

Name _____

How Are Isotopes Related To Elements?

Open-Ended Response Answer Key

1. Radiocarbon dating relies on the radioactive isotope carbon-14 (^{14}C), which is incorporated into living organisms. When an organism dies, ^{14}C begins to decay at a known rate. By measuring the remaining ^{14}C in a sample, scientists can estimate the time since the organism's death. However, this method is limited to dating objects up to about 50,000 years old.
2. Isotopes play a crucial role in nuclear medicine, where radioactive isotopes are used as tracers to diagnose and treat various medical conditions. For instance, technetium-99m is used in imaging procedures to identify abnormalities in the body. Radioactive isotopes emit radiation that can be detected and used for medical diagnostics.
3. In nuclear physics and energy production, isotopes like uranium-235 are fissile materials capable of undergoing nuclear fission. When uranium-235 absorbs a neutron, it can split into smaller nuclei, releasing a tremendous amount of energy. This process is the basis for nuclear reactors and nuclear weapons.
4. Isotopes are essential in understanding the elemental composition of celestial bodies and stars. By analyzing the isotopic ratios in meteorites and celestial objects, scientists can gain insights into the origin and evolution of elements in the universe. Isotopic abundances can reveal information about nucleosynthesis processes in different stellar environments.

