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Background Ionized Radiation Battery Energy Nuclear

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Abstract

What is or was the tree of life? Was it a way of remembering the origins of a tribe of people. Was it a better way to live one's life? Was it an actual tree who's bark, roots, leaves, or fruit had amazing wound healing properties? I believe the religious perspective of the tree of life in the bible was not a tree, but the symbolic representation for the (Christ atonement), and the resurrection of the dead, to immortal bodies. Why rock the ark? When a believer anyway. Have the vagaries of religious symbolism been superseded by the steady principles of science? Qualitative analysis. A fairly accurate description of an event, of what's going on. Quantitative analysis, Being able to find a way to successfully measure what just happened, and repeatability being as predictable and repeatable as the sun rising in the east and setting in the west. So how can proven scientific principles be applied more correctly to the understanding of electricity in its current or future forms? Conventional manufacture of electricity uses the flow of the negative charged electrons that orbit an atoms nucleus; that are available in the metallic crystal structure.

As the atoms have a nucleus of positive charged protons and neutral charged neutrons, with matching number of negative charged orbiting electrons to nucleus protons. The electrons pushing out the previous electrons maintain an overall charge balance in the metal. A force in joules like water flowing down a pipe over a vertical cliff (gravity+pressure) is captured by a turbine blade, then is converted by an electrical dynamo into electrical pressure (voltage). The electrical pressure pushes those tiny sub atomic electrons all the way down the wire. More voltage pressure more pushy pushy on the electrons. Each replacing the next in line. Like factory workers. Until the electrons arrive at the end of the wire. To possibly an electric motor which can do as much work as the original joules of work created when the water flowed down the vertical pipe. So electrical pressure can push electrons along in a sea of electrons in a metallic crystal, a metal. Electrostatics is where opposite polarity, charged particles attract each other (Coulombs Law). Radioactive decay material can be opposite polarity, charged particles. Negative charged beta particles at the speed of light; where the charge and size is equivalent to a negative charged electron. Alpha particles consisting of the helium atom nucleus of two protons and two neutrons.

The Scientific Procedure_(1) Qualitative: To take a radioactive decay element producing negative charged material (beta/electron) as a one half of a battery cell. While also taking a radioactive decay element producing positive charged material (alpha/twin protons) as the second cell of other half of the battery. Sufficient quantity of radioactive decay material per second, as opposite charged particles, create the electrostatic attractive force, to draw the negative charged Beta particles as electrons, to the positive charged alpha particles.

(1) Quantitative: $2\beta^{-}+ {}^{4}/_{2}\alpha^{2+} \rightarrow {}^{4}/_{2}He$ (g)+Q/t {Q/t=*I*} from the process of creating the helium atom in the laboratory in an attempt to create useful current from the attractive electrostatic force of opposite charge decay particles.

The Scientific Procedure_(2) Qualitative: Using radioactive decay material that produces the dual positive charged alpha particle in the confined environment of the previous battery positive cell. A controlled quantity of electrons through a restricted current supply is introduced. To test the fundamental principle of a full outer electron shell as a duet and octet, versus ionic/electrostatic; balance charged force. Using the alpha particle as the basis of an atom or molecule, can a diatomic Helium molecule be forced into creation?

(2) Quantitative: (e^- α^{2+} e^- e^- α^{2+} e^-)=He_2 diatomic Helium Molecule. Or (e^- $\alpha^{2+}\alpha^{2+}$ e^-) $^{2+}$=$(He_2)^{2+}$ Helium diatomic complex ion molecule.

***Keywords:** Radioactive elements; Electrode; Noble gas; Radioactive decaying*

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Introduction

Natural nuclear decay of radioactive elements forms the Earth's background radiation, which envelopes all living things. In some places, concentrated deposits of radioactive decay elements form what is called low-level radiation. This is the case when extracting and processing rare earth elements [1]. Of power sources of a high energy value for the creation of electrical power for the industrial economic benefit of ever-larger populations of people. Only the nuclear fission branch of nuclear energy has been achieved for levels of electrical power generation sufficient for those levels of human economic growth. Yet all this power generated for massive, ever-growing human wealth, has its origins in the natural properties of these tiny little, out of sight out of mind sub, atomic particles; (Qualitative) [2]. Electron mass being 9.1×10^{-31}kg [3] (Quantitative) [2].

The simplest low energy, nuclear battery, harness the products of the natural decay process of radioactive elements. Where these decay products are of opposite electrical charge, the manipulation of these opposite electrical charged subatomic particles allows a controlled electron flow sufficient to produce a working electrical current. With the electrical attractive force of the negatively charged beta (electron) particle {x2}, to the opposite dual positive charged alpha particle, causing the two subatomic particles to combine into the neutrally charged, stable, full outer, valance shell, noble gas Helium [4,5].

In nature, all the lighter atoms and molecules prefer a full stable, outer electron shell of eight electrons (octet). Even salts in solution with opposing attractive electrical charges (positive cations and negative anions) have full, stable, outer shells of eight electrons [6]. Tiny little atoms like the stable, inert, chemically unreactive helium atom; has a full, stable outer electron shell of two (duplet). This fundamental chemistry principle found in nature strongly suggests that the alpha particle which forms the helium nucleus (two protons+two neutrons) will accept two beta particles as two electrons to become a helium gas atom.

By the Formula: $2\beta^- + {}^4/_2\,\alpha^{2+} \rightarrow {}^4/_2He(g) + Q/t$ $\{Q/t=I\}$ [7]. Nuclear fission and nuclear fusion research have provided humans with the tools of elemental transmutation [8]. Converting one elemental substance into another elemental substance. Just as cosmic rays convert some of the atmospheres of Carbon12 into radioactive Carbon14 [9]. In a two cell electrochemistry battery, excess electrons produced by the 'oxidation reaction cell' are attracted through an external wire to the positive ions produced by the positive ions produced at the 'reduction reaction cell' [10]. By creating short-lived, high energy radioactive isotopes (in a nuclear reactor environment) which produce decay material of opposing electrical charge [11].

A positive electrode and a negative electrode, for a two cell nuclear battery, may be created. Where β^- created in negative nuclear decay cell moves along negative electrode to an external wire, and is attracted to positive subatomic particles at the positive electrode, located in positive nuclear decay material [12]. With the Helium gas electro-chemically manufactured, created a product [12]. Similar to natural occurring Helium from natural radioactive processes in the earth [5].

But why stop there?

By regulating and restricting the proportion of electrons to alpha particles in a closed environment it can be postulated that diatomic helium can be formed. Either type of covalent bonded Helium can be theoretically predicted ($e^- \alpha^{2+} e^- e^- \alpha^{2+} e^-$)=$He_2$ diatomic Helium molecule or $(e^- \alpha^{2+} \alpha^{2+} e^-)^{2+}$=$(He_2)^{2+}$ Helium diatomic complex ion-molecule [13].

But why stop there? Theoretically, as well as the electrical manipulation of the alpha particle to produce the helium atom; combined with nuclear transmutation techniques; various Helium isotopes are feasible. Helium isotopes are the forerunner to the science of economically viable nuclear fusion. Producing enough helium isotopes to provide commercially viable amounts is the next goal. From low energy nuclear batteries, nuclear transmutation of elements, use of radioactive waste products as source material for fusion reactors; is a pure scientific research goal [14]. With significant future commercial implications.

Theory

1. Will a positive charge be attracted to a negative charge? Yes, ‘Coulomb’s Law of Charge’ [15]. Will a positive ion from a radioactive element, from that radioactive element’s decay process be attracted to a negative ion from its radioactive element, from that radioactive element’s decay process? Yes, so an alpha particle with 2 positive charges (2 protons) in its nucleus would be attracted to 2 negatively charged ions or 2 free electrons. Yes. ‘Coulomb’s Law of Charge’ [15]. But an alpha particle with 2 protons in its nucleus and 2 neutrons in its nucleus is the Helium nucleus! Therefore adding 2 negatively charged electrons to an alpha particle with 2 positively charged protons should almost certainly create a Helium atom [5]

2. Helium is created in the sun [16]

3. Helium three deposits on the moon are a more suitable fuel for nuclear fusion

4. Quote “Our sun was created when a cloud of interstellar dust and gas collapsed due to the gravitational attraction between the different parts”. When the core reached the temperature of 10,000,000 K, nuclear fusion of hydrogen into helium started” End Quote [17]

5. Quote “On Earth, the only source of Helium is through radioactive decay processes_α (alpha) particles emitted during nuclear decay are eventually converted to helium atoms” end Quote [5]. What if a radioactive deposit rich in trapped alpha particle decay element material. Was exposed to salt solutions rich in positive and negative ions in solution. Electrostatic attraction [18]. Would the alpha subatomic particle (positively charged with 2 protons) be more electronegative than other elements, and therefore accept the outer shell valance electrons more readily the some of the positive ions in solution? [18] Checkpoint 5, quote, reference [5]

6. Therefore there is sufficient theoretical evidence to speculate on a nuclear battery based on at least two radioactive elements of opposing decay charges, such as one radioactive decay element yielding a positively charged alpha particle while the second radioactive element yielding the negative decay product, the beta particle, (single electron at the speed of light). With the obviously manufactured byproduct being the neutrally charged, inert gas, unreactive, Noble gas, Helium gas! [12]

7. Taking the above theory a step further. As Helium 3 is considered a fusion nuclear fuel, just as deuterium, tritium, and lithium

By the formulas: quote

"$^{2}/_{1}H + ^{2}/_{1}H \rightarrow ^{3}/_{1}H + ^{1}/_{1}H$

$^{2}/_{1}H + ^{3}/_{1}H \rightarrow ^{4}/_{2}He + ^{1}/_{0}n$

$^{6}/_{3}Li + ^{2}/_{1}H \rightarrow 2^{4}/_{2}He$ $\{^{6}/_{3}Li + ^{2}/_{1}H \rightarrow 2^{4}/_{2}\ \alpha^{2+}\}$

$^{1}/_{1}H + ^{2}/_{1}H \rightarrow ^{3}/_{2}He$

$^{3}/_{2}He + ^{3}/_{2}He \rightarrow ^{4}/_{2}He + 2^{1}/_{1}H$" end quote [19]

Can a suitable form of Helium be manufactured on earth, (a) artificially from naturally radioactive decay products like the alpha particle, or (b) from alpha yielding radioactive byproducts from the commercial nuclear process, or (c) a new process additional and within a current commercial nuclear reactor?

Such as by the Formula, $2\beta^{-} + ^{4}/_{2}\alpha^{2+} \rightarrow ^{4}/_{2}He$ (g) $+Q/t$ $\{Q/t=I\}$ [7] and $(e^{-}\ \alpha^{2+}\ e^{-}\ e^{-}\ \alpha^{2+}\ e^{-}) = He_2$ diatomic Helium Molecule. Or $(e^{-}\ \alpha^{2+}\ \alpha^{2+}\ e^{-})^{2+} = (He_2)^{2+}$ Helium diatomic complex ion molecule [13]. As on fusion method requires a magnetic containment system, the above elements are prepared as positive ions: $^{1}/_{0}H^{+}$, $^{1}/_{1}H^{+}$,$^{3}/_{1}H^{+}$, $^{6}/_{3}Li^{+}$, and proposed $(e^{-}\ \alpha^{2+}\ \alpha^{2+}\ e^{-})^{2+} = (He_2)^{2+}$ [13].

Nuclear decay ionization battery $^{60}/_{27}Co$ NEGATIVE potential current calculation (TABLE 1).

See appendix for calculation and calculation method.

TABLE 1: **Available negative charge (beta/electrons) in Amps and mA from the radioactive decay cycle of a given mass of $^{60}/_{27}Co$.**

Time in years	Mass start cycle	Mass per second available radioactive decay material	NEGATIVE charged particles beta-electrons available per second	$^{60}/_{27}Co$ negative current flow amps
Initial	1,000 g $^{60}/_{27}Co$	6.0170×10^{-6} grams/sec of mass $^{60}/_{27}Co$ material	6.017038×10^{16} beta particles per second	Negative charge 1.0028×10^{-2} amps=10.0 mA
2.6 years	710.42 g $^{60}/_{27}Co$	4.274624×10^{-6} grams/sec of mass $^{60}/_{27}Co$ material	4.274624×10^{16} beta particles per second	Negative charge 7.1243739 $\times 10^{-3}$ amps=7.12 mA
5.2 years	504.69910 grams	3.0367938×10^{-6} grams/sec or mass $^{60}/_{27}Co$ material	3.0367938×10^{16} beta particles per second	Negative charge 5.061323×10^{-3} amps=5.06

				mA
5.27 years (half-life $^{60}_{27}Co$)	500 g $^{60}_{27}Co$	3.008796×10^{-6} grams/sec of mass $^{60}_{27}Co$ material	3.008796×10^{16} beta particles per second	Negative charge 5.01466×10^{-3} amps=5.0 mA

Nuclear decay ionization battery $^{252}_{98}Cf$ POSITIVE potential current calculation (TABLE 2).

See appendix for calculation and calculation method.

TABLE 2: **Available positive charge (alpha/proton pairs) in Amps and mA from the radioactive decay cycle of a given mass of $^{252}_{98}Cf$.**

Time in years	**Mass start cycle**	**Mass per second available radioactive decay material**	**POSITIVE charged particles alpha twin protons available per second**	**$^{252}_{98}Cf$ Positive current flow amps**
Initial	1,000 g $^{252}_{98}Cf$	1.219607×10^{-5} grams/sec Mass $^{252}_{98}Cf$ material	2.903827×10^{16} of alpha particles per second	Positive charge of 9.679423×10^{-3} amps=9.68 mA
2.6 years (half-life)	500 g $^{252}_{98}Cf$	6.0980369×10^{-6} grams/sec Mass $^{252}_{98}Cf$ material	1.451913×10^{16} alpha particles per second	Positive charge of 4.8397118×10^{-3} amps=4.84 mA
5.2 years	250 g $^{252}_{98}Cf$	3.049018×10^{-6} grams/sec Mass $^{252}_{98}Cf$ material	7.259567×10^{15} alpha particles per second	Positive charge of 4.8397118×10^{-3} amps=2.42 mA
5.27 years	201.708 g $^{252}_{98}Cf$	2.4600456×10^{-6} grams/sec. Mass $^{252}_{98}Cf$ material	5.8572515×10^{15} alpha particles per second	Positive charge of 1.9524×10^{-3} amps=1.95 mA

Experiment to determine if the viable, long-lasting battery, with enough current from radioactive decay elements, producing opposing charged ions, with a helium atom byproduct/ Cobolt60-Californium 252-nuclear ionized radiation battery (**FIG. 1 and FIG. 2**).

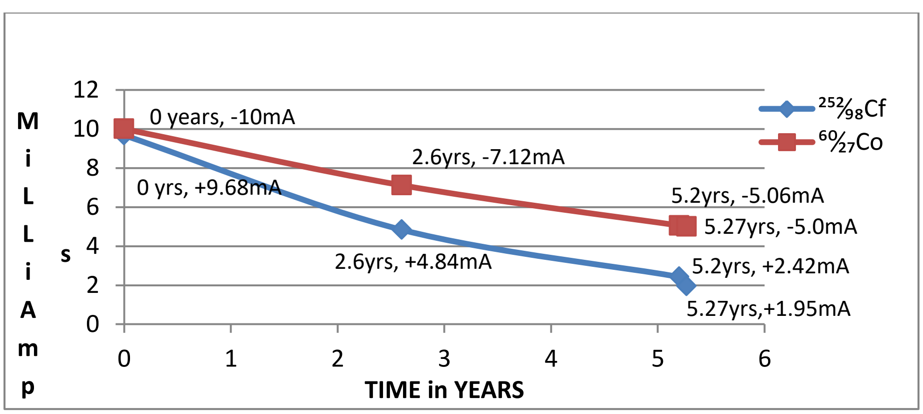

FIG. 1. **Compare +ve ion and electron currents available californium 252 to cobalt 60 over decay cycles.**

