3.27 Radioactivity, Half-Life and Nuclear Uses: 10-minute Pack

Total Marks

AQA 8464 · Calculator allowed · about 10 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Nuclides can be written in the form (mass number)/(atomic number) Symbol, for example an α particle is written 4/2 He. Americium-241 (241/95 Am) is an α-emitting source used in household smoke detectors. It decays by α emission to form an isotope of neptunium (Np).

(a) Write the balanced nuclear equation for the α decay of americium-241, giving the mass number and atomic number of the neptunium nuclide formed. **(2)**

(b) A different isotope, americium-243 (243/95 Am), also decays by α emission. Without writing the full equation, state the mass number and atomic number of the daughter nuclide formed. **(2)**

(Total for Question 1 is 4 marks)

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2 A nurse spills a small amount of a radioactive liquid tracer on her glove while preparing an injection.

(a) State whether this is an example of contamination or irradiation, giving a reason for your answer. **(2)**

(b) Explain why contamination is generally considered a greater long-term hazard than irradiation, and suggest one way the nurse's contamination in part (a) could have been avoided. **(2)**

(Total for Question 2 is 4 marks)

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Mark scheme · 3.27 Radioactivity, Half-Life and Nuclear Uses: 10-minute Pack

Question 1

(a) α particle shown correctly as 4/2 He and equation attempted using conservation of mass number and atomic number **M1**

(a) 241/95 Am -> 237/93 Np + 4/2 He, cao **A1**

(a) Answer: 241/95 Am -> 237/93 Np + 4/2 He

(b) mass number = 243 - 4 = 239 **M1**

(b) atomic number = 95 - 2 = 93 (neptunium-239), cao **A1**

(b) Answer: Mass number 239, atomic number 93 (neptunium-239).

Question 2

(a) contamination, cao **B1**

(a) because radioactive material is now on her (on the glove/skin), and will continue to irradiate her until it is removed, rather than her simply being near a source, oe **B1**

(a) Answer: Contamination, because radioactive material is now on her, continuing to expose her until removed, rather than her just being near a source.

(b) contamination keeps radioactive material in contact with (or inside) the body, giving continued exposure that could last a long time, until it is removed or decays, unlike irradiation, which stops as soon as the person moves away from the source, oe **B1**

(b) any sensible precaution, e.g. wearing gloves/protective clothing while handling the liquid tracer, working over a tray to contain spills, oe **B1**

(b) Answer: Contamination keeps the source in continued contact with the body, giving a prolonged dose, unlike a brief external exposure. Precaution: wearing gloves/protective clothing while handling the tracer.

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