LAB 27
Radiometric Dating

Purpose

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

Materials

250-ml beakers
(two for each student group)
sand
graph paper

TABLE 27–1 Radiometric Dates of Samples

Sample Tested	Radioactive Isotope Used	Number of Half-Lives	Calculations	Age of Sample

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 Mastondon tooth that was unearthed near the lower Hudson River in New York State.
3. Beaker B represents the amount of the daughter element, Nitrogen 14, which is the product of the radioactive decay of Carbon 14.
4. Record the starting amount of each element on Table 27–2.
5. Pour out half of the volume of beaker A into beaker B. This will represent one half-life. Record your data on Table 27–2.

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 on Table 27–1.

TABLE 27–2 Radioactive Decay Data for Carbon 14

Amount of C–14 (beaker A)	Amount of N–14 (beaker B)	Number of Half-lives
		0

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 on Table 27–3.
4. Pour out half of the volume of beaker A into beaker B. This will represent one half-life. Record your data on Table 27–3.
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 rock from the Canadian Shield, knowing that the half-life of Potassium 40 is 1.3 billion years. Record your answers and show your work on Table 27–1.

TABLE 27–3 Radioactive Decay Data for Potassium 40

Amount of P–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 isotope 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 the radioactive decay of Potassium 40.
3. Record the starting amount of each element on Table 27–4.
4. Pour out half of the volume of beaker A into beaker B. This will represent one half-life. Record your data in Table 27–4.
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 on Table 27–1.

TABLE 27–4 Radioactive Decay Data for Potassium 40

Amount of P–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 the Earth?

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

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