Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 20, Review Quiz 1 Answers

1

Write balanced equations for the following nuclear reactions:

a. Arsenic-69 decays by positron emission.
b. Nickel-59 decays by electron capture.
c. Iodine-135 decays by beta emission.
d. Polonium-210 decays by alpha emission.

a. ${}^{69}_{33}\text{As} \longrightarrow {}^{0}_{+1}\beta + {}^{69}_{32}\text{Ge}$

b. ${}^{59}_{28}\text{Ni} + {}^{0}_{-1}\text{e} \longrightarrow {}^{59}_{27}\text{Co}$

c. ${}^{135}_{53}\text{I} \longrightarrow {}^{0}_{-1}\beta + {}^{135}_{54}\text{Xe}$

d. ${}^{210}_{84}\text{Po} \longrightarrow {}^{4}_{2}\alpha + {}^{206}_{82}\text{Pb}$

2

Neutron bombardment of cobalt-59 produces an alpha particle and a new isotope. Write a balanced equation for this nuclear reaction.

$${}^{59}_{27}\text{Co} + {}^{1}_{0}\text{n} \longrightarrow {}^{4}_{2}\alpha + {}^{56}_{25}\text{Mn}$$

3

The half-life of argon-41 is 1.8 hours. How many atoms will remain if a 3.5×10^{24} atom sample of argon-41 decays for 8.0 hours?

$$\ln \text{Q}_f = -\left(\frac{0.693}{1.8\,\text{h}}\right)(8.0\,\text{h}) + \ln\left(3.5\times10^{24}\,\text{atoms}\right)$$

$$\text{Q}_f = 1.6\times10^{23}\,\text{atoms}$$

4

The half-life of silver-110 is 25 seconds. How much time is required for an 8.8 g sample of silver-110 to decay to 2.1 g?

$$\mathrm{t} = \left(\frac{25\,\mathrm{s}}{0.693}\right) \ln\left(\frac{8.8\,\mathrm{g}}{2.1\,\mathrm{g}}\right) = 52\,\mathrm{s}$$

5

A 3.20 mol sample of zirconium-95 requires 103 days to decay to 1.05 mol. Calculate the half-life of zirconium-95.

$$103\,\mathrm{d} = \left(\frac{\mathrm{t}_{1/2}}{0.693}\right) \ln\left(\frac{3.20\,\mathrm{mol}}{1.05\,\mathrm{mol}}\right)$$

$$\mathrm{t}_{1/2} = 64.1\,\mathrm{d}$$

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