**Why:** When was the solar system formed and how do we know it? In this activity, you will use radiometric dating to find the age of the solar system. Earth formed at the same time the solar system formed. By finding the age of the Earth we also find the age of the solar system. If we find the age of the solar system we find the age of the Earth.

- 1. What will you find by the end of this activity?
- 2. Why does finding the age of the solar system also find the age of the Earth?



## Model 1: Parent and Daughter Isotopes in Rock Samples

3. What do the red and blue dots represent in model #1?

4. Generally, what happens to the amount of red dots between sample #1 and sample #6? Blue dots?

## 5. How much time occurs between the samples?

Sample #	Half-Lives	<b>Age (Billion Years)</b> (x-axis)	<b># of parent</b> Isotopes (y- axis)	# of daughter isotopes		

## 6. Use the information in Model 1, count the dots to complete the data table below

- 7. Examine the values you got in #6.
  - a. After each half-life what happens to the # of parent isotopes?
  - b. How much time is there between half-lives?
  - c. The number of parent isotopes decreases by \_\_\_\_\_ every \_\_\_\_\_ billion years.

**Read this:** Many isotopes of an element can be unstable. Because they are unstable they change into a more stable form. This change is called **radioactive decay**. In radioactive decay, an unstable isotope of an element changes into a more stable isotope of a different element.

The unstable isotope is called the **parent isotope** and the form that it changes into is the **daughter isotope**. The amount of time it takes for half of the parent isotopes to change into the daughter isotopes is called the **half-life**.

- 8. What is the NAME of the parent isotope in model #1?
- 9. What is the NAME of the daughter isotope in model #1?

10. In model #1 \_\_\_\_\_\_ decays (changes) into \_\_\_\_\_\_.

11. What is the half-life in model #!? How do you know?

12. Graph the data you found in #6. You will graph the **age of the sample on the x-axis** and the **number of parent isotopes on the y-axis**. Connect the dots in a smooth curve. Be sure to have a title, and x-axis label, and a y-axis label for a complete graph.

					3					
	-		-			-			-	-

**Read this:** The graph you made above should NOT be a straight line, rather a curve. (Redraw your graph if it's not a curve). This curve is called a **radioactive decay curve**. The curves are used to find the age of a sample given the amount of parent isotopes.

13. Why is the graph not a straight line, but a curve instead? Use the numbers you collected in #6 to justify your answer.

14. What do you think the word decay means in the term radioactive decay?

15. Below is a sample taken from a grain of sand found on a beach in Western Australia. Use the graph you made in #13 to estimate the age of this grain of sand?



8.2 The Age of the Solar System Part 2

## Model 2: Dating Rock Samples

Radiometric dating of rocks formed when the solar system formed are used to determine the age of the Earth. Below is the Radioactive decay curve for when Potassium-40 decays into Argon-40.

Potassium-Argon Radioactive Decay Curve



- 1. What is the parent isotope?
- 2. What is the daughter isotope?

3. Recall that a half-life is an amount of time it takes for  $\frac{1}{2}$  of sample to decay (50%) According to model #2 What is the half-life of Potassium?

4. Use the graph in model #1 to find the ages of rocks that are thought to have formed when the solar system formed.

Rock sample	% Potassium-40	Age
Lunar Rocks (AKA Moon Rocks)	9.5%	
Meteorites	9%	
Earth's oldest rocks	10%	

5. Which rock samples are the oldest? Youngest?

6. Claim: What is the age of the Earth and the Solar system?

7. Why do you think the age of the rocks are not all the same?

8. Evidence: Describe how you found your answer to 14. Include **numbers**, given in #12, in your answer.

9. Go back to the Read This sections (Above on p. 2 &3) and define these words

Radioactive Decay:

Parent Isotope:

Daughter Isotope:

Half-life:

Radioactive decay curve:

10. Reasoning: You used a process called **radiometric dating** to determine the age of the Earth and Solar system. Describe the process you used in model 1 to find your answer to #14. Include the words you defined in #16.