

CHAPTER HIGHLIGHTS

The Nucleus

Vocabulary

nucleon	nuclear shell model
nuclide	magic numbers
mass defect	nuclear reaction
nuclear binding energy	transmutation

- The difference between the sum of the masses of the nucleons and electrons in an atom and the actual mass of an atom is the mass defect, or nuclear binding energy.
- Nuclear stability tends to be greatest when nucleons are paired, when there are magic numbers of nucleons, and when there are certain neutron-proton ratios.
- Nuclear reactions, which are represented by nuclear equations, can involve the transmutation of nuclides.

Radioactive Decay

Vocabulary

radioactive decay	half-life
nuclear radiation	decay series
radioactive nuclide	parent nuclide
alpha particle	daughter nuclide
beta particle	artificial
positron	transmutation
electron capture	transuranium element
gamma ray	

- Radioactive nuclides become more stable by radioactive decay.
- Alpha, beta, positron, and gamma emission, and electron capture are types of radioactive decay. The type of decay is related to the nucleon content and the energy level of the nucleus.
- The half-life of a radioactive nuclide is the length of time that it takes for half of a given number of atoms of the nuclide to decay.
- Artificial transmutations are used to produce artificial radioactive nuclides, which include the transuranium elements.

Nuclear Radiation

Vocabulary

roentgen
rem
film badge
Geiger-Müller counter
scintillation counter
radioactive dating
radioactive tracer
nuclear waste

- Alpha particles, beta particles, and gamma rays have different penetrating abilities and shielding requirements.
- Film badges, Geiger-Müller counters, and scintillation detectors are used to detect radiation.
- Everyone is exposed to environmental background radiation.
- Radioactive nuclides have many uses, including radioactive dating, disease detection, and therapy.
- Nuclear waste must be contained, stored, and disposed of in a way that minimizes harm to people or the environment.

Nuclear Fission and Nuclear Fusion

Vocabulary

nuclear fission	shielding
chain reaction	control rod
critical mass	moderator
nuclear reactor	nuclear fusion
nuclear power plant	

- Nuclear fission and nuclear fusion are nuclear reactions in which the splitting and fusing of nuclei produce more stable nuclei and release enormous amounts of energy.
- Controlled fission reactions produce energy and radioactive nuclides.
- Fusion reactions produce the sun's energy in the form of heat and light. If fusion reactions could be controlled, they would produce more usable energy per gram of fuel than fission reactions.