1,000 g Cobolt60 Zero Years Probability Current –ve charge (e-)=10 mA

504.7 grams Cobolt60 At 5.2 Years Probability Current –ve charge (e-)=5.06 mA

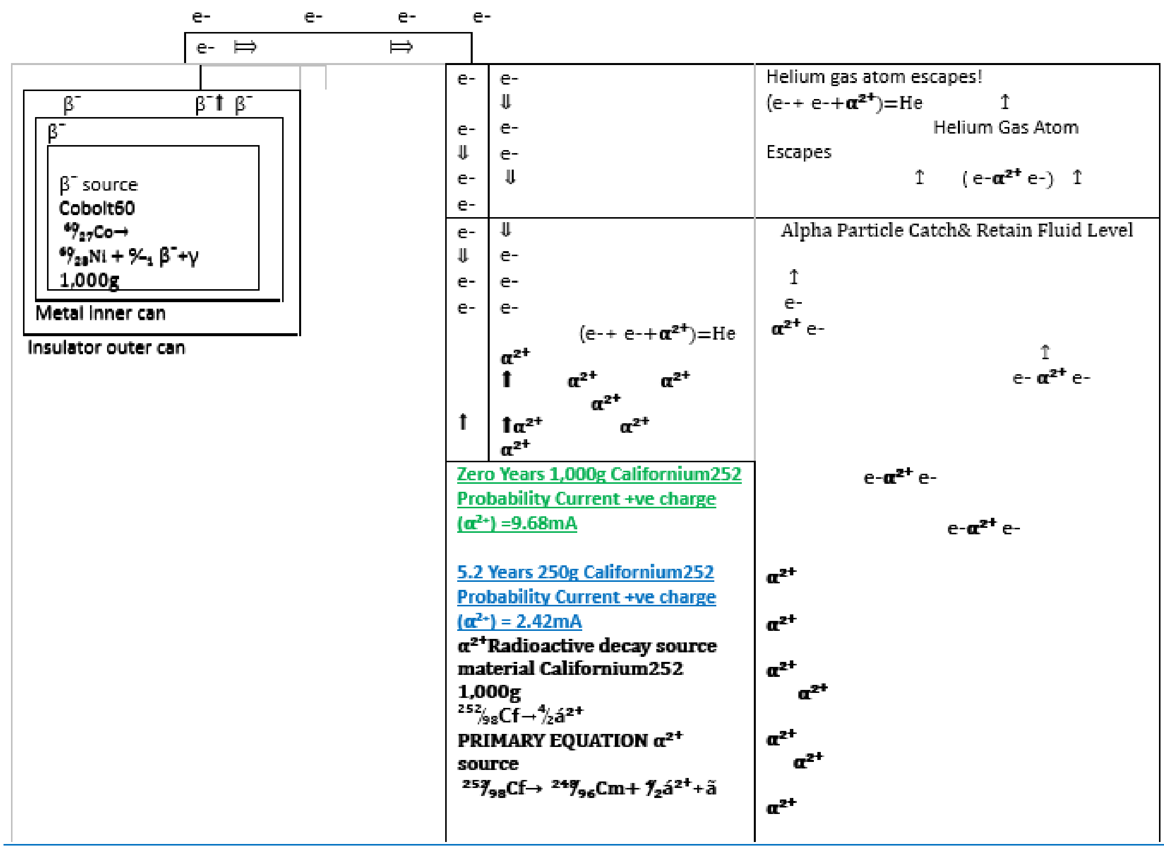

FIG. 2. **Experiment to determine if the viable, long-lasting battery, with enough current from radioactive decay elements.**

There are many theoretical and practical varieties of engineering designs for this particular concept of a nuclear battery. However, the concept itself on which the engineering designs (theoretical and practical) is NOT engineered reversible. As a concept is the foundation principle on which any and all engineering designs are based. The concept, on which this nuclear battery is based, is opposite charged electrical subatomic particles are attracted to each other, ‘Coulomb’s Law of Charge’ [15]. Therefore opposite charged electrical subatomic particles from radioactive decay material are attracted to each other; sufficient to produce a usable flow of electrons (current, I; ranging in amps to milli-amps to nano-amps etc.). By manipulating physical conditions (engineering), negatively charged beta particles emitted (from radioactive decay material) at near light speed can be utilized as a flow of electrons (negative current flow, I), when attracted to oppositely positively charged subatomic proton particles (twin protons combined with twin neutrons from alpha particles), from radioactive decay material, positive current flow, I).

By the Formula: $2\beta^{-} + {}^{4}/_{2}\,\alpha^{2+} \rightarrow {}^{4}/_{2}\,\mathrm{He}\ (g) + Q/t$ $\{Q/t = I\}$ [7]

${}^{60}/_{27}\mathrm{Co} \rightarrow {}^{60}/_{28}\mathrm{Ni} + {}^{0}/_{-1}\,\beta^{-} + \gamma$ [11]

$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm + {}^{4}_{2}\alpha^{2+} + \gamma$

$^{252}_{98}$Californium$\rightarrow {}^{248}_{96}$Curium$+ {}^{4}_{2}\alpha^{2+} + \gamma$, via the formulae: $^{A}/_{z}P \rightarrow (^{A-4}/_{Z-2})\ D + {}^{4}/_{2}He$ [14] or $^{A}/_{z}X \rightarrow (^{A-4}/_{Z-2})\ Y + {}^{4}/_{2}He$ [9]

α^{2+} [8]

β^{-} [8]

Don’t consider these concepts as patentable, however, this document is original and this original document has been darclared as open copyright and open patent document anyway.

Construction diagram of the experiment of ‘the creation of the Helium atom’ (**FIG. 3**) by combining the radioactive, positively charged ion, an alpha particle (derived from radioactive decay element); with negatively charged electrons from an external source. The Helium atom is theoretically created.

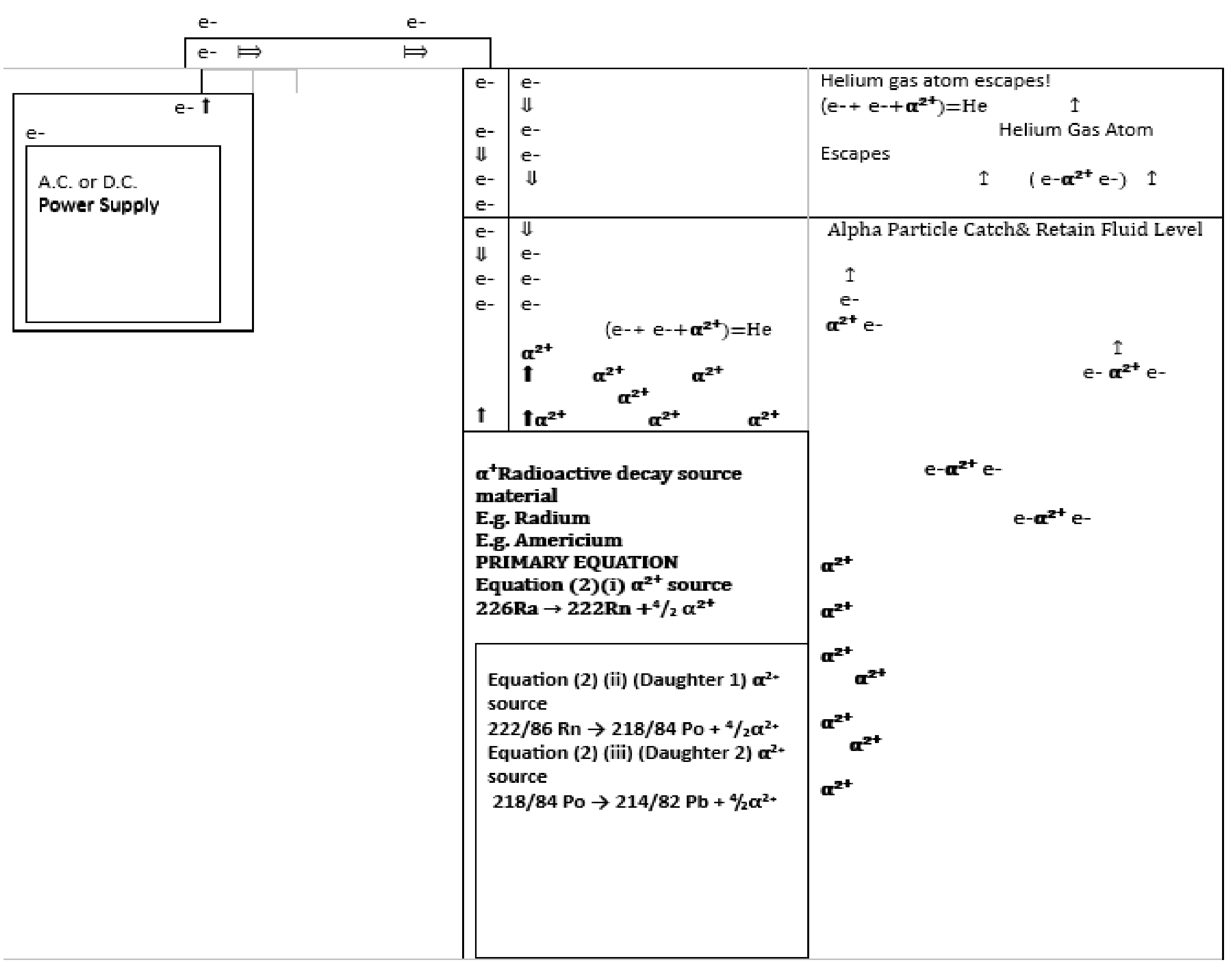

FIG. 3. **Construction diagram of the experiment of ‘The Creation of the Helium Atom’**.

Equations

Equation (2)

(i) α^{2+} source [8]

$226Ra \rightarrow 222Rn + {}^{4}/_{2}\alpha^{2+}$ [20]

${}^{241}/_{95}Am \rightarrow {}^{237}/_{93}Np + {}^{4}/_{2}\alpha^{2+}$ via the formulae: ${}^{A}/zP \rightarrow ({}^{A-4}/_{Z-2})\ D + {}^{4}/_{2}He$ [14] or ${}^{A}/zX \rightarrow ({}^{A-4}/_{Z-2})\ Y + {}^{4}/_{2}He$ [9]

${}^{252}/_{98}Cf \rightarrow {}^{248}/_{96}Cm + {}^{4}/_{2}\alpha^{2+}$ via the formulae: ${}^{A}/zP \rightarrow ({}^{A-4}/_{Z-2})\ D + {}^{4}/_{2}He$ [14] or ${}^{A}/zX \rightarrow ({}^{A-4}/_{Z-2})\ Y + {}^{4}/_{2}He$ [9]

Radioactive decay reactant isotope Radium 226

Decay product Radon gas (radioactive itself)

Equation (3) Opposing charged decay ions forming neutral gas product

$(e- + e- + \alpha^{2+}) = {}^{4}/_{2}\ He$ (gas)

$2\beta^{-} + {}^{4}/_{2}\ \alpha^{2+} \rightarrow {}^{4}/_{2}\ He\ (g) + Q/t\ \{Q/t = I\}$ [7]

Equation (2) (ii) (Daughter 1) α^{2+} source

$222/86\ Rn \rightarrow 218/84\ Po + {}^{4}/_{2}\ \alpha$ [20]

Equation (2) (iii) (Daughter 2) α^{2+} source

$218/84\ Po \rightarrow 214/82\ Pb + {}^{4}/_{2}\ \alpha^{2+}$ [20]

Background Ionized Radiation Battery Energy Nuclear

Theory

Quote "On Earth, the only source of Helium is through radioactive decay processes_α (alpha) particles emitted during nuclear decay are eventually converted to helium atoms" end Quote [5]. As Helium 3 is considered a fusion nuclear fuel, just as deuterium, tritium, and lithium.

