

Chapter 8

Electronic Configurations – 2

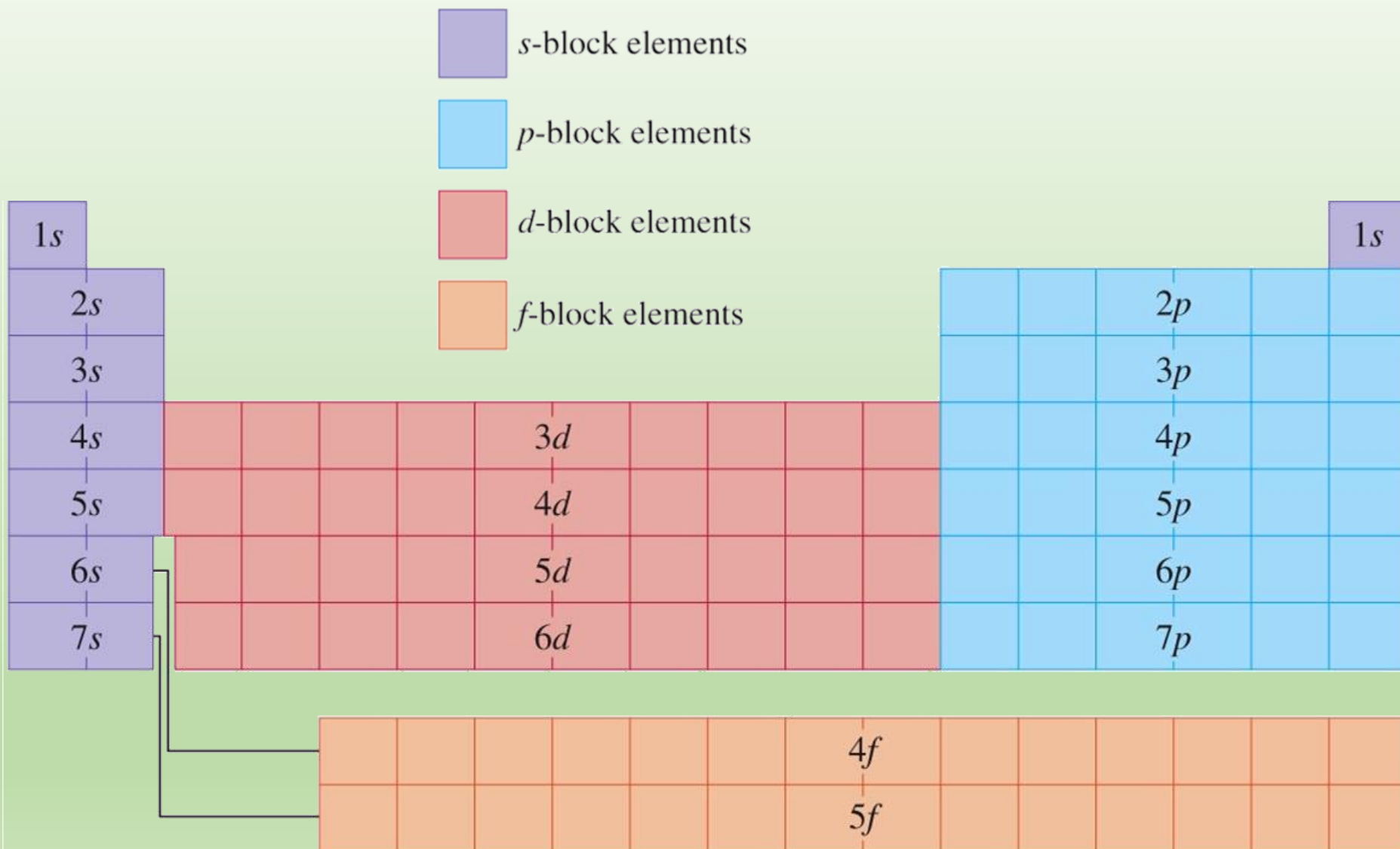
Exceptions, Properties, Ionic Configurations, etc.

