

Unit 3 HW #2: Nuclear Chemistry

1. Classify the following isotopes as stable or unstable (nonradioactive or radioactive).

a. $^{32}_{16}\text{S}$ **stable**

e. ^4_2He **stable**

b. $^{29}_{13}\text{Al}$ **unstable**

f. $^{254}_{101}\text{Md}$ **stable**

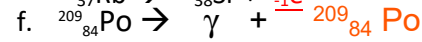
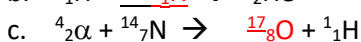
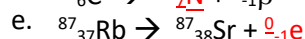
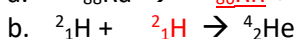
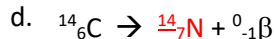
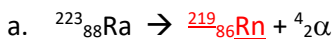
c. $^{122}_{53}\text{I}$ **stable**

g. $^{16}_7\text{N}$ **unstable**

d. $^{164}_{66}\text{Dy}$ **stable**

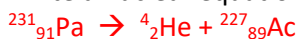
h. $^{179}_{72}\text{Hf}$ **stable**

2. Balance the following nuclear reactions.



3. Write balanced nuclear equations for the following reactions.

a. Write a nuclear equation for the alpha decay of protactinium-231.



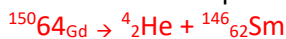
b. Write a nuclear equation for the beta decay of francium-223.



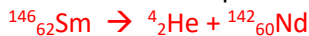
c. Write a nuclear equation for the beta decay of xenon-152.



d. Write a nuclear equation for the alpha decay of $^{150}_{64}\text{Gd}$.



e. Write a nuclear equation for the alpha decay of $^{146}_{62}\text{Sm}$.



f. Write a nuclear equation for the beta decay of cesium-120.



4. Solve the following half-life problems, showing all work and using correct significant digits.

a. Given that the half-life of carbon-14 is 5730 years, consider a sample of fossilized wood that, when alive, would have contained 24 g of carbon-14. It now contains 1.5 g of carbon-14. How old is the sample?

22900 years

b. With a half-life of 28.8 years, how long will it take for 1.00 g of strontium-90 to decay to 125 mg?

86.4 years

c. The half-life of cesium-137 is 30.2 years. If the initial mass of a sample of cesium-137 is 1.00 kg, how much in grams will remain after 151 years?

31.3 g

d. A 1.000 kg block of phosphorus-32, which has a half-life of 14.3 days, is stored for 100.1 days. At the end of this period, how much phosphorus-32 remains? Give your answer in grams.

7.813 g

e. A 64-g sample of germanium-66 is left undisturbed for 12.5 hours. At the end of that period, only 2.0 g remain. What is the half-life of this material?

2.5 hours

f. The half-life of sodium-5 is 1.0 minute. Starting with 1.0 kg of this isotope, how many micrograms will remain after exactly half an hour?

0.93 μg

g. What is the half-life of polonium-214 if, after 820. seconds, a 1.00 g sample decays to 31.25 mg?

164 seconds