E-ISSN: 2664-6773
P-ISSN: 2664-6765
Impact Factor: RJIF 5.6
IJCBS 2024; 6(2): 14-23
www.chemicaljournal.org
Received: 04-04-2024
Accepted: 09-05-2024

Abu Bakr Mahmoud Mohammed
Department of Chemistry, College of Science, Tikrit University, Tikrit, Iraq

Ali Haider Naser Jasim Alattar
Department of Chemistry, College of Science, University of Babylon, Babylon, Iraq

Murtaza Khaled Hussein Abboud
Department of Chemistry, College of Science, University of Kufa, Iraq

Qasim Fadil Olaiwi Almamori
Department of Chemistry, College of Science, University of Babylon, Babylon, Iraq

Corresponding Author:
Abu Bakr Mahmoud Mohammed
Department of Chemistry, College of Science, Tikrit University, Tikrit, Iraq

Nuclear and radiochemistry

Abu Bakr Mahmoud Mohammed, Ali Haider Naser Jasim Alattar, Murtaza Khaled Hussein Abboud and Qasim Fadil Olaiwi Almamori

DOI: https://doi.org/10.33545/26646765.2024.v6.i2a.98

Abstract
This research aims to know the atom and its importance in chemical reactions, closely study its family, and identify its chemical and physical characteristics. It aims to know the atoms, especially their phenomena, and their importance in medicine. This research focuses on the radiological case and is aware of the interpretation and forms of cases that, the excited nucleus emits it as is with the mass number and the factors affecting it. It also first explains the binding energy and its relationship, And the great benefits and what shines Y, the radiation sector also discusses the importance of radiation, its, Woo. benefits, and the important applications of radiation, Woo. What is the importance of the radioactive reaction and knowing the difference between the radioactive reaction and the first laws of radioactivity (the law of disintegration, the age of the Q).

Keywords: Atom, chemical reactions, family of atoms

Introduction
Nuclear chemistry is one of the branches of chemistry which deals with radioactivity radioactivity, nuclear processes and nuclear properties. It is also known as the reactions that occur as a result of a change in the nuclei of atoms. Nuclear chemistry is concerned with studying the structure of the nucleus and the nature of its basic constituent particles, and how this structure affects its stability. Therefore, it is the science that is concerned with studying the phenomena that lead to changing the structure of the nucleus, whether through natural radiation processes or artificial change processes. The latest theories in the field of nuclear chemistry have stated that the nucleus has a structure composed of energy shells similar to the electronic structure of an atom. These facts have been inferred from studying the phenomena associated with nuclear radiation. The energy changes that accompany nuclear changes are considered very large when compared to the energy changes that accompany chemical reactions, and they are nearly millions of times greater, because the nuclear forces that bring together the particles that make up the nucleus are much greater than the chemical forces that form the bonds in molecules and materials. As for the science of radiochemistry, it is considered one of the most important technical applications for studying radioactive materials and the chemical changes they can cause. The fundamental difference between normal chemical processes and those that occur under the influence of nuclear radiation is that in the latter case we track any change that occurs with measurements related to radiation measurement processes. Historical overview, the study of radiochemistry began after studying the effect of, during the study of the uranium salts, it has a high penetrating ability (exceeding the ability of the chemistry of salt and that thorium compounds give a phenomenon, Similar. In 1889 AD, the married couple Pierre and Marie Curie Curie Marie and Pierre began their research in this field. On the basis of an observation after the discovery of radium and polo on radioactive day, this discovery showed that some natural uranium ores (such as pitchblende or ureate) have stronger radioactive properties than pure uranium itself. They concluded from this fact that these ores may contain Elements other than uranium have a radioactive property, as strenuous efforts were made to extract the small quantities of polonium Po84 and radium Ra in the, They are two elements with great radiation potential 88 pitchblende ore that exceed the capacity of uranium, hence the strong radioactive property of pitchblende, which is a black ore containing 75% uranium oxide 8O3U. In 1934 AD, Irene Curé (daughter of Pierre and Marie Curé) explained through her joint work with her husband, Frederic Curé, that bombarding boron and aluminum with alpha rays would lead to the appearance of radioactive properties in them. This discovery was important for the possibility of converting the nucleus to become radioactive artificially, as resulted from their experiments with it.

Properties similar to those of the electron, but with the charge of the positron particle: a Discovery positive particle. The positron had been discovered before as a component of cosmic radiation. After Rutherford presented his famous soil to study the effect of alpha particles on traces of metals, one of the most important compounds other than the atom, which is the nucleus, was the result of the studies that he established: Wu for the structure of the atom, where The first step of the model, The mass of an atom if its soil is placed together This soil is an important step in the development of this science. As for the discovery of the neutron, it was predicted by Rutherford and discovered by Shaddock in 1932 when he bombarded a target with an element. Boron with alpha particles, thus forming nitrogen-01 and a neutron 11+452ÿ14+ 170 reactions, because it is, the discovery of the neutron played an important role in developing the possibilities of conducting many nuclear an uncharged particle that is able to penetrate the nucleus without the need to gain high energy. These nuclear reactions have contributed to understanding a lot about the nature of nuclear structure. Introduction to nuclear chemistry, The atom and the nucleus, The atom is the basic unit that makes up matter, and trying to figure out its composition has become the biggest and most enjoyable challenge, Ancient times until the early twentieth century when the nuclear tax was introduced And many scholars in the world, Modern. The atom: It consists of a non-semin called the wah, and surrounding the wah are other attributes called the wah. The electrons revolve around it in certain orbits, While the nucleus1:0in-1w3hich the mass of the atom is centralized and its diameter is about cm, The nucleus, in turn, is composed of two distinct particles in chambers with an1a0to-m8diameter of about cm. The number of electrons is known as protoons and eutrophs, and the equality of the atom is due to the number of protoons being equal to. And their disappearance in scarcity, Components of the nucleus, mainly from proto (P) and eutroph, the unit is damaged, Where: A = mass number and represents (the number of protons p + the number of eutrophs n) z = atomic number and represents (the number of proto-P). Names you should know: - Protons: The proton: It is a non-ferrous particle with a mass of 10-24 x 1.67 g. It is about 1839 times larger than the electron and carries an electrical charge equal to the charge of the electron, but it has a conductivity. For the proton 2- Neutron The: It is a non-neutral particle of approximately equal charge A neutron is the union of a proton and an electron, In mass and often, The greater the number of eutrophs than the number of protons is called neutron flux. -3 Nucleons: The name given to nuclear particles, i.e. protons and neutrons, and their total number is the mass number. Therefore, it is a common name for both the proton and the neutron. -4 Nuclear coding: It means the method of writing elements in a way that shows the atomic number and mass number, and the method, as shown below, is that the mass number is written to the top left of the element symbol, and the atomic number is written to the bottom left of the element symbol, as follows, Nuclear types:, p, in a state and in energy. And there are four A's and A's Isotopes are characterized by the n -1 contents of the nucleus. Isotopes: These are molecules that are equal in their atomic numbers and differ in their mass numbers. The Rawan isotopes are similar in chemical properties and differ in the physical and nuclear properties of the isotope. Each isotope is expressed as an isotope. But not every waida is a dhair. 36 Cl17 37 Cl1712 H1 3 H1, Light H Deuterium Tritium- Isobars: They are molecules that differ in atomic numbers and are similar in mass numbers. They t different. Differ in physical, chemical and nuclear properties. They are a compound. 13056 130 54 130 523 - Isotones: They are atoms that are equal in number to eutrophs and differ in mass numbers. They different t differ in physical, chemical, and nuclear properties. They are a compound.

