

RADIOACTIVITY

You will:

explain nature of radioactivity and application of radioactive isotopes;

use proton-neutron ratio for identifying the stability of isotopes;

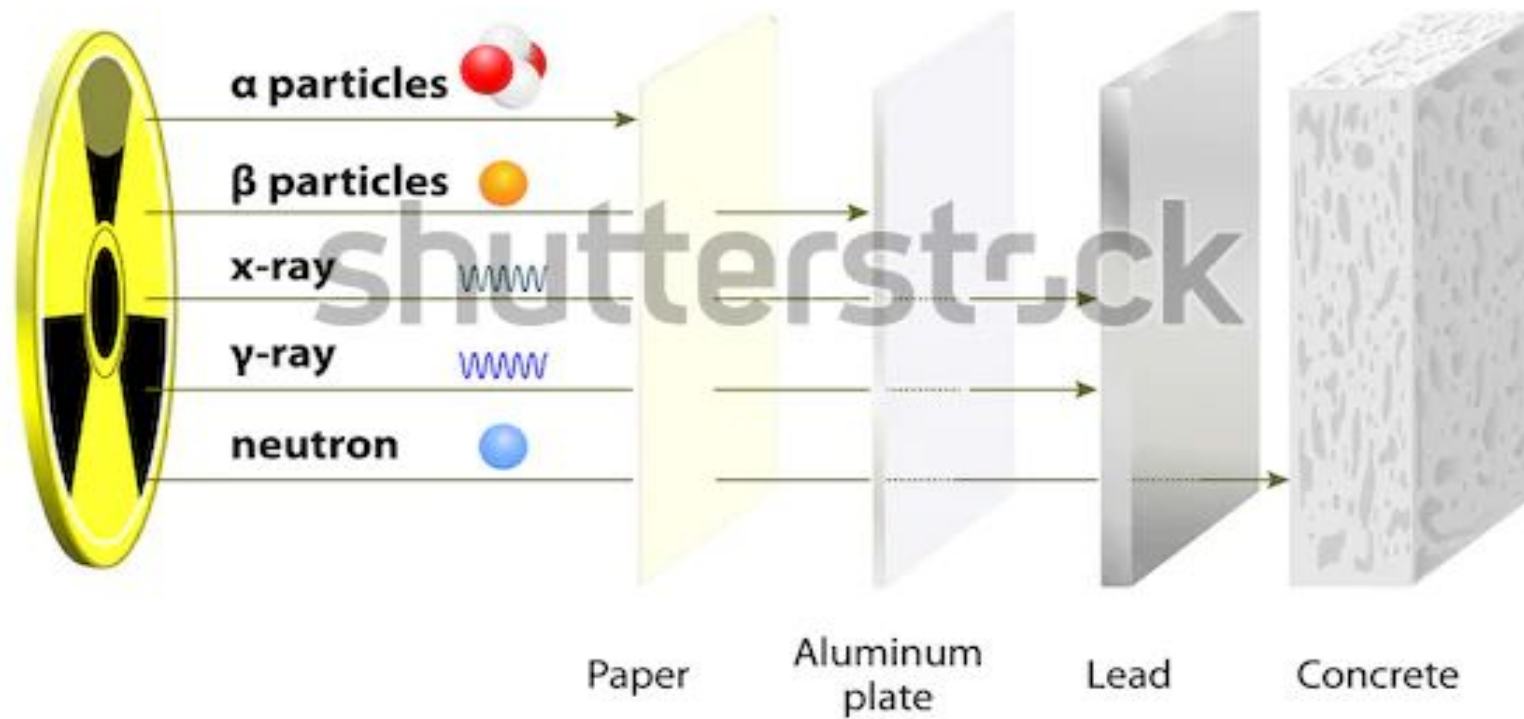
write equations for nuclear reactions.

Kew terms

Operate – әрекет ету/ действовать;
Repulsion - серпу / отталкивание;
Emission - шығу / выбросы;
Dosimetrist - дозиметр / дозиметр;
Geiger counter- Гейгер санағышы/ счетчик Гейгера;
Prone to-бейім / склонный к;
Decay - ыдырау / распад;
Annihilation - жойылу / уничтожение.

