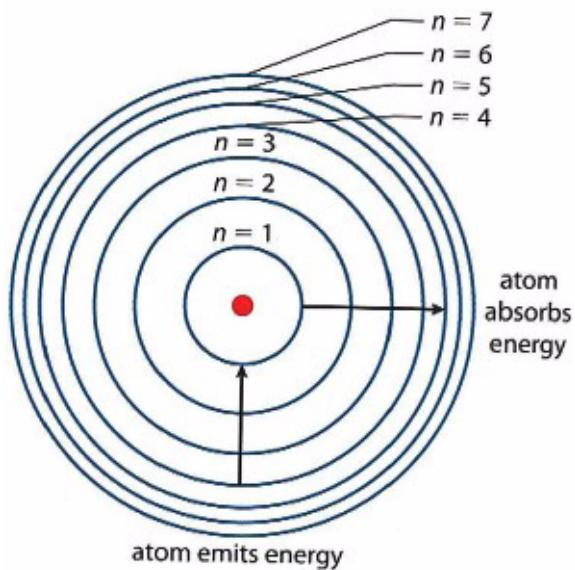
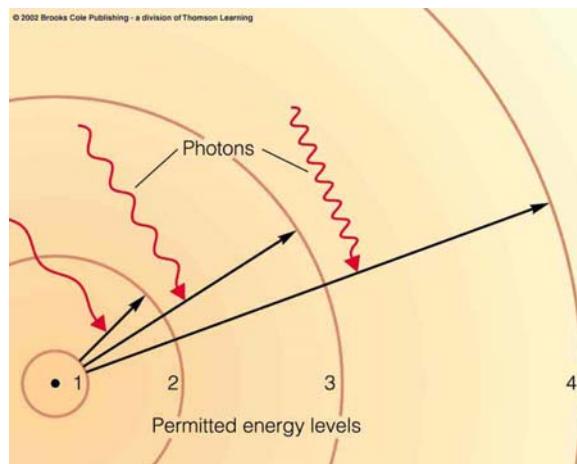


Shells in the Bohr model of the atom

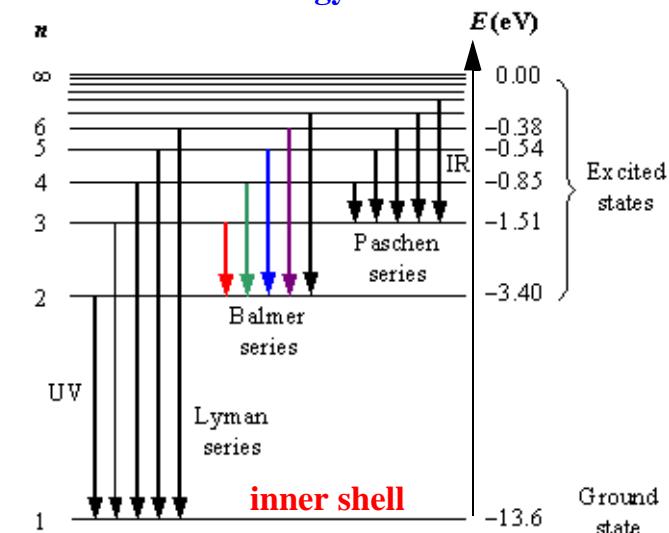
The electrons in an atom can only have certain energy levels that corresponds to the different shells.



An electron can be moved from one shell (energy level) to another if it absorbs a photon with an energy equal to the difference between the energy levels.



If an electron is instead moving from an outer to an inner shell a photon will be sent out (emitted) with the energy equal to the difference between the energy levels.



Electron configurations in chemistry

SHELL:	1	2	3	4						
SUBSHELL:	1s	2s	2p	3s	3p	3d	4s	4p	4d	4f
ORBITAL:	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓

The arrows ↓ indicate that there can be a maximum of two electrons in each orbital and that they have different spin states. These states are called “up” and “down”. So each arrow indicate an electron in a particular state.

