11/13/2019

e⁻ configs + orbital diagrams.

e^- confis | orbital diagram

₁H : $1s^1$

$m_\ell = 0$

[1]
1s $M_s = +\frac{1}{2}$ (↑)

$n=1$ $\ell = 0$

₂He $1s^2$

[↑↓]
1s   (paired spins: ↑↓)

$n=1$ $n=1$
$\ell = 0$ $\ell = 0$
$M_\ell = 0$ $M_\ell = 0$
$M_s = +\frac{1}{2}$ $M_s = -\frac{1}{2}$

₃Li $1s^2 2s^1$

[↑↓]   [↑]
1s   2s

$n=2$
$\ell = 0$
$M_\ell = 0$ (one 2s-orbital)

₄Be $1s^2 2s^2$

[↑↓]   [↑↓]
1s   2s

₅B $1s^2 2s^2 2p^1$

[↑↓]   [↑↓]   [↑ | |]
1s   2s   2p

$n=2$ $\ell = 1$
$M_\ell = -1, 0, +1$

₆C $1s^2 2s^2 2p^2$

[↑↓]   [↑↓]   [↑ | ↑ |]
1s   2s   2p

OR   " ——— "   [↑ | ↓ |]

OR   " ——— "   [↑↓ | |]
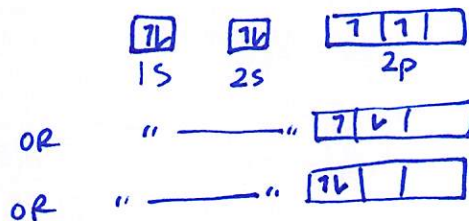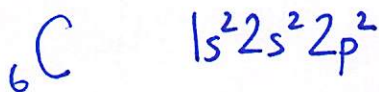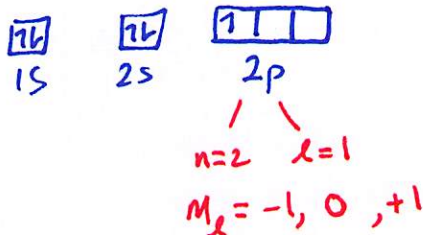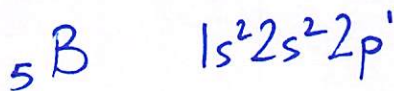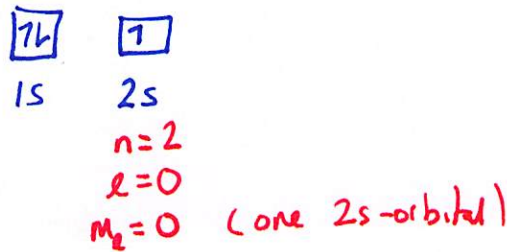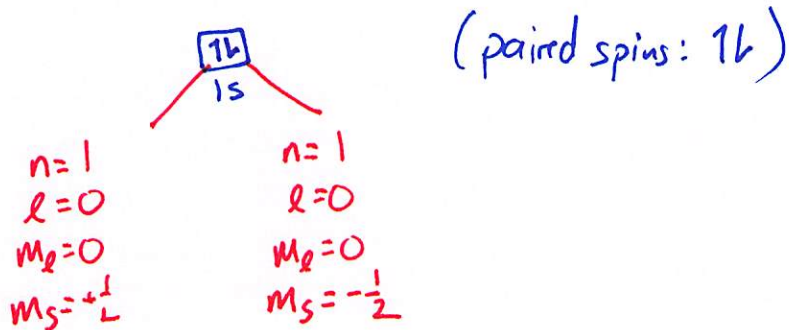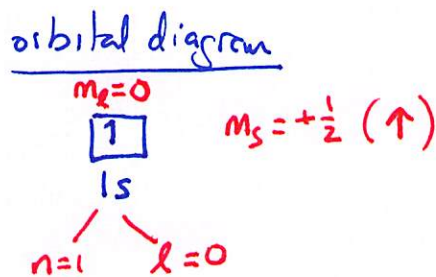
HUND's rule

e⁻s prefer to fill other orbitals in subshell w/ parallel spins, before pairing up!

e^- config's   orb. diag.

$_8O$ $1s^2 2s^2 2p^4$

[↑↓] [↑↓] [↑↓|↑|↑]
1s   2s   2p

paired   un-paired.

$_{10}Ne$ $1s^2 2s^2 2p^6$

[↑↓] [↑↓] [↑↓|↑↓|↑↓]
1s   2s   2p

completely full subshell

full 2nd shell !

