

## CHAPTER 22. NUCLEAR CHEMISTRY

We will spend two lecture days on this chapter.

- ❖ Day 1. Sections 1 – 4. We will cover isotopes,  $\alpha$ ,  $\beta$ ,  $\gamma$ , etc, nuclear stability, types of decay, kinetics of radioactivity, nuclear equations.
- ❖ Day 2. Sections 6 – 10: We will cover uses of radioactivity: dating, medical, transmutations, binding energy, fission, fusion, controlled nuclear reactions, radiation.

**Section 22.1**  Define nucleon, isotope, nuclide, and nuclear reaction.  
 Summarize the differences between nuclear reactions and chemical reactions.

**Section 22.2**  Define radioactivity and radionuclide.  
 Write balanced equations for nuclear reactions, identifying the types of radiation and nuclides involved.  
 Do problems 1 and 2 on page 907, problem 20 on page 931, and problems 26, 28, 30, 32, 34, 36, 38 and 40 on pages 932 and 933.

**Section 22.3**  Use the integrated first-order rate law, solving for half-life, decay constant, or ratio of nuclei initially present to nuclei present at time  $t$ .  
 Do problems 3 – 7 on page 910, and problems 42, 44, 46, 48, 50, 52, and 58 on page 933.

**Section 22.4**  Use the neutron/proton plot for stable isotopes to determine whether a given nuclide is expected to be stable or unstable.  
 Identify nuclear decay processes and the identity of nuclides involved in nuclear decay processes.  
 Do problems 9 and 10 on page 914, and problem 22 on page 932.

### Skip Section 22.5

**Section 22.6**  Classify nuclear reactions as fission or fusion.  
 Calculate the energy released by a nuclear fission or fusion reaction.

**Section 22.7**  Write balanced equations for nuclear transmutations.  
 Do problems 15 and 16 on page 922, and problems 74, 76 and 78 on page 934.

### Skip Section 22.8 and 22.9.

**Section 22.10**  Show how radiocarbon dating is used to determine the age of an object.  
 Do problem 17 on page 927,

*Tell me why the stars do shine,  
Tell me why the ivy twines.  
Tell me what makes skies so blue,  
And I'll tell you why I love you.*

*Nuclear fusion makes stars to shine,  
Tropisms make the ivy twine,  
Rayleigh scattering makes skies so blue,  
Racing hormones are why I love you.*

*Isaac Asimov*



"HAVE YOU COME ACROSS ANY OF THE RARE EARTHS — PRASEODYMIUM, GADOLINIUM, DYSPROSIUM— STUFF LIKE THAT?"

