Chapter 21: Nuclear Chemistry

1. What is a nuclide?
2. What subatomic particle identifies a nuclide?
3. In carbon-12, what does the 12 represent?
4. Define mass defect.
5. What does mass defect represent?
6. What is Einstein’s famous equation?
7. What kinds of elements have the highest nuclear binding energies?
8. How does the stability of a nuclide relate to the nuclear binding energy?
9. On the band of stability, what is the neutron-proton ratio for low atomic number atoms?
10. How does the neutron-proton ratio change as the atomic number increases?
11. Unstable nuclides undergo what type of change?
12. **True or False:** As a radioactive atom undergoes radioactive decay, the atom gives off large amounts of energy and increases its stability.
13. Define nuclear fission.
14. Define nuclear fusion.
15. During radioactive decay, the nucleus disintegrates into a (lighter or heavier) nucleus that is (less stable or more stable)
16. How does alpha decay affect the nucleus?
17. How does beta decay affect the nucleus?
18. How does gamma radiation affect the nucleus?
19. How does positron emission affect the nucleus?
20. Which form of radiation has the greatest penetration power?
21. Put the following in order from greatest mass to least mass: beta, alpha, gamma.
22. Alpha particles are (a) electrons (b)electromagnetic waves (c) helium nuclei
23. Beta particles are (a) electrons (b)electromagnetic waves (c) helium nuclei
24. What is the symbol for an alpha particle?
25. What is the symbol for a beta particle?
26. What is the symbol for a positron?
27. What is the symbol for a gamma ray?
28. Define half-life.
29. What can we say about a nuclide with a short half-life compared to one with a long half-life?
30. Define decay series.
31. What is the difference between natural transmutation and artificial transmutation?

Solve the following problems:

1. How much of a 35.5 g sample of radon-222 is leftover after 30.4 days? The half-life of radon022 is 3.8 days.
2. A sample of cesium-138 is produced in the lab. The sample weighs 50g at the time it is produced. How long will it take before this sample is reduced to only 2.5g? The half-life of cesium-138 is 32.2 minutes.

For level 1’s only:

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| Mass of proton | 1.007276 amu |
| Mass of neutron | 1.008665 amu |
| Mass of electron | 0.0005486 amu |
| 1 amu = | 1.66054 x 10-27 kg |

Calculate the nuclear binding energy per nucleon of a sulfur-32 atom. The measured mass of a sulfur-32 atom is 31.972070amu.