Nuclear Chemistry Worksheet_K

Directions: **Identify the following as alpha, beta, gamma, or neutron**.

1. $_0^1 n$ _____   2. $_{-1}^0 e$ _____   3. $_2^4 He$ _____   4. $_0^0 \gamma$ _____

5. Nuclear decay with no mass and no charge   _____

6. An electron   _____
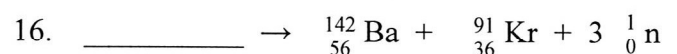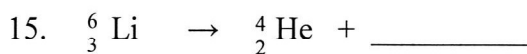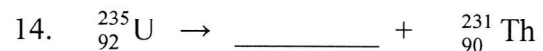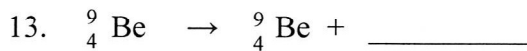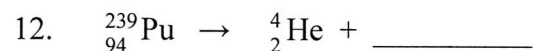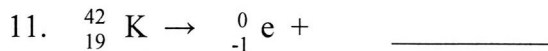
7. Least penetrating nuclear decay   _____

8. Most damaging nuclear decay to the human body   _____

9. Nuclear decay that can be stopped by skin or paper.   _____

10. Nuclear decay that can be stopped by aluminum.   _____

Complete the following nuclear equations.
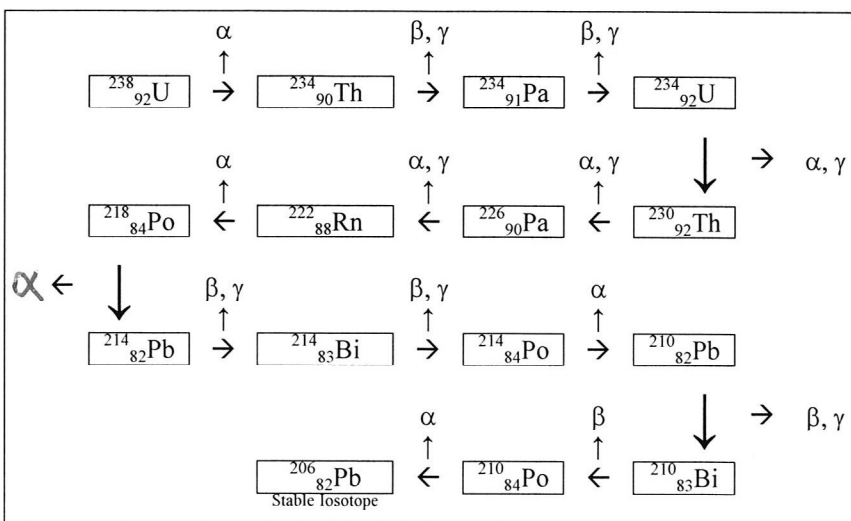
11. $_{19}^{42} K \rightarrow _{-1}^0 e +$ _____   12. $_{94}^{239} Pu \rightarrow _2^4 He +$ _____

13. $_4^9 Be \rightarrow _4^9 Be +$ _____   14. $_{92}^{235} U \rightarrow$ _____ $+ _{90}^{231} Th$

15. $_3^6 Li \rightarrow _2^4 He +$ _____   16. _____ $\rightarrow _{56}^{142} Ba + _{36}^{91} Kr + 3 _0^1 n$

Nuclear Decay Series

The figure maps the radioactive decay of uranium-238 to lead-206. Use the figure to answer the following questions.

17. How many alpha particles are produced as one atom of uranium-238 decays to an atom of lead-206?

_____

18. How many beta particles?

_____

19. Write an equation showing that when protactinium-229 goes through two alpha decays, francium-221 is formed.

20. Write the nuclear equation for the decay of Po-210 if it undergoes 2 consecutive alpha decays followed by a beta decay followed by another alpha decay.

21. The decay chain (or series) of uranium-238 is shown in the following figure. What is the *final product* in this decay series?

22. Using the figure to the right, list each type of decay that uranium-238 goes through to become lead-206.

Mass number →

											U
238											
236											
234									Th←Pa←U		
232											
230								Th			
228											
226						Ra					
224											
222				Rn							
220											
218		Po									
216											
214	Pb←Bi←Po										
212											
210	Pb←Bi←Po										
208											
206	Pb										
204											

81 82 83 84 85 86 87 88 89 90 91 92 93
Tl Pb Bi Po At Rn Fr Ra Ac Th Pa U Np
Atomic number ⟶

23. Thorium-232 undergoes radioactive decay until a stable isotope is reached. Write the reactions for the decay of Th-238. There are eleven steps beginning with Alpha decay with each product becoming the reactant of the next decay. Circle the final Stable isotope.

- Alpha: _____

- Beta: _____

- Beta: _____

- Alpha: _____

- Alpha: _____

- Alpha: _____

- Alpha: _____

- Beta: _____

- Beta: _____

- Alpha: _____

- Beta: _____

Nuclear Chemistry Worksheet_K

Directions: Identify the following as alpha, beta, gamma, or neutron.

