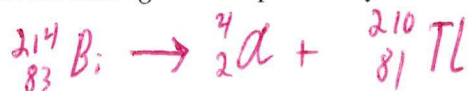


Quiz 20.1 – Radioactive Decay

Name: Key

Question 1

$^{214}_{83}\text{Bi}$ will undergo both alpha decay and beta decay. Write a balanced equation for both of these decay pathways.



Question 2

What 2 different decay pathways can transform $^{11}_6\text{C}$ into $^{11}_5\text{B}$?

Positron emission and electron capture

Question 3

How could we experimentally determine which decay pathway is actually responsible for the transformation in Question 2?

Detect the emitted positrons (or absence thereof)

Question 4

A nuclide is relatively small and has too many neutrons to be stable. What method of decay is most likely for this nuclide?

β -decay

Question 5

Calculate the half-life of an isotope if a sample is reduced to 60% of its original mass after 8 years

$$[A]_t = [A]_0 \cdot \left(\frac{1}{2}\right)^{n} \quad n = 8 \text{ years} / t_{1/2}$$

$$0.6 = 1 \cdot \frac{1}{2}^{8/t_{1/2}} \rightarrow \ln 0.6 = \ln \frac{1}{2}^8 - \ln \frac{1}{2}^{t_{1/2}}$$

Question 6

$$\ln(0.6) = 8 \cdot \ln(0.5) - t_{1/2} \ln(0.5) \rightarrow t_{1/2} = 7.26 \text{ years}$$

A radioactive isotope has a half-life of 3.45 years. If a 15.0 g sample of this isotope is left in a closet for 10 years, how many g of the isotope will remain?

$$[A]_t = [A]_0 \cdot \left(\frac{1}{2}\right)^{t/t_{1/2}} \quad m_t = 15.0 \text{ g} \cdot 0.5^{(10 \text{ years} / 3.45 \text{ years})} = 2.01 \text{ g}$$