Exercise walk-through

4.5 Radioactive contamination and background radiation (4.4.2.4–4.4.3.1)

AQA · GCSE · Physics

Radioactive contamination

- **Contamination** is the unwanted presence of radioactive atoms on or inside other materials. The atoms keep decaying, so the danger continues until they are removed or have decayed.
- **Irradiation** is exposing an object to nuclear radiation. The irradiated object does not become radioactive, and the exposure stops when the source is removed.

Exercises 2.1·2.2

2.1 Define contamination and irradiation. [2]

contamination irradiation

2.2 A nurse holds a gamma source with tongs and limits the time near it. Explain how each precaution reduces her dose. [2]



2.3 State why studies of radiation effects are published and shared. [1]

published studies

Exercises 2.1·2.2

2.1 Define contamination and irradiation. [2]

contamination irradiation

2.1 Contamination: the unwanted presence of materials containing radioactive atoms on other materials. Irradiation: the process of exposing an object to nuclear radiation.

2.2 A nurse holds a gamma source with tongs and limits the time near it. Explain how each precaution reduces her dose. [2]



2.3 State why studies of radiation effects are published and shared. [1]

published studies

2.2 Tongs increase the distance between the source and her hand, reducing exposure; less time near the source reduces the total dose received.

2.3 So other scientists can check the findings by peer review.

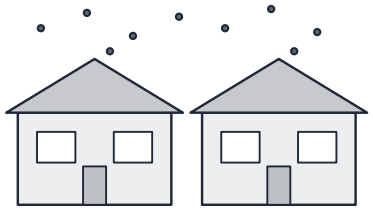
Exercise 3.1

3.1 After a nuclear accident, dust containing radioactive atoms settles on a town.

(a) Explain why settled dust is contamination and can cause continuing irradiation. [2]

(b) Why is an alpha-emitting dust more dangerous once breathed in than when on the skin? [2]

(c) Residents are told to stay indoors. Explain how this reduces their dose from the passing dust cloud. [2]



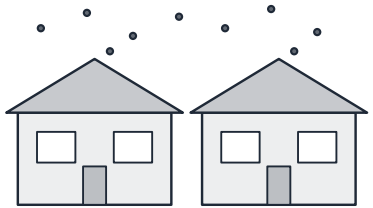
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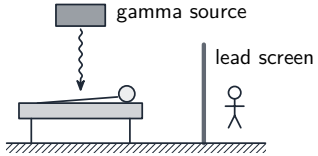
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3.1 (a) Radioactive material has settled **on** surfaces – radioactive atoms are present on the town's surfaces; their continuing decay emits radiation while they remain there. (b) Skin stops alpha particles, so external alpha does little harm; inside the lungs, alpha's strong ionisation damages tissue directly close to the radioactive atoms. (c) Walls and roof absorb/attenuate the passing radiation; staying inside also limits breathing in contaminated dust.

Exercise 3.2

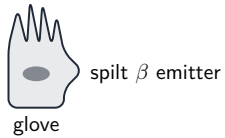
3.2 Medical staff irradiate a patient with gamma rays for 10 minutes.



(a) Explain why the patient does not become radioactive. [1]

(b) The staff stand behind a lead screen. Explain why this protects them but does not stop the treatment. [2]

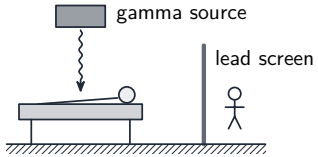
3.3 A laboratory worker spills a beta-emitting liquid on her glove.



Describe the immediate actions she should take and the reason for each, and state how the hazard differs from receiving a 10-second beta irradiation. [6]

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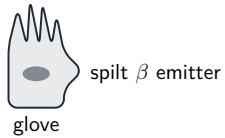
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3.2 (a) Irradiation never makes an object radioactive – no radioactive atoms are transferred to the patient. (b) Lead attenuates gamma and reduces the staff's dose; the treatment beam is directed at the patient along a path that does not pass through the staff's screen.

Full solution on next slide

Full solution 3.2

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3.3 Stop working and contain the spill – prevent spreading material; remove the glove carefully without touching the skin; wash hands and check for contamination on the skin and clothing; report and have the area decontaminated by procedure. The spill is contamination: beta-emitting atoms sit on the glove and keep decaying until removed; a 10-second irradiation delivers a momentary dose that ends when the source is off – no material remains, so no continuing dose.