AQA GCSE Physics | 8463

SPECIFICATION POINT 4.4.2.4

Radioactive contamination

Past-paper questions

Tier	**Foundation**
Question groups	**4**
Available paper years	**2009–2024**

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.

4.4.2.4 Radioactive contamination

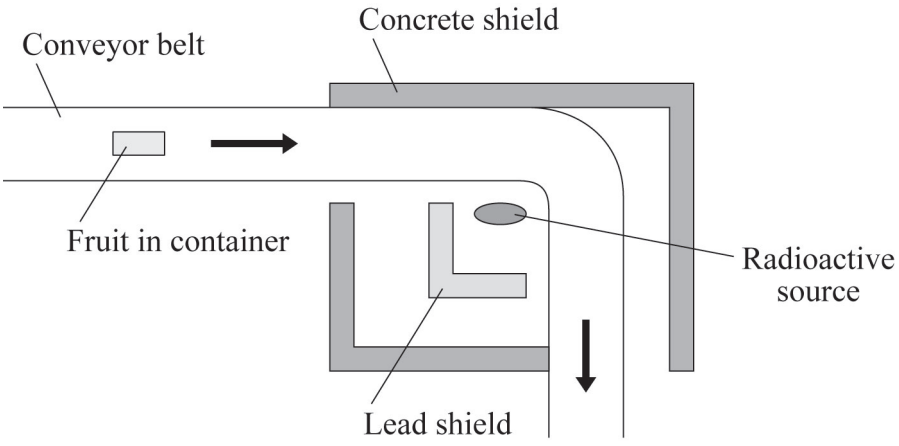
Question 01

March 2009 | PHY1BP | Original Q8 | Legacy

QUESTION EIGHT

In some countries, fruit is passed in front of a radioactive source. The gamma radiation from the source kills bacteria. This keeps the fruit fresh for longer.

The main process is shown in the diagram.



8A Gamma radiation is used because it is . . .

1 able to penetrate the container and fruit.

2 stopped by the lead shield.

3 not harmful to people.

4 the only radiation that can kill bacteria.

8B The amount of radiation absorbed by the fruit can be increased by . . .

1 moving the source further from the fruit.

2 packing the fruit in thicker containers.

3 slowing down the conveyor belt.

4 speeding up the conveyor belt.

4.4.2.4 Radioactive contamination

Question 01 · continued March 2009 | PHY1BP | Original Q8 | Legacy

8C Some fruit growers use X-ray machines instead of gamma ray sources.

The X-rays are safer to work with because . . .

1 gamma ray sources are used in hospitals.

2 X-ray machines can be switched on and off.

3 gamma rays have a lower frequency than X-rays.

4 X-rays have a shorter wavelength than gamma rays.

8D Some scientists investigated the effect of radiation on the vitamin C content of fruit.

They measured the amount of radiation absorbed by some fruit.

They also measured the amount of vitamin C in the fruit before and after the radiation treatment.

Which row of the table describes the variables for a fair test?

	Amount of radiation absorbed	Amount of vitamin C lost during irradiation	Size and type of fruit
1	independent	dependent	control
2	independent	control	dependent
3	dependent	independent	control
4	control	independent	dependent

4.4.2.4 Radioactive contamination

Question 02

June 2011 | PHY1F | Original Q8 | Legacy

8 (a) By 2023, nearly all of the existing nuclear power stations in the UK will be closed down.

8 (a) (i) Before a nuclear power station can be demolished, the remaining nuclear fuel, radioactive waste materials and reactor must be carefully removed.

What is this process called?

Put a tick (✓) in the box next to your answer.

decommissioning ☐

decontaminating ☐

dismantling ☐

(1 mark)

8 (a) (ii) The workers are exposed to radiation as they remove the reactor. One of the biggest risks is from the isotope cobalt-60, which has a half-life of 5.3 years.

Explain the advantage of waiting 11 years after a nuclear power station has closed down before starting to remove the reactor.

.....

.....

.....

.....

