Name Key Date

Nuclear Decay and Half Life Practice

Part A: Nuclear Decay

The following atoms all undergo alpha particle emission. Write the complete nuclear equation.

$^{210}_{84}Po \rightarrow {}^{4}_{2}He + {}^{206}_{82}Pb$

$^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th$

$^{238}_{90}Th \rightarrow {}^{4}_{2}He + {}^{234}_{88}Ra$

$^{222}_{86}Rn \rightarrow {}^{4}_{2}He + {}^{218}_{84}Po$

The following atoms all undergo beta decay. Write the complete nuclear equation.

$^{14}_{6}C \rightarrow {}^{0}_{-1}e + {}^{14}_{7}N$

$^{90}_{38}Sr \rightarrow {}^{0}_{-1}e + {}^{90}_{39}Y$

$^{40}_{19}K \rightarrow {}^{0}_{-1}e + {}^{40}_{20}Ca$

$^{13}_{7}N \rightarrow {}^{0}_{-1}e + {}^{13}_{8}O$

The following all undergo positron emission. Write the complete nuclear equation.

$^{116}_{50}Sn \rightarrow {}^{0}_{+1}e + {}^{116}_{49}In$

$^{61}_{29}Cu \rightarrow {}^{0}_{+1}e + {}^{61}_{28}Ni$

$^{30}_{16}S \rightarrow {}^{0}_{+1}e + {}^{30}_{15}P$

Complete the missing information in the reactions. Then, label the reaction one of the following:

Alpha Decay Beta Decay Positron Emission

$^{14}_{6}C \rightarrow {}^{14}_{7}N + {}^{0}_{-1}e$ Type: Beta Decay

$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He$ Type: Alpha decay

$^{15}_{8}O \rightarrow {}^{15}_{7}N + {}^{0}_{+1}e$ Type: Positron emission

$^{32}_{15}P \rightarrow {}^{32}_{16}S + {}^{0}_{-1}e$ Type: Beta decay

$^{105}_{47}Ag + {}^{0}_{-1}e \rightarrow {}^{105}_{46}Pd$ Type: Beta decay

$^{41}_{21}Sc \rightarrow {}^{0}_{+1}e + {}^{40}_{20}Ca$ Type: Positron emission

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For the following, write the equations for the following reactions:

1. The alpha decay of radon-198

$^{198}_{86}Rn \rightarrow {}^{4}_{2}He + {}^{194}_{84}Po$

2. The positron emission from Mg-23

$^{23}_{12}Mg \rightarrow {}^{0}_{+1}e + {}^{23}_{11}Na$

3. Decay of uranium-237 by beta emission

$^{237}_{92}U \rightarrow {}^{0}_{-1}e + {}^{237}_{93}Np$

4. A sample of chlorine-32 slowly decays into sulfur. What type of emission can explain this decay? Positron emission

$^{32}_{17}Cl \rightarrow {}^{0}_{+1}e + {}^{32}_{16}S$

Part B: Solving half-life problems

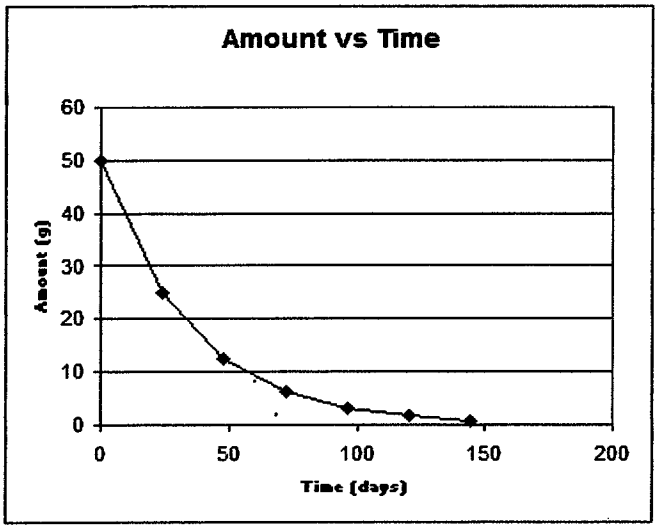
5. Thallium-208 has a half-life of 3 minutes. How long will it take for 120g of thallium-208 to decay to 7.5g? 12 min.

120g – 3 min
60g – 6 min
30g – 9 min
15g 7.5g – 12 min (4 half-lives)

6. The half-life of Gold-198 is 4 days. How much of a 96g sample of gold-198 would be left after 20 days? 3 g. (5 half-lives)

7. 150g of an isotope (with a half-life of 36 hours) is present. How much time would have elapsed when only 9.375g remain? 144 hours (4 half-lives)

8. The graph below depicts the radioactive decay of an isotope of chlorine. Using this information, answer the following:



a. What is the half-life of this isotope?
25 days

b. How much time would it take for this element to go through 4 half-lives?
100 days

c. How much of the original sample (in grams) would be left after 4 half-lives?
3.125 g.

d. If a 40g sample was measured in 2000, how much (in grams) of that chlorine would be present today?

$N(t) = N_0 \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$

$N(t)$ = amount left
N_0 = initial amount
t = time elapsed
$t_{1/2}$ = half-life

Part C: Nuclear chemistry applications:

9. What is the difference between nuclear fusion and nuclear fission?
fusion = joining 2 or more nuclei
fission = splitting a nucleus

10. Why do some isotopes give off radiation?
their nucleus is unstable