Absolute Age Literacy Activity **RADIO ACTIVE DATING**

Discovery Education Article, "Radiometric Dating"

Objectives: Main Idea and Context Clues

Directions: Follow the procedures below to complete the literacy activity correctly.

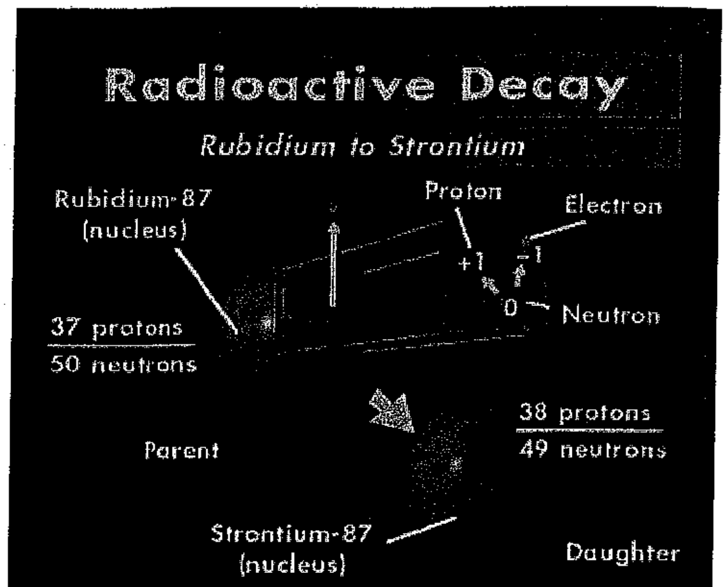
Procedures:

1. **Take one section of the article, "Radiometric Dating."**
2. **Read the section.**
3. **Write the main idea of the section on the back of the article.**
4. **Annotate (highlight) from the text that helped you indicate the main idea.**
5. **Put your name and block on the front.**

Radiometric Dating

(1) In order to construct the geologic time scale, scientists need to know the ages of rock formations. In dating rocks, there are two main ways that they can do so: relative dating and absolute dating.

By examining the positions and arrangements of rock formations, scientists can establish a relative sequence of events that must have happened to explain what they see. This is called relative dating. Relative dating gives rock formations an age relative to other rock formations or features. But scientists also want to know the exact age of rock formations in years. Any method for dating rocks that gives a number in years is called absolute dating.



When a parent isotope such as rubidium-87 decays it forms a daughter isotope that has one fewer neutron and one more proton.

(2) There are several methods of absolute dating. Measuring the effects of cyclic events such as seasonal changes is one way to do this kind of dating. For example, counting rings in trees and sediment layers in glacial lakes can give absolute dates. Trees grow a new outer layer each year, forming a new ring. And each spring when glaciers start to melt, they bring fresh sediments into the lakes they feed. This sediment forms a new layer that records a one-year cycle. These methods work well for events that happened fairly recently in geologic time. But for dating events that occurred throughout Earth's 4.56-billion-year history, other methods are needed.

(3) One of the most effective methods for measuring geologic time in years relies on the processes that occur within certain types of atoms known as radioactive isotopes. Elements are made up of atoms that contain the same number of protons in the nucleus. Isotopes are atoms of an element that have the same number of protons but different numbers of neutrons. Many isotopes have a stable arrangement of protons and neutrons in the nucleus. But in some cases, the number of neutrons is large enough to cause the nucleus to be unstable. Such atoms are called radioactive isotopes. Over time, the nucleus breaks apart, emitting particles and energy.

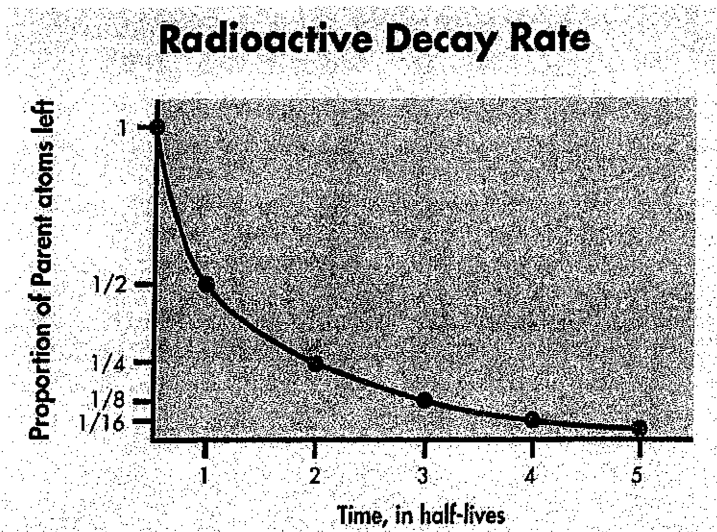
(4) When a radioactive isotope decays, it forms a new isotope, which has a different number of protons or neutrons. (If the new isotope has a different number of protons, it is also a new element.) The original isotope is known as the parent isotope. The decay product is known as the daughter isotope. For each radioactive isotope, the decay rate can be measured. Different radioactive isotopes have different decay rates.

Radiometric Dating

(5)

Radiometric dating relies on the known rate at which a parent isotope decays to form a daughter isotope. This rate is called the isotope's half-life. A half-life is the amount of time it takes for half of the atoms of the parent isotope in a sample to decay and form daughter isotopes.

Each radioactive isotope has its own unique half-life. So, scientists use different radioactive isotopes to measure different spans of geologic time. Radioactive isotopes with longer half-lives are used to date geologic events that occurred hundreds of millions of years ago, such as the formation of certain rock layers. Radioactive isotopes with shorter half-lives are used to date geologic events that occurred tens of thousands of years ago, such as the deaths of certain organisms.



The number of radioactive parent atoms in a sample steadily decreases with time. Knowing the half-life of a parent isotope and measuring the proportion of parent atoms left allows scientists to calculate the absolute age of a rock or mineral sample.

The table below shows a few of the radioactive isotopes that scientists use to measure the absolute ages of rocks.

Parent Isotope	Stable Daughter Product	Half-Life Values
Uranium-235 (U-235)	Lead-207 (Pb-207)	704 million years
Potassium-40 (K-40)	Argon-40 (Ar-40)	1.25 billion years
Uranium-238 (U-238)	Lead-206 (Pb-206)	4.5 billion years
Thorium-232 (Th-232)	Lead-208 (Pb-208)	14.0 billion years
Rubidium-87 (Rb-87)	Strontium-87 (Sr-87)	48.8 billion years
Samarium-147 (Sm-147)	Neodymium-143 (Nd-143)	106 billion years