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Exceptions

- There are a things to watch out for when filling out shells.
 - Fill s in the higher n number before starting d:
 - Fill the 4s before 3d because of energy consideration. Same goes for 5s before 4d.
 - Fill s completely before d for two columns
 - Chromium (4th column in transition metals) and elements below:
Should be $4s^2, 3d^4$; But is $4s^1, 3d^5$ (for Mo: $5s^1, 4d^5$) This is to make the d configuration more stable.
 - Copper and the elements below it are filled as:
Should be $4s^2 3d^9$; But is $4s^1, 3d^{10}$ (for Ag: $5s^2, 4d^{10}$)

The Periodic Table Divided in Blocks



Electronic Configuration of Periodic Table

Groups

1 1A 2 2A 13 3A 14 4A 15 5A 16 6A 17 7A 18 8A

1 H $1s^1$ 2 He $1s^2$

2 Li $2s^1$ 4 Be $2s^2$ 5 B $2s^2 2p^1$ 6 C $2s^2 2p^2$ 7 N $2s^2 2p^3$ 8 O $2s^2 2p^4$ 9 F $2s^2 2p^5$ 10 Ne $2s^2 2p^6$

3 11 Na $3s^1$ 12 Mg $3s^2$ 3 3B 4 4B 5 5B 6 6B 7 7B 8 8B 9 9B 10 10B 11 11B 12 12B 13 Al $3s^2 3p^1$ 14 Si $3s^2 3p^2$ 15 P $3s^2 3p^3$ 16 S $3s^2 3p^4$ 17 Cl $3s^2 3p^5$ 18 Ar $3s^2 3p^6$

4 19 K $4s^1$ 20 Ca $4s^2$ 21 Sc $4s^2 3d^1$ 22 Ti $4s^2 3d^2$ 23 V $4s^2 3d^3$ 24 Cr $4s^1 3d^5$ 25 Mn $4s^2 3d^5$ 26 Fe $4s^2 3d^6$ 27 Co $4s^2 3d^7$ 28 Ni $4s^2 3d^8$ 29 Cu $4s^1 3d^{10}$ 30 Zn $4s^2 3d^{10}$ 31 Ga $4s^2 4p^1$ 32 Ge $4s^2 4p^2$ 33 As $4s^2 4p^3$ 34 Se $4s^2 4p^4$ 35 Br $4s^2 4p^5$ 36 Kr $4s^2 4p^6$

5 37 Rb $5s^1$ 38 Sr $5s^2$ 39 Y $5s^2 4d^1$ 40 Zr $5s^2 4d^2$ 41 Nb $4s^1 4d^4$ 42 Mo $5s^1 4d^5$ 43 Tc $5s^2 4d^5$ 44 Ru $5s^1 4d^7$ 45 Rh $5s^1 4d^8$ 46 Pd $4d^{10}$ 47 Ag $5s^1 4d^{10}$ 48 Cd $5s^2 4d^{10}$ 49 In $5s^2 5p^1$ 50 Sn $5s^2 5p^2$ 51 Sb $5s^2 5p^3$ 52 Te $5s^2 5p^4$ 53 I $5s^2 5p^5$ 54 Xe $5s^2 5p^6$

6 55 Cs $6s^1$ 56 Ba $6s^2$ 57 La $6s^2 5d^1$ 72 Hf $6s^2 5d^2$ 73 Ta $6s^2 5d^3$ 74 W $6s^2 5d^4$ 75 Re $6s^2 5d^5$ 76 Os $6s^2 5d^6$ 77 Ir $6s^2 5d^7$ 78 Pt $6s^1 5d^9$ 79 Au $6s^1 5d^{10}$ 80 Hg $6s^2 5d^{10}$ 81 Tl $6s^2 6p^1$ 82 Pb $6s^2 6p^2$ 83 Bi $6s^2 6p^3$ 84 Po $6s^2 6p^4$ 85 At $6s^2 6p^5$ 86 Rn $6s^2 6p^6$

7 87 Fr $7s^1$ 88 Ra $7s^2$ 89 Ac $7s^2 6d^1$ 104 Rf $7s^2 6d^2$ 105 Db $7s^2 6d^3$ 106 Sg $7s^2 6d^4$ 107 Bh 108 Hs 109 Mt 110 Ds 111 Rg 112 Cn 113 114 115 116 117 ** (292) 118

Legend:

- s-block elements (blue)
- p-block elements (pink)
- d-block elements (orange)
- f-block elements (green)