1. $^1_0$n **neutron**   2. $^0_{-1}$e **beta**   3. $^4_2$He **alpha**   4. $^0_0\gamma$ **gamma**

5. Nuclear decay with no mass and no charge   **gamma**

6. An electron   **beta**

7. Least penetrating nuclear decay   **alpha**

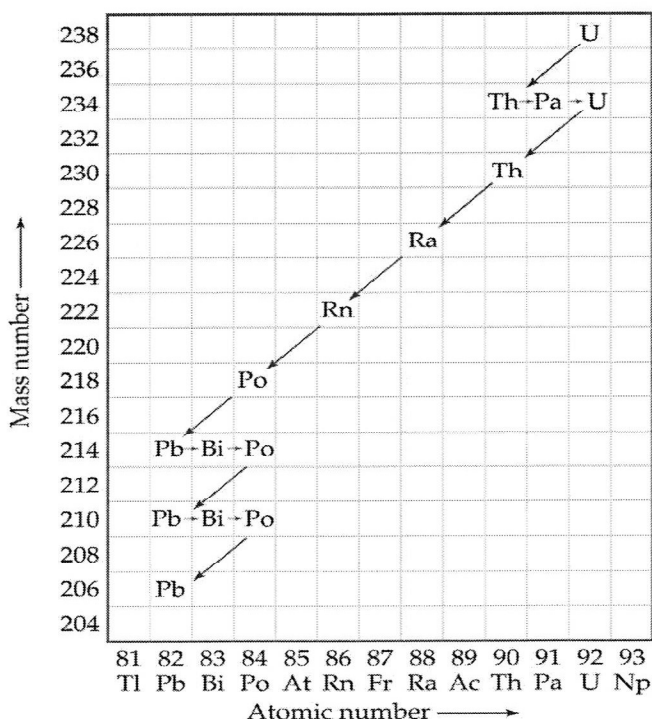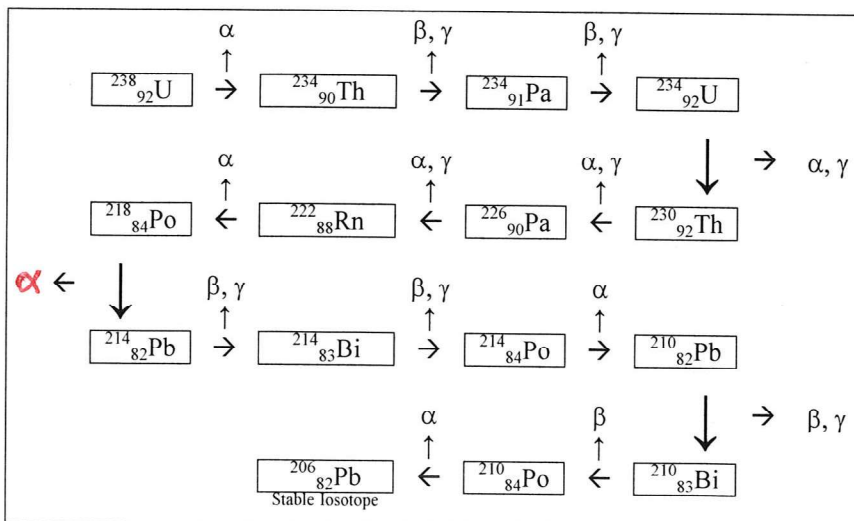8. Most damaging nuclear decay to the human body   **gamma**

9. Nuclear decay that can be stopped by skin or paper.   **alpha**

10. Nuclear decay that can be stopped by aluminum.   **beta**

Complete the following nuclear equations.

11. $^{42}_{19}$K $\rightarrow$ $^0_{-1}$e + **$^{42}_{20}$Ca**

12. $^{239}_{94}$Pu $\rightarrow$ $^4_2$He + **$^{235}_{92}$U**

13. $^9_4$Be $\rightarrow$ $^9_4$Be + **$^0_0\gamma$**

14. $^{235}_{92}$U $\rightarrow$ **$^4_2$He or $^4_2\alpha$** + $^{231}_{90}$Th

15. $^6_3$Li $\rightarrow$ $^4_2$He + **$^2_1$H**

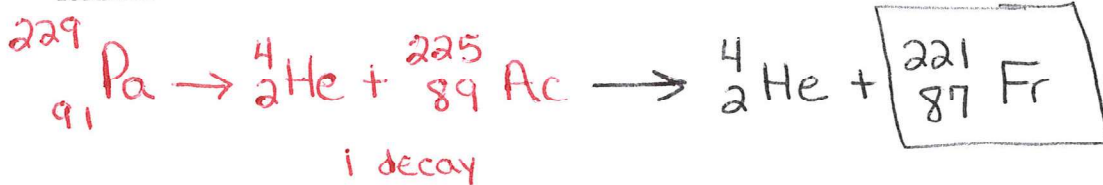16. **$^{236}_{92}$U** $\rightarrow$ $^{142}_{56}$Ba + $^{91}_{36}$Kr + 3 $^1_0$n
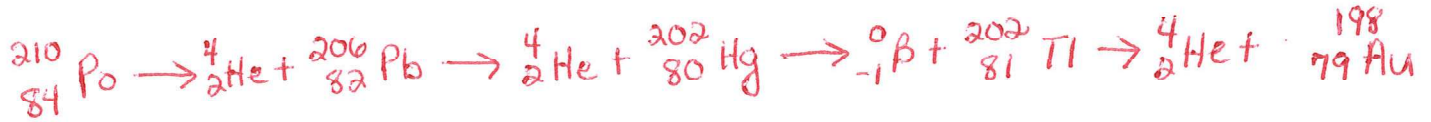
Nuclear Decay Series

The figure maps the radioactive decay of uranium-238 to lead-206. Use the figure to answer the following questions.

