Study the expense of long-term and relative to alpha particles and protons among the various elements

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ABSTRACT In this research study theory to calculate the range of alpha particles and protons with atomic number (1,2) through the passage in the media watchdog of the elements (Lanthanum La and Samarium Sm and Alerdiom Er and Altantalm Ta and gold Au, Lead Pb and uranium U) with atomic numbers (57.62, 68,73,82,92) the results showed that the extent of alpha particles and protons in these circles depends on Quicken goals Atomic exponentially in addition, we find that the term proportional directly proportional to the charged particle energy as well as its dependence on the mass and charge density of the charged particle. The curves showed that the extent of alpha particles and protons increases with increasing energy, although theoretical calculations of the extent of all the shells passers in goals Atomic Energy held in extent (0.3-100MeV) for protons, while Alpha is the extent (1.6-100MeV).

As for the term relative lost by each of the alpha particles and protons in goals (IAEA) (La, Sm, Er, Ta, Au, Pb, U). And compared the results obtained to the extent with the results of the program SRIM2003 Tests showed good agreement with the use of the equation, especially due to the difficulty in obtaining results of the process over. A computer program has been adopted in the Matlab programming language equations for calculating the range to get the desired results and that is described as graphs

1. INTRODUCTION

When the passage of charged particles (Charge Practical) through the physical medium, they will lose part of their kinetic energy at each collision with atoms of target material and the process continues with the length of the path of the particle through the center will result in the continued decrease in the kinetic energy of charged particles until it reaches zero, where he inspected all kinetic energy and up at a certain point, therefore, the total range (Total Range) charged particles bystanders during physical medium can be defined as, Average length of the path that broken-charged particle is known in terms of the ability of the stop [1]

\[ R = \int_0^E dx \left( \frac{dE}{dx} \right) = \int_0^E \left( \frac{1}{\frac{dE}{dx}} \right) dE = \int_0^E \frac{dE}{S \cdot N} \ldots (1) \]

Where, R: term for the charged particle
When high energies are used to calculate the equation for the term [2] which are:

\[ R = \int_0^E \frac{dE}{-\frac{dE}{dx}} \ldots \ldots (2) \]

Where dE represents the rate of energy, But when the low-lying energies shall be inaccurate to calculate the total range and because the value of the lost energy \( \frac{dE}{dx} \) is the value of the non-specific integration due to the fact that the proportion of the energy \( E = 0 \) Unknown [3].

It is interesting that the very attempt to calculate the rate of packet transmission distance of the particles in the center by integrating the ability of suspended particles as a function of energy falling

\[ R(T) = \int_0^T \left[-\frac{dE}{dx}\right]^{-1} dE \ldots (3) \]
Makes a theoretical calculation of the Rang of a very difficult task [4,5], so a number of scientists have gone to the experimental equations to calculate that amount and Adloha on the basis of their findings. Bragg and Kleeman [6] gave a formula to calculate the Rang of the grave in the middle of their range if it is known in the midst of another:

\[
\frac{R_1}{R_2} = \frac{\rho_2}{\rho_1} \left[ \frac{A_1}{A_2} \right]^{1/2}
\] (4)

\((\rho_1, \rho_2)\) represent the density of the middle first, second and A1, A2 mass number of materials. But at the same speed Gesimitan Mahontin primary \(\beta\), the ratio between the Mdyatea is simply [7].

\[
\frac{R_1(\beta)}{R_2(\beta)} = \frac{Z_1^2 M_1}{Z_2^2 M_2} \ldots
\] (5)

as \(M_1\) and \(M_2\) is the mass static and the \(Z_1\) and \(Z_2\) is the atomic number for both Algesimitan. If the grave is the second charged proton \((M_2 = 1\) and \(1 = Z_2\)) Fbalamkan writing term for other serious as follows:

\[
R(\beta) = \frac{M}{Z^2} R_p(\beta) \ldots
\] (6)

The \(R_p\) is protons Rang and \((Z, M)\) mass and charge the other on the shipment, respectively.