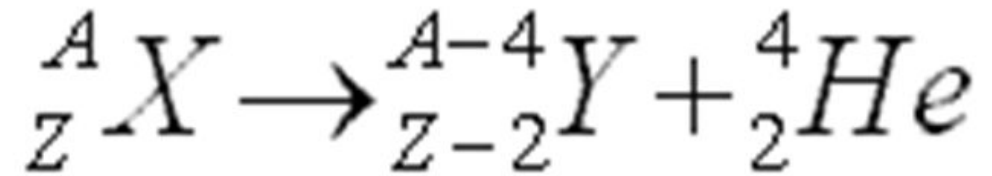
Radioactivity means a spontaneous emission of radioactive particles by an unstable nucleus. Atoms which are **prone to decay** are classified as radioactive. Conversely, an isotope is considered stable if it does not spontaneously transform into another element by radioactive emission. In the late 19th century Ernest Rutherford was able to identify three common radioactive emissions which were released by radioactive atoms. He was also able to show how they behave in an electric field, which allowed him to find charges of each particle. He named them as alpha, beta and gamma radiation.

TYPES OF RADIATION AND PENETRATION



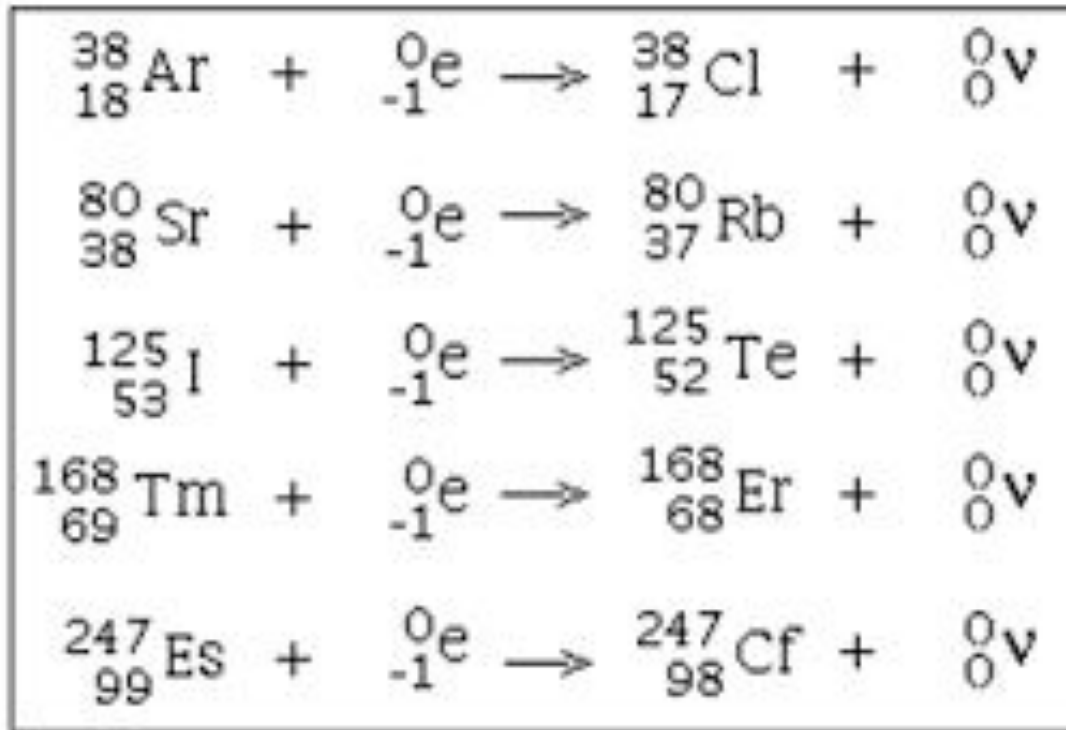
CHAPTER

The alpha particles are bare helium nuclei that lost their electrons (He^{2+}). It is represented as α or ${}^4_2\alpha$. When an element emits an alpha particle its mass is reduced by 4, and proton number by 2:



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The above reaction is called a nuclear equation, or nuclear reaction. Highly energetic electrons and positrons are called beta particles or beta rays. Sometimes positrons are termed antielectrons, because they have similar mass like an electron, but they are positively charged. Beta rays are represented as β^- for an electron, and β^+ for a positron. If they collide with each other, they are annihilated and energy is produced in the form of gamma rays. When an electron is emitted from a nucleus, it transforms a neutron to a proton. Conversely, positron emission results in the transformation of proton to a neutron.



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Gamma rays are highly energetic photons. Usually, it is released by following alpha or beta emission of an atom. When an atom ejects an alpha or beta particle, a newly formed atom is in the higher energetic state. It has to release a certain amount of energy to be energetically stable. This excess energy is released in the form of gamma rays. In the following example, uranium is transformed into thorium which is in the high-energy state when it is produced. It releases excess energy by gamma rays to be in more stable, low-energy state. Gamma rays do not affect the number of nucleons.