Q1.

(i) State the name of an instrument that can be used to measure radioactivity.

(1)

.....

(ii) State **two** sources of background radiation.

(2)

1 .....

2 .....

(Total for question = 3 marks)

Q2.

Some rocks contained uranium when they were formed.

Radioactive decay in these rocks produces radon gas.

Explain why people living near these rocks have an increased health risk from background radiation.

(3)

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(Total for question = 3 marks)

Q3.

Everyone is exposed to background radiation. Some of this radiation comes from natural sources.

(i) One example of a source of background radiation that does not occur naturally is radiotherapy.

State **one** other source of background radiation that does not occur naturally.

(1)

.....

.....

(ii) Radon gas is a natural source of background radiation.

In some parts of the country, a lot of the background radiation comes from radon gas.

Explain why there is no radon gas in some other parts of the country.

(2)

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.....

(Total for question = 3 marks)

Q4.

A teacher uses a Geiger-Müller tube and a counter to measure background radiation.

The reading on the counter tube is 34 counts per minute.

(i) The teacher puts a source of beta radiation 15 cm in front of the same Geiger-Müller tube.

The reading on the counter tube is now 468 counts per minute.
Calculate how much radiation detected by the Geiger-Müller tube comes from the source of beta radiation.

(1)

..... counts per minute

(ii) The teacher puts a thick sheet of aluminium between the source of beta radiation and the Geiger-Müller tube.

Estimate the reading on the counter tube.

(1)

..... counts per minute

(iii) Give a reason why the answer to (ii) is only an estimate.

(1)

.....

.....

(Total for question = 3 marks)

Q5.

The intensity of gamma radiation can be measured using a Geiger-Müller tube and counter.

The count rate recorded by the counter tube depends on how far away the Geiger-Müller tube is from the gamma radiation source.

The equation relating count rate to distance from the source is

$$\text{count rate} = \frac{k}{d^2}$$

where d is the distance from the source and k is a constant.

A Geiger-Müller tube is placed 0.70 m from a source of gamma radiation.
The counter displays a count rate of 85 000 count per minute.

Calculate the count rate recorded when the Geiger-Müller tube is placed 1.3 m away from the same gamma radiation source.

(3)

count rate = ... counts per minute

(Total for question = 3 marks)

Q6.

The teacher moves the radiation detector to different distances from the radioactive source.

The teacher determines the mean detector reading at each distance from the source.

The teacher plots the results on graph paper, as shown in Figure 8.

