

25 NUCLEAR CHEMISTRY

Practice Problems

In your notebook, solve the following problems.

SECTION 25.1 NUCLEAR RADIATION

- What happens to the mass number and atomic number of an atom that undergoes beta decay? *AN + 1 MN No change*
- A radioisotope of an element undergoes alpha particle decay. How do the atomic number and mass number of the particle change? *AN - 2 MN - 4*
- Give the composition of the nucleus of the following isotopes.
 - ${}^{64}_{28}\text{Ni}$ *28p, 36n*
 - ${}^{136}_{53}\text{I}$ *53p, 83n*
 - ${}^{195}_{79}\text{Au}$ *79p, 116n*
- Complete each of the following equations.
 - ${}^{14}_6\text{C} \rightarrow {}^0_{-1}\text{e} + ?$ *${}^{14}_7\text{N}$*
 - ${}^{241}_{95}\text{Am} \rightarrow {}^4_2\text{He} + ?$ *${}^{237}_{93}\text{Np}$*
 - ${}^{16}_7\text{N} \rightarrow {}^{16}_8\text{O} + ?$ *${}^0_{-1}\text{e}$*

SECTION 25.2 NUCLEAR TRANSFORMATIONS

- Write a nuclear equation for the following radioactive processes.
 - alpha decay of francium-208 *${}^{208}_{87}\text{Fr} \rightarrow {}^4_2\text{He} + {}^{204}_{85}\text{At}$*
 - electron capture by beryllium-7 *${}^7_4\text{Be} + {}^0_{-1}\text{e} \rightarrow {}^7_3\text{Li}$*
 - beta emission by argon-37 *${}^{37}_{18}\text{Ar} \rightarrow {}^{37}_{19}\text{K} + {}^0_{-1}\text{e}$*
 - positron emission by fluorine-17 *${}^{17}_9\text{F} \rightarrow {}^{17}_8\text{O} + {}^0_{+1}\text{e}$*
- Complete the equations for these transmutation reactions.
 - ${}^3_3\text{Li} + {}^1_0\text{n} \rightarrow {}^4_2\text{He} + ?$ *${}^2_1\text{H}$*
 - ${}^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow ? + {}^{141}_{56}\text{Ba} + 3{}^1_0\text{n}$ *${}^{92}_{36}\text{Kr}$*
 - ${}^{27}_{13}\text{Al} + {}^4_2\text{He} \rightarrow ? + {}^1_0\text{n}$ *${}^{30}_{15}\text{P}$*
 - ${}^{235}_{92}\text{U} \rightarrow {}^{90}_{38}\text{Sr} + ? + {}^1_0\text{n} + 4{}^0_{-1}\text{e}$ *${}^{144}_{58}\text{Ce}$*
 - ${}^1_0\text{n} + ? \rightarrow {}^{144}_{58}\text{Ce} + {}^{90}_{38}\text{Sr} + 6{}^1_0\text{n} + 2{}^0_{-1}\text{e}$ *${}^{239}_{94}\text{Pu}$*
- Polonium-214 has a relatively short half-life of 164 s. How many seconds would it take for 8.0 g of this isotope to decay to 0.25 g? *$5 \frac{1}{2}$ lives $164 \times 5 = 820 \text{ s}$*
- How many days does it take for 16 g of palladium-103 to decay to 1.0 g? The half-life of palladium-103 is 17 days. *$4 \frac{1}{2}$ lives $17 \times 4 = 68 \text{ days}$*
- By approximately what factor would the mass of a sample of copper-66 decrease in 51 minutes? The half-life of copper-66 is 5.10 min. *$\frac{51 \text{ min}}{5.1 \text{ min}} = 10 \frac{1}{2}$ lives*
- In 5.49 seconds, 1.20 g of argon-35 decay to leave only 0.15 g. What is the half-life of argon-35? *$3 \frac{1}{2}$ lives $\frac{5.49}{3} = 1.83 \text{ s}$ $(\frac{1}{2})^{10} = \frac{1}{1024}$*

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