

Radioactive Speed Dating

Purpose

To correctly estimate the age of the various virtual objects (skulls, rocks, etc.) using the principles of radiometric dating

Apparatus

computer

PhET simulation, "Radioactive Dating Game" (available at <http://phet.colorado.edu>)

Discussion

Radiometric dating is a nuclear decay-based method for determining the age of very old things. Here's how it works: Radioactive nuclei transform from one nuclear structure to another at a mathematically reliable rate. In a given amount of time, half the original nuclei have decayed to the new nuclear structure. That given amount of time is called the "half-life." After one half-life, half of the original nucleus remains. After two half-lives, a quarter remains, and so on. By measuring the percent of the original nuclei that remain, the age of the decaying sample can be determined. For example, carbon-14 has a half-life of 5700 years. If an object were found in which 25.0% of the original carbon-14 remained, the age of the object would be taken as approximately 11,400 years. Other percentages can be translated to ages using an exponential function.

Procedure

Step 1: Open the "Radioactive Dating Game" simulation. Click on the "Dating Game" tab in the simulation window.

Step 2: Use scientific techniques applicable to the simulation to estimate the ages of all the objects that allow estimates. Do not attempt to hack. Do not use any other reference sources. Do not cheat.

Step 3: When you have entered six correct estimates in Table 1, record the time displayed on the computer screen (this is not a part of the sim). Obtain a stamp from the instructor. Reward credit begins at six "smilies" and increases with each additional three "smilies." Record the time and obtain a stamp in Table 1 at each milestone.

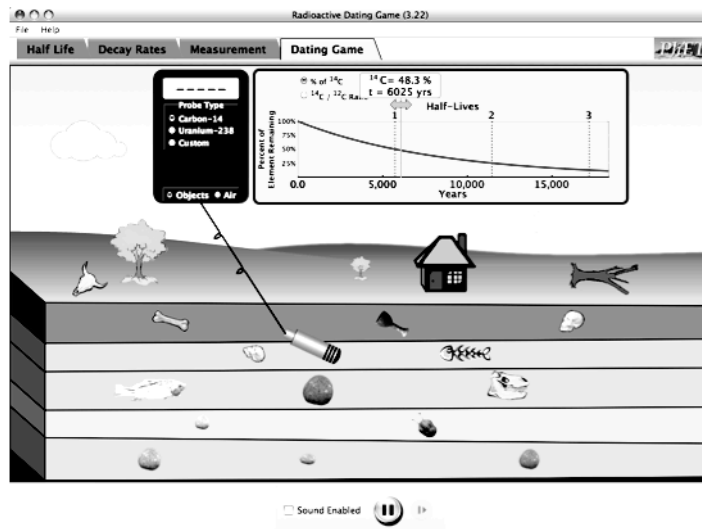


Fig. 1. Radioactive Dating Game Sim in the Dating Game tab

Table 1

“Smilies”	Total Reward	Computer Time	Instructor’s Stamp
6			
9			
12			
15			
18			

Summing Up

1. Carbon dating isn’t a valid technique for dating fossils beyond a certain age. And it’s not a valid technique for dating inorganic items (such as rocks). How did you overcome its limitations?

2. What are the limitations of uranium-238 dating? How did you overcome its limitations?

3. Two “accepted” ages are clearly in error. What are they, and why do they produce invalid “correct” responses? (Scientists do not use radiometric dating techniques on such objects.)