Electron configurations in physics

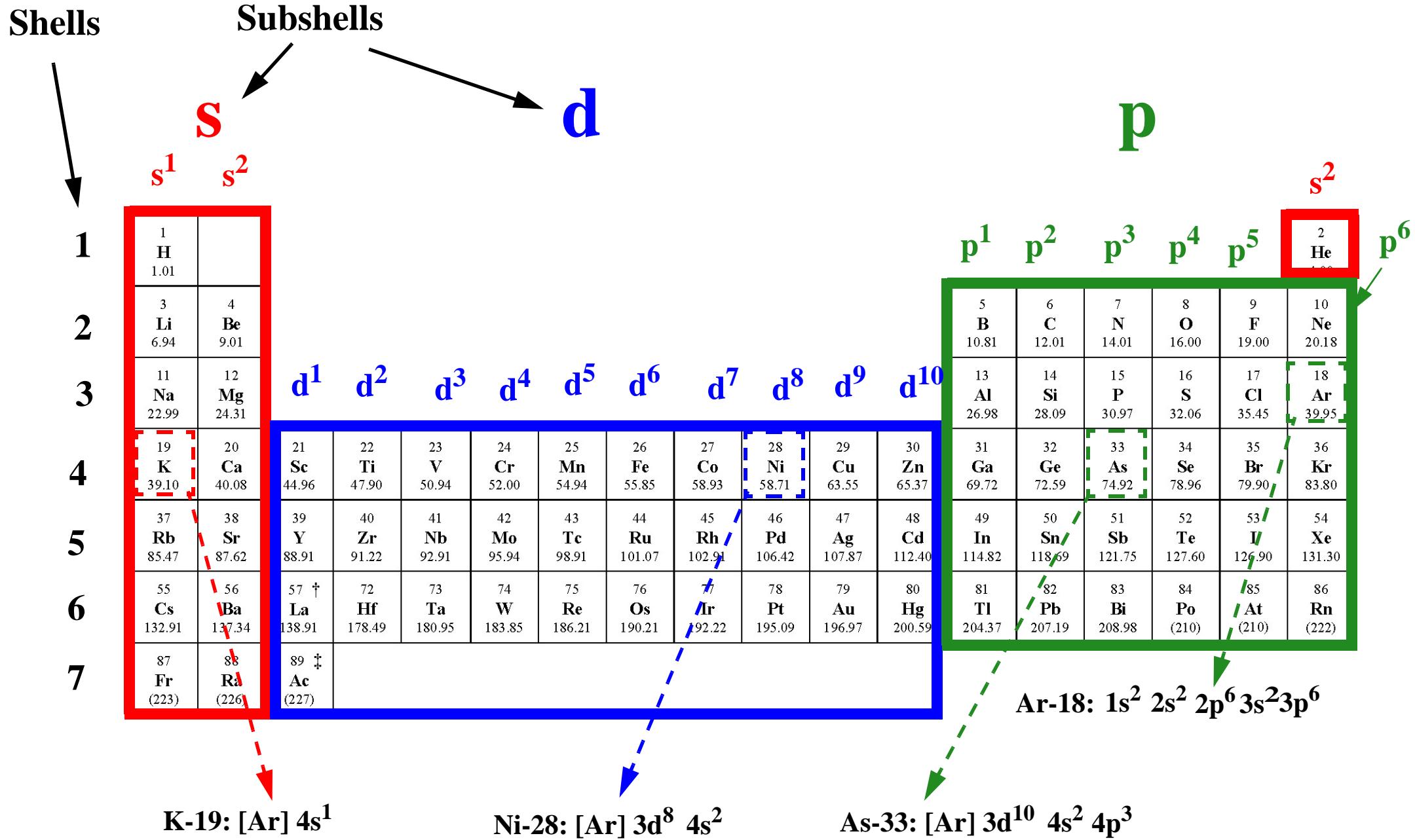
SHELL:	K	L	M	N						
n =	1	2	3	4						
SUBSHELL:	1s	2s	2p	3s	3p	3d	4s	4p	4d	4f
l =	0	0	1	0	1	2	0	1	2	3
ORBITAL:	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓	↑↓
m_l =	0	0	-1	0	+1	0	-1	0	+1	-2
SPIN:	±½	±½	±½	±½	±½	±½	±½	±½	±½	±½

n, l, m_l and m_s are called quantum number and they describe in what state the electron is in.

Pauli principle: Two electrons cannot have the same quantum numbers.

Hunds principle: Two electrons prefer to be alone in an orbital than together with a second electron.