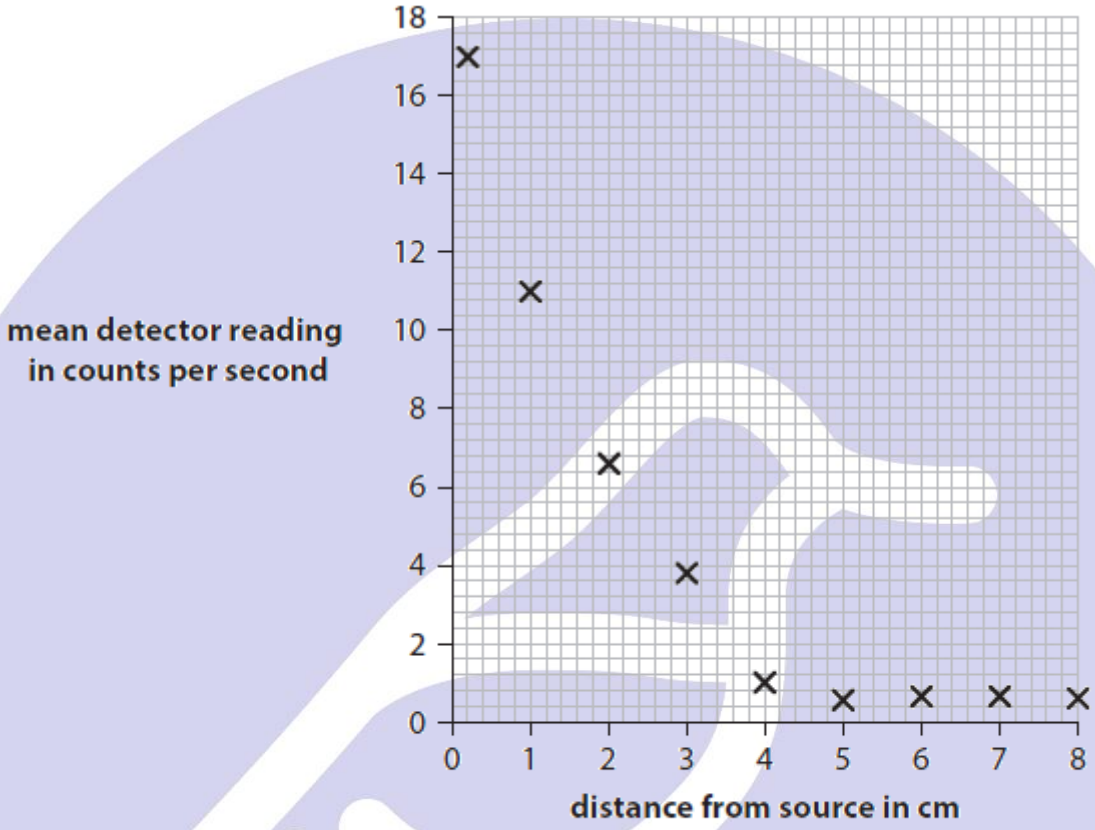

Figure 8

(i) The source emits alpha radiation **only**.

Explain how the graph in Figure 8 shows that the source only emits alpha radiation.

(2)

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.....

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(ii) Give a reason why the mean detector reading in Figure 8 does not fall to zero in this experiment.

(1)

.....

.....

(Total for question = 3 marks)

Q7.

This question is about radioactivity.

Figure 3 shows a Geiger-Muller (G-M) tube attached to a counter.
The G-M tube is used to measure the activity of a source of beta (β) radiation.
There is an aluminium sheet between the beta source and the G-M tube.
The counter is switched on and after 1 minute shows a count of 268.

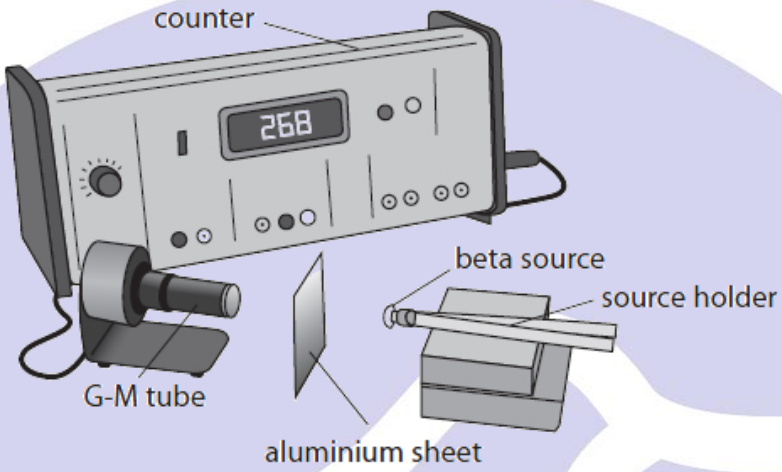

Figure 3

(i) The aluminium sheet is taken away.
The counter is reset to zero and then switched on again.
A new count is taken for 1 minute.

Explain why the new count is greater than 268.

(2)

.....

.....

.....

.....

(ii) The beta source is then also taken away.
The counter is reset to zero and switched on again.
A new count is taken for 1 minute.

Give a reason why there would now be a reading on the counter.

(1)

.....

.....

(iii) State the SI unit for the activity of a radioactive source.

(1)

.....

(Total for question = 4 marks)

Q8.

A teacher determines the background radiation count rate in a laboratory.

Explain how to determine a value for the background radiation count rate.

(3)

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(Total for question = 3 marks)

Q9.

Figure 17 shows a Geiger-Müller (GM) tube used for measuring radioactivity.

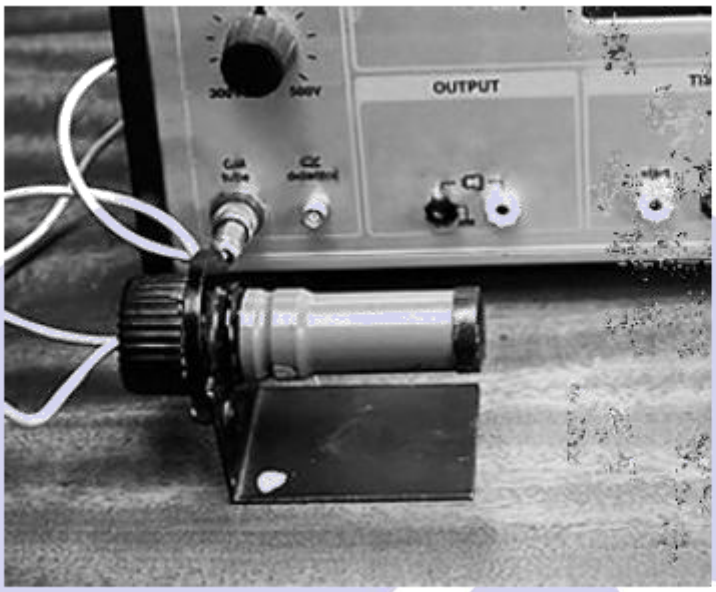

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Figure 17

Describe how a teacher should use a Geiger-Müller (GM) tube to compare the count-rates from two different radioactive rocks.

