1. What is a mass number?

2. What is an atomic number?

3. Determine how many protons, neutrons, and electrons the isotope Magesium-26 ($_{12}^{26}$Mg) has.

4. Write the isotopic notation of these elements: (Include the mass number and atomic number.)

   a. An atom of calcium that has 21 neutrons.

   b. An atom of uranium that has 146 neutrons.

5. What is a nucleon?

6. Use the Law of Charges to explain why you wouldn't expect the protons in a nucleus to stay so close together.

7. What is a mass deficit?

8. What is binding energy? What is it used for?

9. The mass of a ^{19}F nucleus is 18.9984 amu.

   a. Calculate the total binding energy.

   b. Calculate the binding energy per nucleon.

10. What causes the strong nuclear force: Why does it act only over a short distance?

11. Which element has the most stable nucleus?

12. Use Figure 16.2 to determine which elements have stable nuclei.

    a. ^{14}N   b. ^{88}Ru   c. ^{118}Sn   d. ^{50}Ca

13. What do you call an element that has unstable nuclei?

14. What is an alpha particle made up of?

15. What is a beta particle made up of?

16. Write the equation for ^{222}Rn going through alpha decay.

17. Write the equation for ^{131}I going through beta decay.

18. Write the equation for ^{14}N going through gamma decay.

19. Which type of natural radiation can penetrate through concrete?

20. What are the two forms of artificial radioactivity?

21. What happens when a positron collides with an electron?

22. What is a half-life?

23. A substance has a half-life of 3 days. If you start with 120 grams of the substance, how many grams will be left after:

   a. 3 days

   b. 6 days

   c. 9 days

24. A substance has a half-life of 26 years. If you start with 800 grams of the substance, how much will you have in 10 years?

25. A substance has a half-life of 5 minutes. How long will it take 100 grams of the material to decay to less than 10 grams?

26. How is radioactivity dangerous to living organisms?

27. List three ways radiation is useful.

28. What two units are used to measure radiation dosage?

29. Why do alpha particles have an RBE of 4 while beta particles and gamma rays only have an RBE of 1?

30. What is the difference between nuclear fission and nuclear fusion?

31. What is a disadvantage of nuclear fission?

32. What is a disadvantage of nuclear fusion?

33. Do we use fission or fusion for making electricity?

34. Write a fission equation using ^{239}Pu as the fuel. Assume that 4 neutrons are produced and the rest of the nucleus splits exactly in half.

35. Write a fusion equation using ^{27}Al and ^{3}H. They will make ^{27}Mg and one other product.

36. What is isotopic enrichment?

37. Why is it impossible for a nuclear power plant to create a nuclear explosion like a bomb?

38. What caused the nuclear meltdown of the Fukushima power plant in Japan after the tsunami in 2011?

39. Honors: You start with 78.0 grams of a radioactive material. After 48 hours, you have 51.2 grams of radioactive material remaining. Calculate the half-life of the material.