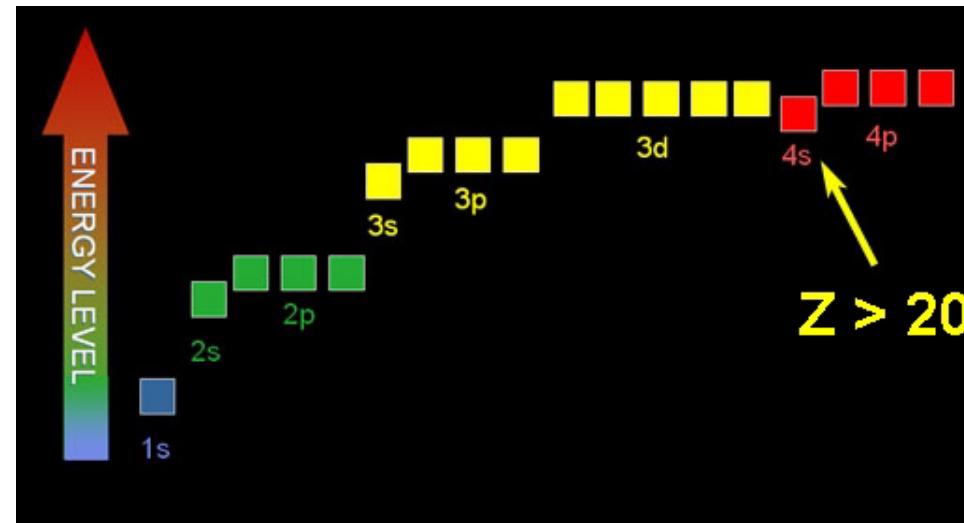
Shells and subshells in the periodic table



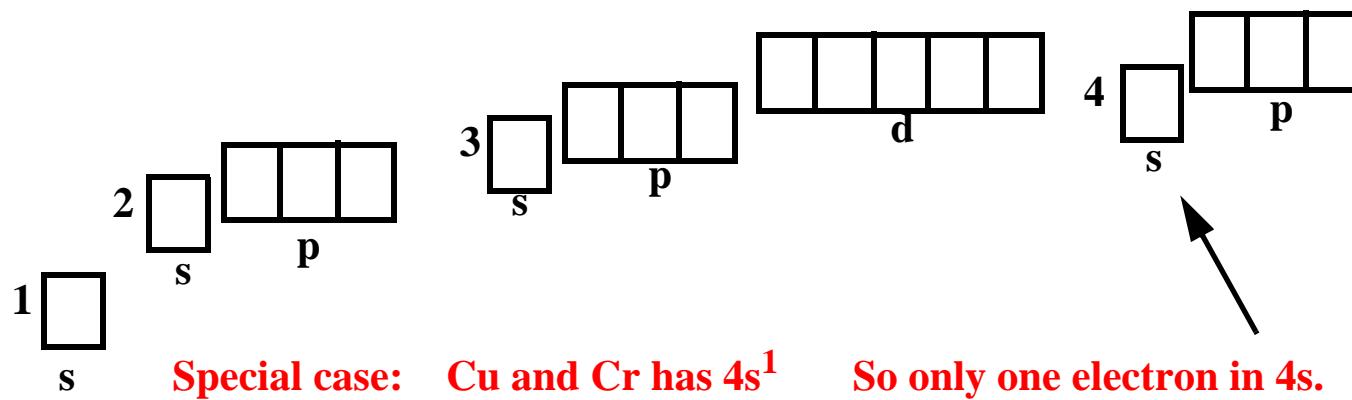
Electron configurations for Zn-30, Cu-29, Ni-28, Co-27, Fe-26

ORIBTAL:	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$\frac{\uparrow\downarrow}{s}$
Zn-30	$1s^2$	$2s^2$	$2p^6$			$3s^2$	$3p^6$			$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$4s^2$
ORIBTAL:	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$\frac{\uparrow}{s}$
Cu-29	$1s^2$	$2s^2$	$2p^6$			$3s^2$	$3p^6$			$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$4s^1$
ORIBTAL:	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$\frac{\uparrow\downarrow}{s}$
Ni-28	$1s^2$	$2s^2$	$2p^6$			$3s^2$	$3p^6$			$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$4s^2$
ORIBTAL:	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$\frac{\uparrow\downarrow}{s}$
Co-27	$1s^2$	$2s^2$	$2p^6$			$3s^2$	$3p^6$			$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$4s^2$
ORIBTAL:	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$\frac{\uparrow\downarrow}{s}$	$\frac{\uparrow\downarrow}{p_x}$	$\frac{\uparrow\downarrow}{p_y}$	$\frac{\uparrow\downarrow}{p_z}$	$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$\frac{\uparrow\downarrow}{s}$
Fe-26	$1s^2$	$2s^2$	$2p^6$			$3s^2$	$3p^6$			$d_{x^2-y^2}$	d_{zx}	d_{z^2}	d_{yz}	d_{xy}	$4s^2$

