

33 Atomic Nucleus and Radioactivity

Solutions to Chapter 33 Exercises

2. X-rays are high-frequency electromagnetic waves, and are therefore most similar to even higher-frequency electromagnetic waves—gamma rays. Alpha and beta rays, in contrast, are streams of material particles.
3. Gamma radiation is in the form of electromagnetic waves, while alpha and beta are particles.
5. It is impossible for a hydrogen atom to eject an alpha particle, for an alpha particle is composed of four nucleons—two protons and two neutrons. It is equally impossible for a 1-kg melon to disintegrate into four 1-kg melons.
6. Alpha and beta rays are deflected in opposite directions in a magnetic field because they are oppositely charged—alphas are positive and betas negative. Gamma rays have no electric charge and are therefore undeflected.
15. Because it has twice as much charge as a beta particle, an alpha particle interacts more strongly with atomic electrons and loses energy more rapidly by ionizing the atoms. (The slower speed of the alpha particle also contributes to its ability to ionize atoms more effectively.)
40. Agree with your friend that sees helium as being alpha particles. It's true, alpha particles emitted by radioactive isotopes in the ground slow down and stop, capture two electrons, and become helium atoms. Our supplies of helium come from underground. Any helium in the atmosphere is dissipated to space before long.
49. Stone tablets cannot be dated by the carbon dating technique. Nonliving stone does not ingest carbon and transform that carbon by radioactive decay. Carbon dating works for organic materials.

Chapter 33 Problem Solutions

1. At the end of the second year $\frac{1}{4}$ of the original sample will be left; at the end of the third year, $\frac{1}{8}$ will be left; and at the end of the fourth year, $\frac{1}{16}$ will be left.