

Nuclear Reactions

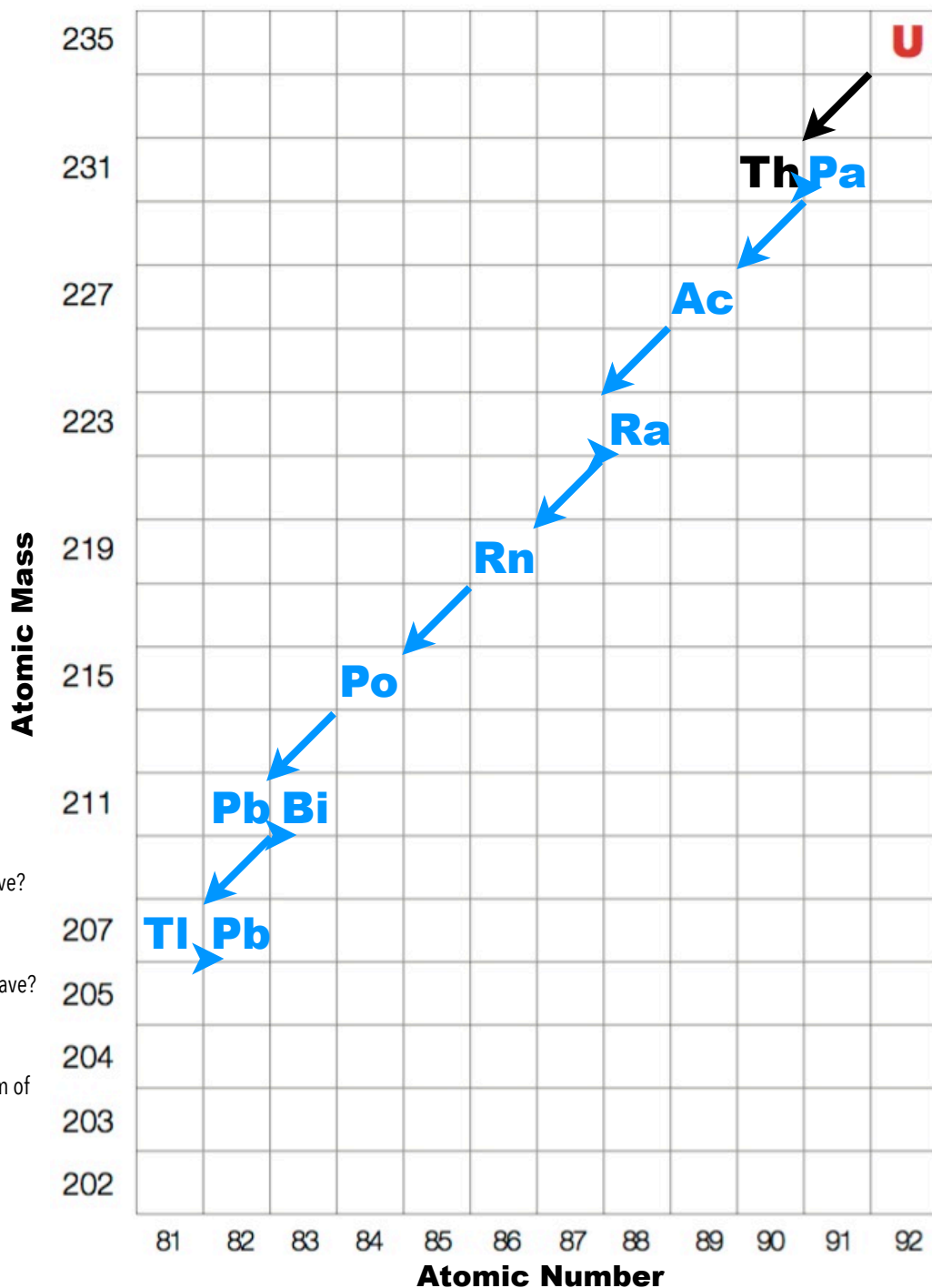
Complete the following nuclear reactions. To the right of each one, circle which type of nuclear reaction took place.

