Announcements

Monday, November 23, 2009

Quiz 3 is this Wednesday, Nov 25, covering 6.7-6.8, all of 7, and 8.1-8.6

MasteringChemistry due dates (all at 11:59 pm)

- Ch 7: Wed, Nov 25
- Ch 8: Wed, Dec 2
- Ch 9: Fri, Dec 4

Electron configurations

Ca: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$: $[Ar]\ 4s^2$

Sc: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$: $[Ar]\ 4s^2 3d^1$

rearranged: $3p^6\ 3d^1\ 4s^2$

Sometimes, electron configurations are rearranged into order of increasing *n* (to group valence electrons better)

Se: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^4$

periodic table (filling) order

$n=4$ valence shell

6 valence electrons

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^4$

Abbreviated configurations:

Po: filling: $[Xe]\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^4$ — 6 v.e.

rearranged: $[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^4$

inner core | valence

Bh: filling: $[Rn]\ 7s^2\ 5f^{14}\ 6d^5$

transition element

rearranged: $[Rn]\ 5f^{14}\ 6d^5\ 7s^2$

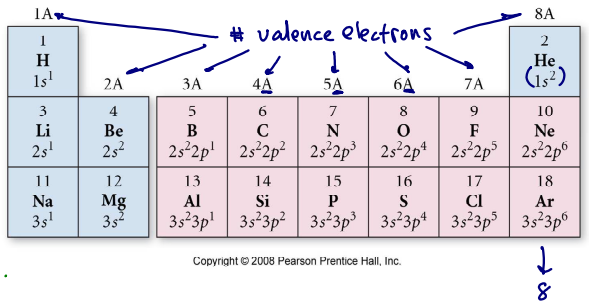
inner | core | valence e⁻

inner : [noble gas]

core : [n.g.] + filled d or f

valence : highest n (+ d for transition elements)

Outer Electron Configurations of Elements 1–18



Valence electrons: number of electrons in outermost principal energy level (*n*) (plus outermost d electrons for transition elements)

Core electrons: inner electrons plus filled d or f sublevels

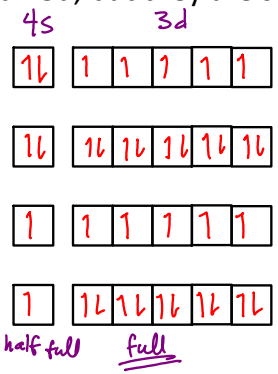
4s has lower energy than 3d, but they are still close.

Mn: [Ar] $4s^2$ $3d^5$

Zn: [Ar] $4s^2$ $3d^{10}$

Cr: [Ar] $4s^1$ $3d^5$ (not $4s^2 3d^4$)

Cu: [Ar] $4s^1$ $3d^{10}$ (not $4s^2 3d^9$)



most stable
- all orbitals full
- entire subshell half-full

(You should be aware of the conditions behind these anomalies and be able to explain it if it occurs elsewhere, but do not memorize every exception on the periodic table!)

Magnetic properties

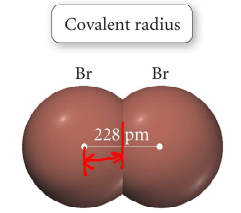
Unpaired electrons in the orbital diagram will make the element **paramagnetic** (weakly attracted to magnetic field)

Mn: 5 unpaired / Cr: 6 unpaired / Cu: 1 unpaired

If all electrons are paired, the element is **diamagnetic** (not attracted by magnetic field)

Zn: all paired

Periodic trends in atomic radius



$$\text{Br radius} = \frac{228 \text{ pm}}{2} = 114 \text{ pm}$$

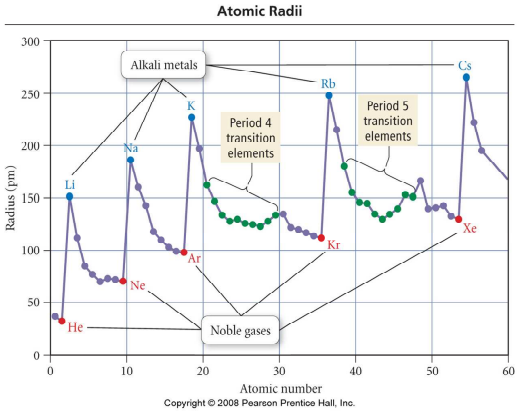
Atomic radius **increases** going down a column:

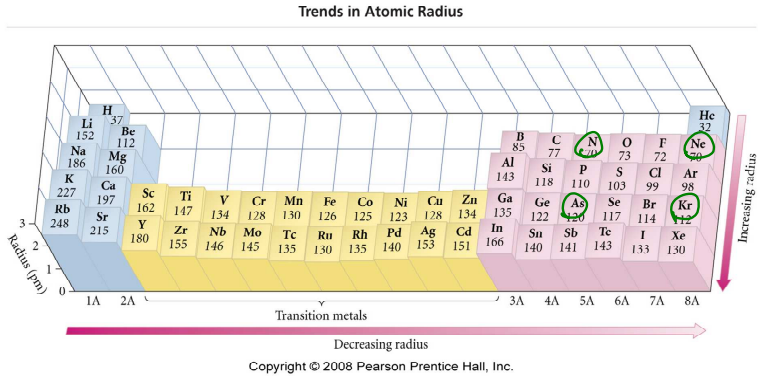
adds shells going down

Atomic radius **decreases** going across a period (row):

smaller

[add e^- to same shell
add p^+ to nuc.] increased attraction



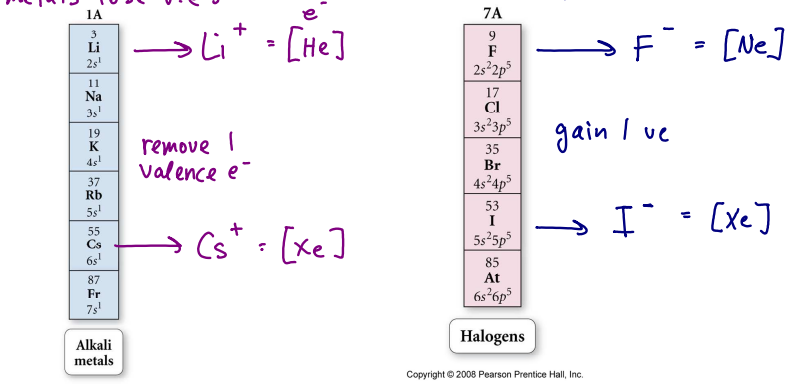


Ions

Main group ions: (s & p blocks)

metals lose v.e's

nonmetals gain ve to get to 8



IIA lose 2 ve, Al loses 3 ve

Transition metal ions:

incr. "n"

Zn: [Ar] $3d^{10}$ $4s^2$ — 4s: ↿⇂ ; 3d: ↿⇂ ↿⇂ ↿⇂ ↿⇂ ↿⇂

Experimentally, the Zn^{2+} ion is diamagnetic:

Zn^{2+}: [Ar] $3d^{10}$ — 4s: □ ; 3d: ↿⇂ ↿⇂ ↿⇂ ↿⇂ ↿⇂ full

Transition metals tend to lose the s electrons **before** the d electrons!

(Writing the configuration in order of increasing *n* makes ion formation easier!)

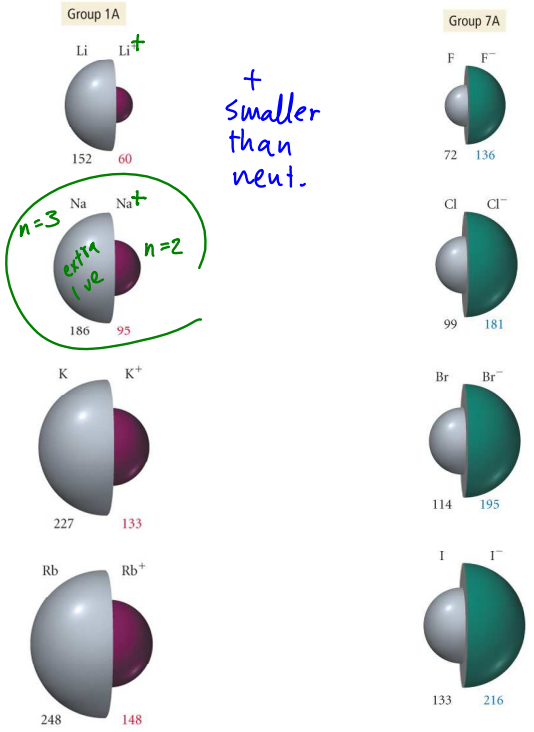
Ag: [Kr] $5s^1$ $4d^{10}$

Ag^+: [Kr] $4d^{10}$ (the only Ag ion)

Ionic radius

Na: [Ne] $3s^1$ → remove a shell!
Na^+: [Ne]

Cl: [Ne] $3s^2 3p^5$ → add $1e^-$ to same shell → increases e^- repulsion
Cl^-: [Ne] $3s^2 3p^6$



+ smaller than neut.

− larger than neut