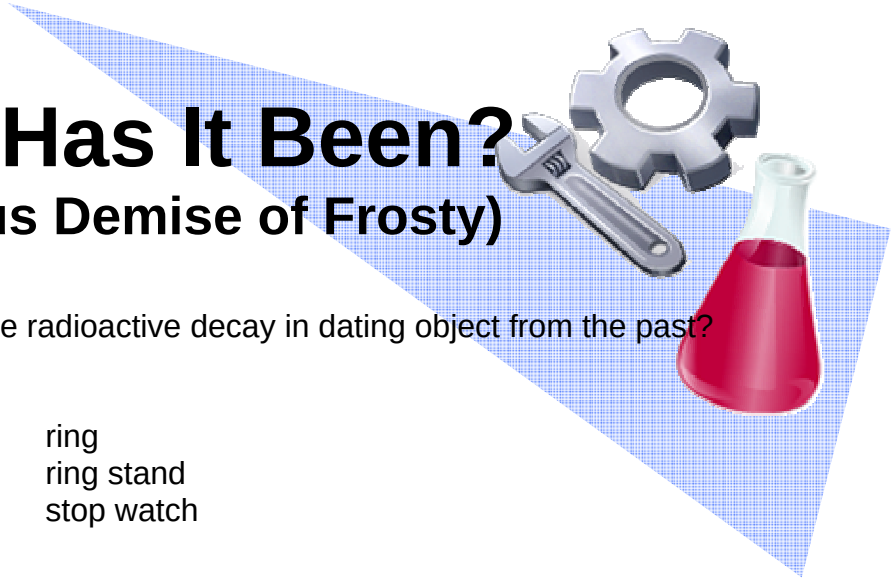
PS – Activity #17

How Long Has It Been?
(or The Mysterious Demise of Frosty)



QUESTION: How do scientists use radioactive decay in dating object from the past?

MATERIALS:

funnel (4")	ring
graduated cylinder (100 mL)	ring stand
graph paper	stop watch
ice	

PROCEDURE:

1. The Scenario: Frosty the Snowman lies melting in the funnel at your lab station. There were no eyewitnesses, but there are several suspects. All the suspects have holes in their alibis. You need to determine the exact time when Frosty was put into the funnel to melt away, leaving no trace.
2. As soon as you arrive on the scene, record the volume of Frosty's melted remains (water) in your graduated cylinder and the time on the clock.
3. Once you have the beginning volume and time recorded, continue to record the volume of Frosty's remains in the Data Table every 2 minutes, until he is completely gone.
4. Make a graph of your data.

DATA: See next page

QUESTIONS:

1. What are the units for the ***RATE*** at which Frosty melted?

2. What was Frosty's original volume?

3. Using your graph, what was the exact time Frosty met his demise?

4. What is the shape of your graph?

5. What does your graph tell you about the rate at which Frosty melted and the rate of radioactive decay?

6. What assumptions are made when using this type of dating technique?

7. Carbon 14 is used for dating organic samples that are generally thought to be relatively young. Why don't scientists use it to date samples thought to be very old?

8. In the case of radiometric isotopes, what actually happens to change one isotope into another?

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TIME	VOLUME OF FROSTY'S REMAINS
Start time:	**Start volume:**
2 min	
4 min	
6 min	
8 min	
10 min	
12 min	
14 min	
16 min	
18 min	
20 min	
22 min	
24 min	
26 min	
28 min	
30 min	

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TEACHER BACKGROUND

Development:

Say to students:

"Carbon-14 undergoes beta decay with a half-life of 5720 years. The element carbon is an essential element in all living matter. Carbon-14 is produced constantly as our atmosphere is bombarded by cosmic rays. It is incorporated into the carbon cycle, so that all living things, including you, contain radioactive carbon-14.

Living things have about 15 disintegrations per minute per gram of carbon. Because living things constantly interchange carbon atoms, the amount of carbon-14 remains constant, but when organisms die, no new carbon-14 enters the organism. However, the carbon-14 that was in the organism at death continues to disintegrate.

By measuring how much carbon is left in a sample as well as its radioactivity, we can calculate when the organism died. It's a way of working backwards to solve a puzzle.

In this activity, you will work backwards to solve a puzzle, much like scientists work backwards to find the time that an organism died."

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