

GCSE Combined Science: Trilogy

Worksheet: Radioactive contamination

TIME 30 min	TOTAL 27 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Radioactive contamination

NAME	CLASS	DATE
-------------	--------------	-------------

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1

What is meant by radioactive contamination?

Tick (✓) **one** box.

The unwanted presence of materials containing radioactive atoms on or in other materials

☐

Exposing an object to nuclear radiation

☐

The decay of an unstable nucleus

☐

The number of decays each second

☐

[1 mark]

0 1 . 2

What is meant by irradiation?

Tick (✓) **one** box.

Exposing an object to nuclear radiation

☐

Radioactive atoms getting onto an object

☐

Heating an object with infrared radiation

☐

An object absorbing light from the Sun

☐

[1 mark]

0 1 . 3

Surgical instruments are sterilised by irradiating them with gamma rays.
Do the instruments become radioactive?

[1 mark]

0 1 . 4

Give **one** precaution a worker could take to avoid being contaminated when handling a radioactive liquid.

[1 mark]

0 2

A worker stands 2 metres from an unshielded gamma source for a short time, without touching it or any radioactive material.

0 2 . 1

Which term describes this worker's exposure?

Tick (✓) **one** box.

Contamination

☐

Irradiation

☐

Both contamination and irradiation

☐

Neither

☐

[1 mark]

0 3

Hospital workers prepare radioactive substances for patients. They must protect themselves from both irradiation and contamination.

0 3 . 1

Describe **three** precautions the workers should take.

.....

.....

.....

.....

.....

.....

[3 marks]

0 3 . 2

Explain why the workers wear a dosimeter.

.....

.....

[1 mark]

0 3 . 3

Explain why it is important that the results of studies on the effects of radiation on humans are published and shared with other scientists.

.....

.....

.....

.....

[2 marks]

0 4

A technician needs to transfer a small volume of a radioactive liquid between containers.

0 4 . 1

Describe **three** precautions the technician should take to minimise the risk of contamination.

.....

.....

.....

.....

.....

.....

[3 marks]

0 5

Table 1 describes four situations involving radioactive sources.

Table 1

Situation	Contamination or irradiation?
A worker accidentally swallows a small amount of a radioactive liquid.	
A worker briefly stands near an unshielded gamma source, without touching anything radioactive.	
Radioactive dust settles on a worker’s overalls.	
An object is placed in a beam of gamma rays to sterilise it, without touching any radioactive material.	

0 5 . 1

Complete Table 1 to show whether each situation is contamination or irradiation.

[4 marks]

0 6

Polonium-210 emits alpha particles.

0 6 . 1

Explain why a sample of polonium-210 is not very hazardous outside the body, but is extremely hazardous if it gets inside the body.

[4 marks]

0 6 . 2

Explain why a person who has swallowed a radioactive substance is described as contaminated, not irradiated.

[2 marks]

0 7

A worker who has been handling a radioactive powder is checked with a contamination monitor before leaving the lab. The monitor reads significantly above background near the worker's hands, but at background level everywhere else.

0 7 . 1

Explain what this shows, and describe what the worker should do next.

.....

.....

.....

.....

.....

.....

[3 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Radioactive contamination · 27 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: The unwanted presence of materials containing radioactive atoms on or in other materials

01.2 [1 mark]

Correct: Exposing an object to nuclear radiation

01.3 [1 mark]

Answer: No

- no (an irradiated object does not become radioactive) (1)
-

01.4 [1 mark]

Answer: Wear disposable gloves.

- wear gloves / protective clothing (1)
- use tongs (1)
- wear a mask / work in a fume cupboard so that radioactive material is not breathed in (1)

Any 1 of the points above.

Question 2 (1 mark)

02.1 [1 mark]

Correct: Irradiation

Question 3 (6 marks)

03.1 [3 marks]

Answer: Wear gloves and protective clothing, handle the substances with tongs behind lead shielding, and keep the time near the sources as short as possible.

- wear gloves / protective clothing to prevent radioactive material getting on the skin (1)
- use tongs / handle the substances from a distance (1)
- use shielding, e.g. lead screens / lead-lined containers (1)
- spend as little time as possible near the radioactive substances (1)
- wear a dosimeter (film badge) to monitor the dose received (1)
- work in a ventilated area / fume cupboard so radioactive material is not breathed in (1)

Any 3 of the points above.

03.2 [1 mark]

Answer: To monitor the radiation dose each worker receives.

- to measure / monitor the radiation dose received, so that it stays below the safe limit (1)

03.3 [2 marks]

Answer: So other scientists can check them through peer review, and so the confirmed results can be used to make work with radiation safer.

- so that other scientists can check the findings / repeat the studies (peer review) (1)
- so that the findings can be confirmed and used to improve safety / set dose limits (1)

Question 4 (3 marks)

04.1 [3 marks]

Answer: Any three of: gloves/apron; a lined tray; remote handling tools; a designated work area; eye protection.

- wear gloves (and a lab coat or apron) so the liquid cannot touch the skin (1)
- work over a tray lined with absorbent material, in case of spills (1)
- use remote handling tools (e.g. tongs or a pipette) rather than handling the container directly (1)
- work in a designated area (e.g. a fume cupboard) and wash hands thoroughly afterwards (1)
- wear eye protection in case of splashes (1)

Any 3 of the points above.

Question 5 (4 marks)

05.1 [4 marks]

Answer: Contamination; irradiation; contamination; irradiation.

- contamination (radioactive material is now inside the body) (1)
 - irradiation (exposed to radiation from outside; no radioactive material is transferred) (1)
 - contamination (radioactive dust is now on the overalls) (1)
 - irradiation (exposed to the radiation, but no radioactive material is transferred to the object) (1)
-

Question 6 (6 marks)

06.1 [4 marks]

Answer: Outside, the alpha particles are stopped by air or dead skin and never reach living cells. Inside, they are absorbed by nearby living cells, and being strongly ionising they cause severe damage.

- outside the body the alpha particles are absorbed by the air / by the outer layer of the skin (1)
 - so they do not reach living cells (1)
 - inside the body the alpha particles are absorbed by the (living) cells close to the source (1)
 - alpha particles are strongly ionising, so they cause a lot of damage to these cells (e.g. to DNA, which can cause cancer) (1)
-

06.2 [2 marks]

Answer: The radioactive atoms are now inside the body, so the exposure continues until they decay or are removed.

- the radioactive atoms are inside the person's body (1)
 - so the person keeps being exposed to radiation until the atoms decay or leave the body (irradiation only happens while the person is near a source) (1)
-

Question 7 (3 marks)

07.1 [3 marks]

Answer: Their hands are contaminated but the rest of their body is not; they should wash their hands and be re-checked before leaving.

- the raised reading near the hands shows the worker has radioactive contamination on their hands (some powder has got onto the skin) (1)
 - the background-level reading everywhere else shows the rest of the worker's body and clothing is not contaminated (1)
 - the worker should wash their hands thoroughly and be re-monitored before being allowed to leave, and should avoid touching other surfaces until this is done (1)
-