

PERIODIC TABLE AND ELECTRON CONFIGURATION



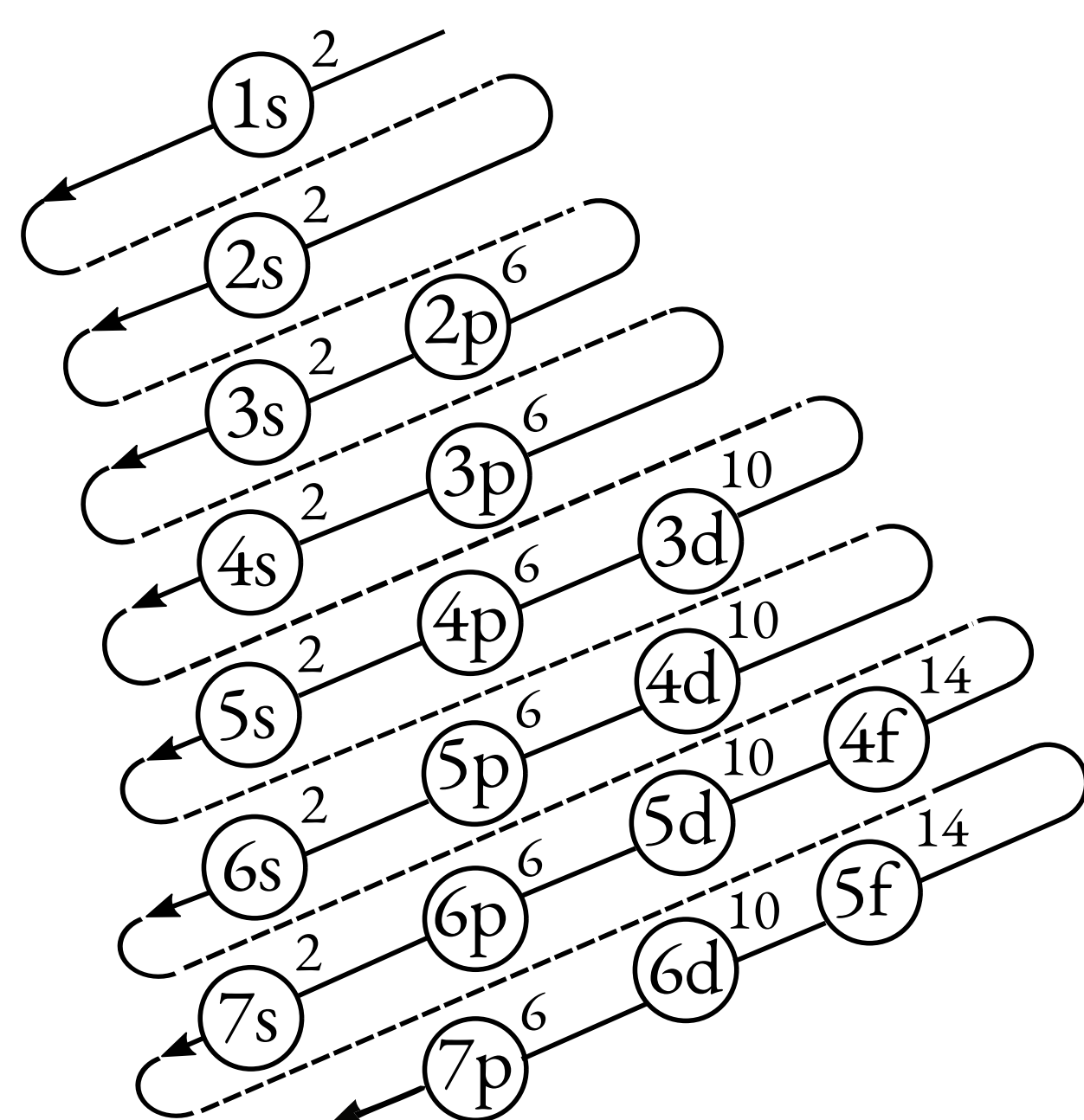
15-16 year-olds

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Electron Configuration

The **electron configuration** is the **distribution** of the **electrons** of an **atom** into **atomic orbitals** (s, p, d y f). **Möller's diagram** helps us to know the **order** in which the different orbitals should be **filled**, following the **arrows**.

Orbital	Shape	Maximum number of electrons
s		$2e^-$
p		$6e^-$
d		$10e^-$
f		$14e^-$



Möller's diagram. Adapted from https://commons.wikimedia.org/wiki/File:Diagrama_de_Configuraci%C3%B3n_electr%C3%B3nica.svg.

Images adapted from <https://www.coursehero.com/sg/general-chemistry/quantum-theory/>.

Ground state

State of **minimum energy**. Electrons **follow Möller's diagram**.

