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How to calculate half life of an element

Calculate the half-life of a radioactive element The relationship between time, half-life, and the amount of radionuclide is defined by: $N = N_0 e^{-\lambda t}$. The relationship between the half-life and the decay constant shows that highly radioactive substances rapidly transform to daughter nuclides, while those that radiate weakly take longer to transform. Since the probability of a decay event is constant, scientists can describe the decay process as a constant time period. Radioactive decay is a random process at the single-atom level; is impossible to predict exactly when a particular atom will decay. However, the chance that a given atom will decay is constant over time. For a large number of atoms, the decay rate for the collection as a whole can be computed from the measured decay constants of the nuclides, or, equivalently, from the half-lives. Radioactive decay simulationA simulation of many identical atoms undergoing radioactive decay, starting with four atoms (left) and 400 atoms (right). The number at the top indicates how many half-lives have elapsed Given a sample of a particular radionuclide, the half-life is the time taken for half of its atoms to decay. The following equation is used to predict the number of atoms (N) of a a given radioactive sample that remain after a given time (t): $N = N_0 e^{-\lambda t}$ In this equation, λ, pronounced "lambda," is the decay constant, which is the inverse of the mean lifetime, and N0 is the value of N at t=0. The equation indicates that the decay constant λ has units of t-1. The half-life is related to the decay constant. If you set N = $\frac{N_0}{2}$ and t = t1/2, you obtain the following: $t_{1/2} = \frac{\ln 2}{\lambda}$ Nuclear half-life: intro and explanationNuclear half-life is the time that it takes for one half of a radioactive sample to decay. In this video, we will learn the basics of nuclear half-life, and examine graphs and practice problems. This relationship between the half-life and the decay constant shows that highly radioactive substances are quickly spent, while those that radiate weakly endure longer. Half-lives vary widely; the half-life of 209Bi is 1019 years, while unstable nuclides can have half-lives that have been measured as short as 10−23 seconds. Example What is the half-life of element X if it takes 36 days to decay from 50 grams to 12.5 grams? 50 grams to 25 grams is one half-life. 25 grams to 12.5 grams is another half-life. So, for 50 grams to decay to 12.5 grams, two half-lives, which would take 36 days total, would need to pass. This means each half-life for element X is 18 days. home / math / half-life calculator The following tools can generate any one of the values from the other three in the half-life formula for a substance undergoing decay to decrease by half. Please provide any three of the following to calculate the fourth value. Half-Life, Mean Lifetime, and Decay Constant Conversion Please provide any one of the following to get the other two. Definition and Formula Half-life is defined as the amount of time it takes a given quantity to decrease to half of its initial value. The term is most commonly used in relation to atoms undergoing radioactive decay, but can be used to describe other types of decay, whether exponential or not. One of the most well-known applications of half-life is carbon-14 dating. The half-life of carbon-14 is approximately 5,730 years, and it can be reliably used to measure dates up to around 50,000 years ago. The process of carbon-14 dating was developed by William Libby, and is based on the fact that carbon-14 is constantly being made in the atmosphere. It is incorporated into plants through photosynthesis, and then into animals when they consume plants. The carbon-14 undergoes radioactive decay once the plant or animal dies, and measuring the amount of carbon-14 in a sample conveys information about when the plant or animal died. Below are shown three equivalent formulas describing exponential decay: where   N0 is the initial quantity   Nt is the remaining quantity after time, t   t1/2 is the half-life   τ is the mean lifetime   λ is the decay constant If an archaeologist found a fossil sample that contained 25% carbon-14 in comparison to a living sample, the time of the fossil sample's death could be determined by rearranging equation 1, since Nt, N0, and t1/2 are known. This means that the fossil is 11,460 years old. Derivation of the Relationship Between Half-Life Constants Using the above equations, it is also possible for a relationship to be derived between t1/2, τ, and λ. This relationship enables the determination of all values, as long as at least one is known. CC0/rawpixel/Pixabay Life insurance is something most people have at least heard of, but not everyone understands who should get it and what it's actually for. Contrary to what you might expect, life