Chapter 10 Nuclear Changes
Guided Notes

The Discovery of Radioactivity

- What is Radiation?
  -
- Where does radiation come from?
  - The _____ (solar) or _____ of the elements (_____).
  - Produced when particles _____ or _____

Radioactivity

- This is the process of _____ and _____ and _____
- Nuclei with more than _____ are radioactive.
- They are _____, so they _____
- Release 3 _____ types of radiation

Isotopes

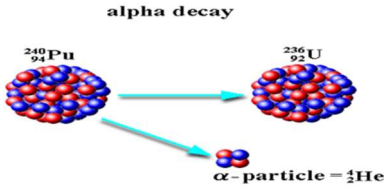
- Two or more varieties of an element having the same number of protons but different number of _____.
- Certain isotopes are "_____" and _____to lighter isotopes or different _____.

Nuclear Radiation

- When an _____ decays, particles and energy called _____ are emitted from it.

Radiation Type	Form	Symbol	Mass (kg)	Charge

Alpha Particles

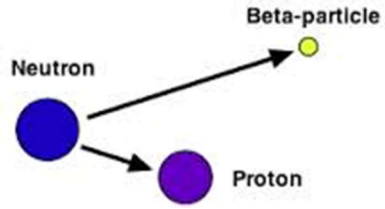


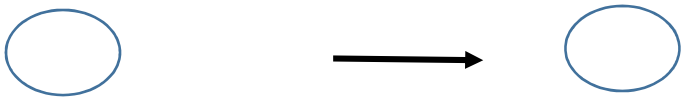
- Emitted from the decaying _____.
- Made of _____ and _____
- Alpha particle =_____
- Electric charge of _____
- Atomic mass of _____
  - New element: decreases the atomic number by 2 and the mass number by 4
- Much more _____compared to others
- Most _____.
- The _____ form of nuclear radiation.
- Can be stopped by a _____.

EX: 

Beta Particles

- A _____ decays into a _____
- Emits a _____ (beta particle).
- May be positively charged (+), _____
- Not as massive as alpha particles, so they can pass through _____



Ex: 

What happens to the element after this reaction?

What happens to the mass of the element after this reaction?

Practice Problems: Identify the type of Reaction

A. $^{234}_{90}\mathrm{Th} \rightarrow {}^{234}_{91}\mathrm{Pa} + {}^{0}_{-1}\mathrm{e}$ _____

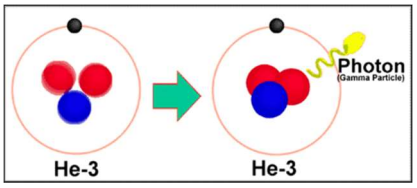
B. $^{222}_{88}\mathrm{Ra} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{218}_{86}\mathrm{Rn}$ _____

C. $^{230}_{90}\mathrm{Th} \rightarrow {}^{4}_{2}\mathrm{He} + {}^{226}_{88}\mathrm{Ra}$ _____

D. $^{38}_{19}\mathrm{K} \rightarrow {}^{38}_{18}\mathrm{Ar} + {}^{0}_{+1}\mathrm{e}$ _____

Gamma Rays

- _____ is electromagnetic radiation.
- The nuclear structure stays the same, it simply represents a _____
- Happens in conjunction with _____ emissions. Rather than emit another particle, excess _____ is given off in gamma rays.
- Gamma Ray=_____
- They have _____ and no charge and travel at the speed of light.
- The most penetrating form of nuclear radiation.
- _____and _____, are required to stop gamma rays.

