

## Chapter 22

Problems pages 723-724

2. Certain ratios, even numbers of nucleons, magic numbers
4.
  - a. decrease mass number by four and atomic number by two
  - b. increase atomic number by one with mass number unchanged
  - c. decrease atomic number by one with mass number unchanged
  - d. decrease atomic number by one with mass number unchanged
15. Radiation can penetrate paper.
17. Radiation ionizes the atoms and molecules in the tissue.
19. Comparing the daughter nuclides with the parent nuclides in your sample with the same values in objects of known ages by using a graph of exponential decay from the half life.
22. The fuel provides fissile material for energy production.  
The coolant transfers heat out of the reaction chamber.  
The moderator slows neutrons produced by fission.  
Shielding keeps radiation from escaping the reaction chamber.  
Control rods absorb free neutrons.
24. The high temperatures required to fuse nuclides is extremely large.
26. 0.04213 amu
27.  $5.2 \times 10^{-12} \text{ J}$
33.
  - a. Beta particle
  - b. alpha particle
  - c. electron
  - d. Carbon-13
34.  ${}^{210}_{84}\text{Po} \rightarrow {}^4_2\text{He} + {}^{206}_{82}\text{Pb}$
35.  ${}^{210}_{82}\text{Pb} \rightarrow {}^0_{-1}\beta + {}^{210}_{83}\text{Bi}$
36. 6.25 g
37. 37.44 days
40.
  - a. Plutonium-239
  - b. Carbon-13
  - c. Neutron
  - d. Barium-139
49. If the rate of decay is shown to vary, the age of the material could not be determined using radioactive decay.
50. Carbon-12 has a neutron to proton ratio of 1:1 and an even number of nuclides.