

Solutions

2.1 Natural: radon from rocks; cosmic rays (also food/the body). Man-made: fallout from weapons testing; nuclear accidents.

2.2 $88 - 48 = 40$ Bq.

2.3 The patient's dose ends soon after the scan – activity falls quickly.

3.1 (a) Radon gas; natural. (b) $3 \times 0.3 = 0.9$ mSv. (c) Radiation levels differ by place: radon depends on local rock; cosmic rays increase with altitude.

3.2 (a) The activity falls rapidly after the scan, so the total dose to the patient stays small. (b) Gamma is the most penetrating, so it leaves the body and reaches the external detector. (c) 24 hours = 4 half-lives; fraction = $1/2^4 = 1/16$.

3.3 (a) Source B: with a 24 000-year half-life it remains active for millennia, so it needs secure long-term storage. (b) Source A: its short half-life means very high activity now – far more decays per second than B in that hour. (c) Store in sealed, shielded containers (alpha is stopped by modest shielding – but containment must prevent ingestion); label, keep away from people, and monitor for leakage over the long term.