

NUCLEAR CHEMISTRY WORKSHEET

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Most nuclear reactions involve changes in the number of protons and/or neutrons in the nucleus of an atom. These changes are called *transmutations* because an atom of one element is changed into an atom of a different element. During these changes, nuclear particles may be absorbed and/or emitted along with a release of energy.

There are four types of nuclear reactions:

- 1) *natural radioactive decay*: transmutations occur by natural radioactivity (the ability of a nucleus to emit a nuclear particle and energy without external stimulation);
- 2) *artificial transmutation*: transmutations occur by nuclear disintegration caused by external stimulation as a scientist bombards a nucleus with a particle (the addition of another nuclear particle makes the nucleus unstable);
- 3) *fission*: certain nuclei having a large mass are bombarded with special particles that cause the nuclei to split into two nuclei each having a smaller mass;
- 4) *fusion*: nuclei of light elements are combined to form heavier nuclei.

Nuclear reactions are written using symbols in the A_ZX notation. The symbols for the major nuclear particles involved in nuclear reactions are given below.

Alpha particle	${}^4_2\text{He}$ (an alpha particle is a helium nucleus)
Proton	${}^1_1\text{H}$ (the most common hydrogen nucleus is a proton)
Neutron	${}^1_0\text{n}$
Electron	${}^0_{-1}\text{e}$ or ${}^0_{-1}\beta$ (also called a beta particle)
Positron	${}^0_1\text{e}$ or ${}^0_1\beta$
Gamma ray	${}^0_0\gamma$

The table below contains information about nuclear reactions involving the emission of radiation.

Type of Reaction	NUCLEAR CHANGES		
	Radiation (Particle)	Effect on the Atomic Number	Effect on the Atomic Mass
Alpha emission (α)	${}^4_2\text{He}$	decrease by 2	decrease by 4
Beta emission (β)	${}^0_{-1}\text{e}$ or ${}^0_{-1}\beta$	increase by 1	no change
Positron emission (β^+)	${}^0_1\text{e}$ or ${}^0_1\beta$	decrease by 1	no change
Gamma emission	${}^0_0\gamma$	no change	no change
Electron capture (EC)	${}^0_{-1}\text{e}$ or ${}^0_{-1}\beta$	decrease by 1	no change

Key Terms Nuclear Changes Answers

Morris Hein, Susan Arena, Cary Willard

Key Terms Nuclear Changes Answers:

Key Concepts in Historical Geography John Morrissey, David Nally, Ulf Strohmayer, Yvonne Whelan, 2014-02-17 This ambitious volume reviews the best recent work in historical geography. It demonstrates how a dual sense of history and geography is necessary to understand such key areas of contemporary debate as the inter relationship between class, race and gender, the character of nations and nationalism, the nature and challenges of urban life, the legacies of colonialism and the meaning and values attributed to places, landscapes and environments. Mike Heffernan, University of Nottingham. Key Concepts in Historical Geography forms part of an innovative set of companion texts for the Human Geography sub disciplines. Organized around 24 short essays, it provides a cutting edge introduction to the central concepts that define contemporary research in Historical Geography. Involving detailed and expansive discussions, the book includes an introductory chapter providing a succinct overview of the recent developments in the field, 24 key concepts entries with comprehensive explanations, definitions and evolutions of the subject. Pedagogic features that enhance understanding including a glossary, figures, diagrams and further reading. Key Concepts in Historical Geography is an ideal companion text for upper level undergraduate and postgraduate students and covers the expected staples from the discipline from people, space and place to colonialism and geopolitics in an accessible style. Written by an internationally recognized set of authors, it is an essential addition to any human geography student's library.

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