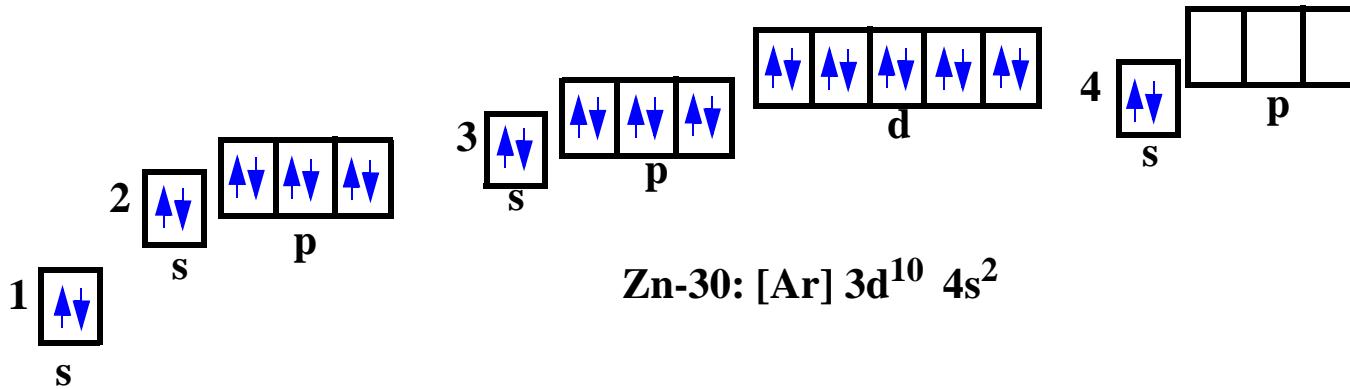
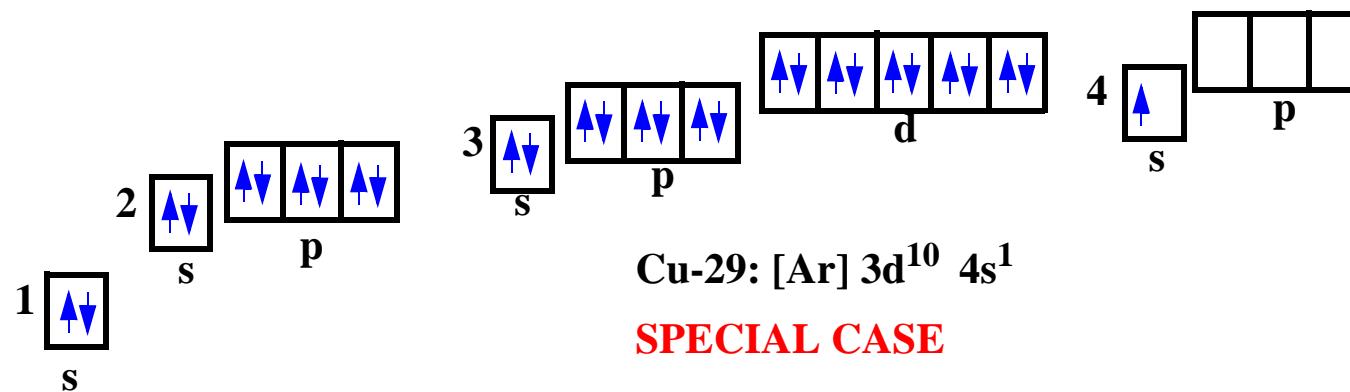
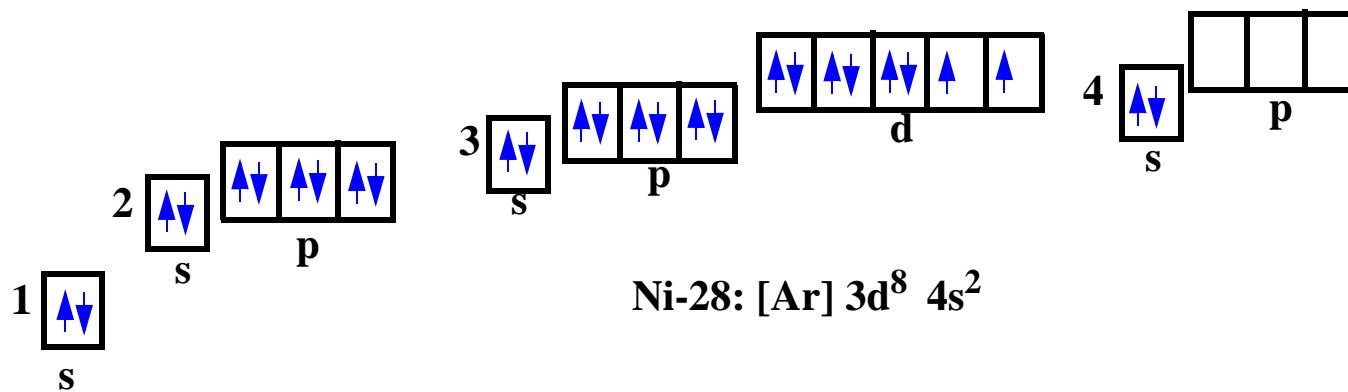
Energy levels



