

### Chapter 25: NUCLEAR CHEMISTRY

The number and arrangement of its electrons dominate the chemical reactivity and physical properties of an atom.

Hence, we focus on electron configurations in chemistry.

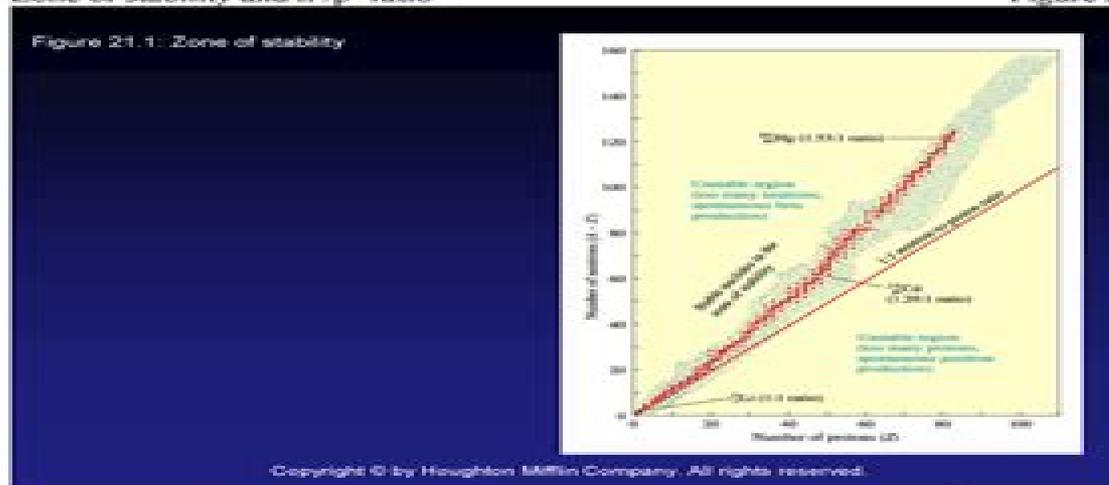
However, we live in a world with nuclear power plants, nuclear weapons, and medical applications of radioactive isotopes, including waste from their use and production.

Nuclear radiation can break chemical bonds, including bonds in DNA.

#### §25-7 Nuclear stability

Zone of stability and  $n^0/p^+$  ratio

Figure 25-7: Zumdahl 4<sup>th</sup> Fig 21.1



neutrons and protons are attracted to each other, so the more neutrons, [what?]

$p^+$  = proton

$n^0$  = neutron

$e^-$  = electron

Stable nuclei most likely have even number of  $p^+$  & even number of  $n^0$  (Table 25-3)

| Number of $p^+$ | Number of $n^0$ | Number of naturally occurring stable nuclides | Examples   |
|-----------------|-----------------|---|--|
| even            | even            | 163   | $^4\text{He}$ , $^{12}\text{C}$ , $^{16}\text{O}$ , $^{18}\text{O}$ , $^{20}\text{Ne}$ |
| even            | odd             | 55  | $^3\text{He}$ , $^7\text{Be}$ , $^{13}\text{C}$ , $^{17}\text{O}$ , $^{21}\text{Ne}$   |
| odd             | even            | 50  | $^7\text{Li}$ , $^{11}\text{B}$ , $^{14}\text{N}$ , $^{19}\text{F}$ , $^{23}\text{Na}$ |
| odd             | odd             | 4   | $^2\text{H}$ , $^6\text{Li}$ , $^{10}\text{B}$ , $^{14}\text{N}$                       |

Shell model for nucleus gives magic numbers: 2, 8, 20, 28, 50, 82, 114 (for  $p^+$ ), 126 (for  $n^0$ )

<http://www.nndc.bnl.gov/nudat2/>

Brookhaven National Laboratory puts # neutrons on x axis

§25-1 Nuclear reactions destroy atoms -- contrary to Dalton's Atomic Theory  
But Mass number = # nucleons ( $p^+$  &  $n^0$ ) is unchanged

$\implies$  mass is approximately conserved

Mass-energy is conserved.  $\Delta E = (\Delta m)c^2$

Charge is conserved.

# Chapter 25 Nuclear Chemistry Study Guide For Content Mastery

**R Bogdan**



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