

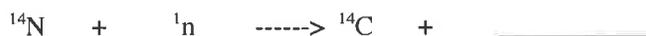
WS 28.1 Radioactive Dating!

	# of protons	# of neutrons	Mode of radioactive decay	Half-Life, $t_{1/2}$
C-11	_____	_____	β^+ decay (positron emission)	20.3 minutes
C-12	_____	_____	none (stable isotope)	N/A
C-13	_____	_____	none (stable isotope)	N/A
C-14	_____	_____	β^- decay (beta emission)	5730 years
Pb-210	_____	_____	β^- decay (beta emission)	22.3 years
U-238	_____	_____	α decay (alpha emission)	4.47×10^9 years
Rf-261	_____	_____	α decay (alpha emission)	62 seconds

1. Complete the chart, above.

2. Carbon-14 forms in the upper atmosphere when nitrogen nuclei are struck from neutrons (from cosmic radiation).

a. Complete the equation that shows the formation of C-14:



b. Write an equation for the beta-decay of Carbon-14.

c. After we die, how long will it take for half of our carbon-14 atoms to undergo radioactive decay? _____

3. $X_t = X_i(0.5)^N$

a. Define: X_t _____ X_i _____ N _____

b. If a sample contained 12.00 grams of C-14 17,190 years ago, how many grams of Carbon-14 would it contain now?

c. How many grams of a 100.0 gram sample of C-14 would remain after 20,000 years?

d. If an organic sample only contains 12.5% of its original C-14, how old is it?

e. How old is an organic sample if it only contains 10.0% of its original C-14?

4. Rutherfordium-261 undergoes alpha decay with a half-life of _____. (look it up in the chart!)

a. Write an equation for the alpha decay of Rf-261.

b. If you start with a 1.0 mg sample of Rf, how many milligrams of Rf would remain after 160 seconds?

c. How long would it take for a sample of Rf to decay so that only 20.0% of the Rf atoms remained?

5. Lead-210 beta decays with a half-life of _____ years.

a. Write an equation for the Beta-decay of lead-210.

b. If a sample contains 50.0 mg of lead-210, how many milligrams will remain, as lead-210, after 100. years?

6. Uranium-238 is one of many radioactive isotopes found in the “spent fuel” of a nuclear reactor.

U-238 alpha decays with a half-life of 4.47×10^9 years.

a. How long would it take for a 20.0 kg sample of U-238 to decay so that only 18.0 kg remained as U-238?

b. Write an equation for the alpha decay of uranium.

c. Explain why samples of uranium ore often contain trapped helium gas. Refer to your equation, above.

d. Based on the half lives given in #4 and #6 for Uranium and Rutherfordium, which would you rather stand next to: a 1.00 gram sample of Rf-261, or a 1.00 g sample of U-238? _____

Explain: