Definition of nuclear fission assignment

In nuclear physics and nuclear chemistry, nuclear fission refers to either a nuclear reaction or a radioactive decay process in which the nucleus of an atom splits into smaller parts (lighter nuclei), often producing free neutrons and photons (in the form of gamma rays), and releasing a very large amount of energy, even by the energetic standards of radioactive decay. The two nuclei produced are most often of comparable but slightly different sizes, typically with a mass ratio of products of about 3 to 2, for common fissile isotopes. 1][2] Most fissions are binary fissions, but occasionally (2 to 4 times per 1000 events), three positively charged fragments are produced in a ternary fission. The smallest of these ranges in size from a proton to an argon nucleus. Fission as encountered in the modern world is usually a deliberately-produced manmade nuclear reaction induced by a neutron. It is less commonly encountered as a natural form of spontaneous radioactive decay (not requiring a neutron), occuring especially in very high-mass-number isotopes.

The unpredictable composition of the products (which vary in a broad probabilistic and somewhat chaotic manner) distinguishes fission from purely quantum-tunnelling processes such as proton emission, alpha decay and cluster decay, which give the same products every time. Fission of heavy elements is an exothermic reaction which can release large amounts of energy both as electromagnetic radiation and as kinetic energy of the fragments (heating the bulk material where fission takes place).

In order for fission to produce energy, the total binding energy of the resulting elements must be greater than that of the starting element. Fission is a form of nuclear transmutation because the resulting fragments are not

the same element as the original atom. Nuclear fission produces energy for nuclear power and to drive the explosion of nuclear weapons. Both uses are possible because certain substances called nuclear fuels undergo fission when struck by fission neutrons, and in turn emit neutrons when they break apart.

This makes possible a self-sustaining chain reaction that releases energy at a controlled rate in a nuclear reactor or at a very rapid uncontrolled rate in a nuclear weapon. The amount of free energy contained in nuclear fuel is millions of times the amount of free energy contained in a similar mass of chemical fuel such as gasoline, making nuclear fission a very dense source of energy.

The products of nuclear fission, however, are on average far more radioactive than the heavy elements which are normally fissioned as fuel, and remain so for significant amounts of time, giving rise to a nuclear waste problem. Concerns over nuclear waste accumulation and over the destructive potential of nuclear weapons may counterbalance the desirable qualities of fission as an energy source, and give rise to ongoing political debate over nuclear power.