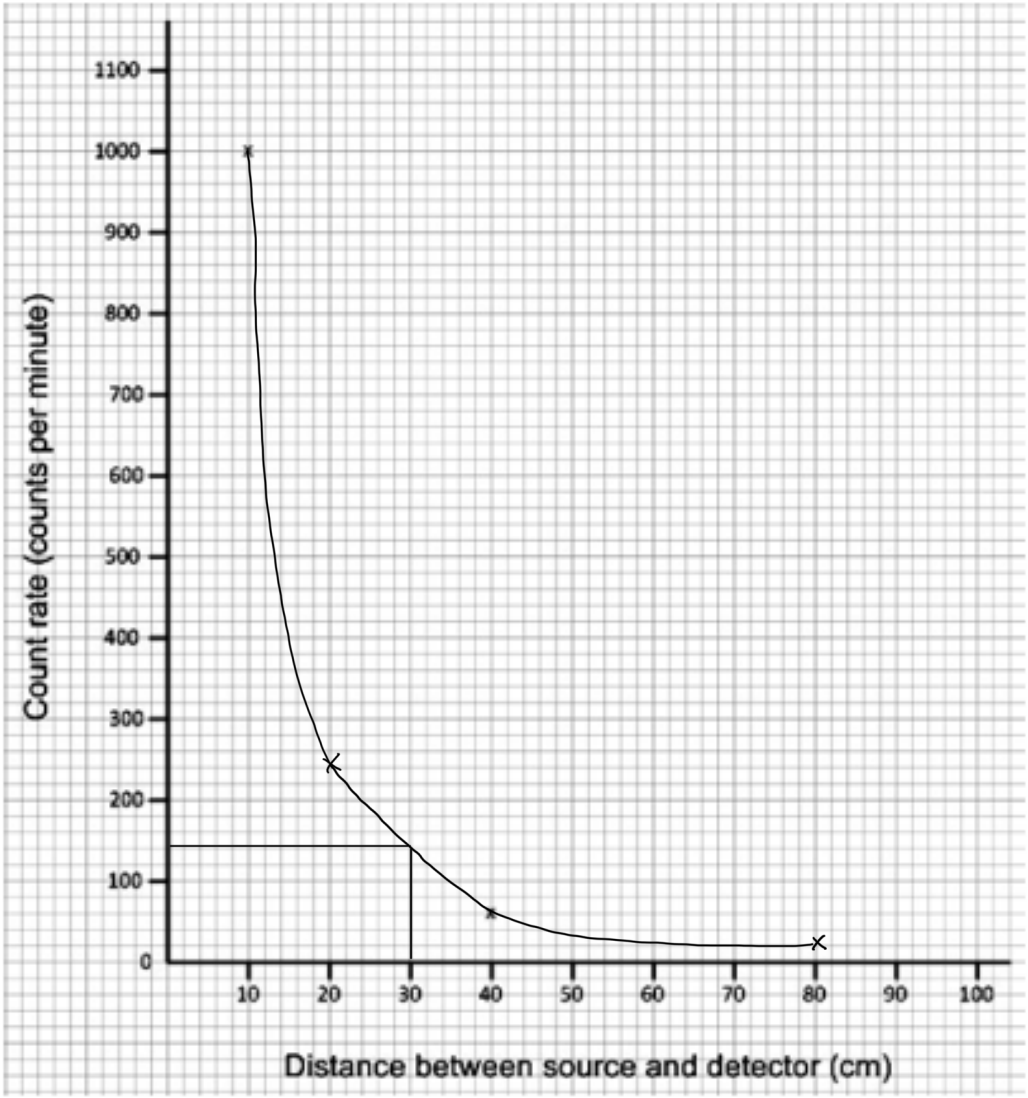
The count rate was too high for the detector to accurately detect.

[1]

(b) **(i)** Plot the results on the graph below.

Two points for 10 cm and 40 cm have been plotted for you.

Join the points with a smooth curve.



[2]

(ii) Use the graph to estimate the count rate at **30 cm**.

Answer = ... 140 ..... counts per minute

[1]

(c) **(i)** What pattern is shown by the results as the distance is increased from 20 cm to 40 cm?

When the distance doubles the count rate quarters, this is inverse square behaviour.

[2]

(ii) The student wants to find the count rate at 5 cm. Estimate the count rate at a distance of 5 cm.

10 cm = 1000 cpm
÷2 ↓ ↓ ×2²
5cm = 4000 cpm

Answer = 4000 counts per minute

[1]

(d) The student considers the risks of doing experiments with radioactive sources.

He does experiments with two radioactive sources, **A** and **B**.

He writes down his conclusions about the sources in the table below.

Radioactive material	State	Distance from source	Irradiation risk	Contamination risk
A	solid	1 m	high	none
A	solid	4 m	low	none
B	gas	1 m	very high	high
B	gas	4 m	high	high

Describe the difference in the risks for irradiation and contamination for **A** and **B**.

Material A is much less risky than material B. As it is a solid, moving it further away greatly reduces the risk of irradiation whereas as B is a gas (spreads out easily) and even when the distance is further away, the risk is still high. Lastly, due to A being a solid there is no risk of contamination, whereas as B is a gas there is a high risk of contamination. (difficult to contain or control gas than solid.)

[4]

Total Marks for Question Set 20: 11