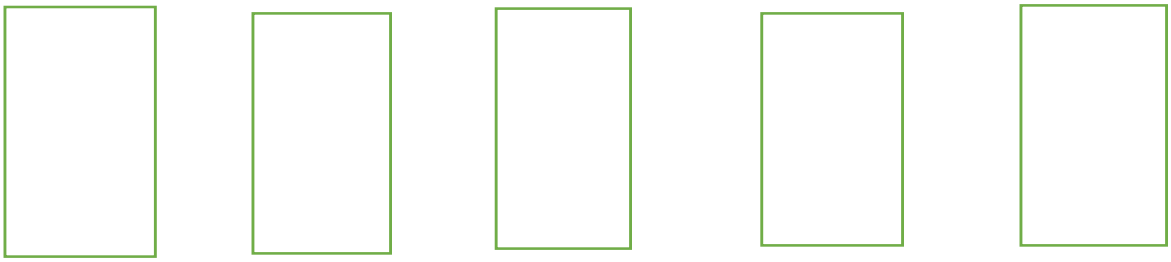


Transmutation

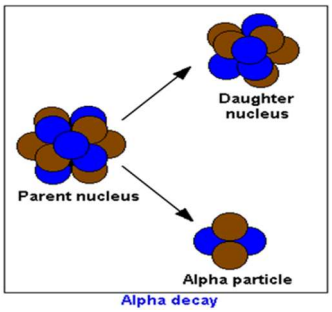
- Transmutation is the process of _____ to _____through nuclear decay.

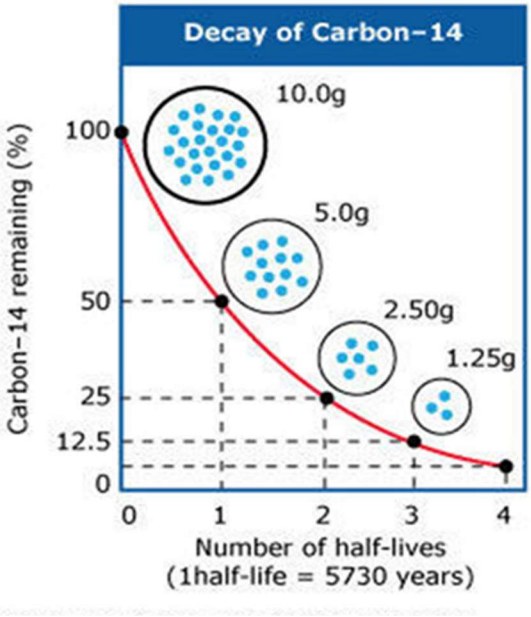
Radioactive Decay Rates

- Half-Live
  - The "half-life" (h) is the _____ it takes for _____ of a radioactive substance to _____.
    Example: Half-life of Radon_____



- The nucleus left after the isotope decays is called the _____.

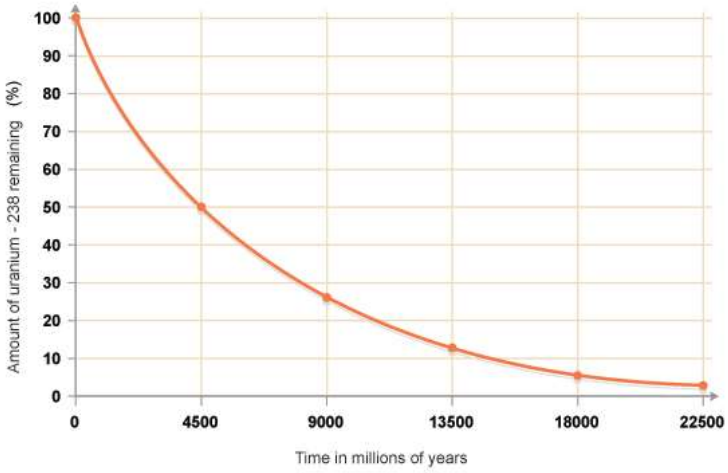




- Half-lives _____ the radioactive isotopes.

Use the chart on the right to answer the following questions.

1. How many half-lives does it take for Uranium-238 to decay to only 12.5%?
2. How long did it take for Uranium-238 to decay to 6.25%?
3. How much Uranium-238 is still left over after 4500 million years?
4. In fraction form, how much of the original sample of Uranium-238 is still left over after 22,500 million years?



