Extension Worksheet – Option I, Worksheet 2

1 The physical half-life of a radioactive isotope used in medical diagnosis is 4.0 days and the biological half-life is 3.0 days.

a Distinguish between physical and biological half-life. [2]

b Calculate the time that must elapse before the activity of a sample in a patient is reduced to 80% of its original value. [3]

2 A gamma ray source is injected into a tumour in a patient. The mass of the tumour is 25 g, the activity of the source is 8.2×10^8 Bq and the energy released, in each decay, is 25 keV. The quality factor for gamma radiation is 1.

Determine the dose equivalent in the tumour during a period of 30 minutes. [3]

3 A certain volume of albumen contains a sample of technetium-99. A volume of 10 cm^3 of this albumen is injected into the blood stream of a patient and another 10 cm^3 is mixed with 5.0×10^3 cm^3 of water. A 5.0 cm^3 sample taken from the blood of the patient some time later has an activity of 110 kBq whereas, at the same time, a volume of 5.0 cm^3 of the water mixture had an activity of 105 kBq.

Estimate the volume of blood in the patient. [3]