

Q1. (2019)

A teacher investigated how the count rate from a sample of protactinium changed over time.

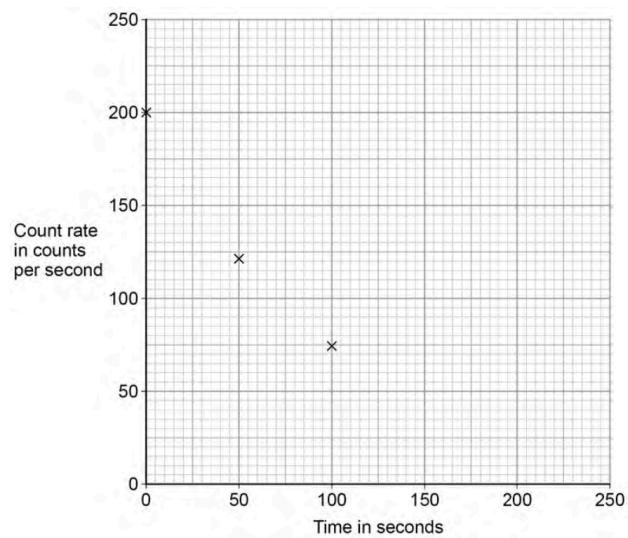
Table 2 shows the results.

Table 2

Time in seconds	Count rate in counts per second
0	200
50	122
100	74
150	45
200	27

Figure 6 shows some of the teacher's results.

Figure 6



0 4 . 6 The teacher read an article about the effects of radiation on the human body.

Why are articles in scientific journals generally more trustworthy than articles in newspapers?

[1 mark]

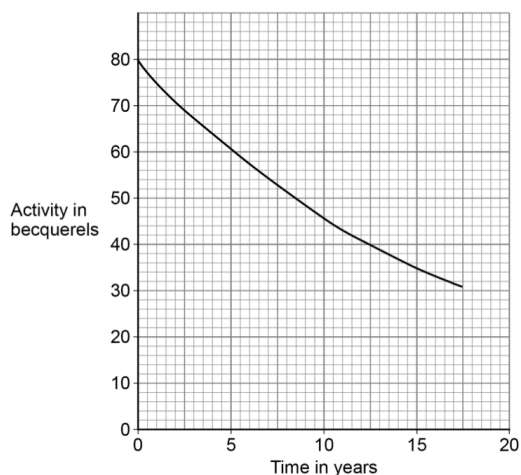
Q2. (2020)

0 2 Between 1951 and 1992 the USA tested nuclear weapons in a desert.

The desert now contains radioactive tritium.

Figure 3 shows how the activity of the tritium in a sample taken from the desert changed with time.

Figure 3



a)

0 2 . 2 The sample was collected from the desert in 1992.

Determine the activity of the tritium in the sample in 2007.

[2 marks]

Activity = _____ Bq

b)

0 2 . 3 How much time did it take for the activity of the tritium in the sample to decrease from 80 Bq to 40 Bq?

[1 mark]

Time = _____ years

c)

0 2 . 4 What is the half-life of tritium?

[1 mark]

Half-life = _____ years

d)

0 2 . 5 The sample started with 45 billion atoms of tritium.

After 4 years the sample had 36 billion atoms of tritium.

Calculate the percentage of the tritium in the sample that remained after 4 years.

[2 marks]

e)

- 0 2 . 6 A scientist determined the activity of a sample of tritium every minute for 3 minutes.

Table 1 shows the results.

Table 1

Time in minutes	Activity in Bq
0	149
1	151
2	148
3	152

Why do the activity readings in Table 1 vary?

[1 mark]

Tick (✓) **one** box.

Radioactive decay is a random process.

☐

Temperature changes affect the radioactive decay.

☐

The number of radioactive nuclei keeps increasing and decreasing.

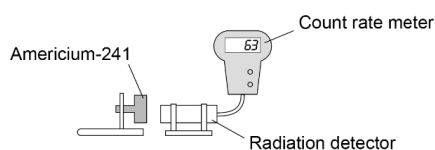
☐

Q3. (2022)

- 0 3 A teacher demonstrated that the radioactive isotope americium-241 emits alpha particles.

Figure 4 shows the equipment used.

Figure 4



a)

- 0 3 . 2 What is the furthest distance that alpha radiation can travel in air?

