

P.G.SEMESTER-II

CC- V (ADVANCES IN CHEMISTRY)

UNIT-I: NUCLEAR CHEMISTRY

**TOPIC-NUCLEAR REACTIONS AND THEIR
TYPES (PART 1)**

Dr. JASMINE SINGH

ASSISTANT PROFESSOR

DEPARTMENT OF CHEMISTRY

M.B.R.R.V.PD. SINGH COLLEGE, ARA

(MAHARAJA COLLEGE)

NUCLEAR REACTION AND THEIR TYPES

Without the sun, life on the earth would not be able to exist. This is because every form of a living creature is dependent on solar energy in one form or another, the best example being the plants as they depend on solar energy for the preparation of food. It is so far from the earth and still able to send large amounts of heat and light. But do you know how this enormous energy is produced in the Sun? Probably you must be guessing right, it is due to the nuclear reactions in which hydrogen molecules combine together and release a tremendous amount of energy. Let's learn about nuclear reactions and the type of nuclear reactions.



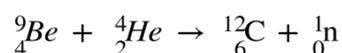
Rising sun

Nuclear reactions are processes in which-

1. one or more nuclides are produced from the collisions between two atomic nuclei or one atomic nucleus and a subatomic particle.
2. The nuclides produced from nuclear reactions are different from the reacting nuclei (commonly referred to as the parent nuclei).

DEFINITION OF A NUCLEAR REACTION

The reaction in which nuclei of atoms interact with other nuclei of elementary particles such as alpha particles, protons, neutrons etc. resulting in the formation of a new nucleus and one and more elementary particles are called nuclear reactions. For example,



In all the nuclear reactions the total number of neutrons and protons are conserved. Unlike the chemical reaction in which the number of atoms of each element is conserved. It is expressed in the same way as the normal chemical reaction in which the left side of the arrow represents the reactant and the right side of the arrow represents the product.

PROCESSES THAT ARE NOT CONSIDERED TO BE NUCLEAR REACTIONS

1. Nuclear scattering processes – processes that involve the collision and subsequent separation of atomic nuclei without any notable changes in the nuclear composition. In these processes, only momentum and energy are transferred.
2. Nuclear Decay – a process through which an unstable nucleus emits radiation in order to lose energy.

3. Spontaneous fission reactions – nuclear fission reactions that do not require a neutron to proceed and are, therefore, not induced.

WHY DO NUCLEAR REACTIONS RELEASE TREMENDOUS AMOUNTS OF ENERGY?

The mass of an atomic nucleus is always less than the sum of the individual masses of each subatomic particle that constitutes it (protons and neutrons).

This difference in mass is attributed to nuclear binding energy (often referred to as a mass defect).

During a nuclear reaction (such as a fission or fusion reaction), the mass accounted for by the nuclear binding energy is released in accordance with the equation $E = mc^2$ (energy = mass times the square of the speed of light).