32 S (16p + 16n).
31 P (15P + 16n).
30 Si (14P + 16n).

1-Isomers: They are nuclear compounds that are similar in their chemical and physical properties, but they differ in their nuclear properties, such as the state energy and the lifetime of the atom. They have the same atomic number and mass number (that is, they also have the same number of neutrons), but they differ in the amount the internal energy it carries, or in other words, it occupies different energy levels. Thus, the nucleus that occupies the highest energy level is the unstable nucleus. In its nuclear symbolization, the lowercase letter m is added next to the mass number to the right. Examples of these are: 60m co33, 6027 11, Mass and energy, Binding energy: mc=E 2 From the relationship of E. Stein energy Bloc 10x2.99710 Speed of light = s/cm From the E-stein equation, it follows that the mass of the nucleus is a measure of its energy content, and it has been shown that the mass of the nucleus is less than the sum of the masses of its components of particles (protozoans and eutrophs). The mass difference represents the binding energy, which is the energy that binds the states together. This nuclear binding energy is due to the fact that the sum of the masses of the nucleoids that are separated from each other is greater than the to mass of the nucleus that comes with them, and this mass difference has been transformed into scattered energy, which caused the nucleoids stick together. -24 10 x 1.66, and by substituting this expression into the E-stein equation as follows: E=1.66x10 -24 (2.9979x10 10) 2-3 =1.492x10 erg, Replace the erg unit with the electron volt (ev) unit, which is the positive energy of the charge of an electron moving across a difference of one volt.

1ev = 1.602x10-12 erg Mev = 1.602x106 erg, to convert atomic mass unit amu to energy in Mev.

1amu = 931.5 Mev/amu, Atomic mass unit (amu), The atomic mass unit, U, is determined by determining the mass of 1 mol of carbon-12, so it is as follows, Atomic mass unit = mass of 1 mole in kilograms / number of avo-adro, 10x6.02 23,The mass of 1 mol of carbon is 0.012 kg and Avcadro's number is equal to

10 x 6.02 / 0.012 = one carbon atom since one atomic mass unit = 1/12 x one carbon atom permission:

x12 10 x 6.02 / 0.012 = one atomic mass unit 1amu = 1.66x10-24g E4xample: Calculating the binding energy of helium, He2 M = Zmp + Zmn - M M: represents the difference between the mass of the helium nucleus and its components of prototes and neutrophils Z,Z: the number of protozoans and tetramers, respectively Mn, Mp: the mass of protozoa and protozoa, respectively.

M= 2x1.007825 + 2x1.00866 - 4.0026 M: mass of helium nucleus = 0.03037amu E=0.03037 x 931.5 = 28.3Mev E= 28.34 = 7.1Mev Mev28.3 represents the binding energy between all helium molecules, and Mev7.1 represents the binding energy of one helium after dividing the total binding energy by the mass number of helium. I calculated that the binding energy, of the binding energy of the Wi-Fo-D-A-Ha is in the range of Mev (7.4-8.8). t affection, so.

Iron (A=56) and iron (A=59) are the highest value relative to the binding energy for the rest of the elements.

Their high abundance is due to their stability due to the high binding energy of their charges. This is the relationship of U with A.

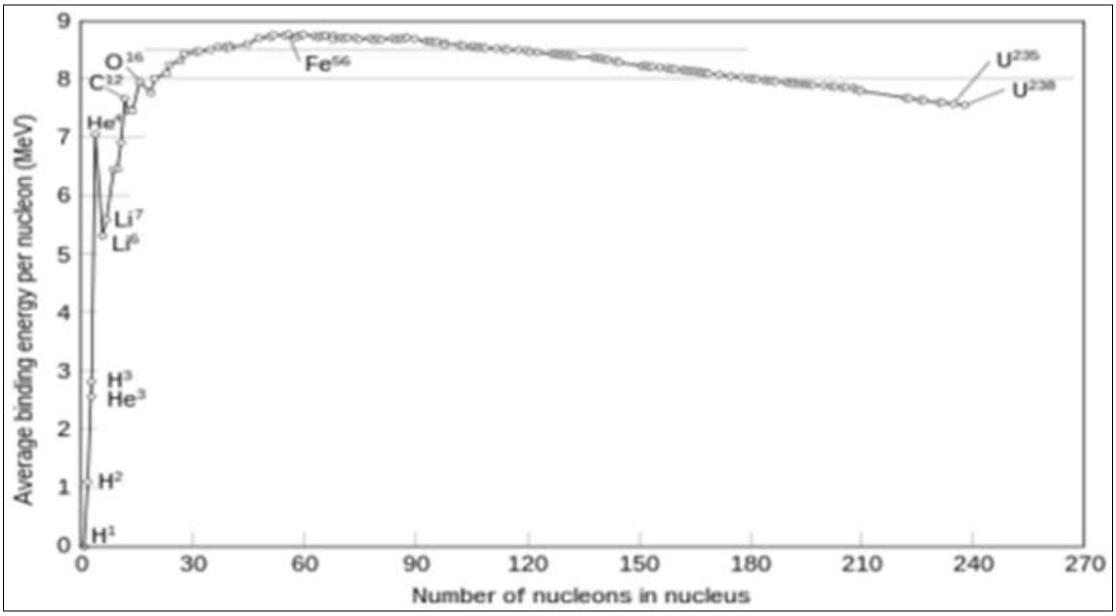

Fig 1: The relationship of binding energy with mass number

Factors affecting the binding energy in the nucleus, There are several factors that affect binding energy that can be considered in two ways: Liquid drop mod- el: This model provides an equation that determines the factors affecting the strength of the connection between the states (protoplasms and neutrophils) within the nucleus. This equation consists of five terms: M. The number of states is called the h limit. 1 - The size limit (number of nuclei): The binding energy is proportional to the number 2 - The surface limit (saturation forces): The binding energy decreases as the surface area, represented by the number 2, increases. 3- The Coulomb limit (repulsion between protons): The binding energy decreases due to the repulsion between the eutrophs represented by z. 4- The asymmetry limit: The binding energy increases with the similarity of the number of proto and nucleotides (Z-2A), so their negative effect will disappear. Eb = 14A -13.1 2 - 0.6 ÿ, 5- Spin duplex limit: the Mop value of the spin in terms of binding energy. 18.1± (ÿ2) Surface limit Volume limit Binding energy, Coulomb limit, the limit of twisting is the limit of asymmetry, 2-Integumentary model of the nucleus: This model appeared as a result of the first model for interpreting some theoretical phenomena. This model assumes, that protons and eutrophs form nuclear structures similar to the interstitial arrangement of electrons in the atom, where the nucleus is stable. If the prototes and eutrophs are in closed (saturated) shells, then addition outside the closed shells is their connection. Weak, as their shells are open (unsaturated), which leads to the formation of unstable molecules. Thein nature and number of eutrophs and protoacetyl compounds has a major impact on the degree of abundance of ar its stability.