2. RANGE OF ALPHA PARTICLES

There are several formulas and quasi-experimental trial for the purpose of calculating the Rang of alpha particles in the air such as [8,9].

\[
R_{\alpha}^{air}(mm) = \begin{cases} 
4\text{MeV} < E_\alpha^5 & e^{1.61 \sqrt{E_\alpha}} \text{ For } E_\alpha \\
(0.05E_\alpha + 2.85) & \text{ For } 4 \text{ Mev} \leq E_\alpha \leq 15 \text{ MeV}
\end{cases}
\] (7)

And

\[
R_{\alpha}^{air}(Cm) = \begin{cases} 
4\text{MeV} < 0.56E_\alpha & \text{ For } E_\alpha \\
1.24E_\alpha - 2.62 & \text{ For } 4\text{MeV} \leq E_\alpha \leq 8 \text{ MeV}
\end{cases}
\] (8)

Possible to predict the Rang of alpha particles in the air between the card (4-7MeV) using a modified version of equation (7) and follows [10].

\[
R_{air} = 0.3E^{3/2}
\] (9)

The Rang of alpha particles in other materials such as liquids and steel (except air) will be shorter because of the high density, as well as the number of collisions of particles occurring along the migration path. The Rang of alpha particles in a fluid and steel, compared with nearly long in the air, according to the formula.

\[
R(cm) = 0.00032 \left( \frac{A^{1/2}}{\rho} \right) R_{air}
\] (10)
The R (cm) is the Rang of gross alpha b cm in materials other than air, and A is the atomic weight of the central absorber and ρ is the density of the middle-sucking mgCm$^{-3}$ and $R_{air}$ term rate is linear for gross alpha in the air. If we multiply the linear range of the alpha particles are measured in cm circles heavily absorbent absorber units (mgCm$^{-3}$) the Rang of alpha particles in the center absorber can be expressed in units of (mgCm$^{-2}$) as follows.

$$R(\text{mgcm}^{-2}) = (R(cm))(\rho)$$  \hspace{1cm} (11)

The R (mgcm$^{-2}$) is the Rang of alpha particles in units of mgcm$^{-2}$ any units of the fish mass. Anyway empirically see it, except for some specific cases, the alpha particles emitted from the nuclide what her energies and ranges similar is that of milestones for those Almued. was found experimentally that the ranges of those minutes up to 9.3 cm in the air degree 15 ° pressure 750mm in these circumstances, found that the term is directly proportional to the cube of the speed of the grave [11]. Rang of alpha particles as well as charged particles such as protons and Aldiotronat which lose energy in elements of the center absorber with atomic number Z> 10 units of fish mass of absorbent can be calculated directly by comparing them with the term calculated for the same charged particles and the same energy in the air according to the following formula and described by Friedlander et al [10,11].

$$\frac{R_z}{R_{air}} = 0.90 + 0.0275Z + (0.06 - 0.0086Z) \log \frac{E}{M}$$  \hspace{1cm} (12)

The $R_z$ is the Rang of the charged particles in units of mass fish mgcm$^{-2}$, $R_{air}$ is the Rang of the charged particles in the air in the same units of mass fish. Z is the atomic number of the element absorber, E Energy grave in units of MeV, M is the mass number of serious (for example, one of the protons 2 Diotronat 0.4 to alpha particles). Formula in the above can be applied to the charged particles of a wide range of energies almost within range (0.1-1000MeV) and elements of the sorbent with atomic number (Z> 10) As for the elements of the absorbent light, the limit Z 0.0275 + 0.90 replaces the value of 1.00 with the exception of hydrogen and helium, we use the value of 0.30 and 0.82 on the sequence. for alpha particles can only calculate the term in units of fish mass according to the equation described by Vance and Ehman as follows [10].

$$R(\text{mgcm}^{-2}) = 0.173 E^{3/2} A^{1/3}$$  \hspace{1cm} (13)

The E is the energy in units of MeV gross alpha and A is the atomic weight of the central absorber. Determine the Rang units (mgcm$^{-2}$) to the center of the absorber can be converted into a linear term in units of cm at the same center-absorber which density (ρ) the following relationship.

$$R(cm) = R(\text{mgcm}^{-2})/\rho$$  \hspace{1cm} (14)
When the center-absorber is not an element pure but a mixture molecularly (such as water, paper, Polyethylene... etc.) or a combination of elements such as alloys, The Rang of the alpha particles in the center absorber is calculated according to the equation below, depending on the basis of the atomic weights of the elements and the percentage of components absorbent material, in other words, the weighted fraction of each component of the center-absorber. Thus Rang to fish in units of mass of alpha particles in the elements or compounds or mixtures are calculated according to the following equation [10,11]:

$$\frac{1}{R(mgcm^{-2})} = \frac{w_1}{R_1} + \frac{w_2}{R_2} + \frac{w_3}{R_3} + \ldots + \frac{w_n}{R_n}$$

(15)

The $w_1$, ..., $w_3$, $w_2$, $w_1$ is the molecular weight of each element in the middle absorbent and $R_n$ ..., $R_2$, $R_1$ is the Rang b $mgcm^{-2}$ to alpha particles for each element of the center absorber. Equation (15) Barak called the base to collect term, which can be written as follows [12].

$$\frac{1}{R_c} = \sum_i \frac{w_i}{R_i}$$

(16)

$R_c$ and $R_i$ term in the composite element on the sequence $w_i$ and the molecular weight of component $i$. The term account in vehicles depending on the base of the collection Barak increasingly relied upon at high energies as that that rule is inaccurate at medium energies and low-lying part of the non-Alladegh This is due to the ability to stop Barak within this range be inaccurate.

3. RESULTS AND ACCOUNTS

a-Calculation Of Range For Alpha Particle In Atomic Target

By equation (13) by the Rang of alpha particles in units of $mgcm^{-2}$ passer in circles Atomic (La, Sm, Er, Ta, Au, Pb, U) in the range of energy (1.6-100Mev) The note from Figure 1 that he increase Energy gross alpha increases the Rang of its penetration of the center position with the observation that the Rang of alpha particles in various circles is about the same when the energies of low-lying with a slight difference at high energies can be attributed to the atomic weight of the central absorber $a$, and to the nature of the center-absorber. By alpha particles and the Rang of his drawing power as a function of gross fallen by the language of the program Matlab.

![Graph](image)

Fig (1) The Rang of alpha particles falling on the atomic goals (La, Sm, Er, Ta, Au, Pb, U)

b-Calculation Of Range For protons In Atomic Target

By the Rang of the protons in the atomic circles mentioned in section (1) and the Rang of energy (0.3-100MeV) as we used the equation (13) in the calculation of the Rang of alpha particles passing through those circles Atomic first and then was compensation in the equation.

$$R_1(\beta) = \left(\frac{Z_2^2 M_1}{Z_1^2 M_2}\right)R_2(\beta)$$

(17)

On the grounds that the grave second is gross alpha and took the process of calculating the long and drawn as a function of energy gross Fallen using the program language of the Matlab as shown in
Figure 2, which shows the range of the protons in the medium earlier because of which we find that the range of the protons is the same in all those circles at energies low-lying, but note that the term is different at high energies and can be attributed to the effect of the atomic weight of the middle of the absorber as well as high-energy electrons. It curves term note that increases with increasing particle energy -charged any incident that term is directly proportional to the energy and we noticed earlier that the capacity of the stop up less energy that any term energy relationship is a direct correlation.