(4)

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(Total for question = 4 marks)

Q10.

A teacher sets up an experiment to show some students how far beta particles travel in air.

Figure 10 shows some of the equipment she uses.

(Source: *www.einstein.yu.edu*)

Figure 10

(i) State the scientific name for the radioactivity detector shown in Figure 10.

(1)

.....

(iii) Describe how the teacher could show how far beta particles travel in air.

(4)

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(Total for question = 7 marks)

Q11.

A G-M tube is connected to a counter.
A teacher places the G-M tube near to a radioactive source.
A student starts the counter and clock at the same time and writes down the readings shown on the counter every 15 s.

The student plots the readings with a line of best fit, as shown in Figure 10.

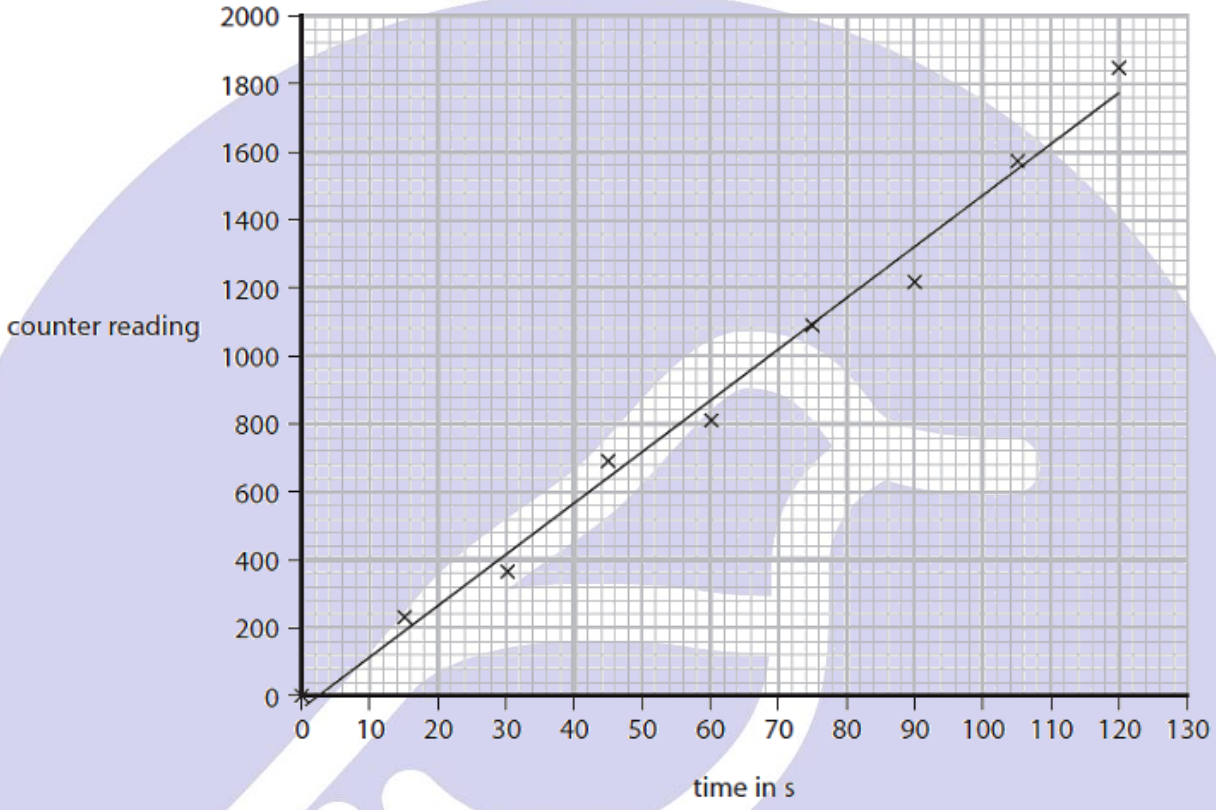

Figure 10

(i) Calculate the average count rate, in counts / s, from the graph.

Show your working on the graph.

(2)

average count rate = ... counts / s

(ii) The student says that the experiment must have been done carelessly because the data seemed quite scattered
away from the best fit line.

The teacher claims such results should be expected in radioactivity experiments.
Justify the teacher's claim.

(2)

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(Total for question = 4 marks)