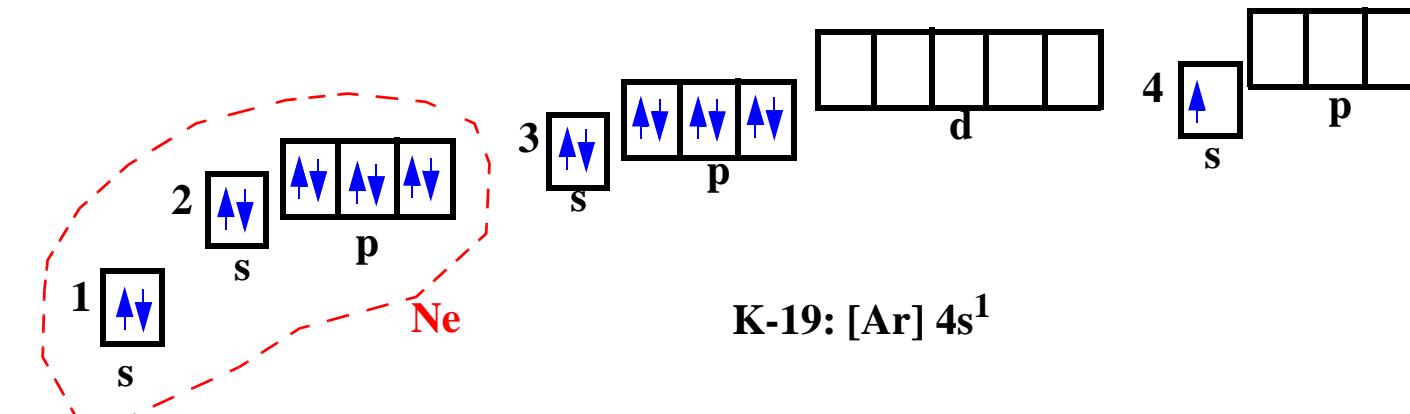
Draw this picture and fill it up from the bottom



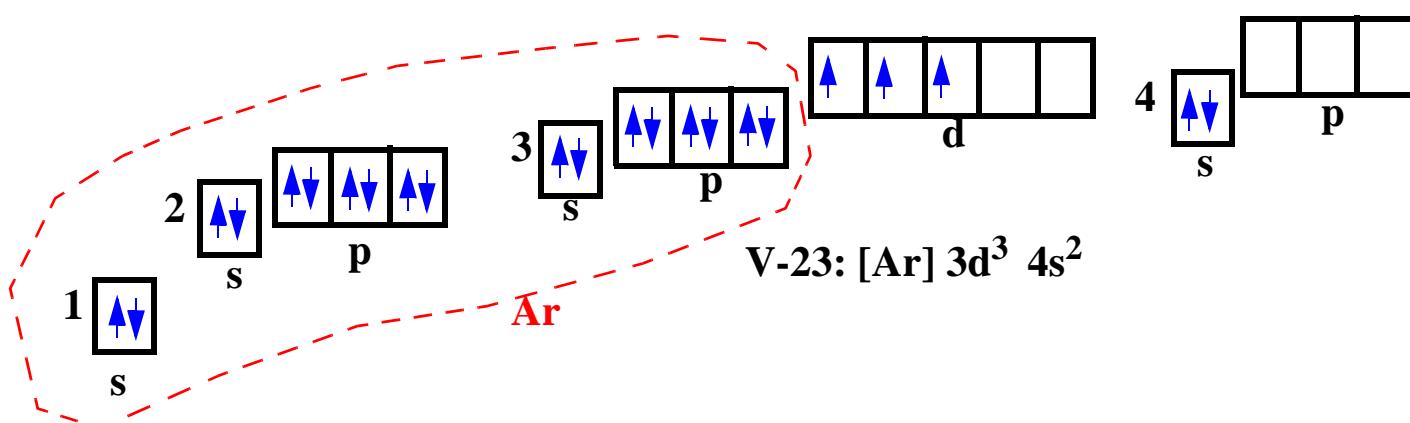
Energy levels for Ni-28, Cu-29 and Zn-30



