**Radioactive Decay/Half-Life Practice Quiz**

**Part I. Radioactive Decay**

1. What is an alpha particle composed of?

2. What is a beta particle composed of?

3. What is the relative mass of an alpha particle?

4. What is the relative mass of a beta particle?

5. What is the charge (sign and magnitude) on an alpha particle?

6. What is the charge (sign and magnitude) on a beta particle?

7. Is it possible to have radiation without emitting either alpha or beta particles? Explain.

8. Give an example of harmful radiation similar to gamma.

9. Give an example of benign (non-harmful) radiation similar to gamma.

10. Why are alpha, beta and gamma radiations harmful to humans? What large molecule in cells is affected?

11. What happens to the atomic number of an isotope during alpha decay?

12. What happens to the mass number of an isotope during alpha decay?

13. What happens to the atomic number of an isotope during beta decay?

14. What happens to the mass number of an isotope during beta decay?

15. What happens to the atomic number of an isotope during gamma decay?

16. What happens to the mass number of an isotope during gamma decay?

17. What are isotopes of an element?

18. Explain why some isotopes are radioactive while others are not (for example Pb-218 vs Pb-206). Include in your explanation the concept of the “stability band”.

19. When Np-237 (atomic number 93) alpha decays, what isotope does it become? (include the element symbol, mass number and atomic number). Show the nuclear equation for this decay.

20. When Cm-247 (atomic number 96) beta decays, what isotope does it become? (include the element symbol, mass number and atomic number). Show the nuclear equation for this decay.

21. When Fm-257 (atomic number 100) alpha decays then beta decays, what isotope does it become? (include the element symbol, mass number and atomic number of both the alpha decay and the beta decay products. Show the two nuclear equations for this decay series.

**Part II. Radioactive Decay Half-Life Calculations** *Use the correct format for solving formulas (List the values for the known variables, list the unknown variable you are solving for, write the formula, then plug in for the variables in the formula. Calculate. Don’t forget to include the units!)*

22. Suppose you have a 100 mg sample of Au-191, which has a half-life of 3.4 hours. How much will remain after 48 hours? Use the formula: A = Ao x (1/2)T/T1/2

23. Cobalt-60 is a radioactive isotope used in cancer treatment. Co-60 has a half-life of 5 years. If a hospital starts with a 500 mg supply, how many mg will be left after 15 years? How many mg will the hospital have to purchase to replenish its original supply? Use the formula: A = Ao x (1/2)T/T1/2

24. You start with a 8160 µg sample of Co-60  
 A = Ao x (1/2)n , where n = the number of half-lives = T/T1/2

A. How many half-lives (n) have passed if 255 µg of Co-60 remain from the sample of 8160 µg?   
Hint: log(0.5)n = nlog(0.5)

B. Given a half-life of 5 years for Co-60, how many years have passed?

25. (Advanced) In this question you are solving for the length of one half-life.

After one hour a sample of an unknown isotope has decayed from 5.0 x 105 cpm (counts per minute) to 2.0 x 103 cpm. What is the half-life of the isotope in minutes?