Unit 2:
The Periodic Table & Periodic Law

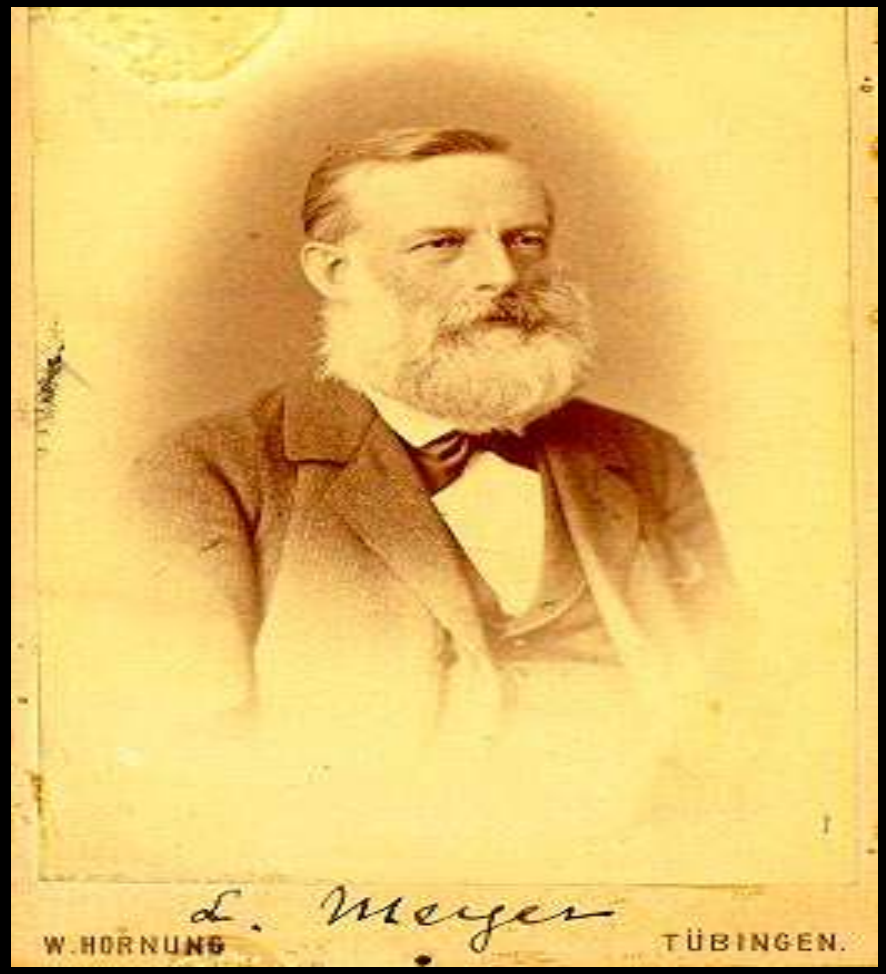
Who developed the Periodic Table?

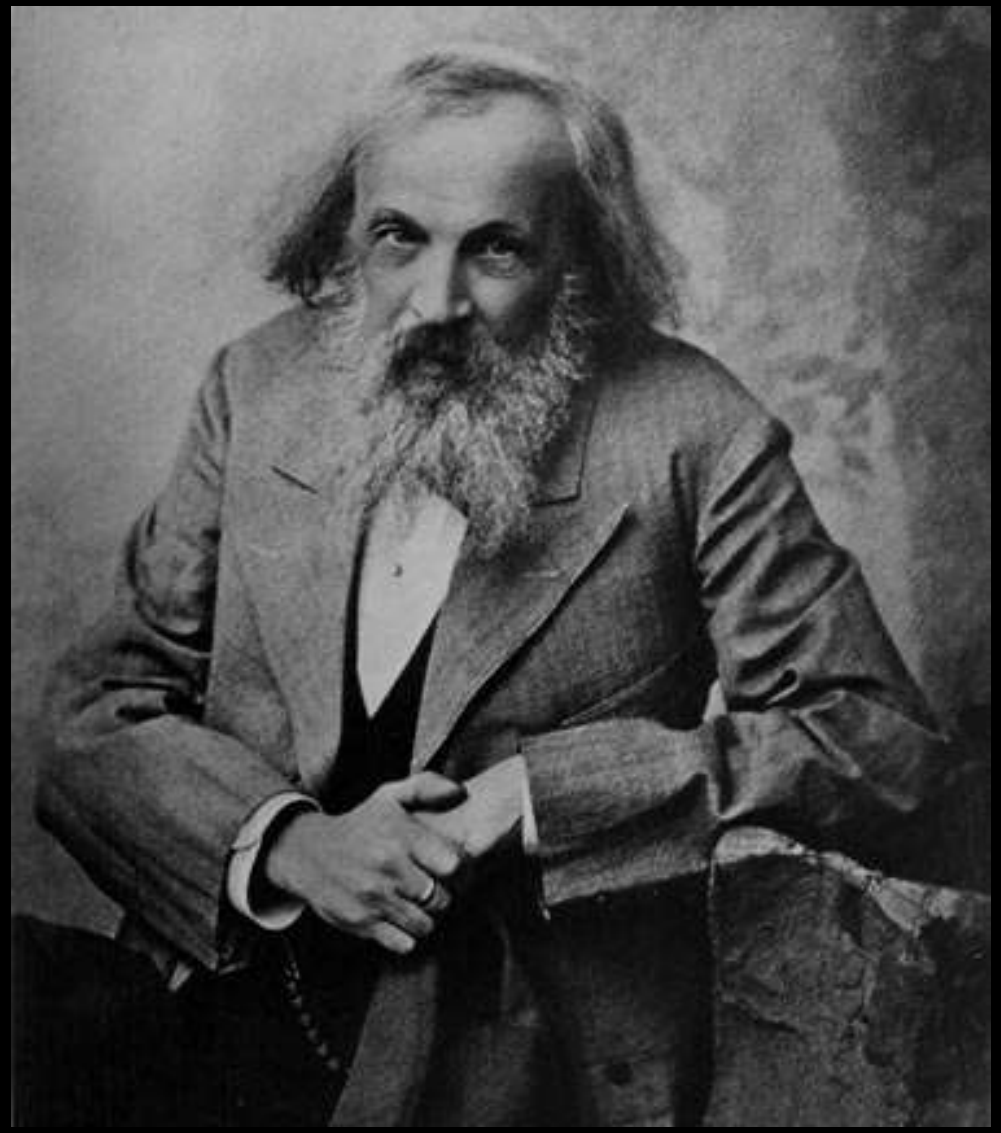
Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
H = 1							
Li = 7	Be = 9.4	B = 11	C = 12	N = 14	O = 16	F = 19	
Na = 23	Mg = 24	Al = 27.3	Si = 28	P = 31	S = 32	Cl = 35.5	Fe = 56, Co = 59,
K = 39	Ca = 40	— = 44	Ti = 48	V = 51	Cr = 52	Mn = 55	Ni = 59, Cu = 63.
(Cu = 63)	Zn = 65	— = 68	— = 72	As = 75	Se = 78	Br = 80	
Rb = 85	Sr = 87	Yt = 88	Zr = 90	Nb = 94	Mo = 96	— = 100	Ru = 104, Rh = 104,
(Ag = 108)	Cd = 112	In = 113	Sn = 118	Sb = 122	Te = 125	I = 127	Pd = 106, Ag = 108.
Cs = 133	Ba = 137	Di = 138	Ce = 140	—	—	—	
(—)	—	—	—	—	—	—	— — — —
—	—	Er = 178	La = 180	Ta = 182	W = 184	—	
(Au = 199)	Hg = 200	Tl = 204	Pb = 207	Bi = 208			Os = 195, Ir = 197,
—	—	—	Th = 231	—	U = 240		Pt = 198, Au = 199.

Periodic Table History

German Julius Lothar Meyer (1830-1895) and Russian Dmitri Ivanovich Mendeleev (1834-1907) demonstrated a connection between atomic mass and elemental properties.

Julius Lothar Meyer





The Periodic Table Continued

- Mendeleev is given credit for the periodic table because he emphasized the use of the table to predict new elements and their properties
- In 1872, Dmitri Mendeleev developed the first periodic table based on increasing atomic mass

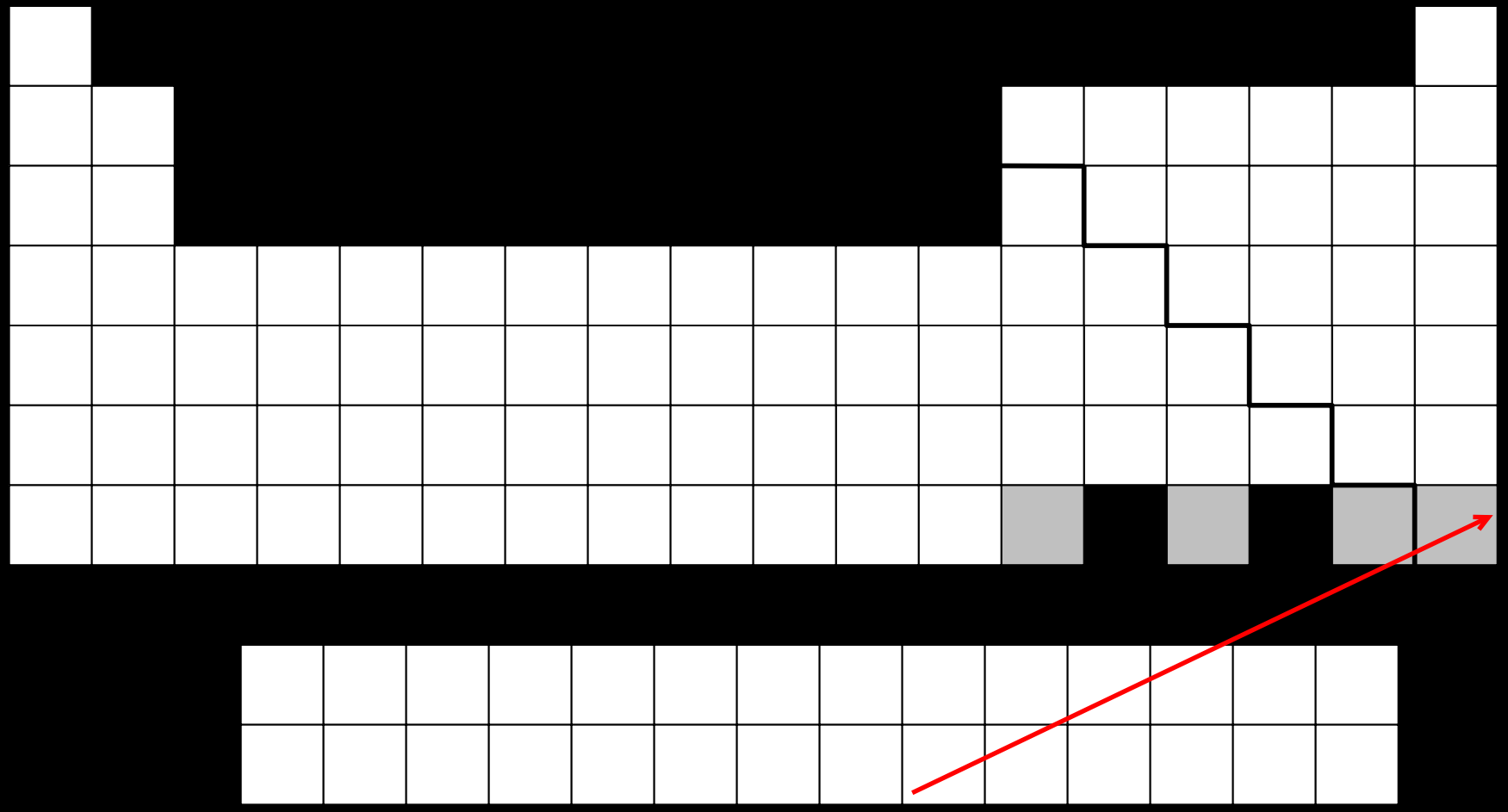
Periodic Table Continued

In 1913, Henry Moseley (British) arranged the table according to atomic number

The Modern Periodic Table

- Periodic Law: The physical and chemical properties of elements are periodic functions of their atomic numbers

The Periodic Table

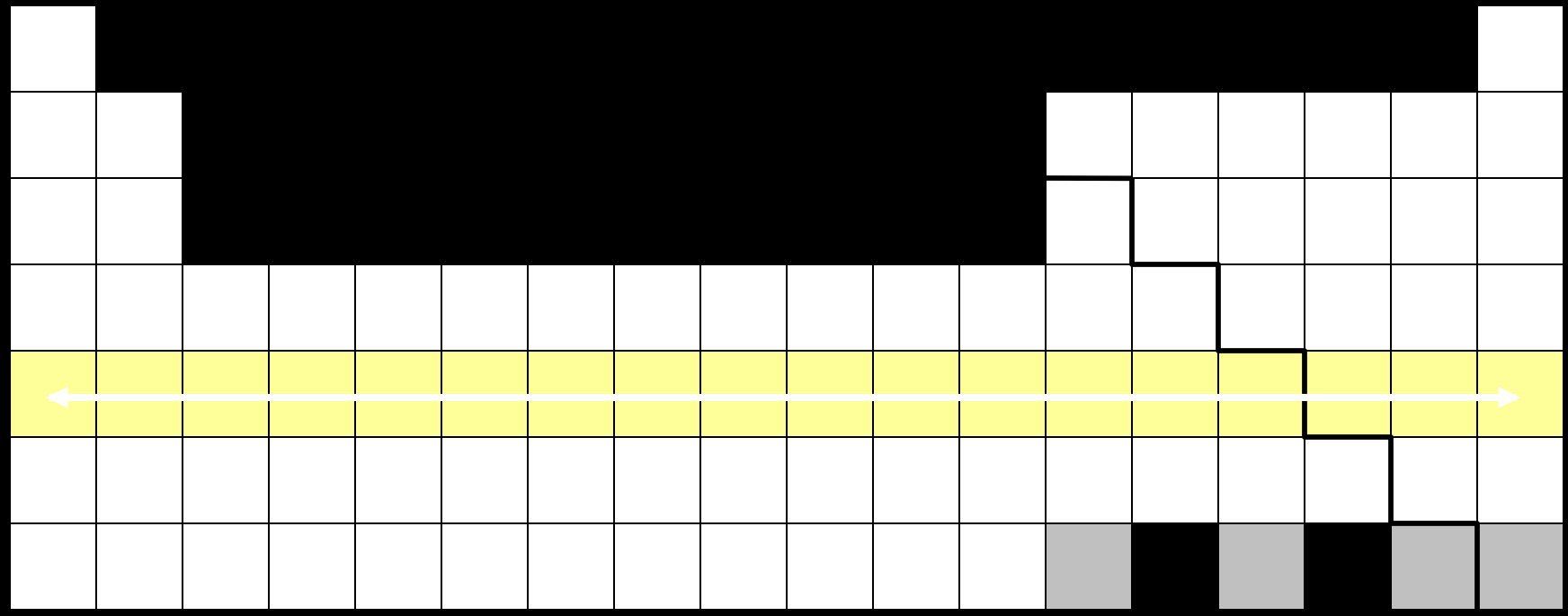


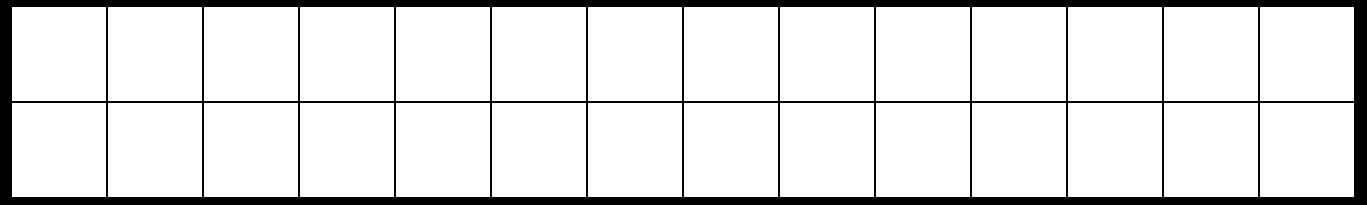
All elements up to #118 have been synthesized in lab by research scientists

The Modern Periodic Table

- The Modern Periodic Table is divided into:
- A. Periods: horizontal rows of elements
- There are 7 periods

Horizontal rows are called periods.