(2 marks)

4.4.2.4 Radioactive contamination

Question 02 · continued

8 (b) It is almost certain that new nuclear power stations will be built in the UK.

The table shows the results of surveys asking people in the UK whether they were in favour of, or against, the building of new nuclear power stations.

	2001	2005	2007
Percentage (%) in favour	20	41	65
Percentage (%) against	60	28	20
Percentage (%) not sure	20	31	15

8 (b) (i) From these surveys, how did public opinion on the building of new nuclear power stations change between 2001 and 2007?

.....

.....

(1 mark)

8 (b) (ii) Suggest a reason why some people may think that the results from these surveys are unreliable.

.....

.....

(1 mark)

8 (b) (iii) Give **one** reason in favour of building new nuclear power stations.

.....

.....

(1 mark)

Question 8 continues on the next page

4.4.2.4 Radioactive contamination

Question 02 · continued

8 (c) The government of one Middle Eastern country has decided to build its first nuclear power station. The oil that would have been used to generate electricity can then be sold to other countries.

On what is this decision based?

Put a tick (✓) in the box next to your answer.

economic issues ☐

ethical issues ☐

social issues ☐

(1 mark)

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4.4.2.4 Radioactive contamination

Question 03

June 2023 | 8463/1F | Original Q3

0 3 Some isotopes emit nuclear radiation.

0 3 . 1 Carbon-12 and carbon-14 are both isotopes of carbon.

Complete the sentences.

Choose answers from the box.

[2 marks]

alpha particles	**electrons**	**neutrons**	**protons**

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have the **same** number of _____ .

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have a **different** number of _____ .

0 3 . 2 Different radioactive isotopes have different half-lives.

What does 'half-life' mean?

[1 mark]

Tick (✓) **one** box.

- Half the time taken for all of the nuclei in a sample to decay. ☐
- The time taken for half the nuclei in a sample to decay. ☐
- The time taken for one nucleus to split in half. ☐

Question 3 continues on the next page

4.4.2.4 Radioactive contamination

Question 03 · continued

0 3 . 3 **Table 2** shows the half-life of some different isotopes of carbon.

Table 2

Isotope	Half-life in seconds
Carbon-15	2.45
Carbon-16	0.75
Carbon-17	0.19
Carbon-18	0.09

Which isotope is the least stable?

[1 mark]

Tick (✓) **one** box.

Carbon-15 ☐

Carbon-16 ☐

Carbon-17 ☐

Carbon-18 ☐

4.4.2.4 Radioactive contamination

Question 03 · continued

0 3 . 4 Workers in nuclear power stations must be aware of nuclear irradiation and radioactive contamination.

Draw **one** line from each term to an example of the term.

[2 marks]

Term	Example
Radioactive contamination	Exposure to a beam of gamma rays
Nuclear irradiation	Exposure to ultraviolet radiation from the Sun
	Accidental transfer of plutonium onto a human body
	Using a mobile phone

Question 3 continues on the next page

4.4.2.4 Radioactive contamination

Question 03 · continued

0 3 . 5 Why are workers required to walk across a sticky floor before leaving the nuclear power station?

[1 mark]

Tick (✓) **one** box.

To remove alpha particles from their shoes. ☐

To remove gamma radiation from their shoes. ☐

To remove radioactive dust from their shoes. ☐

0 3 . 6 The places where people work and live contribute to the nuclear radiation they are exposed to.

Table 3 shows the mean daily dose of radiation caused by two different jobs.

Table 3

Job	Mean daily dose in mSv
Aeroplane pilot	0.072
Nuclear power station worker	0.00050

Calculate the number of days a nuclear power station worker must work before receiving the same dose that an aeroplane pilot receives in one day.

[2 marks]

Number of days = _____

4.4.2.4 Radioactive contamination

Question 03 · continued

0 3 . 7 The process of nuclear fission takes place in nuclear power stations.

The process of nuclear fusion takes place in the Sun.

Draw **one** line from each process to its fuel.

