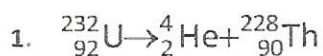


## Decay Practice Worksheet #1

### Types of Decay Reactions

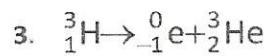
State whether each of the following decay reactions is alpha, beta, or gamma decay.



alpha



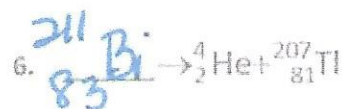
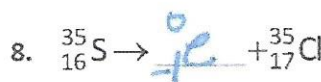
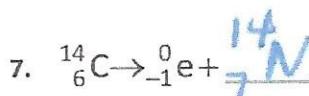
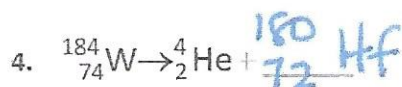
beta



beta

### Balancing Decay Reactions

Fill in the blank in each of the following decay reactions with the correct decay particle or decayed nucleus that will balance the decay reaction, and also state whether it is alpha or beta decay.



### Writing Balanced Decay Reactions

Write the balanced decay reaction formula when each of the following radioactive isotopes decays in the manner stated.



### Predicting Decay Products

14. What is the name of the product isotope formed when Radon-222 decays by alpha decay?



15. What is the name of the product isotope formed when Thorium-234 decays by beta decay?



## Radioactive Decay Worksheet #2

### Isotopes

1. For atoms of the two different isotopes Lithium-6 and Lithium-7...
  - a. ...they must have the same number of what type of subatomic particle?  
*protons*
  - b. ...they must have different numbers of what type of subatomic particle?  
*neutrons*

2. For each of the following isotopes, write in any missing information about that particular isotope.

Name	Oxygen-15	$^{58}_{28}\text{Ni}$	Zirconium- <u>90</u>	Argon- <u>40</u>	<u>Fluorine-19</u>	<u>Zinc - 64</u>
# of protons	<u>8</u>	<u>28</u>	<u>40</u>	<u>18</u>	9	30
# of neutrons	<u>7</u>	<u>30</u>	50	22	10	34

3. Potassium (K) has three naturally-occurring isotopes, Potassium-39, Potassium-40, and Potassium-41. Using a periodic table, which isotope do you think is the most abundant in nature?

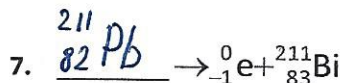
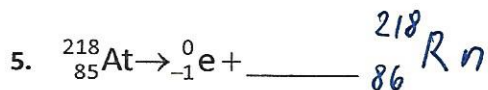
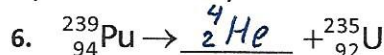
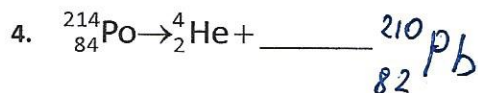
*Potassium - 39*

What leads you to this conclusion?

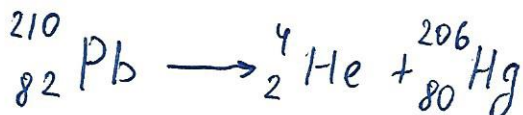
*Atomic mass in periodic table closest to 39*

### Decay Reactions

Fill in the blank in each of the following decay reactions with the correct decay particle or decayed nucleus that will balance the decay reaction, and also state whether it is alpha or beta decay.



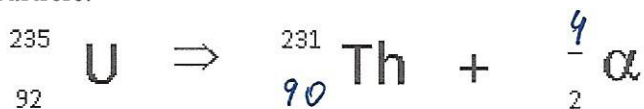
8. Write out the decay reaction for a nucleus of Lead-210 decaying by alpha decay.



9. Why do some elements have more than one mass number?

They have isotops

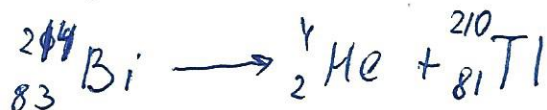
10. Complete the equation shown below for an isotope of Uranium emitting an alpha particle.



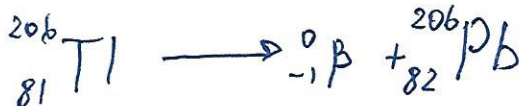
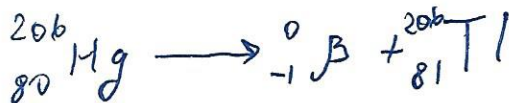
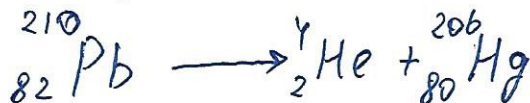
11. When radium emits an alpha particle it forms radon. Write a symbol equation to show this.



12. Write a symbol equation showing what happens when an isotope of Bismuth-214 emits a beta particle.



13. Lead 206 is a stable isotope of lead. Show how, with three decays, Lead 206 can be formed by lead 210.



Alpha, beta, gamma decay worksheet

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 1) Alpha rays can penetrate 1)   B    
A) several millimeters of aluminum.  
B) few millimeters of air.  
C) a piece of paper.  
D) several centimeters of lead.
- 2) Beta rays can penetrate 2)   D    
A) several centimeters of lead.  
B) air only.  
C) a piece of paper.  
D) several millimeters of aluminum.
- 3) Gamma rays can penetrate 3)   C    
A) a piece of paper.  
B) several millimeters of aluminum.  
C) several centimeters of lead.  
D) air only.
- 4) An  $\alpha$  particle is also known as 4)   D    
A) an electron. B) a photon.  
C) a positron. D) a helium nucleus.
- 5) A  $\beta^-$  particle is also known as 5)   A    
A) an electron. B) a helium nucleus.  
C) a positron. D) a photon.
- 6) A  $\beta^+$  particle is also known as 6)   B    
A) an electron. B) a positron.  
C) a photon. D) a helium nucleus.
- 7) A gamma ray is also known as 7)   B    
A) a helium nucleus. B) a photon.  
C) an electron. D) a positron.
- 8) Alpha particles have an atomic mass equal to 8)   C    
A) 2. B) 1. C) 4. D) 6.
- 9) When an alpha particle is emitted from an unstable nucleus, the atomic mass number of the nucleus 9)   D    
A) increases by 4. B) decreases by 2.  
C) increases by 2. D) decreases by 4.
- 10) In beta decay 10)   A    
A) an electron is emitted.  
B) a neutron is emitted.  
C) a proton is emitted.  
D) an electron decays into another particle.

