Isotope contains the atoms of a chemical element that differ only in the number of neutrons but not in the number of protons. Every element contains stable or instable (radioactive) isotopes. Hydrogen for instance has two isotopes: deuterium whose nucleus has one proton and one neutron and tritium whose nucleus has one proton and two neutrons.

See also Radiation Oncology; Radon

Summary Article: isotope
from The Columbia Encyclopedia

(isˈətəp), in chemistry and physics, one of two or more atoms having the same atomic number but differing in atomic weight and mass number. The concept of isotope was introduced by F. Soddy in explaining aspects of radioactivity; the first stable isotope (of neon) was discovered by J. J. Thomson. The nuclei of isotopes contain identical numbers of protons, equal to the atomic number of the atom, and thus represent the same chemical element, but do not have the same number of neutrons. Thus isotopes of a given element have identical chemical properties but slightly different physical properties and very different half-lives, if they are radioactive (see half-life). For most elements, both stable and radioactive isotopes are known.

Radioactive isotopes of many common elements, such as carbon and phosphorus, are used as tracers in medical, biological, and industrial research. Their radioactive nature makes it possible to follow the substances in their paths through a plant or animal body and through many chemical and mechanical processes; thus a more exact knowledge of the processes under investigation can be obtained. The very slow and regular transmutations of certain radioactive substances, notably carbon-14, make them useful as “nuclear clocks” for dating archaeological and geological samples. By taking advantage of the slight differences in their physical properties, the isotopes may be separated. The mass spectrograph uses the slight difference in mass to separate different isotopes of the same element. Depending on their nuclear properties, the isotopes thus separated have important applications in nuclear energy. For example, the highly fissionable isotope uranium-235 must be separated from the more plentiful isotope uranium-238 before it can be used in a nuclear reactor or atomic bomb.