

NUCLEAR CHEMISTRY WORKSHEET

Name _____ Date _____ Block _____

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.

NUCLEAR CHANGES

| Type of Reaction | 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 |

Chapter 28 Nuclear Chemistry Worksheet Answers

Arturo Cuomo



Chapter 28 Nuclear Chemistry Worksheet Answers:

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