Tick (✓) **one** box.

[1 mark]

A few millimetres

☐

A few centimetres

☐

A few metres

☐

b)

The teacher replaced the americium-241 with a source of beta radiation.

- 0 3 . 5 The count rate from the source was 119 ± 7 counts per second.

Calculate the smallest count rate this could have been.

[1 mark]

Smallest count rate = _____ counts per second

Q4. (2023)

0 1

A scientist investigated the radiation emitted by different radioactive isotopes.

The scientist had a sample of polonium-210.

The radiation emitted by polonium-210 can be represented by the symbol ${}^4_2\text{He}$.

a)

0 1 4

The sample of polonium-210 had an activity of 100 Bq.

Complete the sentence.

Choose the answer from the box.

[1 mark]

25	50	100	200
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After one half-life, the activity of polonium-210 in the sample
was _____ Bq.

b)

The scientist investigated another radioactive isotope that is a source of gamma radiation.

Figure 1 shows the equipment used.

Figure 1



0 1 5

The count-rate is the number of counts detected each second.

In 30 seconds the number of counts detected was 1500.

Calculate the count-rate.

[2 marks]

Q5. (2024)

0 3

Some people used to think that radioactive substances had health benefits.

100 years ago, a company made toothpaste containing the radioactive isotopes radium-228 and radium-226.

Figure 3 shows the symbols for these isotopes.

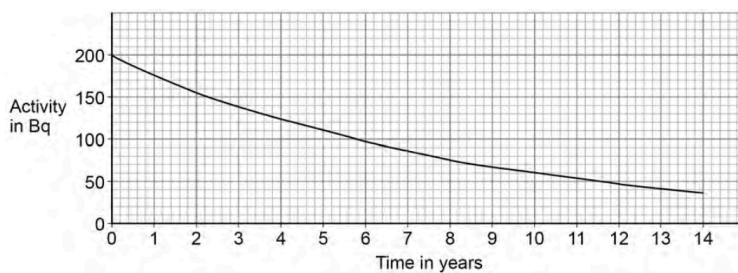
Figure 3



a)

0 3 . 2 Figure 4 shows how the activity of a sample of radium-228 changed over time.

Figure 4



What is the approximate half-life of radium-228?

[1 mark]

Tick (✓) **one** box.

6 years

☐

7 years

☐

14 years

☐

100 years

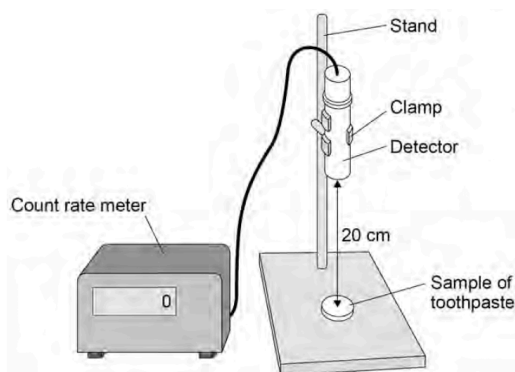
☐

b)

A scientist investigated whether the toothpaste in four tubes of the 100-year-old toothpaste is equally radioactive.

Figure 5 shows the equipment used.

Figure 5



0 3 . 3 When the equipment was arranged as shown in Figure 5, it was **not** possible to detect alpha particles from the toothpaste.

Suggest how the scientist adjusted the equipment to detect alpha particles from the toothpaste.

[1 mark]

c)

- 0 3 . 4 The scientist adjusted the equipment and determined the activity of the toothpaste from each tube.

Table 1 shows the results.

Table 1

Tube	Activity in Bq
A	3150
B	2940
C	3180
D	3050

What was the range of activities shown in Table 1?

[1 mark]

From _____ Bq to _____ Bq

d)

- 0 3 . 5 What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

The activity of the toothpaste

☐

The mass of toothpaste used

☐

The temperature of the toothpaste

☐

The tube of toothpaste used

☐

e)

- 0 3 . 6 What was the dependent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

The activity of the toothpaste

☐

The mass of toothpaste used

☐

The temperature of the toothpaste

☐

The tube of toothpaste used

☐

f)

- 0 3 . 7 When the toothpaste was new, it caused a risk to health because of the nuclear radiation emitted.

What happened to the risk to health from the toothpaste after 100 years?

[1 mark]