Radioactivity: Natural radioactivity is the phenomenonRof emitting nuclear emissions (ÿ, ÿ, ÿ) from some organisms automatically and continuously, and sometimes the entire radioactive process takes place. t heavy right now It is called Bala, One of the orbital electrons close to the nucleus. Emitting these characteristics leads to the transformation of the nucleus into another. A new crown appears due to a significant change in its atomic number, and this phenomenon is characterized as, Dida A, random and subjective. The raAnnd domness of the number of local units in a security unit is not a constant and cannot be affected, Changes in temperature, pressure, humidity, or the state of the solid, liquid, or pure substance Y by any other influence. Even the dissolution of a certain entity has nothing to do with the dissolution of the other entity. The nucleus that has the ability to emit different types of radiation is called the parent nucleus, the large nucleus that remains after radiation is called the daughter nucleus

The simplest case of failure is if the newborn nucleus is stable, but if this nucleus is not stable, then what is called a radioactive chain decay will form. Radioactive decay: It is a spontaneous transformation that includes a transition from a specific quantitative phase of the primary particle to a quantitative phase of the phase, the difference in energy between the energy levels involved in the transition is represented by the state energy. This state appears in every form with symbols such as (Alpha, Beta or Ocama), which expresses the radioactive state, which is the safest condition in the number of radioactive atoms as the intensity of radiation decreases. 2How old was the F_1? To the F. seconds, 10-14 Approximately 10 p.m. to 2 p.m. hours is considered stable in terms of radioactivity. The ages of thousands of millions of years vary within a few hundred years 15 Atoms with millennium ages greater than, Nuclear decay: The project was postponed to another period due to the instability of the family or Damnation or decomposition: it is the transformation of matter, To achieve a more stable situation., Decomposition is self-inflicted and occurs in different ways: 1 - A subjunctive with alpha (ÿ) 2- The beta solution (ÿ) is: a- Negative beta state (electron, -)ÿ)ÿ b- Beta wave (putron, +). c- Capture Electron (Ec, Capture Electron) 3- The condition of kamma (ÿ) (1-2-7-1) Decay-ÿ, Alpha (helium nuclei) and therefore alpha decay: it is a type of radioactive decay where the atomic nucleus is transformed, My mass number decreases by four and the atom number decreases by two into a different atomic nucleus with.

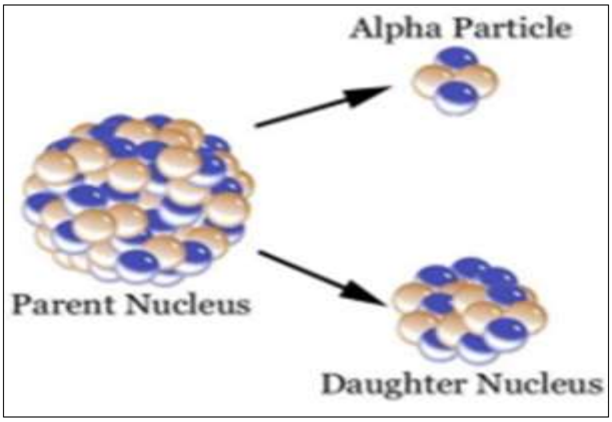

Fig 2: Alpha state

The heavy core (heavier than lead) decreases the value of the bonding energy for each nucleon in order to create a. Lighter and more stable core. Therefore, these cores are unstable and disintegrate into core cores. consists of 92 protons and 146 eutrophs, disintegrates into a helium 238, the urea nucleus, which for example, nucleus composed of 90 protons and 144 eutrophs, and the result of this disintegration is the alpha-semitor 234 nucleus, which is a helium nucleus composed of two protons and Yutru yen. This disintegration process is represented by the following equation: + ÿ, thus, the process of disintegration of the urea nucleus forms one day with a more stable new energy, which is the thorium nucleus. Dar Sim Alpha. Alpha a n a dar sim disintegrates into the nucleus of the atom with + ÿ 214 Also, the day of polo, In order for the nucleus to be radioactive, its mass must be greater than the sum of the masses of the daughter nucleus, the alpha symbol (the name of the parent nucleus is given to the radioactive nucleus that disintegrates, while the name of the daughter nucleus is given to the nucleus coming from Disintegration (Mp - (Md + Mÿ) > 0

A Y B that the following condition is met: Alpha This condition is only met since Mopf is the mass of the parent nucleus, Md is the mass of the daughter nucleus, and Mÿ is the mass, Sim, the lightest particle. Heavier than bullets and a limited number of higher ones in some countries, Alpha is a powerful enetrating force, as it can be easily stopped, due to the large mass that the Sim has, by means of an LED, a piece of paper, or about 10 cm of air.

Decay-ÿ, The atomic nuÿmber changes and the mass number changes, and it is identical to the case of ÿ - and which rotates a pution.+ Electron is the number of electrons, As for the protein nucleophile, it is that the eutrophic nucleophile is transformed by ÿ - A is transformed by. ÿ + Beta ionizers have a weak ability to ionize materials in their path, but their permeability to materials is relatively weak, such that they penetrate a sheet of paper 3 days thick. Electrons can also be accelerated in beta ionizers, increasing their speed to nearly the speed of light. a- ÿ - decomposition (nectron emission) Nectar decay: It is a radioactive state in which the mass number A remains constant and the atomic number Z increases by one unit according to the equation: n = p + ÿ - + ÿ Antidote and the potential energy is solved if the energy is filled with outcrops if available, This decomposition is possible, If the energy equivalent to the mass difference between the mother and its parent is > Mev 0, Example of negative beta decay: + ÿÿÿ (positron emissionb)- lysis + Positron decay: It is a radioactive state in which the mass number A remains constant while the atomic number Z decreases by one unit. P = n + ÿ + + ÿ Utre and It is possible if the nucleus is full of protozoans, and this situation is possible if sufficient energy is available. The equivalent energy of the mass difference between the mother and its part is > Mev 1.02, Example of beta decay: ÿ +.

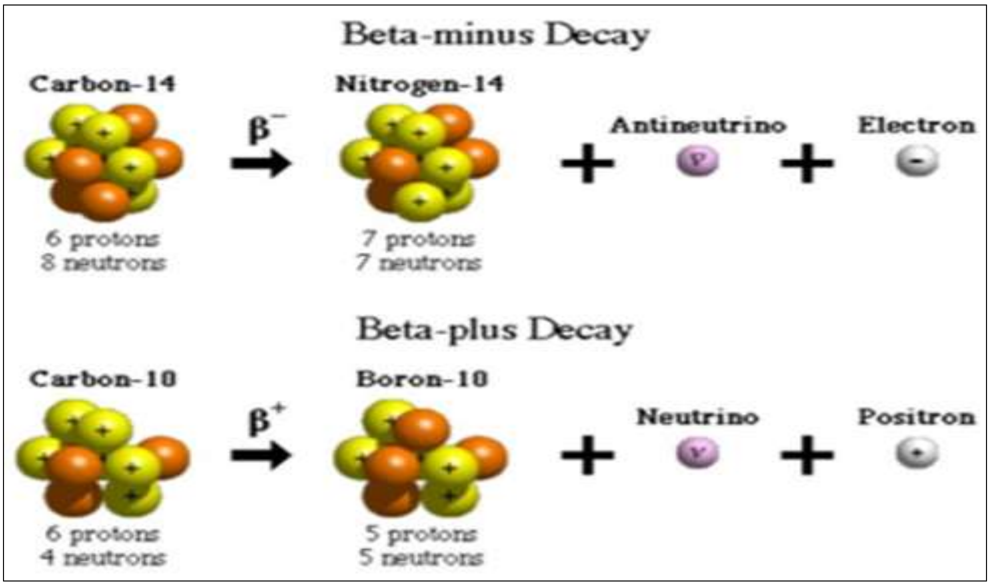

Fig 3: Negative and positive beta decay (Electron Capture, Ec)