By the formulas: quote

"${}^{2}/_{1}H + {}^{2}/_{1}H \rightarrow {}^{3}/_{1}H + {}^{1}/_{1}H$

${}^{2}/_{1}H + {}^{3}/_{1}H \rightarrow {}^{4}/_{2}He + {}^{1}/_{0}n$

${}^{6}/_{3}Li + {}^{2}/_{1}H \rightarrow 2{}^{4}/_{2}He\ \{{}^{6}/_{3}Li + {}^{2}/_{1}H \rightarrow 2{}^{4}/_{2}\ \alpha^{2+}\}$

${}^{1}/_{1}H + {}^{2}/_{1}H \rightarrow {}^{3}/_{2}He$

${}^{3}/_{2}He + {}^{3}/_{2}He \rightarrow {}^{4}/_{2}He + 2{}^{1}/_{1}H$" end quote [19]

As it has already been determined that Helium gas can and is produced from an α (alpha) particles as products emitted during natural nuclear decay [5].

Can a suitable form of Helium be manufactured on earth? (a) Artificially from naturally radioactive decay products like the alpha particle, or (b) from alpha yielding radioactive byproducts from the commercial nuclear process, or (c) a new process additional and within a current commercial nuclear reactor? Such as by the Formula, $2\beta^{-} + {}^{4}/_{2}\alpha^{2+} \rightarrow {}^{4}/_{2}He(g) + Q/t$ $\{Q/t = I\}$ [7] and $(e^{-}\ \alpha^{2+}\ e^{-}\ e^{-}\ \alpha^{2+}\ e^{-}) = He_2$ diatomic Helium Molecule. Or $(e^{-}\ \alpha^{2+}\ \alpha^{2+}\ e^{-}) = (He_2)^{2+}$ Helium diatomic complex ion-molecule [13].

In the above experiment in "**FIG. 3**, construction diagram of the experiment of 'the creation of the helium atom' by combining the radioactive, positively charged ion, an alpha particle (derived from radioactive decay element); with negatively charged electrons from an external source. The helium atom is theoretically created."

An external electrical power source (A.C. or D.C.) provides the electrons needed for the alpha particles to form the end product, Helium gas. The alpha supply can be from any radioactive element that emits alpha particles as a radioactive decay product. Such as E.g. Radium226, Americium241, or Californium252 (${}^{252}/_{98}Cf$).

$226Ra \rightarrow 222Rn + {}^{4}/_{2}\alpha^{2+}$ [20]

${}^{241}/_{95}Am \rightarrow {}^{237}/_{93}Np + {}^{4}/_{2}\alpha^{2+}$ [21]

${}^{252}/_{98}Cf \rightarrow {}^{248}/_{96}Cm + {}^{4}/_{2}\alpha^{2+}$ via the formulae, ${}^{A}/_{Z}P \rightarrow ({}^{A-4}/_{Z-2})\ D + {}^{4}/_{2}He$ [14] or ${}^{A}/_{Z}X \rightarrow ({}^{A-4}/_{Z-2})\ Y + {}^{4}/_{2}He$ [9]

Theoretical experiment for the creation of helium diatomic molecule. By combining the radioactive, positively charged ion, an alpha particle (derived from radioactive decay element), with a smaller number of negatively charged electrons from an external source. The ratio of electrons is restricted to alpha particles is restricted (**FIG. 4**).

The ratio of electrons is restricted by the equipment's adjustable current flow. The positively charged ion alpha particles compete for the restricted number of electrons from the reduced current levels into the closed system.

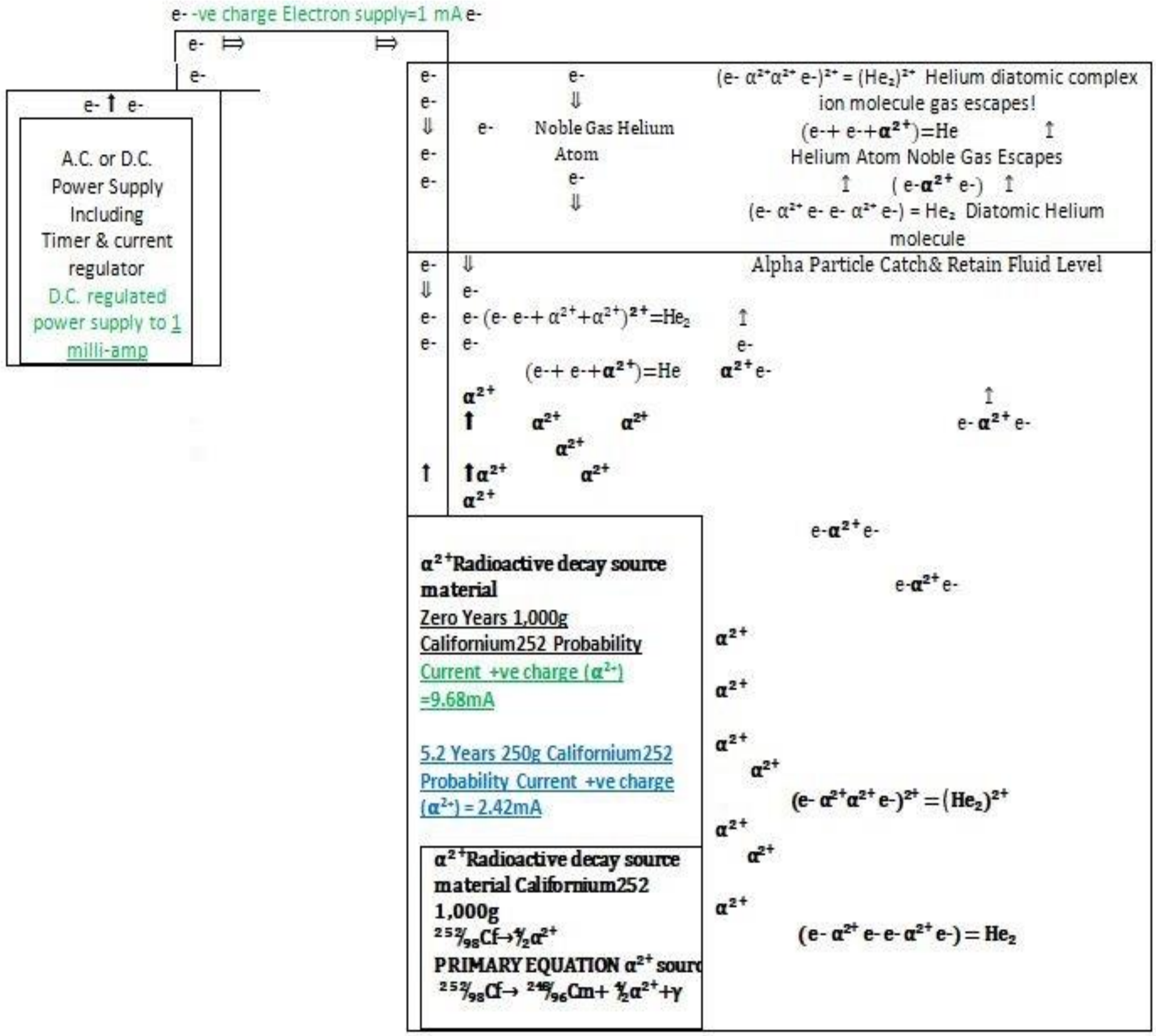

FIG. 4. **Theoretical experiment for the creation of helium diatomic molecule**.

