Name ________________________________ Hour _______

13.1 – Radiometric Dating

Purpose:

The purpose of this lab is to have you use the known radioactive decay rates of specific elements to accurately date simulated rocks, fossils, and organic remains.

Materials:

2 250-mL beakers
Sand
Graph paper

Procedure A: Complete the following steps.

1. Label one 250-mL beaker "A" and the other beaker "B".

2. Fill beaker A with 200 mL of sand. This will represent the amount of the radioactive isotope of carbon-14 found in the remains of a Mastodon tooth that was unearthed near the lower Hudson River in New York State.

3. Beaker B represents the same amount of daughter material, nitrogen-14, which is the product of the radioactive decay of carbon-14.

4. Record the starting amount of each element in Table 13.1.1.

5. Pour half of the volume of beaker A into beaker B. This will represent one half-life. Record your data in Table 13.1.1.

6. Continue to pour out half of the volume of beaker A until less than 25 mL of sand remains in beaker A.

7. Using the number of half-lives it took to lower the volume of beaker A to below 20 mL, determine the age of the Mastodon tooth, knowing that the half-life of carbon 14 is 5,700 years. Record your answers and show your work in Table 13.1.2.

Table 13.1.1 Radioactive Decay Data for Carbon-14		
Amount of C-14 (beaker A)	**Amount of N-14 (beaker B)**	**Number of Half-Lives**
		0

Table 13.1.2 Radiometric Dates of Samples				
Sample Tested	**Radioactive Isotope Used**	**Number of Half-Lives**	**Calculations**	**Age of Sample**

Procedure B: Complete the following steps.

1. Fill beaker A with 150 mL of sand. This will represent the amount of the radioactive isotope of potassium-40 found in a sample of igneous rock from the Canadian Shield in Canada, which are the oldest rocks known to exist in North America.

2. Beaker B represents the amount of daughter element, argon-40, which is one of the products of the radioactive decay of potassium-40.

3. Record the starting amount of each element in Table 13.1.3.

4. Pour out half of the volume of beaker A into beaker B. This will represent one half-life. Record your data in Table 13.1.3.

5. Continue to pour out half the volume of beaker A until less than 50 mL of sand remains in beaker A.

6. Using the number of half-lives it took to lower the volume of beaker A to below 50 mL, determine the age of the rock from the Canadian Shield, knowing that the half-life of potassium-40 is 1.3 billion years. Record your answer and show your work in Table 13.1.2.

Table 13.1.3 Radioactive Decay Data for Potassium-40		
Amount of K-40 (beaker A)	**Amount of Ar-40 (beaker B)**	**Number of Half-Lives**
		0

Procedure C: Complete the following steps.

1. Fill beaker A with 200-mL of sand. This will represent the amount of the radioactive isotopes of potassium-40 found in a sample of sedimentary rock found in Australia, which are the oldest rocks known to exist on the Earth.

2. Beaker B represents the amount of daughter element, argon-40, which is one of the products of radioactive decay of potassium-40.

3. Record the starting amount of each element in Table 13.1.4.

4. Pour out half of the volume of beaker A into beaker B. This will represent one half-life. Record your data in Table 13.1.4.

5. Continue to pour out half of the volume of beaker A until less than 50 mL of sand remains in beaker A.

6. Using the number of half-lives it took to lower the volume of beaker A to below 50 mL, determine the age of the sedimentary rock, knowing that the half-life of potassium-40 is 1.3 billion years. Record your answers and show your work in Table 13.1.2.

Table 13.1.4
Radioactive Decay Data for Potassium-40

Amount of K-40 (beaker A)	Amount of Ar-40 (beaker B)	Number of Half-Lives
		0

Conclusions:

1. Explain why carbon-14 is good for dating the age of the remains of living things.

2. What are the four radioisotopes commonly used for radiometric dating, their half-lives, and their daughter elements?

3. How old did you determine the Mastodon tooth to be?

4. What is the approximate age of the oldest rocks found on Earth?

5. What is the approximate age of some of the rocks from the Canadian Shield?

6. What percentage of all the uranium that was on the Earth at the time of the formation remains on the Earth today?