[2 marks]

Process	Fuel
	Hydrogen
Nuclear fission	Iron
Nuclear fusion	Lead
	Uranium

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4.4.2.4 Radioactive contamination

Question 04

June 2024 | 8463/1F | Original Q6

0 6 A teacher measured the background radiation in a laboratory.

0 6 . 1 Which sources of background radiation are natural and which are man-made?

[2 marks]

Tick (✓) **one** box in **each** row.

Source of background radiation	Natural	Man-made
Cosmic rays		
Medical X-rays		
Nuclear accidents		
Radon gas		

Question 6 continues on the next page

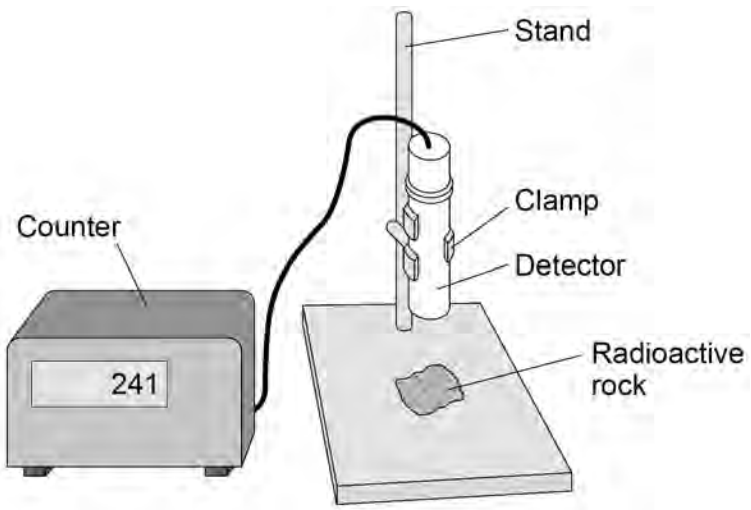
4.4.2.4 Radioactive contamination

Question 04 · continued

The teacher measured the radiation emitted by four different types of radioactive rock.

Figure 12 shows the equipment used.

Figure 12



Each radioactive rock was placed below the detector one at a time.

The radiation was recorded as the number of counts in 1 minute.

The experiment was repeated with different materials between each rock and the detector.

Table 2 shows the results.

Table 2

	Number of counts in 1 minute		
	No material	One sheet of paper	Thick aluminium sheet
No rock	21	20	22
Rock **A**	450	448	18
Rock **B**	385	387	356
Rock **C**	870	21	20
Rock **D**	620	473	214

4.4.2.4 Radioactive contamination

Question 04 · continued

0 6 . 2 Which radioactive rock emitted only alpha radiation?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Rock **A** ☐

Rock **B** ☐

Rock **C** ☐

Rock **D** ☐

Reason _____

_____

0 6 . 3 Which radioactive rock emitted only beta radiation?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Rock **A** ☐

Rock **B** ☐

Rock **C** ☐

Rock **D** ☐

Reason _____

_____

4.4.2.4 Radioactive contamination

Question 04 · continued

0 6 . 4 The teacher took safety precautions during the experiment.

Which precaution would prevent the teacher from becoming contaminated by the radioactive rocks?

[1 mark]

Tick (✓) **one** box.

- Displaying the radiation hazard symbol ☐
- Handling the rocks with clean hands ☐
- Wearing protective gloves ☐

0 6 . 5 What is the activity of each rock after one half-life?

[1 mark]

Tick (✓) **one** box.

- The activity is a quarter of the original activity. ☐
- The activity is half the original activity. ☐
- The activity is double the original activity. ☐
- The activity is zero. ☐

4.4.2.4 Radioactive contamination

Question 04 · continued

0 6 . 6 How does the activity of a radioactive source affect the risk of harm from the source?

[1 mark]

Tick (✓) **one** box.

The smaller the activity, the greater the risk of harm. ☐

The activity does not affect the risk of harm. ☐

The greater the activity, the greater the risk of harm. ☐

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Turn over for the next question