Chapter 19 Review

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Nuclear Chemistry: radioactive decay MUST follow conservation of mass law

Decay mechanism (process)- always releases energy

- **Alpha particle:** positively charged He atom missing both of its electrons
  - 4- He=α
  - Example: 226-Ra → 222-Rn + 4-He + energy released (gamma particle)
- **Beta particle:** splitting a neutron into a proton and an election
  - Example: 32-P → 32-S + electron + gamma ray
- **Gamma ray:** high energy photon of light
  - Example: 238-U → 4-He + 234-Th + 2 gamma ray
- **Positron:** particle with same mass as the electron but opposite charge
  - Example: 22-Na → positron + 22-Ne
- **Electron capture:** one of the inner-orbital electron is captured by the nucleus
  - Example: 201-Hg+ electron → 201-Au + gamma ray
- **Decay series:** occurs until a stable nuclide is formed
  - Example: 235-U → 207 Pb

Nuclear transformation: the change of one element into another

- Example: 14-N + 2-He →17-O + 1-H
- **Transuranium elements:** elements that have been synthesized

Half-life: The time it takes for a given amount of material to reduce to ½ of the original amount

- Example: 100 million 234-Pa → 50 million 234-Pa → 25 million 2350-Pa

1.2 minute 1.2 minutes

- Formula: mass remaining/ mass initial = $(1/2)^{(t/T)}$
  - t= elapsed time
  - T=half life
- **Geiger-Müller counter:** measures radioactivity levels by registering ions and electrons produced as a radioactive particle passes though a gas filled chamber

Carbon-14 dating: objects can be dated through radioactivity

- 14-C → electron + 14-N

Nuclear Energy

- **Artificial Transmutation:**
  - **Fusion:** combining two light nuclei to form heavier nucleus
    - 1-H + 1-H → 2-H + positron + gamma ray

      1-H +2-H → 3- He + gamma ray

      3-He + 3- He → 2-He + 2 1-H + gamma ray

      3- He + 1-H →4-He + positron + gamma ray
  - **Fission:** splitting a heavy nucleus into two nuclei with small mass numbers
    - Neutron + 235-U → 141-Ba + 92-Kr +3 neutrons
- **Natural Transmutation:**
  - 238-U → 234-Th + 4-He

    234-Th → 234-Pa + electron

    234-Pa → 234-U + electron

Effects of Radiation:

- Mutate cells (cancer) – damages DNA