① Atomic #'s

12
Mg
24.31

12 ← atomic # = # protons

24.31 ← average mass → round to a whole # then = #p + #n

normally #p = #e^-

Potassium:

19
K
39.10

#p = 19

#e^- = 19

#n = 39 − 19 = 20 ↙ rounded first!

= mass# − #p

* The name of the atom is based on the # of protons

② Isotopes

* same #p, same # e^-
  ↳ different # of n
  (same element, but a different "version")

12
Mg
24.31

24.31 ← Average mass of all isotopes in the universe!

• guess the most common isotope by rounding to the whole #

isotope name – "mass #"

magnesium-26

Isotope Symbol

$^{26}_{12}Mg$

26 ← mass #

12 ← atomic #

#p = 12

#e^- = 12

#n = 14 (26 − 12)

③ Ions

* same #p, same # n
  ↳ different # e^-

ion symbol: X^{charge}

Cations	Anions
lost e^-	gain e^-
+ charge	− charge

Be: $4p^+$ $4e^-$

⊕⊕⊕⊕
⊖⊖⊖⊖

neutral ∅ charge

N: $7p^+$ $7e^-$

⊕⊕⊕⊕⊕⊕⊕
⊖⊖⊖⊖⊖⊖⊖

neutral, ∅ charge

⊕⊕⊕⊕
⊖⊖

+2 charge lost 2 e^- Be^{2+}

⊕⊕⊕⊕⊕⊕⊕
⊖⊖⊖⊖⊖⊖⊖⊖⊖⊖

−3 charge, gained 3e^- N^{-3}

④ orbitals

* area an e^- is most likely to be found
  ↳ "probability cloud"

shapes: s, p, d, f (d, f: weird!)

x, y, or z orientation

In an energy level:

s – 1 orbital – 2e^-

p – 3 orbital – 6e^-

d – 5 orbital – 10e^-

f – 7 orbitals – 14e^-

up to 7 energy levels

⑤ Orbital rules

① Aufbau

- fill orbitals from lowest energy to highest energy
- fill diagram from bottom to top

"e^- are lazy!"

② Pauli Exclusion

- every e^- needs a unique "address"
- one e^- in an orb. spin up ↑
- one e^- in an orb. spin down ↓

"only fit 2 e^- per orbital!"

↑↓

③ Hunds

- If you have multiple orbitals @ same energy level - spread them out before pairing them up!

"dont share a room!"

⑥ Orbital diagrams

Iodine has 1 "unpaired e^-"

5p ↑↓ ↑↓ ↑
4d ↑↓ ↑↓ ↑↓ ↑↓ ↑↓
5s ↑↓
4p ↑↓ ↑↓ ↑↓
3d ↑↓ ↑↓ ↑↓ ↑↓ ↑↓
4s ↑↓
3p ↑↓ ↑↓ ↑↓
3s ↑↓
2p ↑↓ ↑↓ ↑↓
2s ↑↓
1s ↑↓

* Hunds

* ↑↓ * Pauli!

Iodine 53 e^-

* Start @ bottom!
* Aufbau!

Practice Problems