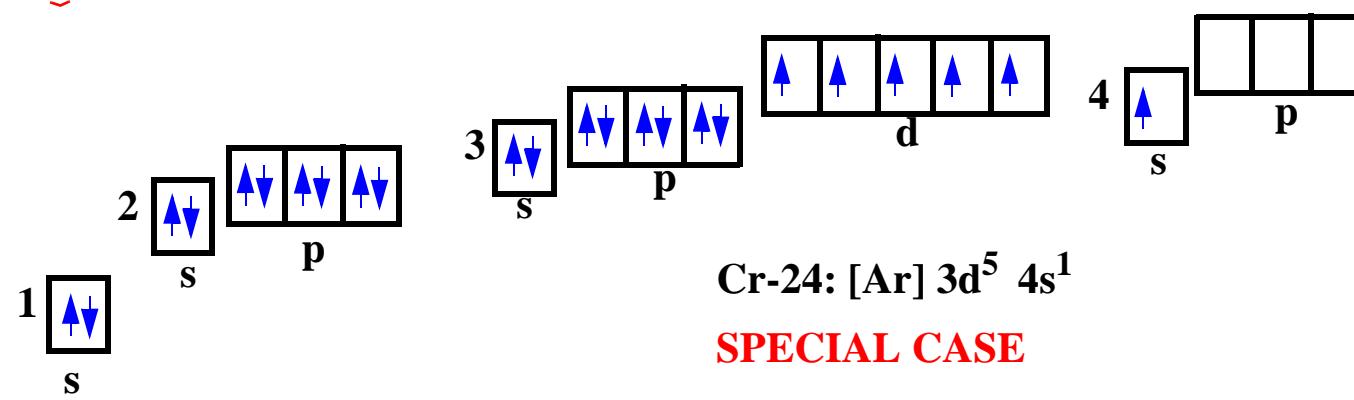
Energy levels for K-19, V-23 and Cr-24



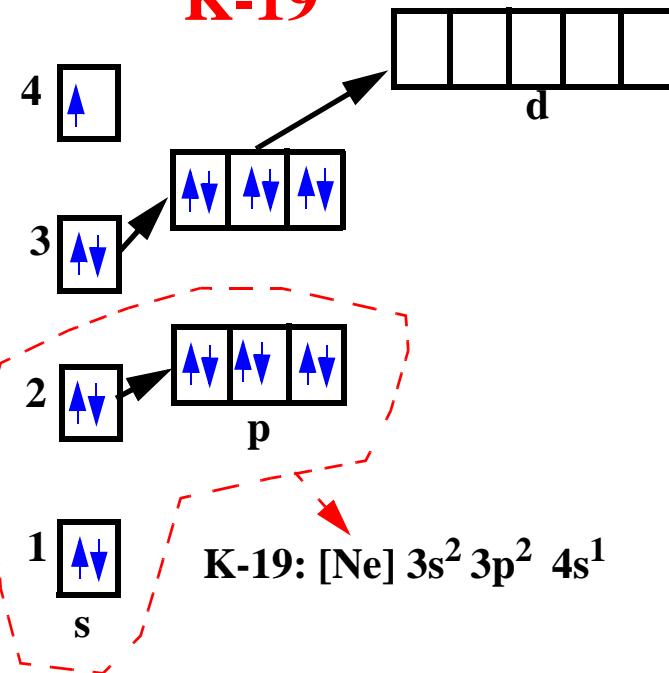
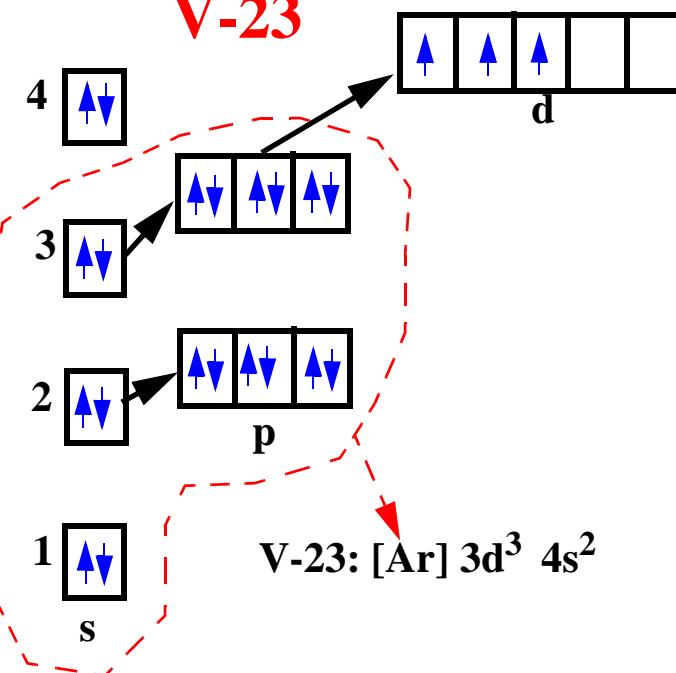
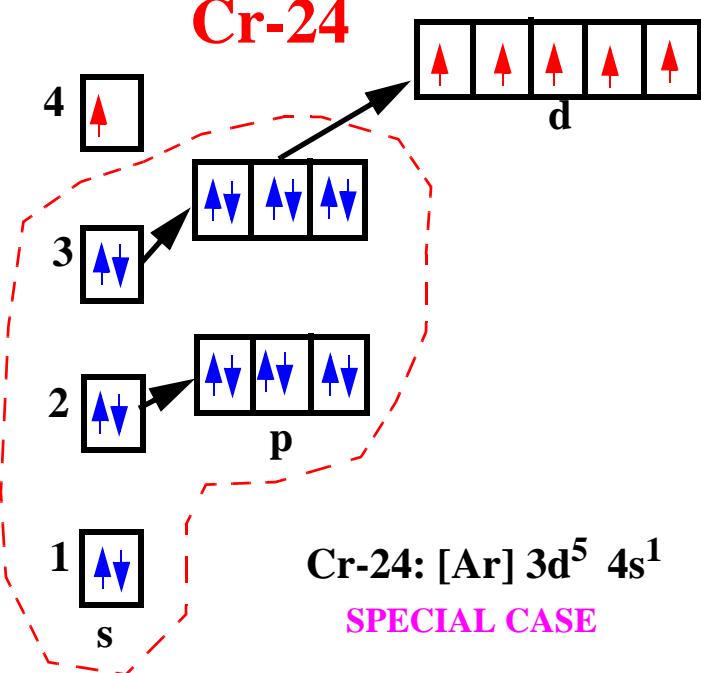