Electron capture usually involves the following processes: -1 Emitting X-rays, -2 Emitting ÿ-ray gamma rays, 3-Electron Auger emitters, 4- Emitting neutrino and neutrino energy, activities of unstable metals, Electron-capturing decay: It is one of the types of radioactive through which the nucleus of an atom moves from an unstable state to a stable state by capturing the electrons contained in the protons and the Yenergy resulting from shifting an orbit close to it and emitting E, provided that the proton-to-eutron ratio is less than Mev 1.02. Ghaf K atomic electrons are most likely to collide close to the nucleus, so the affinity of the nuclei is the limit. This type of capture is called (K capture). As for the electron capture of K ghaf electrons, it is 90%. Therefore, of L ghaf or M ghaf, it is they are less likely. The transfer of the electron from the first orbit into the nucleus to equalize the charge of the putron leads to its atomization and the, It leads to the release of euthermic energy emission of gamma rays as well. The vacuum created by the return of the electron from the K orbital will lead to the first electron from the L orbital being displaced, leading to the release of X rays.

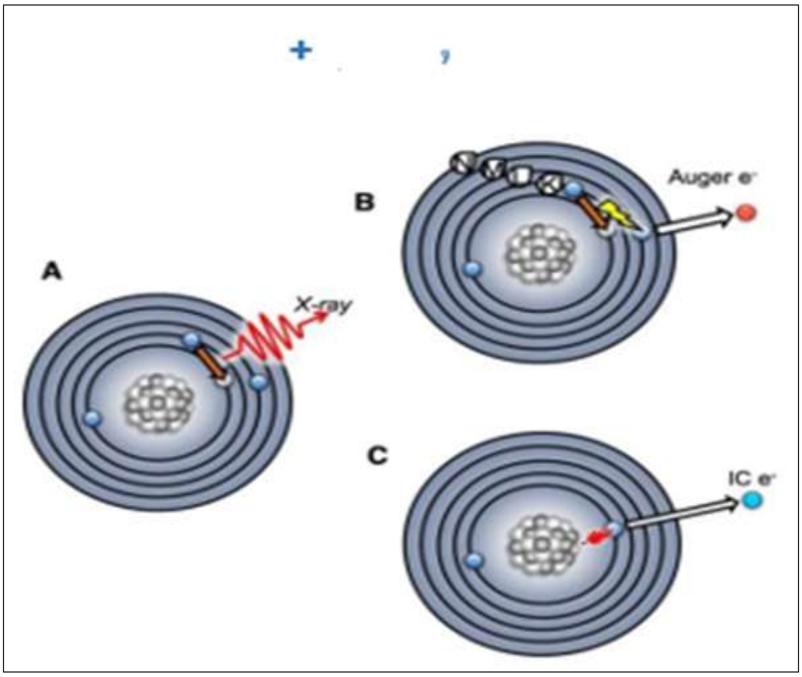

Fig 4: Lovely emissions are unavoidable in electrolytes

Gamma Decay (Decay-ÿ), A change in alpha or beta minutes may not lead to a state of stability, so it may leave it in an excited state. In order for the state to reach a state of stability, there are several possibilities:-1 Gamma ray emission: It can be one stage (direct transmission) or several stages (indirect transmission). 2 Internal transformation: It results from the electromagnetic interaction between the gamma rays emitted by the nucleus and the atomic electrons. If it is assumed that the nucleus may in this case give the excess energy ÿE to one of the particles located in an excited level Ei, excited with the lowest eneIrtgiys always nearby instead of emitting gamma rays and transmitting them to a surface Ghaf K is an eYlectron and Electron OEkf.r. Then the electron is thrown out of the atom with kinetic energy and is sometimes called an electron. -e (: This occurs when the energy is around Mev 1.02, e-3 double configuration (Gamma rays are electromagnetic rays that have no attenuation, so they cannot be deflected by electric or magnetic electricity, and they have a great ability to penetrate materials. + ÿ Note that the kamma state does not affect the state, but rather remains constant. Radioactive elements found in nature: Natural radioactive elements t, which have a mass number of 205 or more, are classified as radioactive strains or families, You can't do it, There are four series:-1 Uranium series -2 Thorium series 3-Actinium series-4 Neptunium series-1 uranium series 109x4.5, the age of the year, The first t is urea yum, it is a stable n, and these chains solve 14 in eight cases 206 This series ends with the capital Pb in alpha and six m ha in beta in addition to the secondary states (4 states in alpha and 4 states in beta), and if n is reduced by 4 units in number, its state is in alpha (n+2P2) and by a small amount in number of atomic masses This is the situation with Beta.

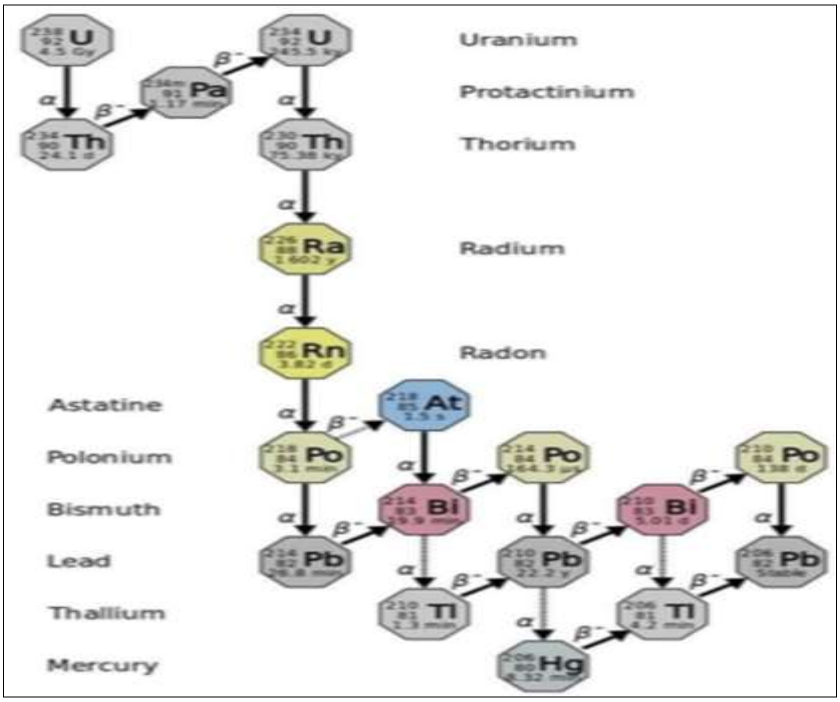

Fig 5: Decay Chain of Uranium-238

Thorium series, The first ar t is thorium (Th) and it is a stable ar208 Ras (Pb It is reduced by four units of d a, which is equal to alpha (n+2P2) and by a small amount, the atomic masses of these, And particles are a beta. This problem solves 10 states, six mha by an alpha and four by a beta, and adding the third state, one by an alpha and one by a beta.