$^{4}/_{2}\alpha^{2+}$ or $^{4}/_{2}\alpha$ [8]

β^{-} or $^{0}/_{-1}\,\beta$ [8]

$^{252}/_{98}$Californium$\rightarrow{}^{248}/_{96}$Curium+ $^{4}/_{2}\alpha^{2+}$ + γ, via the formulae: $^{A}/_{z}P \rightarrow (^{A-4}/_{z-2})D + {}^{4}/_{2}He$ [14] or $^{A}/_{z}X \rightarrow (^{A-4}/_{z-2})\ Y + {}^{4}/_{2}He$ [9]

$(e^{-}\ \alpha^{2+}\ e^{-}\ e^{-}\ \alpha^{2+}\ e^{-})=He_2$ diatomic Helium Molecule. Or $(e^{-}\ \alpha^{2+}\ \alpha^{2+}\ e^{-})=(He_2)^{2+}$ Helium diatomic complex ion molecule [13]

Method 1

(a) Restrict the number of electrons applied to a fluid containing the α^{2+} by controlling the number of amps per second from the power supply. To a number of electrons less than required to make a complete helium molecule from the alpha particles. If the α^{2+} (radioactive decay source material) is 1,000g Californium 252. At initial zero years the probability current +ve charge (α^{2+}) 9.68 mA. As per "**TABLE 2**: Available positive charge (alpha/proton pairs) in Amps and mAmps from the radioactive decay cycle of a given mass of $^{252}_{98}Cf$", The proton charge of 9.68 mA is for dual protons per alpha particle. Equivalent 4.84 mA of electron charge. However to complete a Helium atom two electrons per two protons on the single alpha particle are needed. Thus reducing the amps from the A.C./D.C. regulated power supply to 1 milli-amp. Results in 1 alpha particle per 9.7 electron particles. Thus the observation will be a ratio of 1:9.7 helium to alpha particles

Unless, based on known physics concepts, requiring a full, outer, electron shell; as a more fundamental force than electrostatics. Some alpha particles combine with another alpha particle to share the reduced electron supply. To yield a result of a single diatomic helium ion

(b) Restrict the quantity of alpha particles applied to the fluid in the fluid containing that captures the α^{2+} particles, by closing off the α^{+} radioactive decay source material in a separate internal enclosure

(c) Reduce the ratio of electrons available for the number of alpha particles available each trial. And measure if any of the alpha particles have formed a covalently bonded Helium molecule

(d) What is the percentage of the alpha particles that have formed a covalently bonded Helium molecule; to normal Helium atoms? If any? Two types of covalent bonded Helium predicted. (e^- α^{2+} e^- e^- α^{2+} e^-)=He_2 diatomic Helium Molecule; Or (e^- α^{2+} α^{2+} e^-)=$(He_2)^{2+}$ Helium diatomic complex ion-molecule [13]

(e) If either of the two new Helium molecules forms they may offer new chemical compounds and new types of nuclear fusion fuel

The first experiment was to determine if the alpha particle with two neutrons and two protons as its nucleus would accept two foreign sourced electrons and go from a dual positive charged ion to a neutral charged atom with a stable, first outer shell of two electrons.

In this second experiment, the volume or number of electrons is restricted so, only a percentage of alpha particles will form neutral charged atoms with a stable outer shell of two electrons. In a closed restricted electron environment will two alpha particles (both with dual charges) share two electrons to form a stable first shell of two; and exist as a positively charged diatomic ion? What is the probable percentage of remaining alpha particles, created helium atoms, and diatomic helium molecules?

Therefore which is the fundamental force? For an atom or molecule to create a stable, FULL outer electron shell, or the electromagnetic forces of attraction to be balanced. Remembering, that in chemistry, positive and negative charged ions (cations and anions respectively), exist in solution as common salts with stable FULL outer shells of eight (octet). So some alpha particles should become diatomic helium molecules with a FULL electron outer shell of two [18].

How much helium gas? Math calculations

Californium

${}^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm + {}^{4}_{2}\alpha^{2+} + \gamma$ 2.6 years half life

${}^{252}_{98}Cf \rightarrow {}^{4}_{2}\alpha$

1:1

1,000kg ${}^{252}_{98}Cf$ breaks down to 500 kg in 2.6 years.

mol ${}^{252}_{98}Cf = m/M = 5.0 \times 10^5$ grams/252=1.98 × 10^3 mol

mol ratio 1:1

grams ${}^{4}_{2}\alpha = m \times M = 1.98 \times 10^3$mol × 4=7.93 × 10^3 grams

Or 7.9 kilograms ${}^{4}_{2}He$ gas from 500 kg ${}^{252}_{98}Cf$ over 2.6 years!

Radium

226Ra → 222Rn+4/2α With a half-life of 1,600 years

1:1:1

1,000 kg 226Ra breaks down to 500 kg in 1,600 years

mol ratio 1:1

mol ${}^{226}_{88}Ra = m/M = 5.0 \times 10^5$ grams/226=2.21 × 10^3 mol

Grams ${}^{4}_{2}\alpha = m \times M = 2.21 \times 10^3$mol × 4=8.85 × 10^3 grams

Or 8.85 kilograms ${}^{4}_{2}He$ gas from 500 kg ${}^{226}_{88}Ra$ but it takes 1,600 years

It takes 1,600 years for 8.85 kilograms ${}^{4}_{2}He$ gas to accumulate from 500 kg ${}^{226}_{88}Ra$

Commercial Applications and Conclusions

1. There are NOT enough charged particles available per second to create enough current from either uranium 238 or uranium 235. Longer the half-lifeless radioactive particles released in a short time period. Fast radioactive decay elements release more ionizing radiation in a short period so are more dangerous to tissue, but release a greater number of ionized charged particles in a short time period. Such as 90 Strontium. There is barely enough charged particles available per second to create enough current from radium226, to create the bulky alpha half, of an opposing charge, ionization nuclear battery. One kilo of radium produces only enough alpha particles from radioactive decay to provide conservatively about 8 micro amps of positive charge. Therefore a country would need to have plentiful supplies of positive ion, alpha yielding radium, along with plentiful supplies of a radioactive decay

element yielding negative charged, beta particles, or a nuclear industry with available suitable radioactive waste elements with the ability to separate elements that release opposing ionized charged particles

2. As rooms of fridge size batteries would be required to supply the alpha component of the very slow forming and very low volume of helium gas manufacture. The amount of inert helium gas product from radium is too low, over too long a period of time, to be economic. Unless a more rapid decay alpha particles were extracted from a synthetically created element from a nuclear reactor

3. Uranium 235. Uranium 238. Thorium 232. Radium 226. Are all considered low-level radioactive materials? However, all of these radioactive elements will cause cancer over time and cause death and a reduced life expectancy from cancer caused by radiation exposure. These are NOT for residential or commercial use. A nuclear power company or a military installation could use medium level radioactive decay elements in a nuclear battery process, to produce a greater volume of the charged particle from a lesser volume of radioactive element material

Conclusion

Oppositely charged ions from radioactive decaying elements theoretically should provide enough current (charged particles per second), and an electrical potential difference, to perform electrical work. From micro-amps to milliamps. But common naturally occurring radioactive alpha isotopes, have too long a half-life to provide practical low amps of power. Unless a basketball court of fridge size nuclear batteries is considered more practical than say a small creek hydroelectric unit. Above or below ground.

Synthetically created elements from a nuclear process or nuclear reactor, such as Californium, $^{252}_{98}Cf$ with a half-life of 2.6 years. Still looks like the only possible viable economic ancillary nuclear reactor process. As the alpha particle consists of 2 positive charged protons +2 neutrons, the alpha particle will attract negative ions in the air and water, as well as negative charged beta particles. The radioactive decay product alpha particle is also the exact equivalent of the Helium nucleus, 2 protons +2 neutrons. Not only should the positively charged alpha particle attract a negatively charged beta particle or electron, capturing that beta particle or electron, should see the alpha particle becoming a neutral charged Helium atom. By the Formula: $2\beta^- + {}^4/_2\alpha^{2+} \rightarrow {}^4/_2He$ (g) + Q/t {$Q/t=I$}. Only experimentation will reveal if this theory is correct.

If it does prove possible to create the Helium atom in the lab, or commercially from nuclear waste. There are other Helium isotopes or even molecules that can be constructed from the radioactive decay alpha positively charged particle. Could either or both types of covalent bonded Helium be theoretically predicted? ($e^- \ \alpha^{2+} \ e^- \ e^- \ \alpha^{2+} \ e^-$)=$He_2$ diatomic Helium Molecule. Or ($e^- \ \alpha^{2+}\alpha^{2+} \ e^-)^{2+}=(He_2)^{2+}$ Helium diatomic complex ion-molecule.

Possible fusion reaction products,

${}^4/_2He_2 + {}^4/_2He_2 \rightarrow {}^{16}/_8O$ Terra forming possibilities

Only experimentation will reveal if this theory is correct.

(Author: Leo M Likar/5th and 13th 17th Aug 2018/1st Nov the Formula: $2\beta^{-}+ {}^{4}/_{2}\alpha^{2+} \rightarrow {}^{4}/_{2}He$ (g) + Q/t {Q/t=I} directly from hand written notes 4/July/2016, witnessed) OPEN copyright/OPEN patent.

Acknowledgment

I acknowledge this is all my original work and by publishing, I acknowledge my work now becomes an open patent, and anyone who wishes is free to do further theoretical and or practical work based on my presentation of work.

