Radiometric Dating

Radiometric Dating

Radiometric dating is the process of using the concentrations of radioactive substances to estimate the age of a material.

Study Tip

Calculating half-lives is a concept you might have learned in math. Combining the calculations with this study guide might help you understand the concept better.

Radiocarbon Dating

- Radiocarbon dating can determine the age of once-living organisms aged 100-50,000 years old using young carbon-based materials. It can also use older isotopes to determine the age of older rocks and minerals.
- The atmosphere has 3 isotopes of carbon: carbon-12, carbon-13, and carbon-14.
    - Only carbon-14 is radioactive, and it has a half-life of 5,730 years.
    - After organism's death, the carbon-14 decays to stable nitrogen-14.

Potassium-Argon Dating

- Potassium-Argon dating can determine the age of rocks that range 100,000-1 billion years old. It is mostly used on young geological materials and deposits in the bones of human ancestors.
- Potassium-40 decays to argon-40, with half-life of 1.26 billion years. The potassium-40 : argon-40 ratio in a crystal can help estimate the crystal's age.

Uranium-Lead Dating

- Uranium-lead dating can determine the age of igneous rocks from 1 million-4.6 billion years old.
- The two types of uranium isotopes used for dating are:
    - Uranium-238; it decays into lead-206, with a half-life 4.47 billion years.
    - Uranium-235; it decays into lead-207, with a half-life of 704 million years.

Limitations

- The material being dated must have measurable amounts of the parent/daughter isotopes.
    - Different radiometric techniques should be used to date the same sample. If calculated ages agree, they are thought to be accurate.
- It is not very useful for determining the age of sedimentary rocks. For sedimentary rocks, scientists use nearby igneous rocks that can be dated to get a general time frame.

Concept Check

- What are the three types of radiometric dating? What materials do they use?
- What are some limitations of radiometric dating?