

Chapter 10 – Nuclear Chemistry

Section 10.1 – Radioactivity

- _____ is the process in which an _____ atomic nucleus emits _____.
 - Any atom containing an _____ nucleus is called a _____, or _____ for short.
 - During _____, atoms of one _____ can change into atoms of a _____ element all together.
 - _____ is charged particles and _____ that are emitted from the _____ of radioisotopes.
 - Common types of nuclear radiation include _____.
 - An _____ is a positively charged particle made up of _____ and two neutrons – the same as a _____ nucleus.
 - It has a _____ charge and the common symbol for the alpha particle is _____.
 - _____ particles are the _____ penetrating type of nuclear _____.
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- In the equation above, the _____ on the left (238) equals the _____ of the _____ on the right (234 + 4).
 - Also, the _____ on the left (92) equals the _____ of the _____ on the right (90 + 2).
 - A _____ is an _____ emitted by an unstable _____.
 - In nuclear reactions, a _____ is written as _____ and it has a charge of _____.
 - During a _____, a _____ decomposes into a _____ and an _____. The proton stays trapped in the nucleus while the _____ is _____.
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- Again the _____ and the _____ are the same on _____ of the equation.
 - _____ particles are _____ penetrating than _____ particles.

- A _____ is a penetrating ray of _____ emitted by an _____ nucleus.
 - _____ radiation has no _____ and no _____.
 - During _____ radiation, the _____ and _____ of the atom remain the _____, but the _____ of the nucleus decreases. It often accompanies _____ decay.
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- _____ are _____ penetrating than either _____ particles.

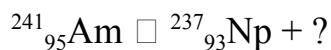
Radiation Type	Abbreviation	Symbol	Charge	Mass

Sample Problem

- Write a balanced nuclear equation for the alpha decay of polonium – 210.

Practice Problems

1. Write a balanced nuclear equation for the alpha decay of thorium – 232.
2. Write a balanced nuclear equation for the beta decay of carbon – 14.
3. What type of decay is in the following reaction?



4. What type of decay is in the following reaction?



- _____ that occurs _____ in the environment is called _____.
- When nuclear radiation _____ background levels, it can damage the _____ of your body.

- Nuclear radiation can _____.
- _____ that are used to _____ nuclear radiation include _____.

Section 10.1 Assessment

1. How does an element change during nuclear decay?
2. What are three types of nuclear radiation?
3. How are atoms affected by nuclear radiation?
4. What devices can be used to detect nuclear radiation?
5. How do types of nuclear radiation differ in electric charge?
6. Describe the penetrating power of each common type of radiation.
7. What is background radiation?
8. What is the effect of beta decay on the composition of the nucleus?
9. Write the balanced nuclear equation for the alpha decay of radium – 226.
10. Fill in the reactant for the following nuclear reaction. $?\square\ ^3_2\text{He} + ^0_{-1}\text{e}$

Section 10.2 – Rates of Nuclear Decay

- Every _____ decays at a specific _____ that can be expressed as a _____.
- A _____ is the time required for _____ of a sample of a radioisotope to _____.

- After _____, half of the atoms in a radioactive sample have _____, while the other _____ remain unchanged.
- Unlike _____ rates, which vary with the _____ of a reaction, _____ rates are _____.
- To calculate the _____, you use the following _____.
- # of half lives =

Sample Problem

- Suppose you have a 1 gram sample of iridium – 182, which undergoes beta decay with a half-life of 15 minutes. After 45 minutes, how much iridium – 182 will remain in the sample?
- In _____, the age of an object is determined by comparing the object's _____ levels with carbon-14 levels in the _____.
- Because atmospheric levels of _____ can _____ over time, the calculated age of a _____ is not totally accurate.
- To get a more accurate _____, scientists compare the _____ levels in a sample to carbon-14 levels in objects of _____ age.
- Objects older than _____ contain too little carbon-14 to be _____.

Section 10.2 Assessment

1. How are nuclear decay rates different from chemical reaction rates?
2. How can scientists determine the age of an object that contains carbon-14?
3. If a radioactive sample has decayed until only one eighth of the original sample remains unchanged, how many half-lives have elapsed?
4. A certain isotope of technetium has a half-life of six hours. If it is given to a patient as part of a medical procedure, what fraction of the radioisotope remains in the body after one day?

5. Can radiocarbon dating be used to determine the age of dinosaur fossils?

Section 10.4 – Fission and Fusion

- _____ is energy released by _____.
- The _____ is the attractive force that binds _____ together in the nucleus.
- Over very _____ distances, the strong nuclear force is much greater than the electric forces among _____.
- The greater the number of _____ in a nucleus, the _____ the electric force that _____ those protons.
- All _____ with more than _____ are radioactive.
- _____ is the _____ of an atomic nucleus into two _____.
- In nuclear _____, tremendous amounts of _____ can be produced from very small amounts of _____.
- _____ is a process in which the _____ of two atoms combine to form a _____.
- As in _____, during _____ a small fraction of the reactant _____ is converted to _____.
- The _____ and other stars are powered by the _____ of _____.
- _____ requires extremely high _____.
- _____ is a state of matter in which _____ have been stripped of their _____.

Section 10.4 Assessment

1. Under what conditions does the strong nuclear force overcome the repulsive effect of electric forces in the nucleus?
2. What property of fission makes it a useful reaction?
3. What particles are affected by strong nuclear forces?
4. How does the products of a fusion reaction differ from the products of a fission reaction?