APPENDIX

For reference

Graph+table calculations

Nuclear Decay Ionization Battery ${}^{60}/_{27}$ Co NEGATIVE Potential Current Calculation

${}^{60}/_{27}Co$ half-life 5.27 years

Initial1,000 g/5.27 years

${}^{60}/_{27}Co \rightarrow {}^{60}/_{28}Ni + {}^{0}/_{-1}\beta^{-} + \gamma$

${}^{60}/_{27}Co \rightarrow {}^{0}/_{-1}\beta^{-}$

1:1

Nuclear Decay Ionization Battery ${}^{252}/_{98}Cf$ POSITIVE Potential Current Calculation

${}^{252}/_{98}Cf$ half-life 2.6 years

Initial 1,000g/2.6 years

${}^{252}/_{98}Cf \rightarrow {}^{248}/_{96}Cm + {}^{4}/_{2}\alpha^{2+} + \gamma$ 2.6 years half life

${}^{252}/_{98}Cf \rightarrow {}^{4}/_{2}\alpha$

1:1

Alternate quick method calculation method available decay material	Alternate quick method calculation methode available decay material
Nuclear decay ionization battery ${}^{252}/_{98}Cf$ POSITIVE potential current calculation ${}^{252}/_{98}Cf$ half-life 2.6 years **1,000 g/**2.6 years=3.846153 × 10^{2} grams/year 3.846 × 10^{2} g/365 days=1.0537407 grams/day 1.0537 g/24 hours=4.390586 × 10^{-2} grams/hour 4.390 × 10^{-2} g/60 min=7.317644 × 10^{-4} grams/min 7.317 × 10^{-4} g/60 sec=1.219607 × 10^{-5} grams/sec Mass ${}^{252}/_{98}Cf$ material available per sec. 1.2196 × 10^{-5} grams/sec <u>Grams to Moles Law via Atomic number</u> <u>Grams per second to Moles per second:</u> mol ${}^{252}/_{98}Cf$=m/M=1.219607 × 10^{-5} grams/252=4.8397118 × 10^{-8} mol Particles=Avogadro's number × mol=6.0 × 10^{23} × mol(4.8397118 × 10^{-8})=2.903827 × 10^{16} particles/atoms **${}^{252}/_{98}Cf \rightarrow {}^{248}/_{96}Cm + {}^{4}/_{2}\alpha^{2+} + \gamma$** 2.6 years half life	**Nuclear decay ionization battery ${}^{60}/_{27}Co$ NEGATIVE potential current calculation** ${}^{60}/_{27}Co$ half-life 5.27 years **1,000 g/**5.27 years=1.8975 × 10^{2} grams/year 1.8975 × 10^{2}/365 days=0.519872 grams/day 0.519872/24 hours=2.16613 × 10^{-2} grams/hour 2.16613 × 10^{-2}/60 min=3.61022 × 10^{-4} grams/min 3.61022 × 10^{-4}/60 sec=6.0170 × 10^{-6} grams/sec or mass ${}^{60}/_{27}Co$ material available per sec <u>Grams to Moles Law via Atomic number</u> <u>Grams per second to Moles per second:</u> mol ${}^{60}/_{27}Co$=m/M =6.0170 × 10^{-6} grams/60=1.0028397 × 10^{-7} mol <u>Avogadro's Number Law</u> Particles=Avogadro's number × mol=6.0 × 10^{23} × 1.0028397 ×10^{-7} mol=6.017038 ×10^{16} particles/atoms 6.017038 ×10^{16} particles/atoms ${}^{60}/_{27}Co$ per second <u>Mol Ratio Law</u>

$^{252}_{98}Cf \rightarrow ^{4}_{2}\alpha$ 1:1 Therefore 6.1147938 $\times 10^{-6}$ grams $^{252}_{98}Cf$ yields 2.903827 $\times 10^{16}$ particles/atoms of $^{252}_{98}Cf$. At a mol ratio of one to one 1:1) 2.903827 $\times 10^{16}$ particles/atoms of $^{252}_{98}Cf$ yields 2.903827 $\times 10^{16}$ of alpha particles. (Coulombs Law):1 amp is 6 $\times 10^{18}$ electrons per second 2.903827 $\times 10^{16}$ alpha particles. alpha particles available per second 2.903827 $\times 10^{16}$ /6 $\times 10^{18}$ (Coulombs Law)=4.8397118 $\times 10^{-3}$ amps 4.8397118 $\times 10^{-3}$ amps $\times$ 2 (2 protons double charge available per particle)=4.853011 $\times 10^{-3}$ amps 9.679423 $\times 10^{-3}$ amps=9.68 mA At 1 second decay of $^{252}_{98}Cf$ gives the amount of available $^{252}_{98}Cf$ mass=1.219607 $\times 10^{-5}$ grams, which yields 2.903827 $\times 10^{16}$ alpha particles Providing the positive charge of 9.679423 $\times 10^{-3}$ amps=**9.68 mA** **So $^{252}_{98}Cf$ with a half-life of 2.6 years (2x $^{+}$ve charge per particle) and coupled to a $^{0}_{-1}\beta^{-}$ emitter half-life of 5 years ($^{60}_{27}Co$ 5.27 years half-life;** **Nuclear Decay Ionization Battery $^{60}_{27}Co$ NEGATIVE Potential Current Calculation**	Therefore at a mol ratio of <u>one to one</u>, (1:1); 1.0028397 $\times 10^{-7}$ mol $^{60}_{27}Co$=6.017038 $\times 10^{16}$ atoms $^{60}_{27}Co$, gives equal 6.017038 $\times 10^{16}$ Beta particles Therefore 6.0170 $\times 10^{-6}$ grams of $^{60}_{27}Co$ yields 6.017038 $\times 10^{16}$ beta particles. Therefore 6.0170 $\times 10^{-6}$ grams of $^{60}_{27}Co$ decay material per second, yields 6.017038 $\times 10^{16}$ beta particles per second <u>(Coulombs Law):</u> 1 amp is 6 $\times 10^{18}$ electrons per second 6.017038 $\times 10^{16}$ beta particles available per second 6.017038 $\times 10^{16}$ beta particles/6 $\times 10^{18}$ (Coulomb's Law)=1.0028 $\times 10^{-2}$ amps=**10 mA**
Nuclear decay ionization battery $^{252}_{98}Cf$ POSITIVE Potential current calculation 2nd cycle $^{252}_{98}Cf$ half-life 2.6 years **500 g**/2.6 years=1.923077 $\times 10^{2}$ grams/year 1.923077 $\times 10^{2}$ g/365 days=0.526870 grams/day 0.526870/24 hours=2.195293 $\times 10^{-2}$g grams/hour 2.195293 $\times 10^{-2}$ g/60 min=3.658822 $\times 10^{-4}$ g grams/min 3.658822 $\times 10^{-4}$ g/60 sec=6.0980369 $\times 10^{-6}$ grams/sec Mass $^{252}_{98}Cf$ material available per sec 6.0980369 $\times 10^{-6}$ grams/sec <u>Grams to Moles Law via Atomic number</u> <u>Grams per second to Moles per second:</u> mol $^{252}_{98}Cf$ =m/M=6.0980369 $\times 10^{-6}$ grams/252= 2.4198559 $\times 10^{-8}$ mol <u>Avogadro's Number Law</u> Particles=Avogadro's number $\times$ mol=6.0 $\times 10^{23}$ $\times$ mol (2.4198559 $\times 10^{-8}$)=1.451913 $\times 10^{16}$ particles/atoms **$^{252}_{98}Cf \rightarrow ^{248}_{96}Cm+^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life $^{252}_{98}Cf \rightarrow ^{4}_{2}\alpha$ 1 : 1 Therefore 6.0980369 $\times 10^{-6}$ grams $^{252}_{98}Cf$ yields 1.451913 $\times 10^{16}$ particles/atoms of $^{252}_{98}Cf$ At a mol ratio of one to one 1:1) 1.451913 $\times 10^{16}$ particles/atoms of $^{252}_{98}Cf$. yields 1.451913 $\times 10^{16}$ of alpha particles Therefore 6.0980369 $\times 10^{-6}$ grams of $^{252}_{98}Cf$. decay material per second, yields 1.451913 $\times 10^{16}$ alpha particles per second <u>(Coulombs Law):</u>1 amp is 6 $\times 10^{18}$ electrons per second 1.451913 $\times 10^{16}$ alpha particles.	**Nuclear decay ionization battery $^{60}_{27}Co$ NEGATIVE Potential current calculation 2nd cycle** $^{60}_{27}Co$ 5.27 years half-life 5.27 years **500 g**/5.27 years=94.876660 grams/year 94.876660/365 days=0.2599360 grams/day 0.2599360/24 hours=1.083066 $\times 10^{-2}$ grams/hour 1.083066 $\times 10^{-2}$/60 min=1.805277 $\times 10^{-4}$ grams/min 1.805277 $\times 10^{-4}$ /60 sec=3.008796 $\times 10^{-6}$ grams/sec or mass $^{60}_{27}Co$ material available per sec <u>Grams to Moles Law via ÷ Atomic number</u> Grams per second to Moles per second: mol $^{60}_{27}Co$=m/M =3.008696 $\times 10^{-6}$ grams/60=5.014660 $\times 10^{-8}$ mol <u>Avogadro's Number Law</u> Particles=Avogadro's number $\times$ mol=6.0 $\times 10^{23}$ $\times$ 5.014660 $\times 10^{-8}$ mol=3.008796 $\times 10^{16}$ particles/atoms 3.008796 $\times 10^{16}$ particles/atoms $^{60}_{27}Co$ per second <u>Mol Ratio Law</u> Therefore at a mol ratio of <u>one to one</u>, (1:1); And 5.014660 $\times 10^{-8}$ mol $^{60}_{27}Co$=3.008796 $\times 10^{16}$ atoms $^{60}_{27}Co$, gives equal 3.008796 $\times 10^{16}$ Beta particles Therefore 3.00879 9 $\times 10^{-6}$ grams of $^{60}_{27}Co$ yields 3.008796 $\times 10^{16}$ beta particles Therefore 3.008796 $\times 10^{-6}$ grams of $^{60}_{27}Co$ decay material per second, yields 3.008796 $\times 10^{16}$ beta particles per second (Coulombs Law): 1 amp is 6 $\times 10^{18}$ electrons per second 3.008796 $\times 10^{16}$ beta particles available per second 3.008796 $\times 10^{16}$ beta particles/6 $\times 10^{18}$ (Coulombs Law) =5.01466$\times 10^{-3}$ amps=5.0 mA