1. ${}_{90}^{230}\text{Th} \rightarrow {}_{88}^{226}\text{Ra} + \boxed{{}_2^4\text{He}}$ α β^- β^+ γ
2. ${}_{85}^{218}\text{At} \rightarrow \boxed{{}_{83}^{214}\text{Bi}} + {}_2^4\text{He}$ α β^- β^+ γ
3. ${}_{6}^{14}\text{C} \rightarrow \boxed{{}_{-1}^0\text{e}} + {}_7^{14}\text{N}$ α β^- β^+ γ
4. ${}_{35}^{80}\text{Br} \rightarrow {}_{36}^{80}\text{Kr} + \boxed{{}_{-1}^0\text{e}}$ α β^- β^+ γ
5. ${}_{83}^{214}\text{Bi} \rightarrow {}_2^4\text{He} + \boxed{{}_{81}^{210}\text{Tl}}$ α β^- β^+ γ
6. ${}_{83}^{212}\text{Bi} \rightarrow \boxed{{}_{-1}^0\text{e}} + \boxed{{}_{84}^{212}\text{Po}}$ α β^- β^+ γ
7. ${}_{35}^{80}\text{Br} \rightarrow \boxed{{}_{-1}^0\text{e}} + \boxed{{}_{36}^{80}\text{Kr}}$ α β^- β^+ γ
8. ${}_{35}^{80}\text{Br} \rightarrow \boxed{{}_{+1}^0\text{e}} + \boxed{{}_{34}^{80}\text{Se}}$ α β^- β^+ γ
9. ${}_{10}^{20}\text{Ne} + {}_0^1\text{n} \rightarrow {}_2^4\text{He} + \boxed{{}_8^{17}\text{O}}$ α β^- β^+ γ
10. ${}_{29}^{64}\text{Cu} \rightarrow \boxed{{}_{+1}^0\text{e}} + \boxed{{}_{28}^{64}\text{Ni}}$ α β^- β^+ γ
11. ${}_{1}^3\text{H} + {}_{52}^{132}\text{Te} \rightarrow \boxed{{}_{+1}^0\text{e}} + \boxed{{}_{52}^{135}\text{Te}}$ α β^- β^+ γ
12. ${}_{1}^2\text{H} + {}_{1}^3\text{H} \rightarrow {}_2^4\text{He} + \boxed{{}_0^1\text{n}}$ α β^- β^+ γ
13. ${}_{1}^1\text{H} + {}_{3}^7\text{Li} \rightarrow {}_2^4\text{He} + \boxed{{}_2^4\text{He}}$ α β^- β^+ γ
14. ${}_{3}^8\text{Li} + {}_{47}^{117}\text{Au} + 2 {}_0^1\text{n} \rightarrow {}_2^4\text{He} + \boxed{{}_{48}^{123}\text{Cd}} + 2\gamma$ α β^- β^+ γ
15. $\boxed{{}_{+1}^0\text{e}} + \boxed{{}_{+1}^0\text{e}} \rightarrow \boxed{{}_{+1}^2\text{e}}$ **Fr** α β^- β^+ γ **None**
16. $\boxed{{}_{+1}^0\text{e}} + \boxed{{}_{-1}^0\text{e}} \rightarrow \boxed{{}_0^0\gamma}$ α β^- β^+ γ

Natural Transmutation of a Uranium Isotope

Draw in a decay scheme for the radioactive isotope of Uranium, U-235. You will begin in the upper right corner and end with a stable isotope of lead (Pb). Use the correct elemental symbol for each product formed and show the path of each transition with an arrow. One possible decay sequence for Uranium 235 is below. Step 1 has been completed for you with Thorium-231.

| STEP | EMISSION |
|------|-----------|
| 1 | α |
| 2 | β^- |
| 3 | α |
| 4 | α |
| 5 | β^- |
| 6 | α |
| 7 | α |
| 8 | α |
| 9 | β^- |
| 10 | α |
| 11 | β^- |
| 12 | Stable |



1. What isotope is the final product?

Pb-207

2. How many protons does this isotope have?

82

3. How many neutrons does this isotope have?

125

4. How many electrons does a neutral atom of this isotope have?

82

5. How do you know that lead is the final product?

Element with 82 protons

6. If U-235 underwent a β^- decay in Step 1, but followed the rest of the decay scheme as written, what elemental isotope would it become?

At-211

7. Do you think this isotope would be stable? Explain your answer.

No, there are no stable isotopes of Astatine (its Z (85) $>$ 83).