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Nuclear Decay Practice

Writing Nuclear Equations – Use Table N! When elements undergo radioactive decay, they change from one element to another. This happens by losing high energy alpha or beta particles, or by emitting positrons. The process of an atom becoming a different atom is called **transmutation**. Nuclear equations are written to track the changes that occur during transmutation. When writing nuclear equations, it is important to make sure that *mass and charge are conserved*. Write the complete nuclear equation for the spontaneous decay of the following nuclides

1. ^{37}Ca Decay Mode: $\beta^+ \left({}^{0}_{+1}\beta\right)$

   Equation: ${}^{37}_{20}Ca \rightarrow {}^{0}_{+1}\beta + {}^{37}_{19}K$

2. Iron-53 Decay Mode: $\beta^+ \left({}^{0}_{+1}\beta\right)$

   Equation: ${}^{53}_{26}Fe \rightarrow {}^{0}_{+1}\beta + {}^{53}_{25}Mn$

3. Neon-19 Decay Mode: $\beta^+ \left({}^{0}_{+1}\beta\right)$

   Equation: ${}^{19}_{10}Ne \rightarrow {}^{0}_{+1}\beta + {}^{19}_{9}F$

4. ^{42}K Decay Mode: $\beta^- \left({}^{0}_{-1}\beta\right)$

   Equation: ${}^{42}_{19}K \rightarrow {}^{0}_{-1}\beta + {}^{42}_{20}Ca$

5. Iodine-131 Decay Mode: $\beta^- \left({}^{0}_{-1}\beta\right)$

   Equation: ${}^{131}_{53}I \rightarrow {}^{0}_{-1}\beta + {}^{131}_{54}Xe$

6. Strontium-90 Decay Mode: $\beta^- \left({}^{0}_{-1}\beta\right)$

   Equation: ${}^{90}_{38}Sr \rightarrow {}^{0}_{-1}\beta + {}^{90}_{39}Y$

7. Radon-222 Decay Mode: $\alpha \left({}^{4}_{2}\alpha\right)$

   Equation: ${}^{222}_{86}Rn \rightarrow {}^{4}_{2}\alpha + {}^{218}_{84}Po$

8. ^{220}Fr Decay Mode: $\alpha \left({}^{4}_{2}\alpha\right)$

   Equation: ${}^{220}_{87}Fr \rightarrow {}^{4}_{2}\alpha + {}^{216}_{85}At$

9. ~~Iron-53~~ Thorium-232 Decay Mode: $\alpha \left({}^{4}_{2}\alpha\right)$

   Equation: ${}^{232}_{90}Th \rightarrow {}^{4}_{2}\alpha + {}^{228}_{88}Ra$

10. ^{198}Au Decay Mode: $\beta^- \left({}^{0}_{-1}\beta\right)$

    Equation: ${}^{198}_{79}Au \rightarrow {}^{0}_{-1}\beta + {}^{198}_{80}Hg$

The Uranium Challenge

Directions: Observe the first few steps of the Uranium decay process. Uranium needs 14 separate decay processes in order to reach a stable nucleus. Fill in the remaining decay equations.

STEP	Decay Mode	Parent Nuclide → Daughter Nuclide
1	α	${}^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th$
2	β^-	${}^{234}_{90}Th \rightarrow {}^{0}_{-1}e + {}^{234}_{91}Pa$
3	β^-	${}^{234}_{91}Pa \rightarrow {}^{0}_{-1}e + {}^{234}_{92}U$

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4	α	$^{234}_{92}U \rightarrow {}^{4}_{2}He + {}^{230}_{90}Th$
5	α	$^{230}_{90}Th \rightarrow {}^{4}_{2}He + {}^{226}_{88}Ra$
6	α	$^{226}_{88}Ra \rightarrow {}^{4}_{2}He + {}^{222}_{86}Rn$
7	α	$^{222}_{86}Rn \rightarrow {}^{4}_{2}He + {}^{218}_{84}Po$
8	α	$^{218}_{84}Po \rightarrow {}^{4}_{2}He + {}^{214}_{82}Pb$
9	β^-	$^{214}_{82}Pb \rightarrow {}^{0}_{-1}\beta + {}^{214}_{83}Bi$
10	β^-	$^{214}_{83}Bi \rightarrow {}^{0}_{-1}\beta + {}^{214}_{84}Po$
11	α	$^{214}_{84}Po \rightarrow {}^{4}_{2}He + {}^{210}_{82}Pb$
12	β^-	$^{210}_{82}Pb \rightarrow {}^{0}_{-1}\beta + {}^{210}_{83}Bi$
13	β^-	$^{210}_{83}Bi \rightarrow {}^{0}_{-1}\beta + {}^{210}_{84}Po$
14	α	$^{210}_{84}Po \rightarrow {}^{4}_{2}He + {}^{206}_{82}Pb$