$_{11}Na$ $1s^2 2s^2 2p^6 3s^1$
      [Ne]

[↑↓] [↑↓] [↑↓|↑↓|↑↓]   [↑]
1s   2s   2p   3s

[Ne]
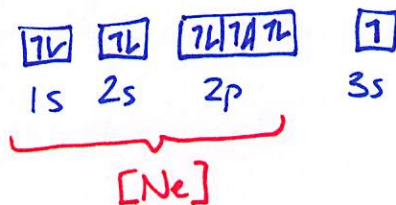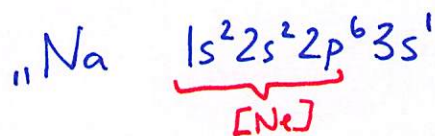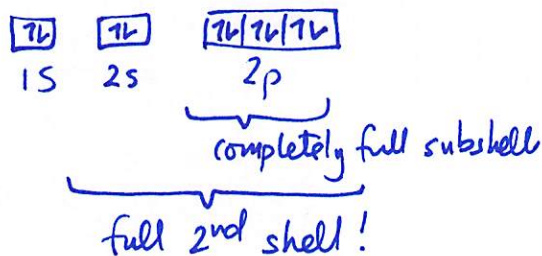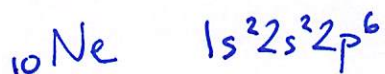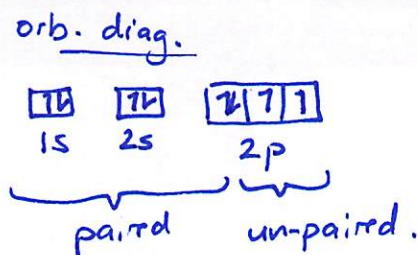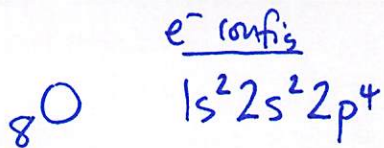
] full

noble gas core abbreviation:

$_{11}Na$: $[Ne]3s^1$, $[Ne]$ [↑]
                                  3s
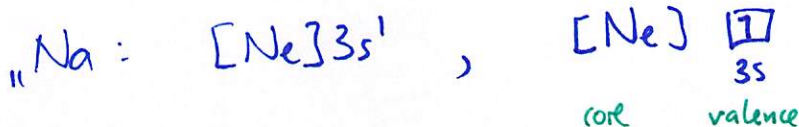
                                 core   valence

] abbreviated.

Electron-configs + PT

outermost e^-'s: valence (largest n) * bonding!
inner e^-'s: core   (small n)

-need a fast way to generate e^- config's.
  (s = 2 e^-'s max,   p = 6 e^-'s,   d = 10e^-,   f = 14 e^-'s)

Dumb: 1s ¹
            2s 2p ² ³
            3s 3p 3d ⁴ ⁵
            4s 4p 4d 4f ⁶
            5s 5p 5d 5f
            6s

DO NOT USE THIS METHOD!

-2-

Hungry-hungry-caterpillar

PT:

Periodic table diagram showing s-block, p-block, d-block, and f-block regions with orbital labels: $1s$ (H, He), $2s$, $3s$, $4s$, $5s$, $6s$ (La), $7s$ (Ac); $3d$, $4d$ (Cd), $5d$, $6d$; $2p$, $3p$ |u|, $4p$, $5p$, $6p$, $7p$; He circled; $4f$ (Ce), $5f$ (Th).

$_{17}Cl \quad 1s^2 2s^2 2p^6 3s^2 3p^5 \quad // \quad Cd \quad \underbrace{1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10}}_{[Kr] 5s^2 4d^{10}}$
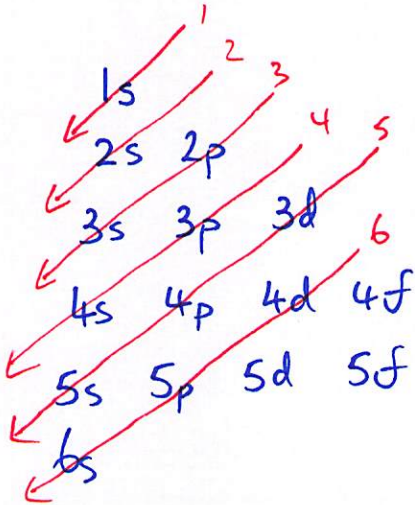
$_{52}Te$ ... full (did in class!)

some exceptions:

$_{24}Cr: \quad [Ar] 4s^2 3d^4 \quad \overset{!!}{\sim} \quad$ reality: $[Ar] 4s^1 3d^5$

$_{29}Cu: \quad [Ar] 4s^2 3d^9 \quad \overset{!!}{\sim} \quad : [Ar] 4s^1 3d^{10}$

$_{24}Cr: \quad [Ar]$

Orbital diagrams: m_ℓ values $-2, -1, 0, +1, +2$ above 3d boxes; $4s$ paired, $3d$ single arrows (✗); right side: $[Ar]$ $4s$ ↑, $3d$ ↑↑↑↑↑ (✓) half-filled d-subshell. $n=3$, $\ell=2$.

$_{29}Cu \quad [Ar]$ $4s$ ↑↓, $3d$ (✗) ; $[Ar]$ $4s$ ↑, $3d$ ↑↓↑↓↑↓↑↓↑↓ (✓) 100% full d-subshell

if we can 'borrow'

$1 ns \; e^- \longrightarrow (n-1)d$ (✓)

$\frac{1}{2}, 1$-full.