insurance isn't just for the elderly. Instead, it's a guarantee for your loved ones that they'll have the financial resources they need in the event of your death. While the specifics can vary from plan to plan, you're paying to ensure the well-being of the people you leave behind, whether that happens today or decades from now.From Lincoln Heritage to MetLife to Erie Insurance, there are many life insurance providers to choose from, each with their own range of plans and options to choose from. Between the range of choices and the prospect of dealing with your own mortality, making sense of life insurance can seem like a daunting task. However, it doesn't have to be. With a bit of basic information, you'll be prepared to decide for yourself if life insurance is right for you and your family.Understanding the Different Kinds of Life InsuranceLife insurance plans in the United States are usually divided into term and permanent policies. A term policy lasts for a set period of time, such as 10 or 20 years. If the insured individual dies while the policy is in effect, the beneficiary receives a payment from the insurance company. Term insurance has the benefit of usually being cheaper than permanent insurance with equivalent benefits.Photo Courtesy: Don Bartletti/Getty Images Permanent insurance — which also includes whole life, variable life and universal life insurance — combines a death benefit with some form of cash savings. Part of the premium covers the cost of the insurance, while the rest is set aside and earns interest. Generally speaking, you can withdraw that amount early or let it ride for a much larger sum upon your death. You may also be able to borrow money against the policy or use it to pay for future premiums.If You Have Dependents, You Need Life InsuranceThe most common reason for needing life insurance is if you have dependents: people who depend on you financially, such as children, a spouse that doesn't work or a parent who you support. At the very least, a life insurance policy can cover the costs of your final expenses, such as the cost of a burial or cremation, funeral and outstanding debts, which in turn keeps those things from burdening your family.Photo Courtesy: Chris Hondros/Getty Images With a better policy, you can also provide money to cover a mortgage, education, or other large expenses that could be too much to manage with the loss of your income otherwise. If used wisely, life insurance is the final way of providing for those you care about.Determining Your Life Insurance NeedsSome people shy away from life insurance policies because they think they can't afford them. While the best plans can definitely be expensive, cheaper plans are available, especially if you're comfortable with a term policy.Photo Courtesy: Sean Gallup/Getty Images Other factors also affect how much life insurance will cost. Smokers and individuals with serious health conditions can expect to pay more for their policies, while younger people and women tend to have lower premiums than older adults and men. In fact, the premium for a plan that has coverage of $250,000 can cost less than $200 per year depending on your demographic and the plan you select.Finding Affordable Life InsuranceThe level of life insurance coverage you need changes over time. When you're young and have no spouse or children, you may not need a policy because no one is counting on your income. The same is true for individuals with adult children and those who have enough money in savings to cover their loved ones' expenses.Photo Courtesy: Lars Baron/Getty Images Another consideration is when to buy a life insurance policy. Some people wait until they marry or have children. Others purchase a guaranteed renewable policy before they have dependents. This type of policy ensures they will always have coverage as long as they pay the premiums on time.Either way, buying one when you're younger and healthier is usually cheaper than waiting until you're closer to needing one, even if you end up spending money on a policy you likely won't need. The right time for you to buy one will ultimately depend on your personal financial and health situation. How to Find a PolicyThere are plenty of online tools that can evaluate your insurance needs and help you choose a policy that works for you. Some are run by individual insurance companies, such as this one from Guardian Life, while others are maintained by independent sources.Photo Courtesy: Tim Boyle/Getty Images Alternatively, you can also seek out an expert who understands the industry and available products to help you make an informed decision. Insurance agents, estate planning lawyers and tax professionals can help you navigate the many life insurance policies and providers out there. They can explain the pros and cons of life insurance and help you find the perfect policy for your situation. MORE FROM ASKMONEY.COM

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