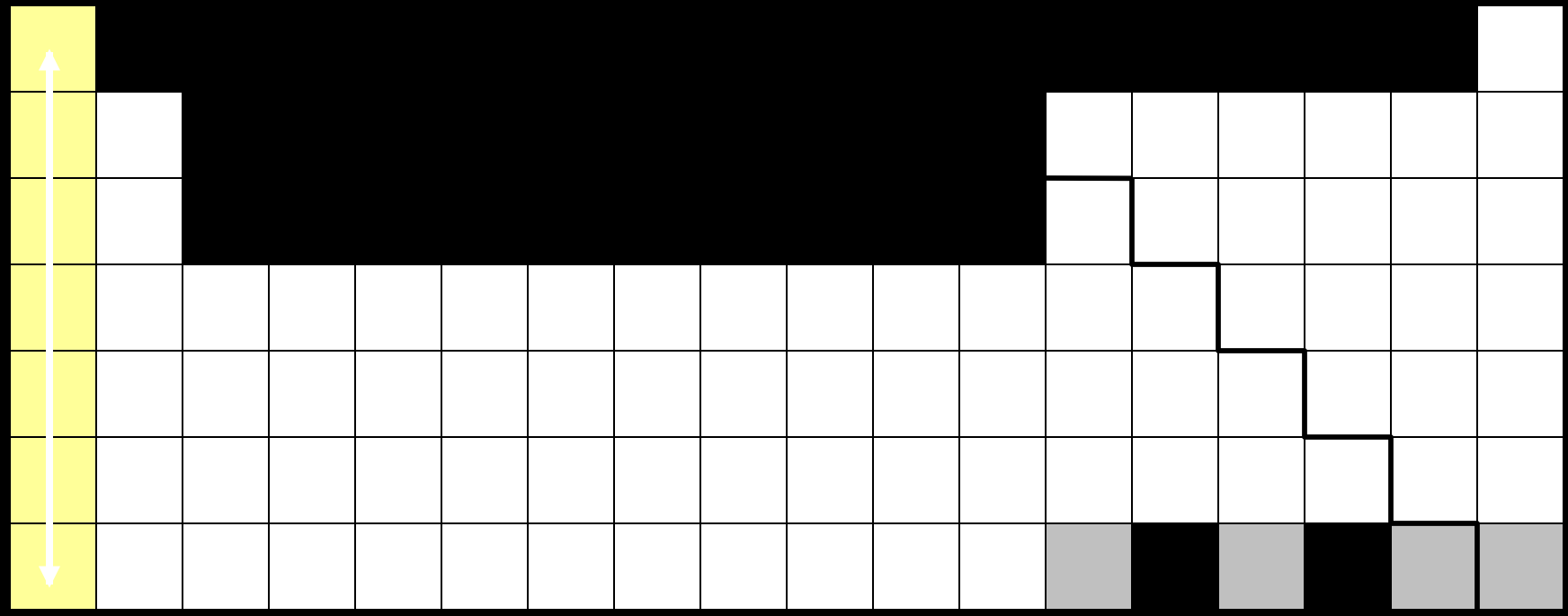


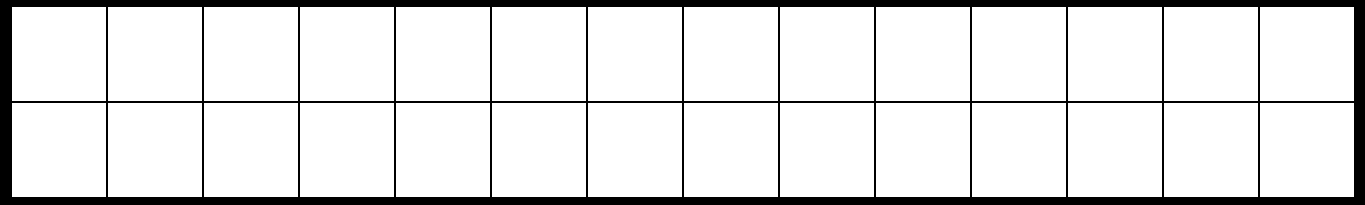


Parts of the Periodic Table

- B. Vertical columns are called Groups or Families
- There are 18 groups
- Groups are numbered in two ways:
