

Lecture 4

Electrophoresis Using Acetic Strips

Cellulose acetate electrophoresis nowadays plays an important role in clinical diagnostics routine procedures but has also helped in investigating a broad range of subjects in life science research.

Cellulose acetate electrophoresis separates proteins primarily by charge. Protein migration takes place on buffer film on the surface of the cellulose acetate paper.

Application

Analysis of haemoglobin is a typical example. Also in separation of enzyme (creatinine, phosphokinase, GOT, acidic erythrocyte, phosphatase, phosphoglucomutase etc), mucopolysaccharide, plasma serum, cerebro-spinal fluid, urine and other body fluids. Another field of application is in quality control of biological compounds. It is an accurate simple method of protein quantification.

Radioactivity

Radioactivity is the spontaneous disintegration of atomic nuclei. The nucleus emits α particles, β particles, or electromagnetic rays during this process. Radioactivity is the process whereby unstable atomic nuclei release energetic subatomic particles. The word *radioactivity* is also used to refer to the subatomic particles themselves. This phenomenon is observed in the heavy elements, like [uranium](#), and unstable [isotopes](#), like [carbon-14](#).

For a better understanding of radioactivity, a review of atomic structure is necessary.

Atoms are made up of a dense positive core called a nucleus surrounded by orbiting electrons. Nucleus contains protons (carry + charge) and neutron which is as heavy as proton but zero charged. Electrons are light and have negative.

Isotopes of elements contain nuclei with same number of protons but different number of neutrons. Atom where the number of protons does not equal to the number of neutrons is unstable.

The chemical properties of an atom are determined by the number of protons in the nucleus e.g every atom which has 6 protons in its nucleus is a carbon atom. Different numbers of neutrons may exist in a carbon nucleus; there can be 5, 6, 7 or 8. Each of these atoms is a different isotope of carbon.

All elements have isotope(s). Some isotopes are stable and some are unstable. An unstable atom has too many neutrons in its nucleus. To get rid of the excess, the nucleus decays into different nucleus by throwing out (emitting) particles and energy.

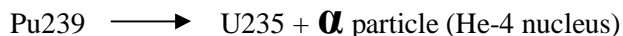
Whenever there is a disintegration of atomic nuclei, the nucleus emits α particles, β particles, or electromagnetic rays during this process

Alpha (α) Decay

Alpha particles (named after and denoted by the first letter in the [Greek alphabet, \$\alpha\$](#)) consist of two [protons](#) and two [neutrons](#) bound together into a particle identical to a [helium nucleus](#), which is produced in the process of [alpha decay](#). The alpha particle can be written as He^{2+} , ${}^4_2\text{He}^{2+}$ or ${}^4_2\text{He}$

.So when an atom undergoes α decay, its atomic number decreases by 2 and its atomic mass decreases by

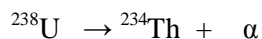
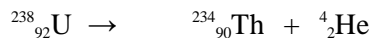
4. An example of α decay is the following



They are a highly [ionizing](#) form of [particle radiation](#), and (when resulting from radioactive [alpha decay](#)) have low [penetration depth](#). They are able to be stopped by a few centimeters of air, or by the skin.



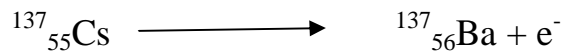
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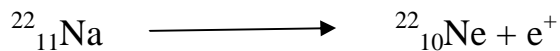
Beta (β) Decay

There are 2 types of β decay; β^+ and β^- decay.

β^- Decay : An excess of neutrons in an atom's nucleus will make it unstable, and a neutron is converted into a proton to change this ratio. During this process, a β particle is released, and it has the same mass and charge as an electron. The resulting atom and the β particle have a total mass which is less than the mass of the original atom. The atomic number of the atom increases by 1



β^+ Decay: When there is an excess of protons in the nucleus, and it is not energetically possible to emit a particle, β^+ Decay occurs. This is where the nucleus becomes stable by converting a proton into a neutron. During β^+ decay, a positron (a particle with the same mass as an electron but with positive charge) and a neutrino are released. Positrons interact with electrons, causing both to be completely destroyed. 2 gamma ray photons with same energy as the mass of the positron and electron are released.



Gamma Radiation (γ)

Gamma ray emission usually occurs with α and β emission. γ rays have no charge or mass, so their emission doesn't change the chemical composition of the atom. Instead, it results in a loss of radiant energy. Gamma ray emission occurs because the nucleus is often unstable after α and β decay. The emission of α and β particles frequently leaves the product nucleus in an excited state. The excited nucleus can relax back to its ground state by emitting a photon.