11) During  $\beta$  decay 11)   D  

- A) a proton is ejected from the nucleus.
- B) a neutron is ejected from the nucleus.
- C) a proton is transformed to a neutron.
- D) a neutron is transformed to a proton.

12) During positron decay 12)   C  

- A) a neutron is ejected from the nucleus.
- B) a neutron is transformed to a proton.
- C) a proton is transformed to a neutron.
- D) a proton is ejected from the nucleus.

13) When a  $\beta$  particle is emitted from an unstable nucleus, the atomic number of the nucleus 13)   B  

- A) does not change. B) increases by 1.
- C) decreases by 1. D) none of the given answers

14) When a positron particle is emitted from an unstable nucleus, the atomic number of the nucleus 14)   A  

- A) decreases by 1. B) does not change.
- C) increases by 1. D) none of the given answers

15) When a gamma ray is emitted from an unstable nucleus, 15)   B  

- A) the number of neutrons drops by one and the number of protons increases by one.
- B) there is no change in either the number of neutrons or the number of protons.
- C) the number of neutrons and the number of protons drop by two.
- D) none of the given answers

16) An element with atomic number 88 goes through alpha decay. Its atomic number is now 16)   C  

- A) 84. B) 88. C) 86. D) 80.

17) An atom has 98 protons and 249 nucleons. If it undergoes alpha decay, what are the number of protons and neutrons, respectively, in the daughter nucleus? 17)   B  

- A) 100, 249 B) 96, 245 C) 100, 245 D) 94, 247

18) An element with atomic number 6 undergoes  $\beta^+$  decay. Its atomic number is now

18)   C  

- A) 6. B) 2. C) 5. D) 7.

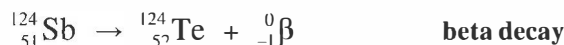
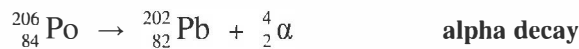
# Writing Nuclear Equations

Name \_\_\_\_\_

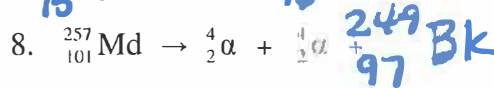
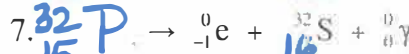
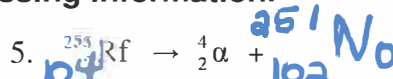
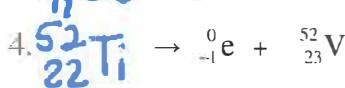
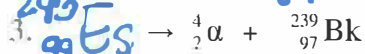
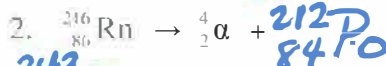
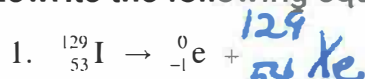
In the early 1900s scientists discovered that various isotopes will undergo nuclear decay. During this process the unstable nucleus of an atom gives off radiation. When scientists studied this radiation they discovered three types of particles: alpha, beta, and gamma. The **alpha particle** is composed of two protons and two neutrons, so it has a mass of 4 amu and a charge of 2+. A **beta particle** is a high energy electron emitted from the nucleus. A **gamma ray** often accompanies the other decay processes. Gamma radiation has no charge and no mass.

Radiation Type	Symbol	Mass (amu)	Charge
Alpha	${}^4_2\text{He}$ or ${}^4_2\alpha$	4	2+
Beta	${}^0_{-1}\text{e}$ or ${}^0_{-1}\beta$	$\frac{1}{1840}$	1-
Gamma	${}^0_0\gamma$	0	0

Equations can be written to show how a nucleus changes during a nuclear decay process. With these nuclear equations we track the atomic number and the mass number. For this reason it is important to correctly write the symbols for each particle involved. A nuclear equation is written for an alpha decay and a beta decay below. Notice that the sum of the atomic numbers is equal on both sides of the arrow. The sum of the mass numbers is also the same on both sides.



Rewrite the following equations. Fill in all the missing information.



Write nuclear equations that describe the following processes.

- Uranium-235 undergoes an alpha decay to produce thorium-231.
- Lanthanum -144 becomes cerium-144 when it undergoes a beta decay.
- Neptunium-233 is formed when americium-237 undergoes a nuclear decay process.
- When protactinium-229 goes through two alpha decays, francium-221 is formed.
- Uranium-238 undergoes an alpha decay and produces two gamma rays.
- The neon-22 nucleus is formed when an element undergoes a beta decay.
- Samarium-146 is produced when an element undergoes an alpha decay.
- The beta decay of dysprosium-165 creates a new element.

Answer the following questions. Include the mass number when naming isotopes.

- What atom produces scandium-47 when it goes through a beta decay?
- What new element is formed when curium-244 emits two alpha particles and three gamma rays?

