DEVIL PHYSICS

BADDEST CLASS ON CAMPUS

## Radioactive Dating Game (22 Points) ~ Answer Key

Go To: http://phet.colorado.edu/en/simulation/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. (1pt) 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 1000 C-14 atoms onto the screen.

   a. (1pt) Click on the *Start/Stop* to stop the C-14 decay as you get close to one half-life. Use the *Step* button to advance the decay to one half-life.
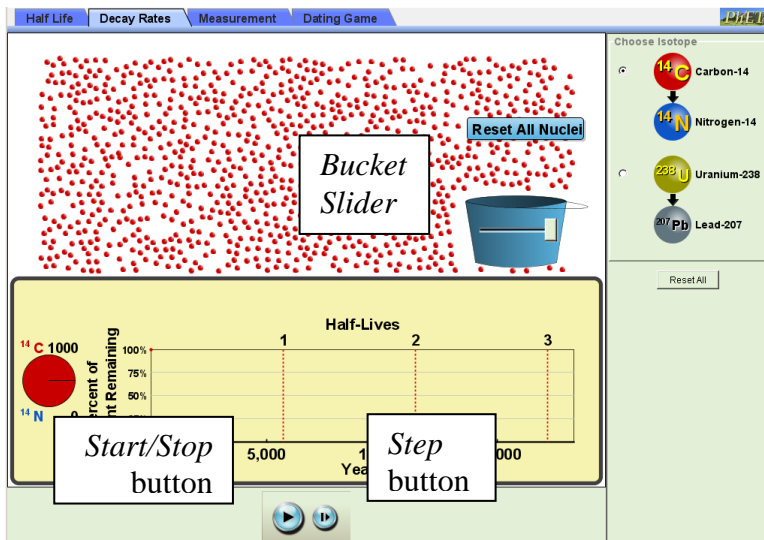
      • After 1 half-life, how many C-14 atoms of the 1000 original remain? *(use the simulator, don't just write down half of the original)* _____

   b. (1pt) Use the *Start/Stop* and *Step* buttons to reach two half-lives. After two half-lives, how many undecayed C-14 atoms remain? _____

      • Calculate the percent of original undecayed C-14 atoms present after 2 half-lives? _____

   c. (1pt) Use the *Start/Stop* and *Step* buttons to reach three half-lives. After three half-lives, how many undecayed C-14 atoms remain? _____

      • Calculate the percent of original undecayed C-14 atoms present after 3 half-lives? _____

   d. (2pts) Repeat Steps (a) to (d) 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? _____

      • Calculate the percent of original undecayed C-14 atoms present after 2 half-lives? _____

      • Calculate the percent of original undecayed C-14 atoms present after 3 half-lives? _____

   e. (1pt) Based on the results of *4a* to *4d*, 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. (1pt) 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. (1pt) 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. (2pts) 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?

   _____

   _____

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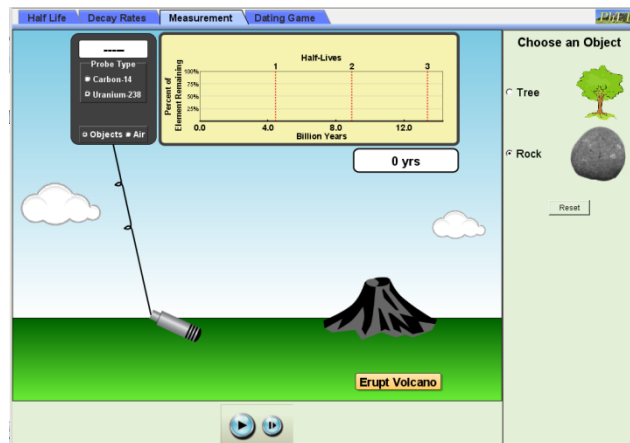
11. Click on *Dating Game* tab. There are objects on the surface and in the five layers containing rocks and fossils beneath the surface.

12. Select the *Carbon-14* detector. Move the Geiger counter to each fossil and record the % of original in the table below

13. Based on the percent of original, make a guess as to the age of the object and record it.

14. On the ½ life graph, move the green arrow right or left until the % of original matches the reading on the detector. Record the estimated age for each fossil in the table.
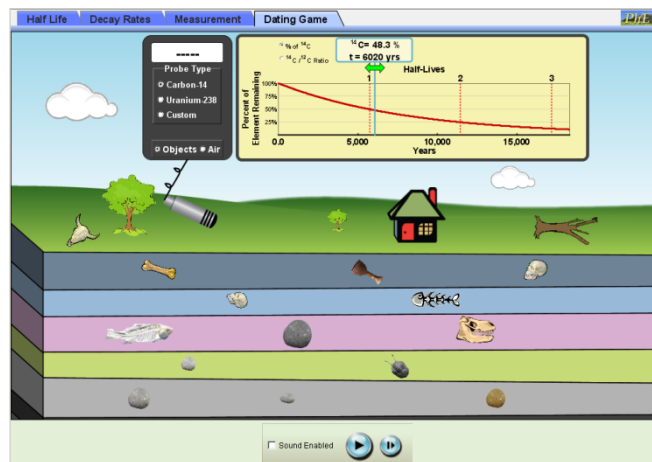
15. Repeat Steps 12 and 13 using the Uranium-238 detector to estimate the rock ages. *For objects with no remaining C-14 or U-238 radiation, use the custom setting to estimate ages. Select different half-lives until you reach the one with the least percent remaining.*

16. (2pts) Using what you have learned in this activity, summarize how you can use radioactive decay to determine the ages of objects.

   _____

   _____

   _____

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Table: Radiometric Ages for Various Objects (9pts)

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

ROOM FOR IMPROVEMENT

IMPROVEMENT: This lab can be improved by:

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When complete, upload to Focus. Ensure your filename is "FirstInitialLastNamePerXLabName"