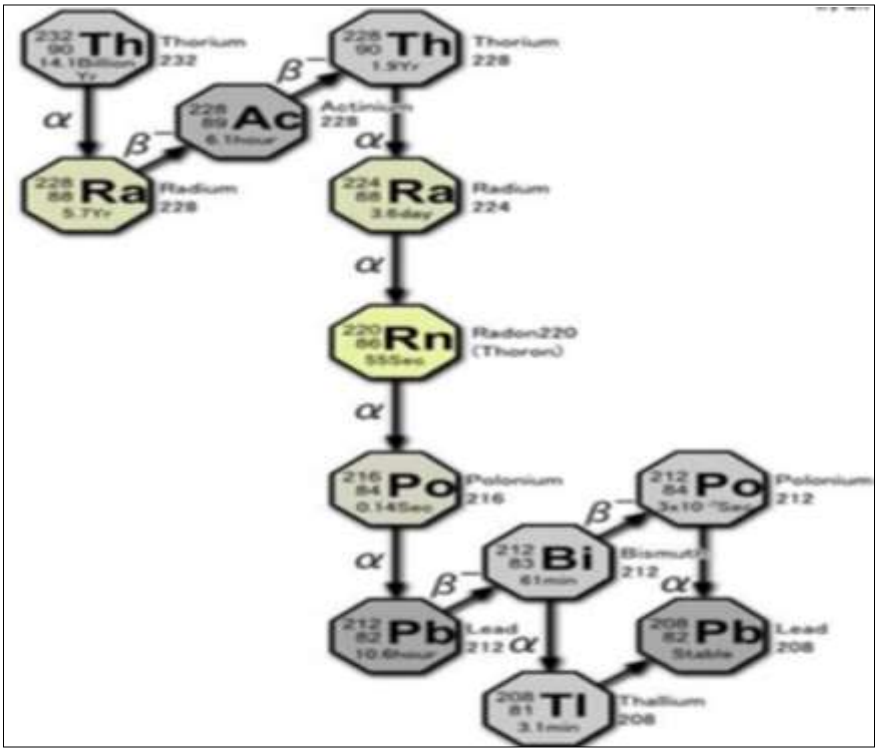

Fig 6: Thorium series

Actinium series: The first period is urea day (U.S.) and it is a stable ar. 207 Ras (Pb It is reduced by four units of n, which are solved by alpha (n+2P2) and by a small amount that the atomic masses of these numbers are solved by beta. These strings solve 11 cases of seven mha by alpha and four beta, in addition to the secondary cases and 5. (1) Beta cases (5) Alpha cases.

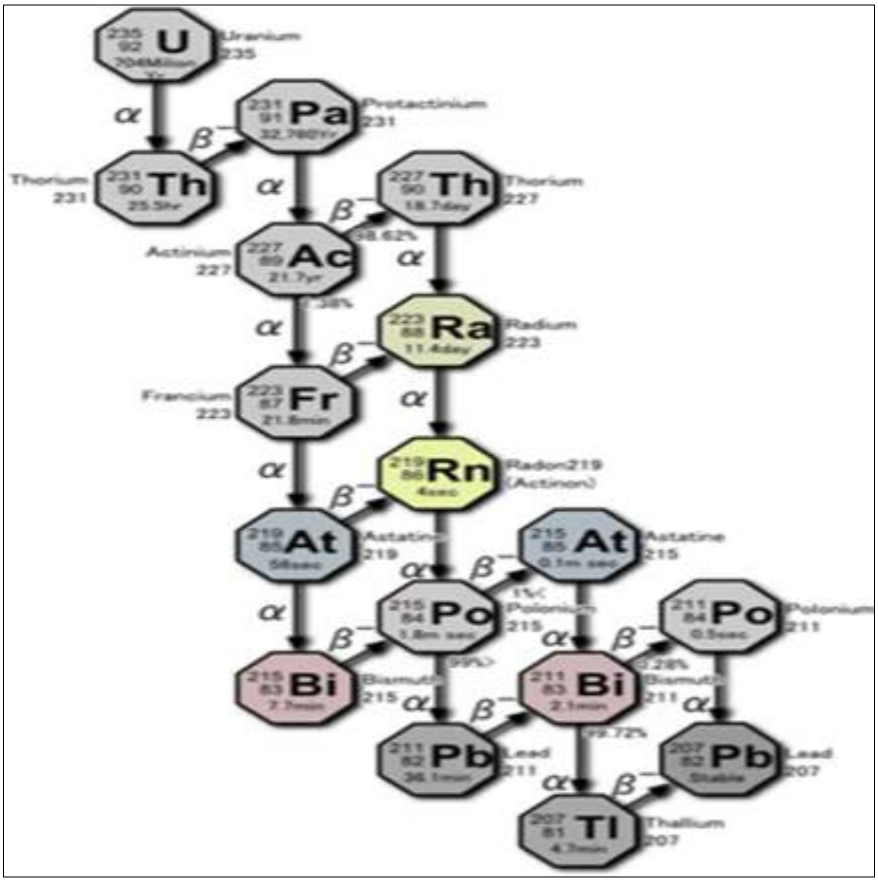

Fig 7: Acti-day series

Neptunium series:) and it is a stable ar209 This series ends with Bismuth (Bi 237 The first p is the pto day (Np R Its age is in the year 1019 It is reduced by four units on D A, which is equal to alpha (n+2P2) and by, The atomic masses of this unit are negligible in the beta state. This problem solves 12 cases, eight in the alpha and four in the beta, adding the two cases. Two seconds, one with an alpha and the other with a beta. 10 x 2.1 (a ratio for the age of the Earth called...6 the world is short (year, the completion of this series is that the age of t the mother didra on her. How old is this chain with the missing chain of Q?

