

VIDEO PROJECT TWO – ISOTOPES AND THE PARTICLES THEY EMIT

11. c. *Students know* some naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.

Sometimes atoms with the same number of protons in the nucleus have different numbers of neutrons. These atoms are called *isotopes* of an element. Both naturally occurring and human-made isotopes of elements can be either stable or unstable. Less stable isotopes of one element, called *parent isotopes*, will undergo radioactive decay, transforming to more stable isotopes of another element, called *daughter products*, which can also be either stable or radioactive. For a radioactive isotope to be found in nature, it must either have a long half-life, such as potassium-40, uranium-238, uranium-235, or thorium-232, or be the daughter product, such as radon-222, of a parent with a long half-life, such as uranium-238.

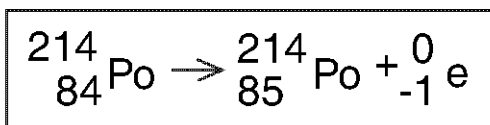
11. d. *Students know* the three most common forms of radioactive decay (alpha, beta, and gamma) and know how the nucleus changes in each type of decay.

Radioactive isotopes transform to more stable isotopes, emitting particles from the nucleus. These particles are helium-4 nuclei (alpha radiation), electrons or positrons (beta radiation), or high-energy electromagnetic rays (gamma radiation). Isotopes of elements that undergo alpha decay produce other isotopes with two less protons and two less neutrons than the original isotope. Uranium-238, for instance, emits an alpha particle and becomes thorium-234.

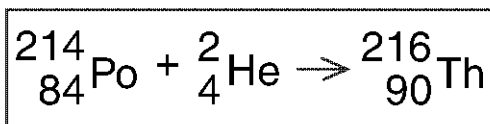
Isotopes of elements that undergo beta decay produce elements with the same number of nucleons but with one more proton or one less proton. For example, thorium-234 beta decays to protactinium-234, which then beta decays to uranium-234. Alpha and beta decay are ionizing radiations with the potential to damage surrounding materials. After alpha and beta decay, the resulting nuclei often emit high-energy photons called *gamma rays*. This process does not change the number of nucleons in the nucleus of the isotope but brings about a lower energy state in the nucleus.

17 Which equation correctly represents the alpha decay of polonium-214?

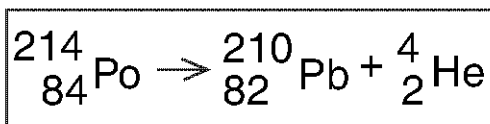
A



B



C



D

