AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.4.2.4

Radioactive contamination

Past-paper questions

Tier	**Foundation**
Question groups	**2**
Available paper years	**2020–2023**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

6.4.2.4 Radioactive contamination

Question 01

November 2020 | 8464/P/1F | Original Q2

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

0 2 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

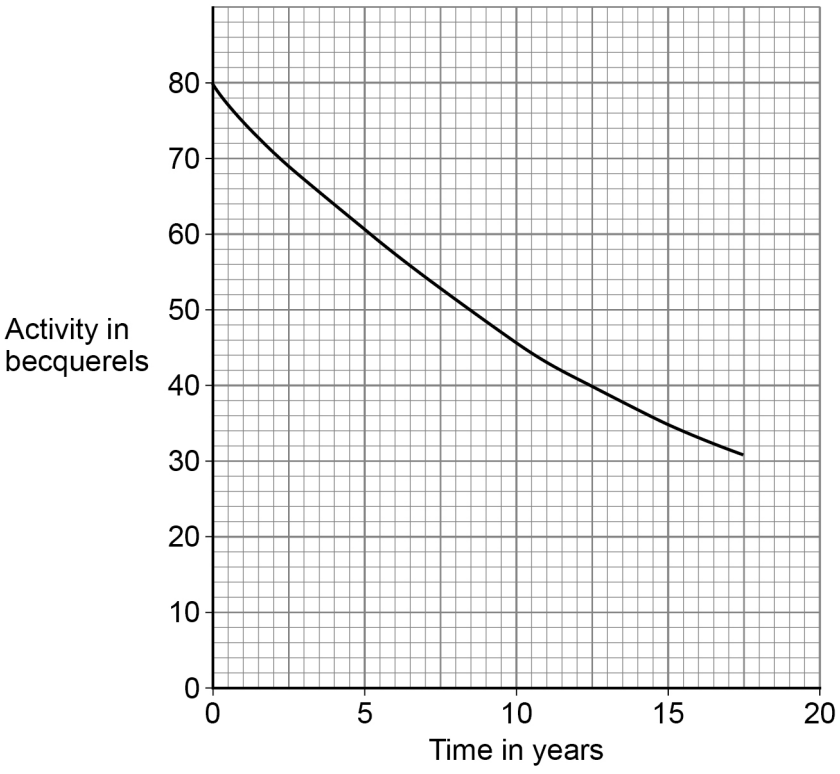
contamination	**irradiation**	**ionisation**	**decay**

Radioactive dust from the nuclear weapons testing settled on the desert. This is called radioactive _____ .

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



6.4.2.4 Radioactive contamination

Question 01 · continued

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

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

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

[1 mark]

Half-life = _____ years

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]

Percentage of tritium remaining = _____ %

6.4.2.4 Radioactive contamination

Question 01 · continued

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. ☐

0 2 . 7 What safety precaution should scientists take when working with radioactive materials in a laboratory?

[1 mark]

Tick (✓) **one** box.

Tie long hair back before handling the materials. ☐

Use long tongs to handle the materials. ☐

Wear safety goggles when handling the materials. ☐

6.4.2.4 Radioactive contamination

Question 01 · continued

0 2 . 8 Studies show that children born near the area of the desert containing tritium were more likely to develop cancer.

It is important that the results from these studies are checked by other scientists.

What is this process called?

[1 mark]

Tick (✓) **one** box.

- Experiment review ☐
- Peer review ☐
- Results review ☐
- Test review ☐

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Turn over for the next question

6.4.2.4 Radioactive contamination

Question 02

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 $^{4}_{2}\text{He}$.

0 1 . 1 Which type of radiation can be represented by the symbol $^{4}_{2}\text{He}$?

[1 mark]

Tick (✓) **one** box.

Alpha ☐

Beta ☐

Gamma ☐

0 1 . 2 How many protons are there in a particle of radiation represented by $^{4}_{2}\text{He}$?

[1 mark]

Tick (✓) **one** box.

2 ☐ 4 ☐ 6 ☐ 8 ☐

0 1 . 3 A polonium-210 (Po) nucleus changes into a lead (Pb) nucleus by emitting a $^{4}_{2}\text{He}$ particle. This is shown by the following nuclear equation.

$$^{210}_{84}\text{Po} \rightarrow {}^{206}_{\mathbf{X}}\text{Pb} + {}^{4}_{2}\text{He}$$

What is the value of **X**?

[1 mark]

Tick (✓) **one** box.

80 ☐ 82 ☐ 84 ☐ 86 ☐

6.4.2.4 Radioactive contamination

Question 02 · continued

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**

After one half-life, the activity of polonium-210 in the sample

was _____ Bq.

Question 1 continues on the next page

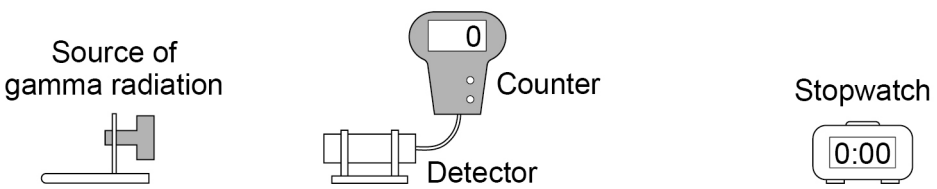
6.4.2.4 Radioactive contamination

Question 02 · continued

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]

Count-rate = _____ counts per second

6.4.2.4 Radioactive contamination

Question 02 · continued

The scientist placed a thick sheet of lead between the source of gamma radiation and the detector.

0 1 . 6 What was the effect of the sheet of lead on the count-rate?

Give a reason for your answer.

[2 marks]

Effect _____

_____

Reason _____

_____

0 1 . 7 The lead was irradiated by the gamma radiation.

What happened to the lead when it was irradiated by the gamma radiation?

[1 mark]

Tick (✓) **one** box.

The lead atoms became radioactive. ☐

The lead gained atoms from the radioactive source. ☐

The lead was exposed to gamma radiation. ☐

Question 1 continues on the next page

6.4.2.4 Radioactive contamination

Question 02 · continued

0 1 . 8 Gamma radiation is emitted from the nucleus of an atom.

Complete the sentence.

Choose the answer from the box.

[1 mark]

electromagnetic waves	**high speed electrons**
neutrons	**positively charged ions**

Gamma radiation consists of _____.

0 1 . 9 **Figure 2** shows the scientist holding the radioactive source using tongs.

Figure 2



Suggest **one** reason why using long tongs rather than short tongs was safer for the scientist.

[1 mark]

_____

_____

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