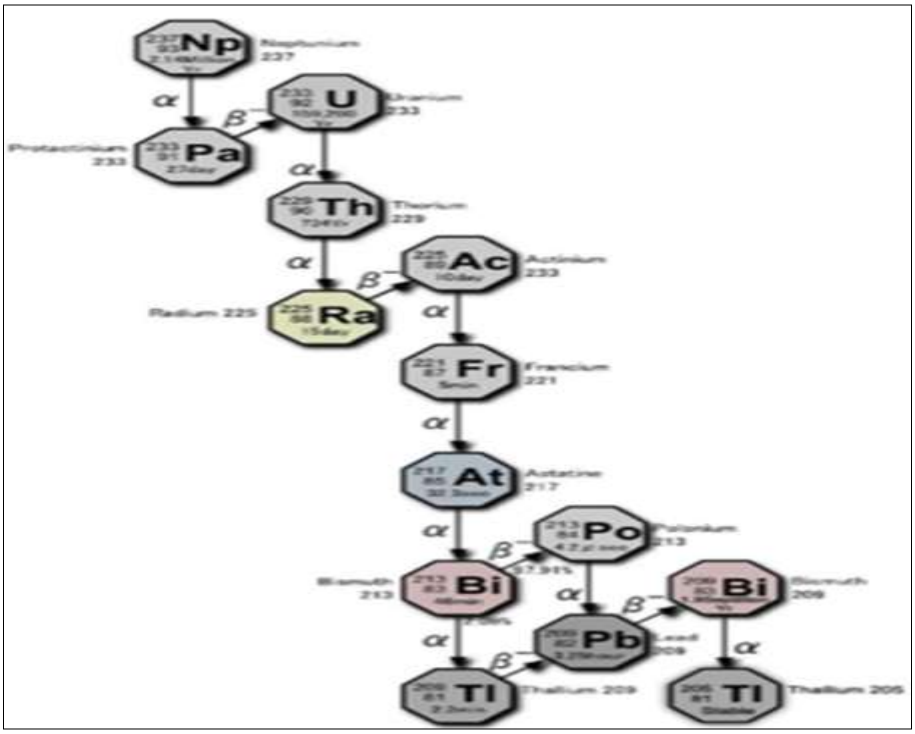

Fig 8: Btoday series

Laws of radioactive decay the number and d that the rate of disintegration in the security unit is proportional to radioactive t, Law of disintegration: Observing the radioactive disintegration of the total number of radioactive atoms produced, ÿN is the number of atoms that disintegrate at the power of ÿt. The number of radioactive atoms N produced is calculated by the power owf itt.h

-ÿN/ÿt ÿ N…. (1-1)

-ÿN/ÿt = Const. x N….. (1-2)

-ÿN/ÿt = ÿN……. (1-3)

ÿ: The dissociation constant, which is called the dissociation constant. It is specific to each R, and its value varies from one R to another. By rearranging the equation dn:

ÿN/N = -ÿ ÿt……. (1-4)

Integrated, you get:

ln N + Const. = -ÿt ……. (1-5)

By substituting t=0 and N=0N into the equation.

ln N0 + Const. = 0… (1-6)

Const. = -ln N0 ……… (1-7)

By substituting into equation (1-5):

ln N - ln N0 = -ÿt ……… (1-8)

ln (N/N0) = -ÿt ……… (1-9)

N/N0 = e-ÿt (1-10)

N = N0 e -ÿt……….. (1-11)

From a scientific standpoint, it is not possible to measure the number of generated particles at the initial level 0=0t and the number of generated atoms and the number of the importance of radioactivity in medicine and its influence, but in practice it is possible to measure the radioactive activity of the axis A and it is consistent with
picture: Mood N and Bah

A = A0 e-ÿt ……. (1-12)

R is the number of disintegrations per second, Where A is the radioactivity of the light.
Half-life 1/2t It is one of the important terms in radiochemistry, and it is known as the nominal period that determines the number of radioactive energies, regardless of the fact that the sample is g1 or g1000, as it is one of the isotopic constants. Radioactive substances, regardless of their quantity. Assume that the amount of radioactive harm is 0N at the rate of safety 0=t. We can calculate the quantity Nt that remains without.

N(t) = N0 e ÿt -.... (2-1)

Decomposition at the rate of t from equation (5-1): where 0N: is the initial value of N (0 = t) (initial ÿ: Mob constant (decomposition constant) When t = 0, the exponential function is 1 and Nt is equal to 0N. When t approaches the limit, the exponential function, Bah: approaches the branches and is decomposed into the quantity, so it has a time of 1/2t in, N t1/2 = N0 x2 ……… (2-2)

N0 x1= N0 e 2 ÿt1/2 -.... (2-3) By substituting into the previous equation, solve for (2-1):e -ÿt1/2 = 12..... (2-4)

-ÿt1/2 = ln12 ……… (2-5)

-ÿt1/2 = ln1 - ln2…… (2-6)

)-ÿt1/2 = 0 - ln2) x -1…… (2-7)

ÿt1/2 = ln2……. (2-8)

1/2 t = 0.693/……. (2-9)

The lifespan of L is a fixed value for each L and is used to identify radioactive phenomena. Nuclear reactions: Nuclear reaction energy: t (the target) and a basic symbol of the kinetic energy of the (projectile) It is an interaction process between the reaction agents alpha, or it must be neutral, either it must be of great energy such as the proton P, deuterium d, this element is like the neutron n, and the projectile combines with the target to form the compound nucleus that disintegrates. To give the result of the reaction, which depends on the energy of the projectile. There are two types of nuclear reactions: A nuclear fission reaction reaction nuclear fusion Y Oh always Woo-1 interaction -2 interactions, It was discovered by Rutherford in 1919 when the isotones were separated by alpha minutes in thea firs Wt oreo action between oxyene and a proton: Pain mission from polo day Q: It is the positive energy of the reaction. Woo the reaction is equated by equalizing the mass numbers and the atomic numbers on both sides of the equation. The chemical reaction and the chemical reaction are similar in terms of absorption or release of energy. In a chemical reaction, the negative energy ÿH represents the positive energy of the reaction and can be positive (endothermic reaction) or negative (exothermic reaction). And the symbol of the energy that is loved by the symbol Q As for the interaction calculated from the difference between the masses of the reactants and their substances in atomic mass units. The value of the reaction energy, Q, is.amu Q = ÿ(m product - m reactant) (931.5 Types of nuclear reactions: The nuclear repercussions vary depending on the projectile. Either the projectile is a eutron, a proton, a deuterium, or a sim-alpha. First: Nuclear reactions with neutrons and without eutrophs, this difference resulted from the difference in the energy of the neutrons and the different reaction directions for the reaction with which the reaction began. (n, ÿ) Reaction Gamma-neutron reaction, this reaction takes place when the speed of the eutrophs is reduced, such as the following reaction: t the reactant, In this interaction, the reaction is directed towards the reaction (n, p) reaction Proton-neutron reaction In this reaction, the proton combines with an electron from the medium surrounding the nucleus, and the proton turns into a hydrone, atom, such as the following reaction: (n, ÿ) Reaction Alpha-neutron reaction. In this reaction, the speed of the neutron must be high, such as: + (ÿ) + + ÿ (n, n) Reaction Neutron-neutron reaction, This reaction takes place when the energy of the neutron is between 111 kiloelectron volts and a few million electron volts (Mev - 100 Kev). In this reaction, the energy of the outgoing neutron is less than the energy of the incoming neutron (the projectile), and the nucleus is left in a state An excitation that then leads to a stable state by emitting rays of radiation, and the resulting nucleus is the interacting nucleus. (n, 2n) Reaction Neutron 2 - Neutron Reaction. This reaction requires a neutron with sufficient energy to overcome the binding energy of the two neutrons, and the product in this reaction is an isotope of the reacting nucleus with an atomic weight one less than the atomic weight of the reactant, such as the following reaction: + () + ÿ, Neutron reaction that leads to nuclear fission, It is an interaction between fast or slow neutrons with heavy nuclei Z < 92. This interaction results in a number of neutrons, two medium nuclei, and a huge energy of 200 Mev per fission, and it will be identified later. Second: Nuclear reactions with protons - Reactions -P Nuclear reactions with protons differ depending on the difference in kinetic energy of the shell (proton), and the proton is the nucleus of the hydrogen atom. Among the proton reactions are the following: (p-ÿ) Reaction Alpha - Proton Reaction. This reaction produces a different nucleus and a helium nucleus such as: + ÿ ++ ÿ + m (P, n) Reaction Neutron - Proton Reaction, this is because the sum of the weights of the resulting materials is greater than reversible. This reaction is always endothermic and, the sum of the weights of the reactants because the weight of the neutron is greater than the weight of the proton. Example: + ÿ + (P, ÿ) Reaction Gamma - Proton Reaction, In this reaction, high energy gamma rays are released as one of the reaction products, such as: + ÿ + (P, d) Reaction Deuteron - Proton Reaction, In this reaction, the product is an isotope of the reacting nucleus, such as: + ÿ +, The deuteron is heavy hydrogen that contains a proton and a neutron., Third: Nuclear reactions with deuterons Reaction-d, There are three types of nuclear reactions with deuterons. The deuteron is produced by a cyclotron with a high energy of up to several megaelectronvolts. These reactions include the following: (d, ÿ) Reaction Alpha - Deuteron Reaction, This reaction is considered exothermic. Examples of this reaction include the following: + ÿ + (d, P) Reaction Proton - Deuteron Reaction, This type of reaction is considered exothermic, and the nucleus resulting from the reaction is an analogue of the reactive nucleus, such as: + ÿ + (d, n) Reaction Neutron - Deuteron Reaction. Examples of this type of interaction include:+ ÿ +Fourth: Reaction -ÿ There are only two types of alpha reactions in which the product is either a neutron or a proton:(ÿ,n) Reaction Neutron - Alpha Reaction, Examples of this type of interaction include:+ ÿ +(ÿ, P) Reaction Proton - Alpha Reaction.