4. CALCULATION OF RELATIVE RANGE FOR ALPHA PARTICLE IN ATOMIC TARGET

When calculating the term proportional to alpha particles we use the following equation:

\[ R = 0.90 + 0.0275Z + (0.06 - 0.0086Z) \log \frac{E}{M} \ldots (8) \]

Which illustrate the grave charged relative to the range in the air on the grounds that the Rang of energy alpha particles passing through the targets of atomic (La, Sm, Er, Ta, Au, Pb, U) is (1.6-100 MeV) and by term relative and drawing as a function of energy alpha particles using the Matlab language program as shown Aalachul (3), which shows the same behavior for a term relationship relative to alpha particles as a function of kinetic energy in various circles. As the value of the term relative is greatest closer the values of low-lying energy as it is clear that the range of particle falling when those values of energy in the middle absorber be much larger than the range of the grave in the air at the same energy and this is because of the impact of the shipment and the atomic weight of the middle of the absorber in gross fallen, when the energies of low-lying particles falling, the term relative in circles most densely E is greater than the term relative in circles less dense electronic confirming what previously stated about the impact of the shipment and the atomic weight of the middle of the absorber, we find that the term relative to gross alpha when energy MeV 1.6 in uranium with atomic number 92, while almost 4.2 in gold with atomic number 79 and in the lanthanum with atomic number 57 will be 3.7 and 2.8 on the sequence. But at high energies, the term proportional to alpha particles in the circles mentioned be close and that means that the impact of energy alpha particles is the basis for determining the range.
5. CALCULATION OF RELATIVE RANGE FOR PROTONS IN ATOMIC TARGET

We have calculated the long relative to the protons in goals (IAEA) (La, Sm, Er, Ta, Au, Pb, U) within the range of the energy (0.3-100MeV) using equation (18) and by term relative to protons and drawing as a function of energy protons using the program in a language of Matlab as shown in Figure 4 showed that the behavior of the term as a function of the relative energy protons have the same behavior in such diverse settings as we find that the term is inversely proportional to the relative energy protons fallen in those circles. We also find that the term relative to the protons at energies of low-lying be a close in all circles diverse and also note that the lower the energy of protons increases the value of term relative making the Rang of the protons in circles varied greater than the Rang of the protons in the air. Also note that the term relatively high energies is greater in the density of electronic media at least since that whenever I said electronic density of the medium, the ratio between the absorber term in the center and the air will be les.

Fig (3) The Rang relative to alpha particles falling on the atomic goals
(La, Sm, Er, Ta, Au, Pb, U)

Fig (4) The Rang of the relative protons falling on atomic goals
(La, Sm, Er, Ta, Au, Pb, U)
5. CONCLUSION

The general formula to calculate the range (1) make a theoretical calculation of the Rang of a very difficult task because it is not accurate to calculate the term when the energies of low-lying, so we adopted the equation (6) to calculate the term for greater accuracy in the calculation of the range.

In light of our study of the Rang of the relative turned out to be the Rang of heavy charged particles in various circles of the largest ranges in the air when the energies of low-lying, while the range of protons in different settings in less than a range of air in the high energies. From our study of the Rang generally turned out in large influenced by many factors, including. The mass of the particle mass -charged heavy impact on the Rang to penetrate the center of the small Vaketh charged particle at the center of the unshielded material increase over the break of the material, but winding paths But note that the increase in mass -term at least. And energy when he was stopping ability is inversely proportional to the energy and including the term is inversely proportional to the ability of the stop clear -term fit directly proportional to the energy and show us that the protons and alpha particles among the pure elements, as well as vehicles. As for the intensity of this factor turned out to big an impact in our calculations of the theoretical capacity of the stop and the Rang of the charged particles (protons, alpha particles) in both water and Almaalr and Kabton prominently Taking The ability of suspension increases with increasing density. So term is inversely proportional to the density of the middle absorbent.

Finally Vqdugdna The shipment of the consignment big role in the calculation of both the ability and the long suspension when he was stopping ability increases with increasing particle charge and the Rang inversely proportional to the Rang to the ability of the stop so is inversely proportional to the square of the shipment.

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References

