Chapter 16 – Atomic Energy

Section 1 - Radioactivity

Essential Questions

- How was radioactivity discovered?
- How do alpha, beta and gamma decay compare?
- What type of penetration power does each of the three types of nuclear radiation possess?
- What are some uses of radioactive material?
- How is the age of an object calculated using half-life?

Discovering Radioactivity

- Henri Becquerel discovered radioactivity by accident in 1896
- Nuclear radiation – high energy given off by the nucleus of some atoms
- The process is called radioactivity or radioactive decay

Types of Radioactive Decay

- There are three types of radioactive decay: alpha, beta, and gamma
- Alpha decay – release of alpha particles from the nucleus
- Beta decay – release of beta particles from the nucleus
- Gamma decay – release of gamma rays from the nucleus

Alpha Decay

- Alpha particle – 2 protons and 2 neutrons; mass number of 4 and charge of 2+
  - Alpha particles are the same as a nucleus of a helium atom
  - Ex: radium 226
- During alpha decay the mass number and the charge stay the same
- End with a different element

Beta Decay

- Beta decay – release of a beta particle from the nucleus of an atom
  - Can be an electron (1-) or a positron (1+)
  - Mass number is 0 – no protons or neutrons
- Different elements may decay differently
- Mass number and charge stay the same
- End with a different element

Gamma Decay

- Gamma rays – energy given off during alpha and beta decay in the form of light
- Release of gamma rays is called gamma decay
  - Happens as the particles in the nucleus move around
  - No mass or charge

Radiation Penetration

- Atoms hit by nuclear radiation can give up electrons and chemical bonds can break: the causes damage to living and nonliving things
- Living things – cells can be damaged by radiation (radiation sickness)
  - Can lead to death
- Nonliving things – can weaken metals and structures
- Gamma causes damage deep, beta closer to the surface – alpha causes the most damage (biggest)

Radioactive Dating

- Carbon atoms are in all living things
- Over time, they are changed by radioactive decay: this can help tell the age of organisms
- Rates of decay are constant
  - Half-life – amount of time it takes for half of a nuclei to decay
- Other elements can also be used for dating organisms

Uses of Radioactivity

- Tracers – radioactive elements whose path can be followed through a reaction
  - Can used to treat or prevent illnesses
  - Sterilize food products
  - Used to detect defects in structures
  - Can be converted to electrical energy