

Radioactive Dating Game Lab

http://phet.colorado.edu/simulations/sims.php?sim=Radioactive_Dating_Game

Purpose: You will use the radioactive decay rate and original-daughter element ratios of carbon-14 and uranium-238 to determine the ages of different objects.

Procedure:

1. Load PhET *Radioactive Dating Game*

2. Click on tab for *Decay Rates*

3. Select *Carbon-14*. Using the graph, the estimated half-life for C-14 is _____ years.

4. Move the bucket slider all the way to the right. This will place 1,000 C-14 atoms onto the screen.

a. Click on the *Start/Stop* to stop the C-14 decay. Click on *Reset All Nuclei*

b. Click on the *Start/Stop* to start the C-14 decay. Stop the decay as you get close to one half-life.

c. Use the *Step* button to stop decay at one half-life.

• After 1 half-life, how many C-14 atoms of the 1,000 original remain? _____

d. Use the *Start/Stop* and *Step* buttons to reach two half-lives. After two half-lives, how many C-14 atoms remain? _____

• What fraction of C-14 atoms present at 1 half-life remain after 2 half-lives? _____

e. Use the *Start/Stop* and *Step* buttons to reach three half-lives. After three half-lives, how many C-14 atoms remain? _____

• What fraction of C-14 atoms present at 2 half-life remain after 3 half-lives? _____

f. Repeat Steps (a) to (e) with uranium-238.

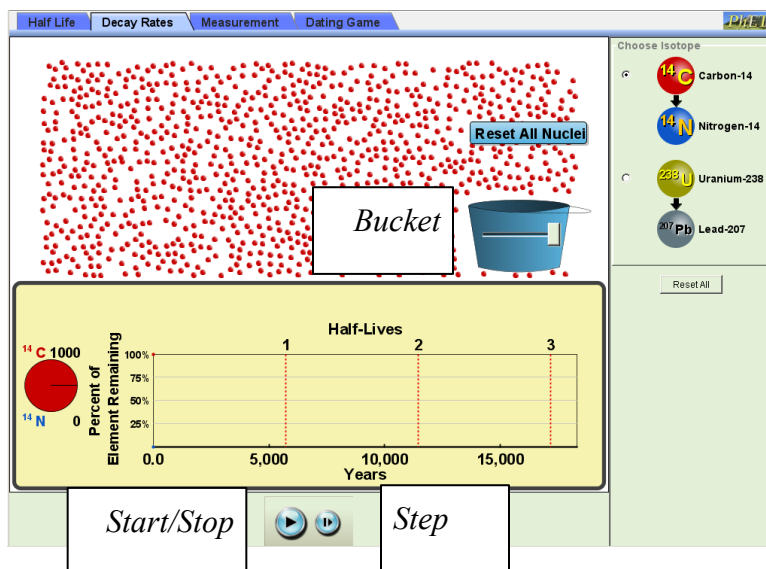
• Estimated half-life for U-238 is _____ years.

• After 1 half-life, how many U-238 atoms of the 1000 original remain? _____

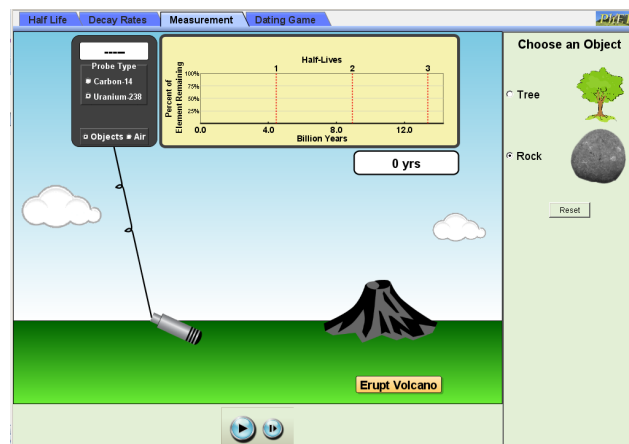
• What fraction of U-238 atoms present at 1 half-life remain after 2 half-lives? _____

• What fraction of U-238 atoms present at 2 half-life remain after 3 half-lives? _____

g. Based on the results of 4a to 4f, explain the meaning of the word “*half-life*” in one sentence.

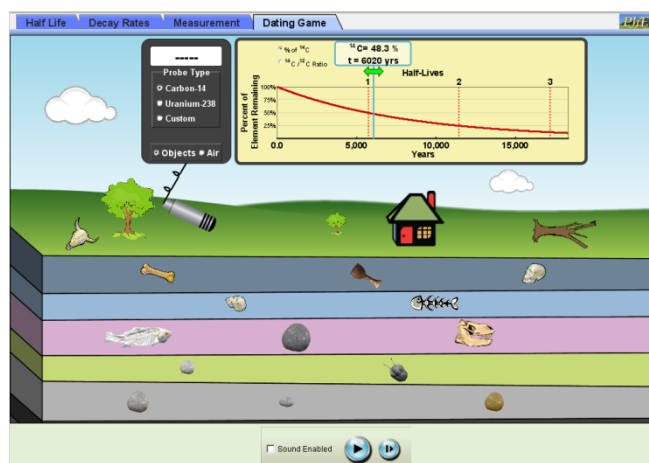


5. Click on the *Measurement* tab.
6. Under *Probe Type*, select *Uranium-238* and *Objects*. Under *Choose an Object*, select *Rock*.
7. Click on *Erupt Volcano*. Let the simulation run until you reach 1 half-life. What % of the original uranium remains? _____. How many years did this take? _____



8. Under *Probe Type*, select *Carbon-14* and *Objects*. Under *Choose an Object*, select *Tree*.
9. Click on *Plant Tree*. Let the simulation run until you reach 1 half-life. What % of the original carbon remains? _____. How many years did this take? _____
10. Explain why uranium-238 is used to measure the age of rocks while carbon-14 is used to measure the age of the tree trunk?

11. Click on *Dating Game* tab. There are objects on the surface and in the five layers beneath the surface. There are both rocks and fossils in each layer.
12. Select the *Carbon-14* detector. Move the Geiger counter to each fossil and record the % of original in the table below
13. On the $\frac{1}{2}$ life graph, move the green arrow right or left until the % of original matches the reading on the detector. Record your estimated age for each fossil in the table



14. Repeat Steps 12 and 13 using the Uranium-238 detector to estimate the rock ages. For fossils with no remaining C-14 signal, use the rock ages to estimate fossil ages in the same layer.
15. Summarize how C-14 and U-238 dating together can be used to determine fossil ages.

Table: *Radiometric Ages for Various Objects*

Object	Measured using C-14 or U-238?	% of Original	Guessed Age	Measured Age
Animal Skull				
Living Tree				
Distant Living Tree				
House				
Dead Tree				
Bone				
Wooden Cup				
1 st human skull				
2 nd human skull				
Fish Bones				
Fish Fossil 1				
Rock 1				
Dinosaur Skull				
Rock 2				
Trilobite				
Rock 3				
Rock 4				
Rock 5				