Excited state

Orbitals are not **filled** following **Möller's diagram**.

Forbidden state

Any orbital has **more electrons** than **allowed** ($\frac{s p d f}{2 6 10 14}$).

Valence Electrons

Valence electrons are those of the **outer shell** of an **atom**, being **responsible** for the **interactions** between **atoms** and the **formation** of chemical **bonds**.

	Examples			
	GROUND (NEUTRAL)	GROUND (CATION)	EXCITED (NEUTRAL)	FORBIDDEN (NEUTRAL)
	$1s^2 2s^2 2p^6 3s^1$ 1 valence e^-	$1s^2 2s^2 2p^6$ 8 valence e^-	$1s^2 2s^2 2p^5 3s^2$	$1s^2 2s^2 2p^4 3s^3$
Sodium (Na)				

Periodic Table of Elements

The **periodic table of elements** arrange the **118 elements** known into **7 periods** (rows) and **18 groups** (columns), **order by its atomic number Z**.

GROUP	OUTER SHELL ELECTRONIC CONFIGURATION	VALENCE ELECTRONS	PERIODIC PROPERTIES	
1	ns^1	1	Same period	Same group
1	ns^1	1	Same number of electronic shells \rightarrow	Same number of outer shell e^-
2 (and He)	ns^2	2	Z and A increase \rightarrow	Z and A increase \downarrow
13	$ns^2 np^1$	3	Metallic character decreases \rightarrow	Metallic character increases \downarrow
14	$ns^2 np^2$	4	Atomic radius decreases \rightarrow	Atomic radius increases \downarrow
15	$ns^2 np^3$	5		
16	$ns^2 np^4$	6		
17	$ns^2 np^5$	7		
18 (except He)	$ns^2 np^6$	8		

Symbol	Mass	Name	State at room T	SYNTHETIC
			\rightarrow Solid	
			\rightarrow Liquid	
			\rightarrow Gas	
			\rightarrow Radioactive	

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
H Hydrogen	He Helium																
Li Lithium	Be Beryllium																
Na Sodium	Mg Magnesium																
K Potassium	Ca Calcium																
Rb Rubidium	Sr Strontium																
Cs Caesium	Ba Barium																
Fr Francium	Ra Radium																
		Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
		Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe

- ALKALI METALS
- ALKALINE EARTH METALS
- LANTHANIDE
- ACTINIDE
- TRANSITION METALS
- POST-TRANSITION METALS
- METALLOIDS
- NONMETALS
- NOBLE GASES

Classification of Chemical Elements

Chemical elements can be classified into **metals**, **metalloids**, **nonmetals** and **noble gases**, according to their **physical** and **chemical properties**:

Metals

Shiny appearance, they are **good conductors** of **heat** and **electricity** and they can make **alloys** with other metals. Most of them are **solids** at room T (Hg is).

Ion formation They tend to **lose electrons**, forming **cations** (\oplus charged ions). **Examples:** $\text{Li} \rightarrow \text{Li}^+ + 1e^-$; $\text{Mg} \rightarrow \text{Mg}^{2+} + 2e^-$; $\text{Al} \rightarrow \text{Al}^{3+} + 3e^-$.

Metalloids

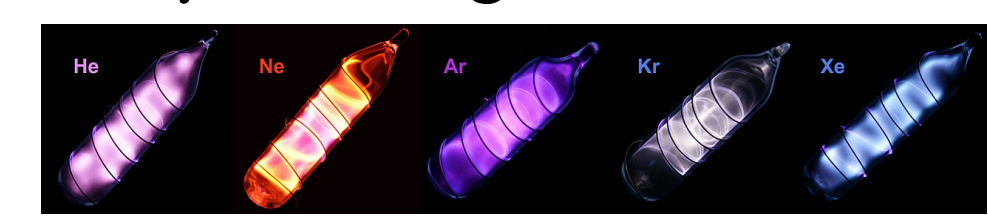
Breakable solids with a **metallic aspect** that are **semiconductors** and **behave like nonmetals**.

Nonmetals

Dull appearance, they are **bad conductors** of **heat** and **electricity** and they can be **breakable**. They can be **solids**, **liquids** or **gases** at room temperature.

Ion formation They tend to **gain electrons**, forming **anions** (\ominus charged ions). **Examples:** $\text{Cl} + 1e^- \rightarrow \text{Cl}^-$; $\text{O} + 2e^- \rightarrow \text{O}^{2-}$; $\text{P} + 3e^- \rightarrow \text{P}^{3-}$.

Noble gases



He, Ne, Ar, Kr, Xe and Rn. **Odourless and colorless monoatomic gases** which **barely react** chemically, since they have **eight electrons** in their **outer shell**.