Lanthanides

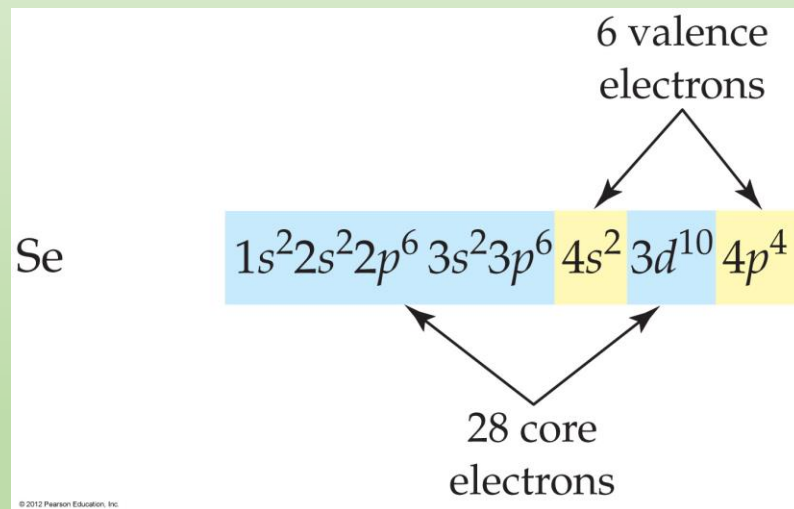
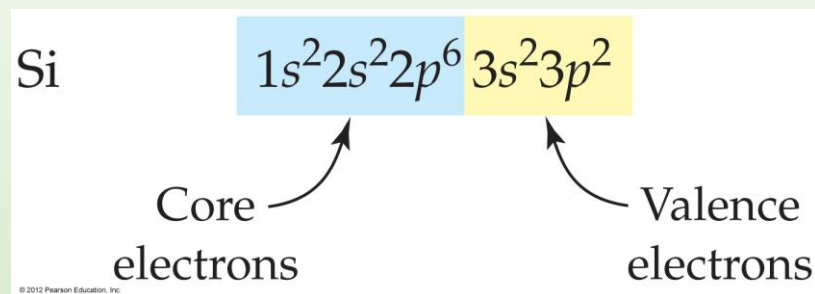
58 Ce $6s^2 4f^2$	59 Pr $6s^2 4f^3$	60 Nd $6s^2 4f^4$	61 Pm $6s^2 4f^5$	62 Sm $6s^2 4f^6$	63 Eu $6s^2 4f^7$	64 Gd $6s^2 4f^7 5d$	65 Tb $6s^2 4f^9$	66 Dy $6s^2 4f^{10}$	67 Ho $6s^2 4f^{11}$	68 Er $6s^2 4f^{12}$	69 Tm $6s^2 4f^{13}$	70 Yb $6s^2 4f^{14}$	71 Lu $6s^2 4f^{14} 5d^1$
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Actinides

90 Th $7s^2 6d^2$	91 Pa $7s^2 5f^2 6d^1$	92 U $7s^2 5f^3 6d^1$	93 Np $7s^2 5f^4 6d^1$	94 Pu $7s^2 5f^6$	95 Am $7s^2 5f^7$	96 Cm $7s^2 5f^7 6d^1$	97 Bk $7s^2 5f^9$	98 Cf $7s^2 5f^{10}$	99 Es $7s^2 5f^{11}$	100 Fm $7s^2 5f^{12}$	101 Md $7s^2 5f^{13}$	102 No $7s^2 5f^{14}$	103 Lr $7s^2 5f^{14} 6d^1$
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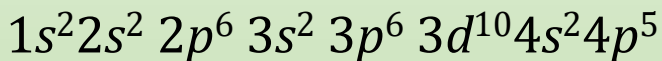
Valence and Core Electrons

- Silicon has 4 valence electrons (those in the $n = 3$ principal shell) and 10 core electrons.
- Selenium has 6 valence electrons (those in the $n = 4$ principal shell). All other electrons, including those in the $3d$ orbitals, are core electrons.

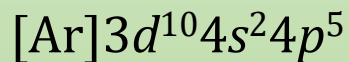


Noble Gas Configurations

- This helps to shorten the electronic configurations so we don't have to write long notations.
- Take the noble gas of the previous period and continue on filling with the rest of the electrons.
- E.g. Bromine configuration is:



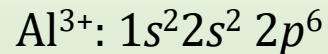
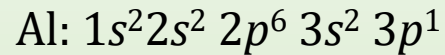
- But the noble gas configuration is:



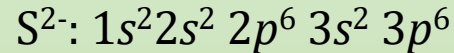
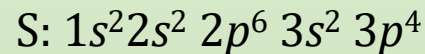
(It is important to remember that the "d" electrons are core so the only the s and p electrons are valence electrons)

Configurations for Ions

- Cations: remove the valence shell electrons of the higher energy first.



- Anions: add the electrons to the lower subshell of valence shell.



Paramagnetism and Diamagnetism

A **paramagnetic substance** is one that is weakly attracted by a magnetic field, usually as the result of *unpaired electrons*.

A **diamagnetic substance** is not attracted by a magnetic field generally because it has *only paired electrons*.

Visit [UC Davis ChemWiki](#) for more information.

Key Words

- Noble gas configuration
- Valence and core electrons
- Electronic configuration of ions
- Paramagnetism
- Diamagnetism