

Absolute Age

Putting an age on earth's past

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SUMMARY

With advances in technology, scientists have been able to figure out how old objects and rocks are. This is a result of a natural process called radioactive decay. Scientists measure half lives to determine the age of an object.

Radioactive decay reveals a rock's age.

- We often hear scientists say that fossil is 350 or 452 million years old. The scientists are saying the object's absolute age. Absolute age is the approximate number of years since an object formed.
- The absolute age does not reveal the exact age, but a close age.
- How do scientists determine this? They use a naturally occurring process called radioactive decay to help. Some atoms are unstable and will break down into a more stable form. This is radioactive decay. (Definition: the break down of an unstable atom to a more stable form.)
- We give names to the atoms in this process. Unstable atoms are called the radioactive parent. The atoms they become are called the daughter product.
- Most elements are stable. (Remember, an element is one type of atom such as 5,000,000 atoms of Oxygen or 3 atoms of Hydrogen. It doesn't matter how many you have, just that they're all the same.) However, some atoms are unstable such as uranium (U), thorium (Th), rubidium (Rb), and potassium (K).
- When scientists observed radioactive decay they noticed that the time it takes for an unstable atom to decay varies. This means that sometimes it would take 10 years or 11 years or 12 years. It was never the same every time.
- However, they discovered that if you have millions of unstable atoms, the time it takes half of them to decay is constant. Scientists call this a half life: the amount of time it takes for half of the atoms in something to decay.
- Each time HALF the remaining PARENT atoms decay, we say a half life has occurred.
 - Example: If 100% of the parents remain, no half lives have occurred.
 - If 50% of the parents remain, 1 half life has occurred.
 - If 25% remain, 2 half lives have occurred.

As you can see in the example, our number keeps getting cut in half. This is because HALF of the remaining PARENT atoms are decaying.

Half Lives Occurred	% Parent remaining	% daughter formed
0	100	0
1	50	50
2	25	75
3	12.5	87.5
4	6.25	93.75

- So, how do you count a half life? When measuring the atoms (I won't explain how this happens), we see what percent remains. If you have 25% parent atoms remaining, 2 half lives have occurred. Likewise, if 75% daughter atoms have formed, 2 half lives have occurred. (See the table on the previous page.)
- How does this relate to age? Remember, the time it takes for half the parents to decay into daughters remains the same for an element. Therefore, if we know how many times a half life has occurred (and each one takes the same amount of time), we know how old the rock is!

Absolute age is determined by counting how many parents remain.

- If we know how long it takes for each half life to occur and we know how many half lives have occurred, we know how old the rock is.
- Remember, the time it takes for half the atoms to decay (call the half life) remains constant for an element. For example, the half life of carbon-14 is always 5,730 years (give or take a little). If we find that a rock has carbon-14 in it and that rock has gone through 2 half lives, we know the age of the rock.
- Here's how to find the age:

of half lives X length of half life

- So, let's look back at our last example. We know the rock has gone through 2 half lives. We know each half life takes 5,730 years. We multiply 2 by 5,730 and we get 11,460. This is the age of the rock.
- Let's try another example. Let's say we detect a rock has 50% of the parent atom, carbon-14, remaining. How old is the rock?
 - First, find how many half lives have occurred. (One has occurred because 50% is one half life Check the table if you're not sure!)
 - Second, how long is the half life of carbon-14 (It is 5,730 years. See page 121 in your book)
 - Third, multiply the number of half lives times how long it takes each half life to occur. (1 x 5730 is 5730)
- You will be given a table (page 121 of your book) that tells you how long each half life takes. You don't need to memorize that information.