Radioactivity and Half-Life

Integrated Science 1

9/24/13

- What are some effects of radiation?

Radioactivity

- An unstable atomic nucleus emits a form of radiation (alpha, beta, or gamma) to become stable.
- In other words, the nucleus decays into a different atom.

Radioactivity

- Alpha Particle – Helium nucleus
- Beta Particle – electron
- Gamma Ray – high-energy photon

Half-Life

- Amount of time it takes for one half of a sample of radioactive atoms to decay

Medical Applications of Half-Life

Nuclide	Half-Life	Area of Body
I–131	8.1 days	Thyroid
Fe–59	45.1 days	Red Blood Cells
Sr–87	2.8 hours	Bones
Tc–99	6.0 hours	Heart
Na–24	14.8 hours	Circulatory System

Half-Life Calculation #1

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

Half-Life Calculation #2

- 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?

Half-Life Calculation # 3

- 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?

Half-Life Calculation # 4

- 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?

Half-Life Calculation # 5

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

Half-Life Calculation # 6

- 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?

Half-Life Calculation # 7

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

Answers to Half-Life Calculations

- Half-Life Calculation #1
  - 6.25 mg
- Half-Life Calculation #2
  - 12.5 mg
- Half-Life Calculation #3
  - 750 mg

Answers to Half-Life Calculations

- Half-Life Calculation #4
  - 12.5 g, 1.5625 g, 0.09765625 g
- Half-Life Calculation #5
  - 5 half-lives

Answers to Half-Life Calculations

- Half-Life Calculation #6
  - 15 minutes
- Half-Life Calculation #7
  - 10 seconds