Nuclear Chemistry Worksheet K

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

1. \( \frac{1}{0}n \)  
2. \( \frac{0}{-1}e \)  
3. \( \frac{4}{2}He \)  
4. \( \frac{0}{0}\gamma \)

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. \( \) \( _{56}^{142}Ba + _{36}^{91}Kr + 3 _{0}^{1}n \)

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.

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: 
- Beta: 
- Alpha: 
- Beta: 

Nuclear Chemistry Worksheet K

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

1. \( \frac{1}{0}n \) neutron
2. \( \frac{0}{-1}e \) beta
3. \( \frac{4}{2}He \) alpha
4. \( \frac{0}{\gamma} \) 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. \( ^{42}_{19}K \rightarrow ^{0}_{-1}e + ^{42}_{20}Ca \)
12. \( ^{239}_{94}Pu \rightarrow ^{4}_{2}He + ^{235}_{92}U \)
13. \( ^{9}_{4}Be \rightarrow ^{9}_{4}Be + \gamma \)
14. \( ^{235}_{92}U \rightarrow ^{4}_{2}He \) or \( ^{4}_{2}He + ^{231}_{90}Th \)
15. \( ^{6}_{3}Li \rightarrow ^{4}_{2}He + ^{2}_{1}H \)
16. \( ^{236}_{92}U \rightarrow ^{142}_{56}Ba + ^{91}_{36}Kr + 3 \frac{1}{0}n \)

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?

18. How many beta particles?
19. Write an equation showing that when protactinium-229 goes through two alpha decays, francium-221 is formed.

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

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.

$$^{210}_{84}\text{Po} \rightarrow \frac{4}{2}\text{He} + \frac{206}{82}\text{Pb} \rightarrow \frac{4}{2}\text{He} + \frac{202}{80}\text{Hg} \rightarrow _{-1}^{0}\beta + \frac{202}{81}\text{Tl} \rightarrow \frac{4}{2}\text{He} + \frac{198}{79}\text{Au}$$

21. The decay chain (or series) of uranium-238 is shown in the following figure. What is the \textit{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.

alpha \rightarrow beta \rightarrow beta \rightarrow alpha \rightarrow alpha

alpha \rightarrow alpha \rightarrow alpha \rightarrow beta \rightarrow beta

alpha \rightarrow beta \rightarrow beta \rightarrow alpha

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: $$^{232}_{90}\text{Th} \rightarrow \frac{4}{2}\text{He} + \frac{228}{88}\text{Ra}$$
- Beta: $$^{228}_{88}\text{Ra} \rightarrow _{-1}^{0}\beta + \frac{228}{86}\text{Ac}$$
- Beta: $$^{228}_{86}\text{Ac} \rightarrow _{-1}^{0}\beta + \frac{228}{84}\text{Th}$$
- Alpha: $$^{228}_{84}\text{Th} \rightarrow \frac{4}{2}\text{He} + \frac{224}{83}\text{Ra}$$
- Alpha: $$^{224}_{83}\text{Ra} \rightarrow \frac{4}{2}\text{He} + \frac{220}{82}\text{Rn}$$
- Alpha: $$^{220}_{82}\text{Rn} \rightarrow \frac{4}{2}\text{He} + \frac{216}{80}\text{Po}$$
- Alpha: $$^{216}_{80}\text{Po} \rightarrow \frac{4}{2}\text{He} + \frac{212}{78}\text{Pb}$$
- Beta: $$^{212}_{78}\text{Pb} \rightarrow _{-1}^{0}\beta + \frac{212}{79}\text{Bi}$$
- Beta: $$^{212}_{79}\text{Bi} \rightarrow _{-1}^{0}\beta + \frac{208}{80}\text{Pb}$$
- Alpha: $$^{208}_{80}\text{Pb} \rightarrow \frac{4}{2}\text{He} + \frac{204}{78}\text{Pb}$$
- Beta: $$^{204}_{78}\text{Pb} \rightarrow _{-1}^{0}\beta + \frac{204}{79}\text{Bi}$$
Scientific Method and Observation Worksheet

While performing experiments scientists must rely on making specific observations. Observations are based on information gained directly from our senses, what we see, hear, taste, touch or smell, or extensions of these senses with scientific tools such as microscopes, scales, thermometers, pH meters and so on. Based on these observations scientists must make judgments or decisions about what they are studying. Observations can be either of a qualitative or quantitative nature. Quantitative observations deal with numerical measurements or counts while qualitative observations deal with qualities such as color, type of material, smells, shapes etc.

For the following list determine if they are A: quantitative or B: qualitative observations.

1. _____ The ball has a mass of 587.8 grams.
2. _____ The lady is 154.5 cm tall.
3. _____ The ball is made of plastic.
4. _____ The object smells like apples.
5. _____ The box has twelve corners.
6. _____ The liquid is at 39 degrees C.
7. _____ The coin appears round.
8. _____ The ball has a mass of 875.2 grams.
9. _____ The ice rink is flat.
10. _____ The soccer ball has three colors.

11. List the five steps of the scientific method.

   a.
   b.
   c.
   d.
   e.

12. Number the following in order, according to the Scientific Method.

   a. _____ your watch stopped
   b. _____ you put the watch in the oven to dry
   c. _____ you decide the likely cause is that water got into the watch
   d. _____ the watch works, it must have been wet
   e. _____ you call the jeweler to help figure out what happened