17. How many alpha particles are produced as one atom of uranium-238 decays to an atom of lead-206?
    8

18. How many beta particles?
    6

19. Write an equation showing that when protactinium-229 goes through two alpha decays, francium-221 is formed.

$$^{229}_{91}Pa \rightarrow ^{4}_{2}He + ^{225}_{89}Ac \rightarrow ^{4}_{2}He + \boxed{^{221}_{87}Fr}$$

1 decay

20. Write the nuclear equation for the decay of Po-210 if it undergoes 2 consecutive alpha decays followed by a beta decay followed by another alpha decay.
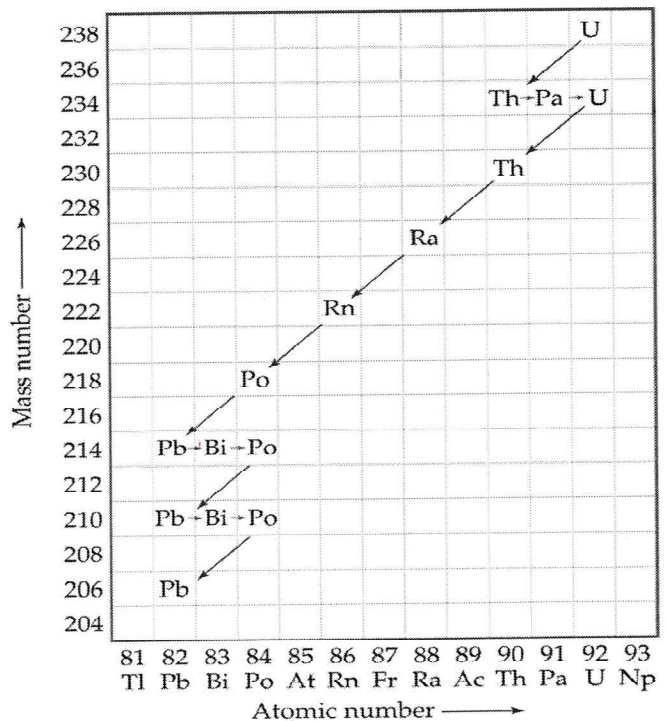
$$^{210}_{84}Po \rightarrow ^{4}_{2}He + ^{206}_{82}Pb \rightarrow ^{4}_{2}He + ^{202}_{80}Hg \rightarrow ^{0}_{-1}\beta + ^{202}_{81}Tl \rightarrow ^{4}_{2}He + ^{198}_{79}Au$$

21. The decay chain (or series) of uranium-238 is shown in the following figure. What is the **final product** in this decay series?

$$Pb - 206$$

22. Using the figure to the right, list each type of decay that uranium-238 goes through to become lead-206.

alpha → beta → beta → alpha → alpha,
↳ alpha → alpha → alpha → beta → beta,
↳ alpha → beta → beta → alpha

Mass number vs Atomic number decay series figure

23. Thorium-232 undergoes radioactive decay until a stable isotope is reached. Write the reactions for the decay of Th-238. There are eleven steps beginning with Alpha decay with each product becoming the reactant of the next decay. Circle the final Stable isotope.

- Alpha: $^{232}_{90}Th \rightarrow ^{4}_{2}He + ^{228}_{88}Ra$
- Beta: $^{228}_{88}Ra \rightarrow ^{0}_{-1}\beta + ^{228}_{89}Ac$
- Beta: $^{228}_{89}Ac \rightarrow ^{0}_{-1}\beta + ^{228}_{90}Th$
- Alpha: $^{228}_{90}Th \rightarrow ^{4}_{2}He + ^{224}_{88}Ra$
- Alpha: $^{224}_{88}Ra \rightarrow ^{4}_{2}He + ^{220}_{86}Rn$
- Alpha: $^{220}_{86}Rn \rightarrow ^{4}_{2}He + ^{216}_{84}Po$
- Alpha: $^{216}_{84}Po \rightarrow ^{4}_{2}He + ^{212}_{82}Pb$
- Beta: $^{212}_{82}Pb \rightarrow ^{0}_{-1}\beta + ^{212}_{83}Bi$
- Beta: $^{212}_{83}Bi \rightarrow ^{0}_{-1}\beta + ^{212}_{84}Po$
- Alpha: $^{212}_{84}Po \rightarrow ^{4}_{2}He + ^{208}_{82}Pb$
- Beta: $^{208}_{82}Pb \rightarrow ^{0}_{-1}\beta + ^{208}_{83}Bi$