

**CHEMISTRY 101 - WORKSHEET**  
**DISCOVERING THE SECRETS OF THE NUCLEUS**

1. Using the form  ${}^A_ZX$ , give the symbol for each of the following

- |                        |       |                |       |
|------------------------|-------|----------------|-------|
| a. an alpha particle   | _____ | e. uranium-235 | _____ |
| b. a beta (-) particle | _____ | f. a proton    | _____ |
| c. a gamma             | _____ | g. a neutron   | _____ |
| d. carbon-14           | _____ | h. a positron  | _____ |

2. Write a nuclear equation for each of the following processes

- a. the alpha decay of Uranium-238
- b. the beta decay (negatron) of Cobalt-60
- c. the gamma decay of Krypton-81

3. Complete the following nuclear equations

- a.  ${}^{234}\text{Pa} \rightarrow {}^{234}\text{U} + \text{_____}$
- b.  ${}^{214}\text{Po} \rightarrow \alpha + \text{_____}$
- c.  ${}^{154}\text{Sm} + n \rightarrow 2n + \text{_____}$
- d.  ${}^{106}\text{Pd} + \alpha \rightarrow \text{_____} + p$

## Nuclear Decay Worksheet

Write an equation for the following elements through the given emission type.

### **Alpha Decay:**

Polonium-218

Polonium-214

Polonium-210

Radium-224

Radium-220

Radon-220

Radon-219

### **Beta Decay:**

Lead-210

Lead-214

Bismuth-210

Bismuth-212

Bismuth-214

Name the type of emission and write equation:

Uranium-234 to Thorium-230

Thorium-230 to Radium-226

Radium-226 to Radon-222

Radon-222 to Polonium-218

Polonium-218 to Lead-214

Lead-214 to Bismuth-214

Bismuth-214 to Polonium-214

Polonium-214 to Lead-210

Lead-210 to Bismuth-210

Bismuth-210 to Polonium-210

Polonium-210 to Lead-206

Look at these eleven steps, what is this sequence called?

## Worksheet- Nuclear Decay

1. Instructions: Fill in the table below for each type of decay- alpha (α), beta (β), and gamma (γ)

Parent Isotope	Particle emitted	New, Daughter isotope	Alpha, Beta, or gamma Decay?	# of protons lost or gained by "parent"	Change in mass number
a. ${}_{88}^{226}\text{Ra} \rightarrow$	${}_{2}^{4}\text{He} +$	${}_{86}^{222}\text{Rn}$	Alpha	Lost 2	minus 4
b. ${}_{84}^{214}\text{Po} \rightarrow$	${}_{2}^{4}\text{He} +$	${}_{82}^{210}\text{Pb}$			
c. ${}_{20}^{47}\text{Ca} \rightarrow$	${}_{-1}^{0}\text{e}^{-} +$	${}_{21}^{47}\text{Sc}$			
d. ${}_{64}^{148}\text{Gd} \rightarrow$	${}_{2}^{4}\text{He} +$	${}_{62}^{144}\text{Sm}$			
e. ${}_{6}^{14}\text{C} \rightarrow$	${}_{-1}^{0}\text{e}^{-} +$	${}_{7}^{14}\text{N}$			
f. ${}_{64}^{148}\text{Gd} \rightarrow$	${}_{0}^{0}\text{Y} +$	${}_{64}^{148}\text{Gd}$			

2. What changes take place in the nucleus when an alpha particle is emitted?

3. What is the identity of an alpha particle?

4. What changes take place in the nucleus when a beta particle is emitted?

5. Which particle is associated with beta decay?

6. Fill in the missing parts of these nuclear reactions: (numbers & elements)

a) ${}_{\quad}^{40}\text{---} \rightarrow$	${}_{-1}^{0}\text{e} +$	${}_{20}^{40}\text{Ca}$	b) $\text{---} \rightarrow$	${}_{2}^{4}\text{He} +$	${}_{88}^{226}\text{Ra}$	c) ${}_{14}^{35}\text{Si} \rightarrow$	${}_{-1}^{0}\text{e} +$	$\text{---}$	
d) ${}_{92}^{238}\text{U} \rightarrow$	${}_{2}^{4}\text{He} +$	$\text{---}$	e) ${}_{53}^{110}\text{I} \rightarrow$	$\text{---} +$	${}_{51}^{106}\text{Sb} +$	${}_{0}^{0}\text{Y}$	f) ${}_{56}^{140}\text{Ba} \rightarrow$	$\text{---} +$	${}_{57}^{140}\text{La}$

7. Write equations for: a) The alpha (α) decay of radon-198  $\text{---} \rightarrow \text{---} + \text{---}$

b) The beta (β) decay of uranium-237  $\text{---} \rightarrow \text{---} + \text{---}$

c) Plutonium-244 undergoes gamma decay  $\text{---} \rightarrow \text{---} + \text{---}$

9. Does the identity of an atom change during radioactive decay? Why or why not?

10. How does the "Law of Conservation of Matter" explain how you write nuclear equations?

11. List the 3 types of radiation (α, β, γ) in order from least penetrating to most penetrating.

12. Why would you expect alpha particles to be less able to penetrate materials than beta?

13. Why are alpha particles and beta particles deflected in opposite directions in an electric field? Why are gamma rays not deflected?