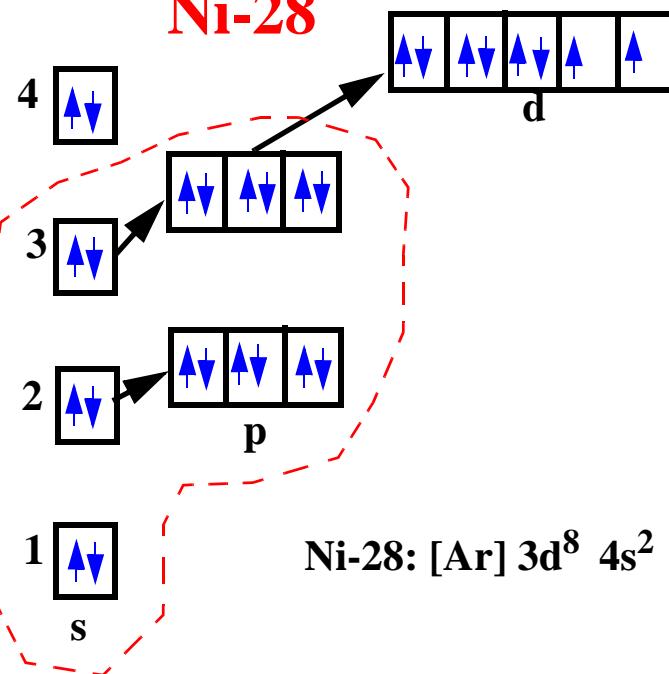
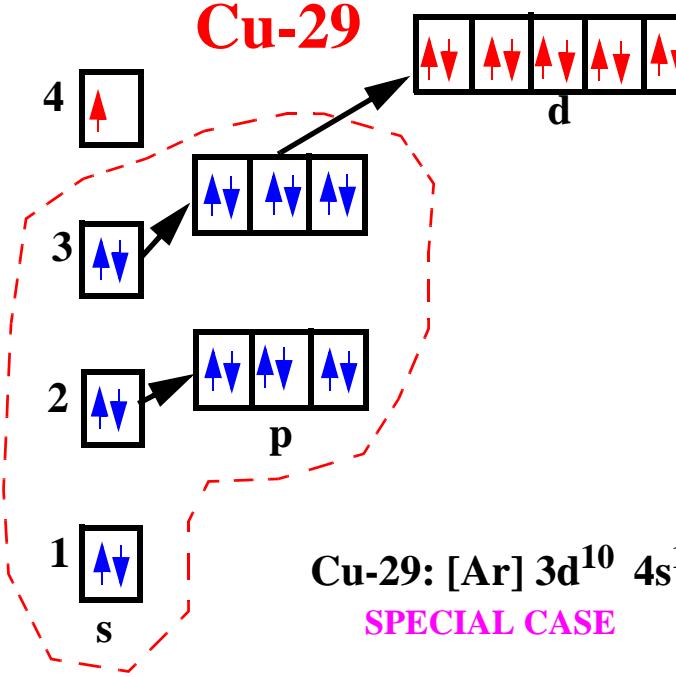
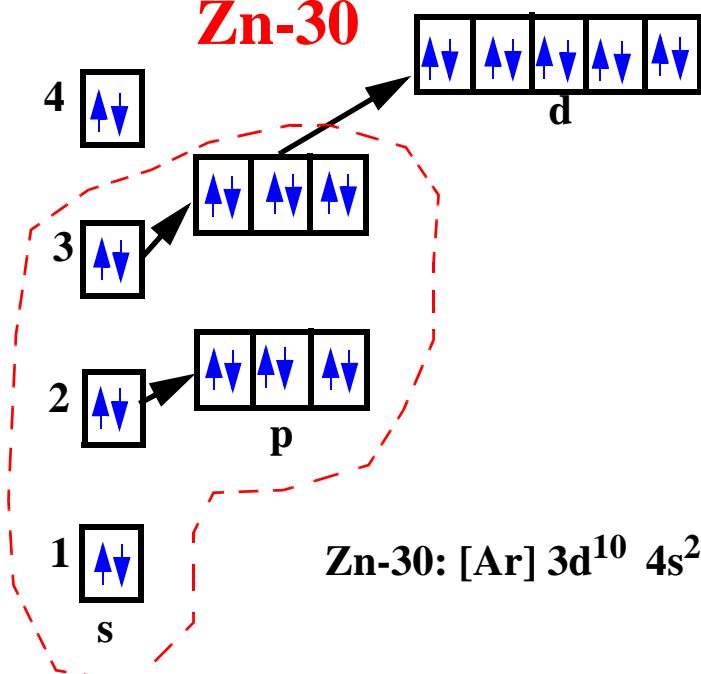
$K-19: [Ar] 4s^1$



$V-23: [Ar] 3d^3 4s^2$



$Cr-24: [Ar] 3d^5 4s^1$
SPECIAL CASE

K-19K-19: [Ne] 3s² 3p² 4s¹**V-23**V-23: [Ar] 3d³ 4s²**Cr-24**Cr-24: [Ar] 3d⁵ 4s¹
SPECIAL CASE**Ni-28**Ni-28: [Ar] 3d⁸ 4s²**Cu-29**Cu-29: [Ar] 3d¹⁰ 4s¹
SPECIAL CASE**Zn-30**Zn-30: [Ar] 3d¹⁰ 4s²