An example of this interaction is the following: + ÿ + Fifth: ÿ-ray reactions among the nuclear gamma ray reactions is the gamma-neutron reaction (n, ÿ). Examples of this reaction include: + ÿ +, When the energy of gamma rays is high, a gamma-proton interaction can occur, Reaction nuclear fission, It is the process of splitting the nucleus of an atom into two or more atoms close in mass. In this process, one substance is, transformed into another substance. This process of fission produces eutrophs and a large amount of energy. Like: Woo, This fission could occur in the universe spontaneously, just as it could occur within a reactor++ ÿ slow, Energy + 3 +.

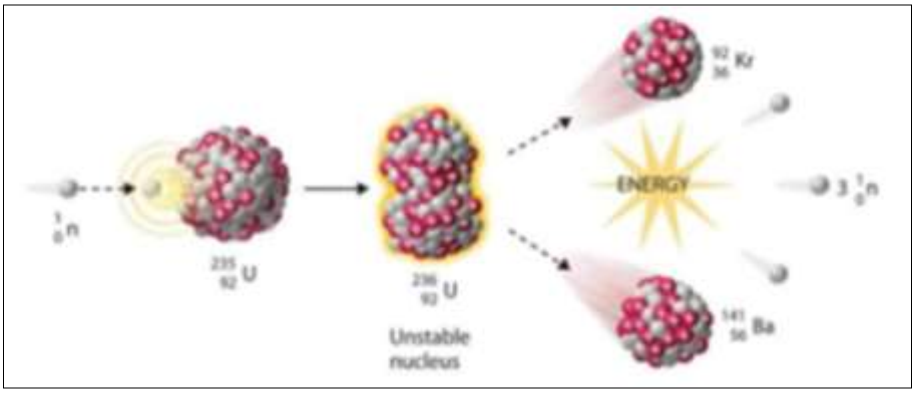

Fig 9: Reaction A smart one Woo

It is a slow eutroph, so the sequential sound of the 23e5 utroph is broken, and, Woo The important factor for initiating the reaction is a number of eutrophs.) it quickly splits into two parts and 236 Pal Utron converts to U (The process continues with a sequential reaction, and to 235 After that, the eutrophies slow down and stop in turn (U control the interference of eutrophic substances such as boron and cadium, which can maintain the level of Woo The interaction Fixed from the Eutroit., A chain reaction is a series of numerous fission reactions that occur in a short period of time. Cha It has enormous energy (and it happens to throw a heavy force like a day with a eutroph, splitting the material into two parts.) Other molecules. This reaction results in the release of eutrophs that split new molecules. - The chain reaction occurs in a nucleus, but without control. It is controlled within the nuclear reactions by controlling the number of eutrophs. The greater the number of eutrophs, the faster the reaction. This is done by passing a fluid, and because of the high thermal energy generated from the reaction, the reactor temperature does not cool the sodium or Co2. These fluids absorb electrolytes, but they have the ability, like heavy water, to produce high temperatures, so they absorb the heat. A nuclear reactor generally consists of: Woo and where the reaction occurs - 1 - The reactor core: which contains the fuel 2- Eutrophic sedatives: Slow the speed of eutrophs generated from light fission and the continuation of the reaction. And) such as paraffin and wax the Woo 3- Coolers: To get rid of the high heat generated during fission 4- The control device is used to stop the chain reaction and control it. Control rods are used, which can be inserted and inserted into the center of the reaction core. Inserting the control rods stops the reaction by removing the eutrophs, so the reaction stops, and inserting them leads to the continuation of the reaction. Generated from fission.

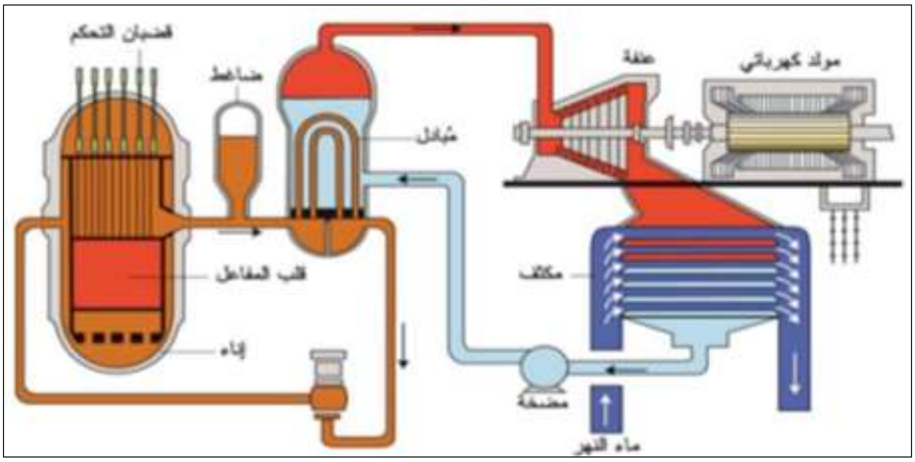

Fig 10: Nuclear Power Plant

Benefits of nuclear reactors

1 - A crown of radioactive isotopes that have many uses. In medicine, the radioactive isotope of radium is used in the dentin of cancer diseases, radioactive phosphorus is used in the dentin of leukemia, radioactive iodine is also used in the diagnosis and treatment of thyroid diseases, and radioactive cobalt is used in the dentin of cancer with radiation. Technique on day 99 to diagnose bone cancer. 2-Electric power generation, 3-Desalination of seawater production of the atomic kiss, as the idea of the kiss depends on splitting the ura-day or, One of the negative applications of the fission reaction is the in a way. Automatically M pluto-day and exposing them to great pressure that leads to their shrinking into small pieces, and thus fission occurs in the cells and releases a large amount of energy. Nuclear reactions are also one of the important alternatives to energy because they produce enormous energy reaction nuclear fusion, in which two light ions are combined to form a heavier and more stable nucleus, and it takes place at high temperatures, it is a reaction. This type of reaction is considered more dangerous than the fission reaction due to the enormous energy released from it. This interaction. For example, the fusion of deuterium and tritium, in the sun: the blood reaction, In the sun, if intense heat is generated by the fusion of four hydrogen atoms, the combustion reaction occurs as in the equation: 4 ÿ +.