alpha particles available per second 1.451913 ×10^{16} /6 × 10^{18} (Coulombs Law)=2.4198559 × 10^{-3} amps 2.4198559 × 10^{-3} amps × 2 (2 protons double charge available per particle)=4.8397118 × 10^{-3} amps 4.8397118 × 10^{-3} amps=4.84 mA At 1 second decay of $^{252}_{98}Cf$ gives the amount of available $^{252}_{98}Cf$ mass=6.0980369 × 10^{-6} grams, which yields 1.451913 ×10^{16} alpha particles Providing the positive charge of 4.8397118 × 10^{-3} amps=**4.84 mA** **$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm+{}^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life $^{252}_{98}Cf \rightarrow {}^{4}_{2}\alpha$ 1 : 1	
Nuclear Decay Ionization Battery $^{252}_{98}Cf$ POSITIVE Potential Current Calculation 3rd cycle **(zero years -2.6 yrs. 2.6 yrs-5.2 yrs=1,000 grams to 500 grams to 250 grams)** $^{252}_{98}Cf$ half-life 2.6 years **250 g**/2.6 years=96.153846 grams/year 96.153846/365 days=0.263435 grams/day 0.263435/24 hours=1.0976466 × 10^{-2} grams/hour 1.0976466 × 10^{-2} g/60 min=1.829411 × 10^{-4} grams/min 1.829411 × 10^{-4} g/60 sec=3.049018 × 10^{-6} grams/sec Mass $^{252}_{98}Cf$ material available per sec 3.049018 × 10^{-6} grams/sec <u>Grams to Moles Law via Atomic number</u> <u>Grams per second to Moles per second:</u> mol $^{252}_{98}Cf$=m/M=3.049018 × 10^{-6} grams/252=1.2099279 × 10^{-8} mol <u>Avogadro's Number Law</u> Particles=Avogadro's number × mol=6.0 × 10^{23} × mol (1.2099279 × 10^{-8})=7.259567 × 10^{15} particles/atoms **$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm+ {}^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life $^{252}_{98}Cf \rightarrow {}^{4}_{2}\alpha$ 1 : 1 Therefore 3.049018 × 10^{-6} grams $^{252}_{98}Cf$ yields 7.259567 ×10^{15} particles/atoms of $^{252}_{98}Cf$ At a mol ratio of one to one 1:1 7.259567 × 10^{15} particles/atoms of $^{252}_{98}Cf$ yields 7.259567 × 10^{15} of alpha particles Therefore 3.049018 × 10^{-6} × 10^{-6} grams of $^{252}_{98}Cf$ decay material per second, yields 7.259567 × 10^{15} alpha particles per second <u>(Coulombs Law):</u>1 amp is 6 × 10^{18} electrons per second 7.259567 × 10^{15} alpha particles alpha particles available per second 7.259567 × 10^{15} /6 × 10^{18} (Coulombs Law)=1.2099279 × 10^{-3} amps 1.2099279 × 10^{-3} amps × 2 (2 protons double charge available per particle)=2.419855 × 10^{-3} amps 2.419855 × 10^{-3} amps=2.42 mA At 1 second decay of $^{252}_{98}Cf$ gives the amount of available $^{252}_{98}Cf$ mass=3.049018 × 10^{-6} grams, which yields 7.259567 × 10^{15} alpha particles Providing the positive charge of 4.8397118 × 10^{-3} amps=**2.42 mA** **$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm+{}^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life	**Nuclear Decay Ionization Battery $^{60}_{27}Co$ NEGATIVE Potential** **Current Calculation Above 1st decay cycle Under the 2nd decay cycle** **For 2.6 years** **Part A** $^{60}_{27}Co$ half-life 5.27 years (5 × 365 + 0.27 × 365=1.825 × 10^{3}+ 98.55=1,825+98.55=1923.55 days) 5.27 years= 1,923.55 days 1,923.6 days 2.6 years=2 × 365+0.6 × 365=730+219=**949** days Starting with 1,000 grams $^{60}_{27}Co$, Amount of grams of $^{60}_{27}Co$ remaining at 2.6 years 1U=1.6605 × 10^{-27} kg 1kg=1 × 10^{-3} grams 1,000g=1 kg U=1/1.6605 × 10^{-27} kg 6.02228 × 10^{26}U=1 kg 6.02228 × 10^{26}U(nuclei)=1 kg Decay constant $^{60}_{27}Co$ $t½=0.693/\lambda$ λ=0.693/1923.55 days λ=3.6027 × 10^{-4} **N**=$N_0e^{-\lambda t}$ **N**=6.02228 × 10^{26} nuclei × $e^{-3.6027 \chi 10^{-4} \chi 949}$ N=6.02228 × 10^{26} nuclei × $e^{-0.341896}$ N=6.02228 × 10^{26} nuclei × 0.7104208 N=4.2783607 × 10^{26} (nuclei) 1U(nuclei)=1.6605 × 10^{-27} kg 4.2783607 × 10^{26} (nuclei) × 1.6605 × 10^{-27} kg=X kg **0.71042 kg** 710.42 grams **710.42 grams$^{60}_{27}Co$ at 2.6 years** (**949** days)

$^{252}_{98}Cf \rightarrow ^{4}_{2}\alpha$ 1 : 1	
Nuclear decay ionization battery $^{252}_{98}Cf$ POSITIVE potential current **Current Calculation 3rd cycle Plus 0.7 years. Into 4th decay cycle** **(zero years-2.6 yrs. 2.6 yrs-5.2 yrs=1,000 grams to 500 grams to 250 grams)** **Part A** $^{252}_{98}Cf$ **half-life 2.6 years** (2.6 × 2=5.2years) **2.6 years**=(2 × 365+0.2 × 365=730+73=**803 days**) 5.2 years=(5 × 365+0.2 × 365=1.825 × 10^3+73=1,825+73=1923.55 days)=5.2 years=**1,898** days **For 5.27 years** (5 × 365+0.27 × 365=1.825 × 10^3+98.55=1,825+ 98.55=1923.55 days)=5.27 years=1,923.55 days **1,923.6** days Starting with 1000 grams $^{252}_{98}$**Cf**, Amount of grams of $^{252}_{98}Cf$ remaining at 5.2**7** years 1U=1.6605 × 10^{-27} kg 1kg=1 × 10^{-3} grams 1,000g=1 kg U=1/1.6605 × 10^{-27} kg 6.02228 × 10^{26} U=1 kg 6.02228 × 10^{26} U (nuclei)=1 kg Decay constant $^{252}_{98}$**Cf** $t½=0.693/\lambda$ λ=0.693/**803** days λ=8.63013698 × 10^{-4} $N=N_0e^{-\lambda t}$ N=6.02228 × 10^{26} nuclei ×$e^{-8.63013698 \times 10^{-4} \times 1923.6}$ N=6.02228 × 10^{26} nuclei × $e^{-1.60093149}$ N=6.02228 × 10^{26} nuclei × 0.2017085 N=3.0394405 × 10^{26} (nuclei) 1U(nuclei)=1.6605 × 10^{-27} kg 1.214745 × 10^{26} (nuclei) × 1.6605 × 10^{-27} kg=X kg 0.201708 kg 0.201708 kg=201.708 grams 6.90 grams **201.708 grams $^{252}_{98}$ at 5.27 years** (**1,923.6** days)	**(CONTINUED)Nuclear decay ionization battery $^{60}_{27}Co$ NEGATIVE** **Current Calculation Above 1st decay cycle Under the 2nd decay cycle** **For 2.6 years** **Part B** $^{60}_{27}Co$ half-life 5.27 years 710.42 grams $^{60}_{27}Co$ at 2.6 years (**949** days) **710.42 g**/5.27 years=134.80455 grams/year 134.80455/365 days=0.3693275 grams/day 0.3693275/24 hours=1.588647 × 10^{-2} grams/hour 1.588647 × 10^{-2}/60 min=2.564774 × 10^{-4} grams/min 2.564774 × 10^{-4}/60 sec=4.274624 × 10^{-6} grams/sec or mass $^{60}_{27}Co$ material available per sec <u>Grams to Moles Law via ÷Atomic number</u> Grams per second to Moles per second: mol $^{60}_{27}Co$=m/M=4.274624 × 10^{-6} grams/60=7.1243739 × 10^{-8} mol <u>Avogadro's Number Law</u> Particles=Avogadro's number × mol=6.0 × 10^{23} × 7.1243739 × 10^{-8} mol=4.274624 × 10^{16} particles/atoms 4.274624 × 10^{16} particles/atoms $^{60}_{27}Co$ per second <u>Mol Ratio Law</u> Therefore at a mol ratio of <u>one to one</u>, (1:1); With 5.014660 × 10^{-8} mol $^{60}_{27}Co$=4.274624 × 10^{16} atoms $^{60}_{27}Co$, gives equal 4.274624 × 10^{16} Beta particles Therefore 4.274624 × 10^{-6} grams of $^{60}_{27}Co$ yields 4.274624 × 10^{16} beta particles Therefore 4.274624 × 10^{-6} grams of $^{60}_{27}Co$ decay material per second, yields 4.274624 × 10^{16} beta particles per second <u>(Coulombs Law):</u> 1 amp is 6 × 10^{18} electrons per second 4.274624 × 10^{16} beta particles available per second 4.274624 × 10^{16} beta particles/6 × 10^{18} (Coulombs Law) =7.1243739 × 10^{-3} amps 7.1243739 × 10^{-3} amps=**7.12 mA**
Nuclear Decay Ionization Battery $^{252}_{98}Cf$ POSITIVE Potential Current **Current Calculation 3rd cycle Plus 0.7 years** **Into 4th decay cycle** **(zero years-2.6 yrs 2.6 yrs-5.2 yrs-5.27 years=1,000 grams to 500 grams to 250 grams to 201.708 grams)** **For Part B** $^{252}_{98}Cf$ half-life 2.6 years **For 5.27 years** 201.708 grams $^{252}_{98}$ at 5.27 years (**1,923.6** days) **201.708 g**/2.6 years=77.580000 grams/year 77.580000/365 days=0.2125479 grams/day 0.2125479/24 hours=8.8561643 × 10^{-3} grams/hour	**Nuclear Decay Ionization Battery $^{60}_{27}Co$ NEGATIVE Potential Current Calculation Above 1st decay cycle Under the 2nd decay cycle** **For 5.2 years** **Part A** $^{60}_{27}Co$ half-life 5.27 years (5 × 365+0.27 × 365=1.825 × 10^3+98.55=1,825+98.55=1923.55 days)=5.27 years=1,923.55 days 1,923.6 days 5.2 years=(5 × 365+0.2 × 365=1.825 × 10^3+73=1,825+73=1923.55 days)=5.2 years=**1,898** days Starting with 1,000 grams $^{60}_{27}Co$, Amount of grams of $^{60}_{27}Co$ remaining at 5.2 years

