

## Chapter 18- Radioactivity and Nuclear Reactions

### I. Radioactivity

- A. The nucleus of an atom is composed of protons and neutrons which comprise most of the atom's mass.
- B. The strong force causes protons and neutrons to be attracted to each other in the nucleus.
  - 1. The strong force is powerful only when neutrons and protons are closely packed together.
  - 2. The protons and neutrons in a large nucleus are held less tightly by the strong force than protons and neutrons in a small nucleus.
- C. Radioactivity—nuclear decay which happens when the strong force is not large enough to hold the nucleus together; the nucleus gives off matter and energy.
  - 1. Isotopes are atoms of the same element with varying numbers of neutrons.
  - 2. A nucleus with too many or too few neutrons compared to protons is radioactive.
  - 3. Atomic number—number of protons in an atom
  - 4. Mass number—number of protons and neutrons in a nucleus
- D. Uranium radioactivity was discovered in 1896 by Henri Becquerel; Marie and Pierre Curie discovered the radioactive elements polonium and radium in 1898.

### II. Nuclear Decay

- A. Nuclear radiation—particles and energy are released from a decaying nucleus.
- B. Alpha particle—two protons and two neutrons with an electric charge of +2
  - 1. Alpha particles leave charged ions in their path when they travel through matter.
  - 2. Alpha particles are the least penetrating form of nuclear radiation.
  - 3. Alpha particles can cause serious biological damage.
- C. Beta particle—neutron decays into a proton and releases an electron at high speed; more penetrating than alpha particles
- D. Gamma ray—penetrating electromagnetic waves that carry energy, but have no mass or charge
- E. Transmutation—process of one element's changing to another through nuclear decay
- F. The half-life of a radioactive isotope is the length of time it takes half the nucleus to decay; half-lives vary from fractions of a second to billions of years.
- G. Carbon dating can be used to date once-living materials while uranium dating can be used to date rocks.

### III. Detecting Radioactivity

- A. Radiation detectors are instruments used to identify ions formed when radiation passes through matter.
  - 1. A cloud chamber detects alpha or beta particles by means of a trail of condensed vapor.
  - 2. A bubble chamber detects radioactive particles by means of a bubble trail in a superheated liquid.
  - 3. Electroscopes can measure charged particles in the air.
- B. A Geiger counter measures radioactivity by producing an electric current when radiation is present.
- C. Background radiation comes from radon gas produced in the Earth's crust, from cosmic rays, and from radioactive isotopes in the body.

# Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key

**Ralph Thomas Myers**



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*Radiochemistry and Radiation Chemistry Symposium, the Institute of Science, Bombay, December 12-16, 1983 ,1983*

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## **Table of Contents Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key**

1. Understanding the eBook Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  - The Rise of Digital Reading Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  - Advantages of eBooks Over Traditional Books
2. Identifying Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  - User-Friendly Interface
4. Exploring eBook Recommendations from Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key

- Personalized Recommendations
  - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key User Reviews and Ratings
  - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key and Bestseller Lists
5. Accessing Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key Free and Paid eBooks
    - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key Public Domain eBooks
    - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key eBook Subscription Services
    - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key Budget-Friendly Options
  6. Navigating Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key eBook Formats
    - ePub, PDF, MOBI, and More
    - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key Compatibility with Devices
    - Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key Enhanced eBook Features
  7. Enhancing Your Reading Experience
    - Adjustable Fonts and Text Sizes of Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Highlighting and Note-Taking Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Interactive Elements Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  8. Staying Engaged with Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Joining Online Reading Communities
    - Participating in Virtual Book Clubs
    - Following Authors and Publishers Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  9. Balancing eBooks and Physical Books Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Benefits of a Digital Library
    - Creating a Diverse Reading Collection Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
  10. Overcoming Reading Challenges
    - Dealing with Digital Eye Strain
    - Minimizing Distractions
    - Managing Screen Time
  11. Cultivating a Reading Routine Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Setting Reading Goals Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
    - Carving Out Dedicated Reading Time
  12. Sourcing Reliable Information of Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key

- Fact-Checking eBook Content of Chapter 18 Overview Radioactivity And Nuclear Reactions Answer Key
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends
  - Integration of Multimedia Elements
  - Interactive and Gamified eBooks

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