Applications to combinatorial reactions: The crown of energy is of no use to anyone, but there it is Y Man has not yet been able to develop the interaction except for destructive, Woo negative applications, represented by the production of the hydroelectric kiss, which depends on the fusion of, Hydro Kiss: One and the other is the hydro kiss, It consists of two fission chambers, one of which is a fission chamber and a core, inside a gas chamber, which consists of heavy hydrone nuclei and is contained in a container surrounding the fission chamber. The explanation for the fission kiss begins first, and then the heat generated by this reaction is used to fuse the atoms. Hydrogen to form helium nuclei and release a huge amount of energy has a destructive capacity that is much greater than the destructive force coming from nuclear bombs, as the power of hydro-kiss bombs is equivalent to 1000 atomic bombs. To overcome the repulsive forces between the hydrogen atoms This requires high temperature* Internal integration has a tremendous destructive force, so it is difficult to apply this interaction to reality. Applications of nuclear radiation: Radiation impacts are used in several applications, including: -1 In physical chemistry: To study chemical reactions in kinetic chemistry, including (the rate and speed of the reaction, the order, the path of the reaction, the nature of the intermediate bodies, activation energy, breakage, and formation of flames). The use of radioactive isotopes has helped in solving and treating many problems in this subject. In analytical chemistry:) Activation analysis: Ar (ppp) is like a milliliter Activation analysis is considered one of the most important methods for determining small quantities of alloys and the impurity of alloys, which is important in scientific and technological fields such as the R in vital materials, control and resistance to fungal pathogens and the detection of toxins, environmental pollution, Cross-sectional analysis awareness, and that the basis aonfd the effects of recurrence in the world. This analysis can be quantitative, namely by irradiating the fluorescence to turn it into a radioactive particle and then diagnosing it through direct radiation. Tagged as indices to set the equivalence point instead of indices, Radiological analysis: Chemical analysis is used if it is not possible to use it.c) Radioactive isotopes in chromatographic analysis: It is known that paper and thin-layer chromatographic analysis Find out what you want is considered one of the most important methods of chemical analysis, but it is difficult, biologically or vascularly, but the use of radioactive isotopes can treat these sensitive nuclear and non-loyalty chemicals, as Radiation from radioactive phenomena is monitored by: 1- Radiological scanning: using a suitable counter 2- Demonstration of the nevus by autoradiography For example, estimating the is Rdone by exposing some of the element in some organic solvents by replacing the normal hydrogen with radioactive tritium. e) Estimating the solubility of substances: It is used to measure the solubility of poorly soluble substances. This method has a high sensitivity compared to traditional methods, where a known source of the solid substance is taken, and the radioactive activity is measured as the concentration of the solution on a saturated Moil suctioned. n from the water and shake hands It is then placed in the radiotherapy room.-3 In biochemistry: Radioactive isotopes have been used in biochemistry. They have enabled scientists to know the vital actions and functions of organs and the mechanics of chemical processes. -4 In medicine: Radioactive isotopes have been used to determine blood circulation, the efficiency of blood flow through the capillaries, and diagnose some diseases such as narrowing of the veins and arteries. The efficiency of the heart has been studied using radioactive isotopes, as well as poisoning for diagnostic or treatment purpose. The processes of absorption and excretion of some substances within the body It has also been used to study blood diseases and malignant diseases, including leukemia and lymphoma In thyroid dentin Use P Iodine I -5 In botany: Radioactive isotopes have been used to study the absorption and signaling of some foodstuffs and pesticides. The plant is immersed in the food solution or the solution containing the pesticide and the radioactive isotope, and then the radiation of the radioactive radiation is followed by radioactive imaging. -6 In hydrology and sedimentology: Radioactive isotopes were used to study the flow of water, including the speed of flow and the rate of drainage, and to investigate dead water and its contamination with radioactive silver. It also studied the movements of silt and its deposits in rivers

Conclusion

To know the reactions that occur as a result of a change in the nuclei of atoms. Nuclear chemistry is concerned with studying the structure of the nucleus and the nature of its basic constituent particles, and how this structure affects its stability. Therefore, it is the science that is concerned with studying the phenomena that lead to changing the structure of the nucleus, whether through natural radiation processes or artificial change processes. The latest theories in the field of nuclear chemistry have stated that the nucleus has a structure composed of energy shells similar to the electronic structure of an atom. These facts have been inferred from studying the phenomena associated with nuclear radiation., The energy changes that accompany nuclear changes are considered very large when compared to the energy changes that accompany chemical reactions, and they are nearly millions of times greater, because the nuclear forces that bring together the particles that make up the nucleus are much greater than the chemical forces that form the bonds in molecules and materials. As for the science of radiochemistry, it is considered one of the most important technical applications for studying radioactive materials and the chemical changes they can cause. The fundamental difference between normal chemical processes and those that occur under the influence of nuclear radiation is that in the latter case we track any change that occurs with measurements related to radiation measurement processes.

References

1. Hussein AAR. Foundations in nuclear and radiochemistry, To Professor.
2. Khaled Y, Al-Yamour. Principles of radiochemistry, ritten by: Od Yen and Sha Custer, translated.
3. Salumi AR, Daoud HF. Nuclear Chemistry (Part One), written by: Wayne and Rydbrick, translated.
4. Salomi AR, Daoud HF. Nuclear Chemistry (Part Two), written by: Wayne and Rydbrick, translated.
5. Al-Qaisi M. Radiochemistry by Professor.
6. https://web.archive.org/web/20170919160546/https://brilliant.org/wiki/nu /clear-decay
7. Wesley A. Nuclear Physics by Irving Kaplan, 2nd edition; c1962.
8. https://web.archive.org/web/20200418080738/https://books.google.com/b ooks?id=ZVgOLCXNoMoC&pg=PA495#v=onepage&q&f=false
9. https://circuitglobe.com/difference-between-alpha-beta-and-gamma-particles.html
10. https://ecotestgroup.com/press/blog/s-difference-alpha-beta-gamma- /radiation
11. https://www.epa.gov/radiation/radiation-basics
12. https://chem.libretexts.org/Courses/can/intro/17%3A_Radioactivity_and_Nuclear_Chemistry/ 17.03%3A_Types_of_Radioactivity%3A_Alpha_Beta_and_Gamma_Decay