$8.8561643 \times 10^{-3}/60$ min=$1.47602739 \times 10^{-4}$ grams/min $1.47602739 \times 10^{-4}/60$ sec= 2.4600456×10^{-6} grams/sec. Mass $^{252}_{98}Cf$ material available per sec 2.4600456×10^{-6} grams/sec. Grams to Moles Law via Atomic number Grams per second to Moles per second: mol $^{252}_{98}Cf$=m/M=2.4600456×10^{-6} grams/252=9.7620859×10^{-9} mol Avogadro's Number Law Particles=Avogadro's number × mol=6.0×10^{23} × mol(9.7620859×10^{-9})=5.8572515×10^{15} particles/atoms **$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm+{}^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life $^{252}_{98}Cf \rightarrow {}^{4}_{2}\alpha$ 1 : 1 Therefore 2.4600456×10^{-6} grams $^{252}_{98}Cf$ yields 5.8572515×10^{15} particles/atoms of $^{252}_{98}Cf$ At a mol ratio of one to one 1:1) 5.8572515×10^{15} particles/atoms of $^{252}_{98}Cf$ yields 5.8572515×10^{15} of alpha particles Therefore 2.4600456×10^{-6} grams of $^{252}_{98}Cf$ decay material per second, yields 5.8572515×10^{15} alpha particles per second (Coulombs Law):1 amp is 6×10^{18} electrons per second 5.8572515×10^{15} alpha particles. alpha particles available per second $5.8572515 \times 10^{15}/6 \times 10^{18}$ (Coulombs Law)=9.762086×10^{-4} amps 9.762086×10^{-4} amps × 2 (2 protons double charge available per particle)=1.9524×10^{-3} amps 1.9524×10^{-3} amps=1.95 mA At 1 second decay of $^{252}_{98}Cf$ gives the amount of available $^{252}_{98}Cf$ mass=2.4600456×10^{-6} grams, which yields 5.8572515×10^{15} alpha particles Providing the positive charge of 1.9524×10^{-3} amps 1.9524×10^{-3} amps**=1.95 mA** **$^{252}_{98}Cf \rightarrow {}^{248}_{96}Cm+{}^{4}_{2}\alpha^{2+}+\gamma$** 2.6 years half life $^{252}_{98}Cf \rightarrow {}^{4}_{2}\alpha$ 1 : 1	1U=1.6605×10^{-27} kg 1 kg =1×10^{-3} grams 1,000g = 1 kg U=1/1.6605×10^{-27} kg 6.02228×10^{26} U=1 kg 6.02228×10^{26} U(nuclei)=1 kg Decay constant $^{60}_{27}Co$ t½=0.693/λ λ=0.693/1923.55 days λ=3.6027×10^{-4} $N=N_0e^{-\lambda t}$ N=6.02228×10^{26} nuclei × $e^{-3.6027 \chi 10^{-4} \chi \mathbf{1898}}$ N=6.02228×10^{26} nuclei × $e^{-0.68379246}$ N=6.02228×10^{26} nuclei × 0.5046993 N=3.0394405×10^{26} (nuclei) 1U (nuclei)=1.6605×10^{-27} kg 3.0394405×10^{26} (nuclei) × 1.6605×10^{-27} kg=X kg 0.50469910 kg 504.69910 grams 504.7 grams **504.7 grams $^{60}_{27}Co$ at 2.6 years** (**1898** days)
	(CONTINUED)Nuclear Decay Ionization Battery $^{60}_{27}Co$ NEGATIVE **Current Calculation Above 1st decay cycle Under the 2nd decay cycle** **For 5.2 years** **Part B** $^{60}_{27}Co$ half life 5.27 years 504.69910 grams $^{60}_{27}Co$ at 5.2 years (**1898** days) **504.69910 g**/5.27 years=95.76833 grams/year 95.76833/365 days=0.26237898 grams/day 0.26237898/24 hours=1.0932457×10^{-2} grams/hour $1.0932457 \times 10^{-2}/60$ min=$1.82207629 \times 10^{-4}$ grams/min $1.82207629 \times 10^{-4}/60$ sec=3.0367938×10^{-6} grams/sec or mass $^{60}_{27}Co$ material available per sec Grams to Moles Law via ÷ Atomic number Grams per second to Moles per second: mol $^{60}_{27}Co$=m/M=3.0367938×10^{-6} grams/60=5.0613230×10^{-8} mol

<table>
<tr><td colspan="2"></td><td colspan="2"><u>Avogadro's Number Law</u>
Particles=Avogadro's number × mol=6.0 × 10^{23} × 5.0613230 × 10^{-8} mol=3.0367938 × 10^{16} particles/atoms
3.0367938 × 10^{16} particles/atoms $^{60}_{27}Co$ per second
<u>Mol Ratio Law</u>
Therefore at a mol ratio of <u>one to one</u>, (1:1);
With 5.0613230 × 10^{-8} mol $^{60}_{27}Co$=3.0367938 × 10^{16} atoms $^{60}_{27}Co$, gives equal 3.0367938 × 10^{16} Beta particles
Therefore 3.0367938 × 10^{-9} grams of $^{60}_{27}Co$ yields 3.0367938 × 10^{16} beta particles
Therefore 3.0367938 × 10^{-9} grams of $^{60}_{27}Co$ decay material per second, yields 3.0367938 × 10^{16} beta particles per second

<u>(Coulombs Law):</u> 1 amp is 6 × 10^{18} electrons per second
3.0367938 × 10^{16} beta particles available per second
3.0367938 × 10^{16} beta particles/6 × 10^{18}(Coulomb's Law)=5.061323 × 10^{-3} amps
5.061323 × 10^{-3} amps=5.06 mA</td></tr>
<tr><th>Years</th><th>Grams</th><th>$^{252}_{98}Cf$</th><th>$^{60}_{27}Co$</th></tr>
<tr><td>Initial 0 years</td><td>1,000</td><td>9.68 mA</td><td>10.0 mA</td></tr>
<tr><td>2.6</td><td>710.42</td><td>4.84 mA</td><td>7.12 mA</td></tr>
<tr><td>5.27</td><td>500</td><td>1.95 mA</td><td>5.0 mA</td></tr>
<tr><td>5.2</td><td>250</td><td>2.42 mA</td><td>5.06 mA</td></tr>
</table>

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