



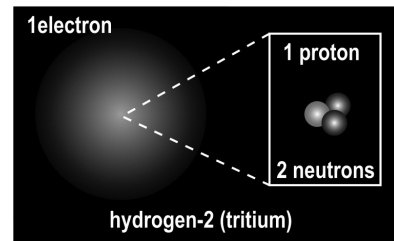
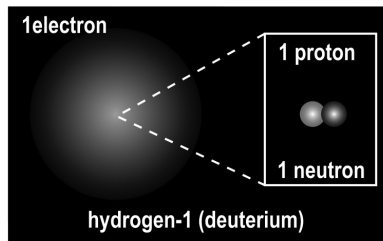
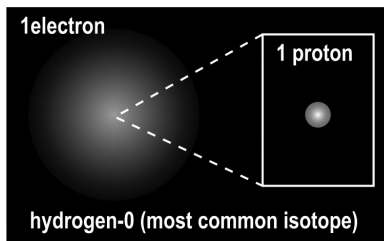
Name _____

Date _____

Class _____

Isotopes

1. a) An element that has different numbers of neutrons in its atoms is called an isotope of the element. Isotopes are identified by the name of the element followed by the atomic mass number of the isotope (e.g., hydrogen-0; hydrogen-1, called deuterium; and hydrogen-2, called tritium).

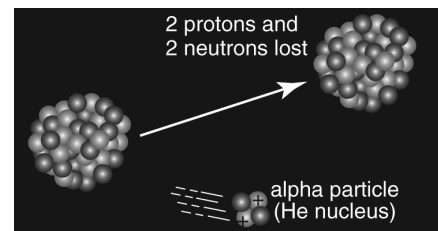


- b) Most elements have more than one isotope. The atomic mass numbers on some periodic tables are stated as decimal numbers because each number is an average of the mixture of isotopes for each element. For example, about two out of every 10 atoms of boron are boron-10. About 8 out of every 10 atoms are boron-11. The average mass number for boron is 10.81.

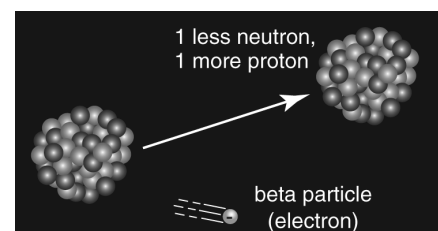
2. Radioactivity

- a) When an unstable atom breaks apart (decays), the nucleus emits fast moving particles and energy. This process is called radioactive decay.
- b) All the isotopes of some elements are radioactive, such as element 43, technetium, or element 86, radon. No stable samples of those elements exist in nature. Element 92, uranium, is another example of an element in which no stable isotopes exist. But uranium decays so slowly that it is still found in the Earth's crust.
- c) There are three types of radioactive decay from unstable isotopes.

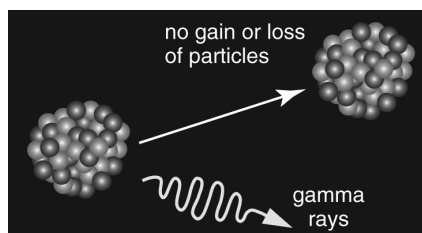
1. *Alpha decay* releases an alpha particle consisting of two protons and two neutrons from the nucleus. Just electrons, from the nucleus.



2. *Beta decay* releases beta particles, which are fast-moving electrons from the nucleus.



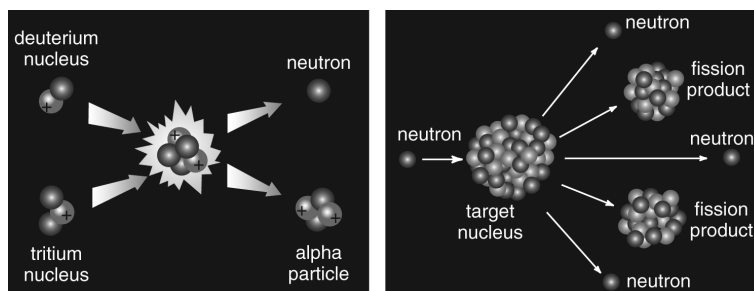
3. Gamma decay releases radiation that is like infrared, visible light, and x-ray radiation, only a much higher energy. This radiation is sometimes called gamma rays.



4. Alpha and beta decay result in nuclei of different a different element.

d) Another form of radiation is neutrons, which come from nuclear interactions. There are two types of nuclear reaction.

1. *Nuclear fusion* (below left) is the combining of two nuclei with low masses to produce one nucleus of larger mass and neutrons.



2. In a *nuclear fission* reaction (above right), a neutron collides with a large nucleus (atomic numbers larger than 90) to produce two smaller nuclei and some neutrons.

e) Radiation can be dangerous.

1. Radiation, especially from nuclear reactions, can penetrate and damage living cells. Illness, disease, and even death can result from an overexposure to radiation. People who work with radioactive materials must wear protective clothing and use insulating shields.
2. Radioactive wastes must be disposed of properly