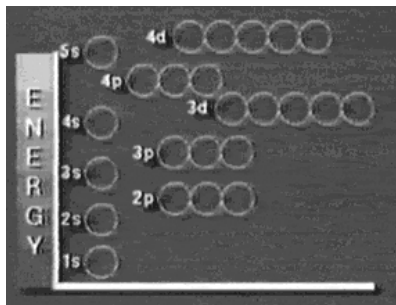


Orbitals and Electron configurations



Pauli Exclusion Principle

- Reference: pg. 203
- The Pauli Exclusion Principle states that each electron (waveform) has a unique set of quantum numbers
- No two electrons can have the same values for all quantum numbers
- Kinda like how each apartment in a building has only one address
- Q: How many electrons will fit in shell 5 (i.e. what is the max. shell population for $n=5$)?

Electrons in $n = 5$ shell

- Q - what is the maximum shell population of $n = 5$
- | | | | |
|--------------|------------|------------|--------------|
| $n = 5$ | $l = 0(s)$ | $m_l = 0$ | $m_s = 1/2$ |
| | | | $m_s = -1/2$ |
| | $l = 1(p)$ | $m_l = 1$ | $m_s = 1/2$ |
| | | | $m_s = -1/2$ |
| | | | $m_l = 0$ |
| | $l = 2(d)$ | $m_l = -1$ | $m_s = 1/2$ |
| | | | $m_s = -1/2$ |
| | $l = 3(f)$ | $m_l = 0$ | $m_s = 1/2$ |
| | | | $m_s = -1/2$ |
| | $l = 4(g)$ | $m_l = -1$ | $m_s = 1/2$ |
| $m_s = -1/2$ | | | |
- A - 50**
 $(2+6+10+14+18)$
 $l = 4$ has 9 orbitals:
 it has 18 electrons
 or $2(5)^2 = 50$

Filling orbitals with electrons: film

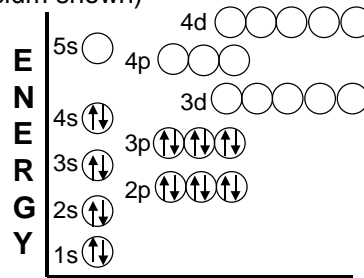
- Movie (10 minutes) (at $t=20$)
- 0 - 3: review
Bohr explained some observations. However, he failed in other areas. Later we will look at probability distributions (Heisenberg's uncertainty principle and orbital shapes). For now we will examine how electrons fill orbitals.
- 3 - 6: filling orbitals with electrons
- We will see that electrons are placed in the lowest energy level possible.

Electron Configurations

- Electrons are placed in the lowest energy levels that are possible while still following the Pauli exclusion principle
- Hund's rule states that the electrons should be spread within a subshell as much as possible
- To know which subshells are lowest in energy refer to fig. 6.20 (arrows going up to left) or fig. 6.19 ...

Electron Configurations

- Electrons fill the lowest energy levels first (calcium shown)



- Read section 6.7 (pg. 204 - 206). Do PE 5,6

Shorthand electron configurations

- Recall that we can indicate position of electrons via orbital diagrams or electron configurations.
- Fitting 100 or more electrons into this pattern becomes cumbersome.
- We can write shorthand electron configurations...
- Read remainder of 6.7 (pg. 206 - 207). PE 7.

Shorthand electron configurations

- Because electrons fill orbitals in a regular pattern, we can shorten the work of writing electron configurations by using the preceding noble gas as a template
- We write the highest shell last to indicate the "valence electrons" - i.e. those furthest out (involved in bonding and chemical reactions)
- We can represent shorthand electron configurations of the noble gasses 2 ways:
E.g. Ar = $1s^2 2s^2 2p^6 3s^2 3p^6$ = $[\text{Ne}]3s^2 3p^6$ = $[\text{Ar}]$
- Use $[\text{Ne}]3s^2 3p^6$ for this course