Extra practice problems for the U13 Nuclear test Answers

1. Determine the energy of a photon that is emitted when an electron on a hydrogen atom falls from the n=5 to to n=3 energy level by using the Rydberg equation.

**1.55 x 10-19 J = 0.969 eV**

2. Determine the number of protons, neutrons and electron in . **p=78, e=78, n=120**

3. Determine the binding energy of . in J, and in MeV given the mass of the nuclide is 197.96789492 u. Then verify the binding energy per nucleon reported in the table. Would you expect this nuclide to undergo fission or fusion?  **2.515 x 10-10 J; 7.9143 MeV per nucleon; Fission b/c greater than Ni max.**

4. a) Use the table of Nuclides to write the nuclear decay reactions for Gold–199, Lead–201, and Polonium–211. b)Determine the energy released during each of the three reactions you wrote.

**a) and b) i)**  **0.4515 MeV**

**ii) 0.8968 MeV**

**iii) 7.594 MeV**

5. Use the table of Nuclides to write the decay series for Uranium – 231 showing the type of decay and the daughter nuclide for each step. **(Too hard to type the actual format but this is the information.)**

**U-231 Positron 🡪 Pa-231 Alpha 🡪 Ac-227 Beta🡪Th-227 Alpha 🡪Rn-222 Alpha🡪Po-215 Alpha 🡪 Pb-211 Beta 🡪 Bi-211 Alpha 🡪 Tl-207 Beta 🡪 Pb-207 Stable**

6. You find an old unopened canister that has a label saying it contained 350 g of cobalt -60 when it was delivered on 9/14/81. Determine the amount and identity of nuclides that you expect to be present in 2019. What kind of safety gear would be required for a radiation worker to safely dispose of this canister?

**0.14 mg of Co-60 remain. Nearly all of the 350 g has turned into the stable Ni-60. But even 0.14 mg has a significant activity. 0.14 mg Co is 5.1 x 1018 and 12.3% of these will decay in a year so it has an activity that is about 5.5 x106 Bq where Bq = disintegrations/second. To stay safe, you will need a lead apron, pants, gloves and helmet to protect you because Co-60 is a Beta emitter.**

7. Use the following graph to determine the half life of Mg – 28. How long would it take for a 500 g sample to be reduced to less than 1 milligram sample of Mg? What would it turn into? **20 hrs ; 16 days ; Si-28**

8. When Uranium-235 is bombarded with a neutron, it undergoes fission and forms Krypton-92, a second daughter nuclide and three more neutrons. Determine the identity of the second daughter nuclide and write a balanced nuclear equation for this fission reaction. Use the table of the nuclides and your data packet to determine the energy released in this reaction.

**a) b) 173.3 MeV**

9. Which would you expect to be more dangerous, a sample of Iodine-131 or Radon-222? Why?

**I-131 is more dangerous because it is a Beta emitter. Alpha particles can be stopped by clothes or paper. Blocking Beta radiation requires lead shielding.**