Half-Life Math Problems

- For example, suppose we had 20,000 atoms of a radioactive substance. If the half-life is 1 hour, how many atoms of that substance would be left after:

Radioactive Half-Life Practice Problems

1. How many grams of iodine 131 (half life- 5 days) would be left after 20 days if you start with 25 grams?

The half life is			
Number of half-lives passed	**Amount of Matter**		**Time**
	Started with		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		

2. How long will it take 600 grams of Plutonium 239 (half life 24,000 years) to decay to 18.75 grams?

The half life is			
Number of half-lives passed	**Amount of Matter**		**Time**
	Started with		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		

3. K-42 has a half-life of 15.5 hrs. If 13.125g of K-42 remains undecayed after 62.0 hours, what was the original sample size?

The half life is			
Number of half-lives passed	**Amount of Matter**		**Time**
	Started with		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		
	How Much is left		

Half-Life Calculations Problems

1. Thallium-208 has a half-life of 3 min. How long will it take for 120.0 g to decay to 7.50 g?

2. An isotope of cesium (cesium-137 has a half - life of 30 years. If 20 mg of cesium-137 disintegrates over a period of 90 years, how many mg of cesium-137 would remain?

3. If 60 g of Lithium-9 has a half-life of 100 years, how long will it take for lithium-9 to decay to 15 g?

4. You have 400 mg of a radioisotope with a half-life of 5 minutes. How much will be left after 30 minutes?

5. Suppose you have a 100 mg sample of Au-191, which has a half-life of 3.4 hours. How much will remain after 10.2 hours?

6. Cobalt-60 is a radioactive isotope used in cancer treatment. Co-60 has a half-life of 5 years. If a hospital starts with a 1000 mg supply, how many mg will need to be purchased after 10 years to replenish the original supply?

7. A radioisotope has a half-life of 1 hour. If you began with a 100 g sample of the element at noon, how much remains at 3 PM? At 6 PM? At 10 PM?

8. How many half-lives have passed if 255 g of Co-60 remain from a sample of 8160 g?

9. Suppose you have a sample containing 400 nuclei of a radioisotope. If only 25 nuclei remain after one hour, what is the half-life of the isotope?

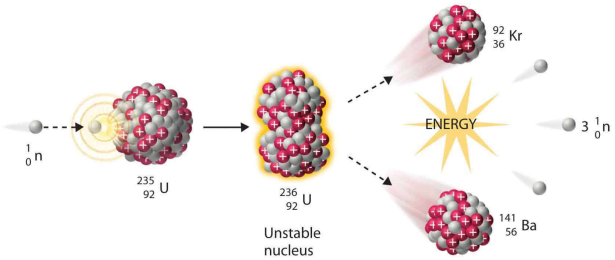
10. If a radioactive element has diminished by 7/8 of its original amount in 30 seconds, what is its half-life?

Nuclear Forces

- The _____ of a nucleus depends on the nuclear _____ the protons and neutrons (_____) together.
- The number of _____determines the _____ of the nucleus. If it has _____, the nucleus becomes _____.

Nuclear Fission

- _____ of atom into two or more smaller fragments, _____ and _____
- Scientists bombard a _____ with _____
- Releases large amounts of _____ and _____
- Nuclear chain reaction - the _____ _____ of nuclear fission due to neutrons dividing other nucleus from the same sample.



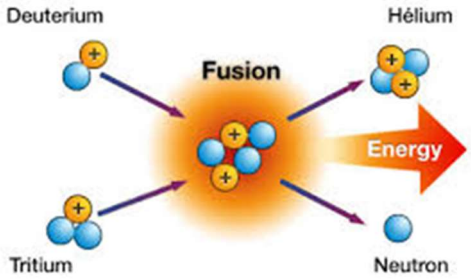
Uses/Issues of Nuclear Fission

- The chain reaction principle is used in the _____.
- Energy produced from fission is used to provide _____ energy to millions of _____ and _____
- High levels of exposure cause _____
- Radiation _____

Nuclear Fusion

- Two or more _____ combining to form a nucleus of _____
- Produces even _____amount of _____than _____.
- Occurs in _____ and other _____.
- Why aren't we using Fusion instead of Fission?

- Nuclear Reactors
  - Not yet _____



Fission	Fusion
1._____ is limited 2.danger of _____ 3.toxic waste 4. _____ pollution	1.fuel is abundant (_____) 2. no _____ of meltdown 3. no toxic waste (_____) 4. not yet sustainable