Nuclear Chemistry Practice Sheet

Using your knowledge of nuclear chemistry, write the equations for the following processes:

1) The alpha decay of iridium-174

2) The beta decay of platinum-199

3) Positron emission from sulfur-31

4) Krypton-76 undergoes electron capture

5) Write the symbols for an alpha particle, beta particle, gamma ray, and positron.

6) If the half-life for the radioactive decay of zirconium-84 is 26 minutes and I start with a 175 gram sample, how much will be left over after 104 minutes?

7) Why is it difficult to make a fusion reaction occur?

Nuclear Chemistry Practice Sheet – Solutions

1) The alpha decay of iridium-174

$$^{174}_{77}Ir \rightarrow ^{4}_{2}He + ^{170}_{75}\mathrm{Re}$$

2) The beta decay of platinum-199

$$^{199}_{78}Pt \rightarrow ^{0}_{-1}e + ^{199}_{79}Au$$

3) Positron emission from sulfur-31

$$^{31}_{16}S \rightarrow ^{31}_{15}P + ^{0}_{+1}e$$

4) Krypton-76 undergoes electron capture

$$^{76}_{36}Kr + ^{0}_{-1}e \rightarrow ^{76}_{35}Br$$

5) Write the symbols for an alpha particle, beta particle, gamma ray, and positron.

Alpha particle (a) = $^{4}_{2}He$

Beta particle (ß) = $^{0}_{-1}e$ **(it's the same as an electron!)**

Gamma ray (?) = $^{0}_{0}g$

Positron = $^{0}_{+1}e$

6) If the half-life for the radioactive decay of zirconium-84 is 26 minutes and I start with a 175 gram sample, how much will be left over after 104 minutes?

Since 104 minutes is equal to four half-lives, the amount of zirconium left over will be:

$$175\left(\frac{1}{2}\right)^{4} = 10.9 grams$$

7) Why is it difficult to make a fusion reaction occur?

A huge amount of energy is required to make fusion reactions occur – typically on the order of 5 x 10^7 K. Since that kind of energy isn't just kicking around all over the place, fusion reactions aren't that common.