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Key Idea: Scientists use radioactive elements to find the absolute age of rocks.

1. Radioactive dating is used to determine a rock’s absolute age.
   1. Background information: atoms are tiny chemical elements that make up everything on Earth. \_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, literally everything.
      1. They are the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ unit of matter on earth
      2. Some atoms are unstable and breakdown over time to become a different atom.
         1. This is called radioactivity
      3. The radioactivity of certain atoms can be used to date rocks, because ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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* 1. The rate of change of a radioactive element is measured in half-lives
     1. A half-life is the length of time it takes for ½ of the atoms in a radioactive sample of an element to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     2. Different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ have different

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*Stop and think: Measurement scale. Do scientists want to use elements with long or short half lives?*

* 1. Only elements with half-lives of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of years are used to date rocks
  2. Uranium 235 has a half-life of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ million years
     1. Uranium 235 is found in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
     2. Uranium 235 breaks down into lead 207
     3. Using radioactive dating with Uranium 235, scientists estimate the Earth is ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years old.
  3. Radioactive dating works best with igneous rocks
     1. Because sedimentary rocks are formed from bits of other rocks, radioactive dating would give the age of each original rock bit, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in which the sedimentary rock was formed.

1. Carbon-14 dating can be used to find the absolute age of the remains of something that was once alive
   1. Carbon is an element found in all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and Carbon 14 is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   2. Carbon 14 has a half-life of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years
   3. Carbon 14 dating can date objects \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_--\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years old. (this means it can date things from the ice age!)

**Practice**. The rate of radioactive decay for each different element is constant. This rate is measured in terms of an element’s half-life, or the time it takes for one-half of a particular radioactive isotope in a sample to decay.

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| --- | --- | --- |
| **Date** | **$ at start of day** | **$ at end of day** |
| Jan. 1 | 100 | 50 |
| Jan. 2 | 50 | 25 |
| Jan. 3 | 25 | 12.50 |
| Jan. 4 | 12.50 | 6.25 |
| Jan. 5 | 6.25 | 3.12 |
| Jan. 6 | 3.12 | 1.66 |
| Jan. 7 | 1.66 | 0.83 |

Lots of things can be measured in half-lives. To illustrate how half-lives work, we are going to give a half-life to money. Most of you like to spend money. Let’s investigate how long it would take to spend one hundred dollars if the half-life of your money was one day. **This means that you can only spend half of what you start the day with.**

Question: "If on January 1 you start with one hundred dollars, on what day will you end up with only one dollar or less?”

1. How many days do you think it will take to spend the hundred dollars?\_\_\_\_\_\_\_

The following table will show you how long it would take.

According to the table, on Jan. 7 you would end up with less than one dollar.

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| --- | --- | --- |
| Date | $ at start of day | $ at end of day |
| Jan. 1 | 1000 | 500 |
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1. How long do you think it would take you to spend one thousand dollars following the same rule?\_\_\_\_\_\_\_\_\_\_
2. Fill in the table to find out.
3. On what day did you spend every dollar?\_\_\_\_\_
4. How many days did it take?\_\_\_\_\_

Graph your data. Place the time (in days) on the X-axis and the amount of money not spent on the Y-axis. Be sure to label the X and Y-axis. Give your graph a title. Use the entire graph.

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Drawing Conclusions…

Answer the following questions on a separate sheet of paper and staple it to the back.

1. How do you think scientists use radioactive dating on fossils?
2. A rock sample has 25% of its original radioactive element and the half-life of the element is 1 million years. How old is the sample?
3. Carbon 14 has a half life of 5,000 years. If a fossil sample has 25% of the original Carbon 14 in it, how old is the fossil?
4. If you start out with 200 g of the fictitious element “fake-ium” , whose half life is 100 years, how much fake-ium would you have after 400 years of decay?

**Homework:** Try to answer these without your notes. Only flip your page back over to look if you REALLY can’t remember. Make sure you study what you can’t remember this information WILL be on your quiz tomorrow.

1. What is absolute dating?
2. What is the difference between relative and age dating of rocks?
3. What are the 2 different ways that scientists can tell exact ages of rocks? DESCRIBE THEM.

3a. which one is used to date igneous rocks? Why can’t scientists use this method to date sedimentary rocks?

3b. which one is used to date things that were once alive?

1. What is a half-life? What does it mean?
2. A rock contains a radioactive element with a half-life of 100 million years. Tests show that the element in the rock has gone through three half-lives. How old is the rock?
3. A rock sample has 25% of its original radioactive element and the half-life of the element is 20 million years. How old is the sample?