- numeric 1-18
- using A or B and a numeral

Vertical columns are called groups or families.



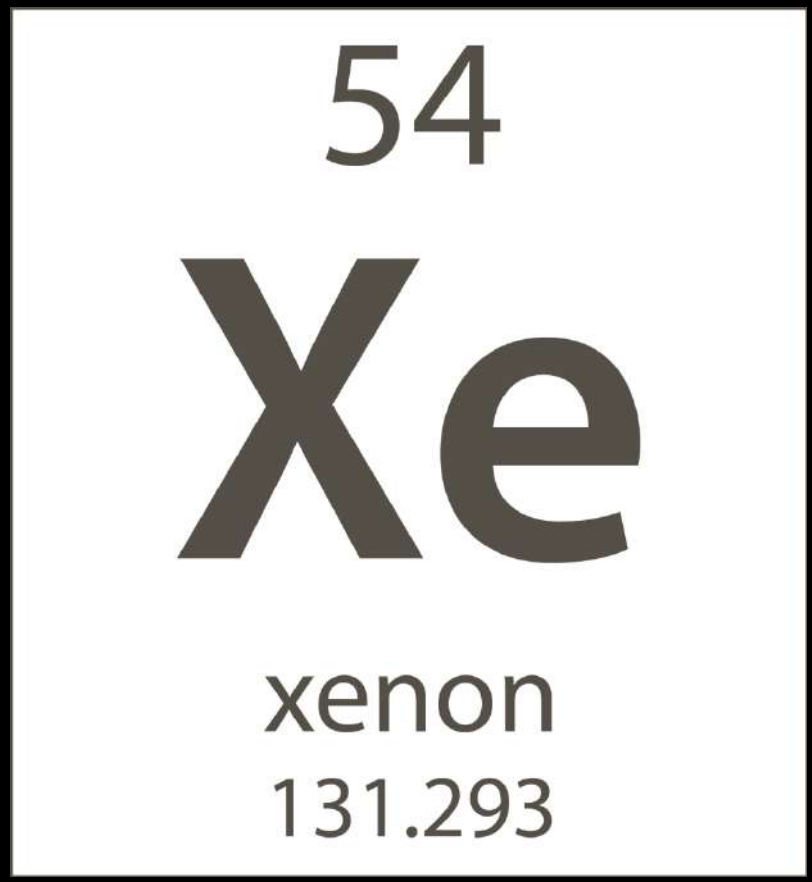


Atomic number

Symbol

Element name

Atomic mass



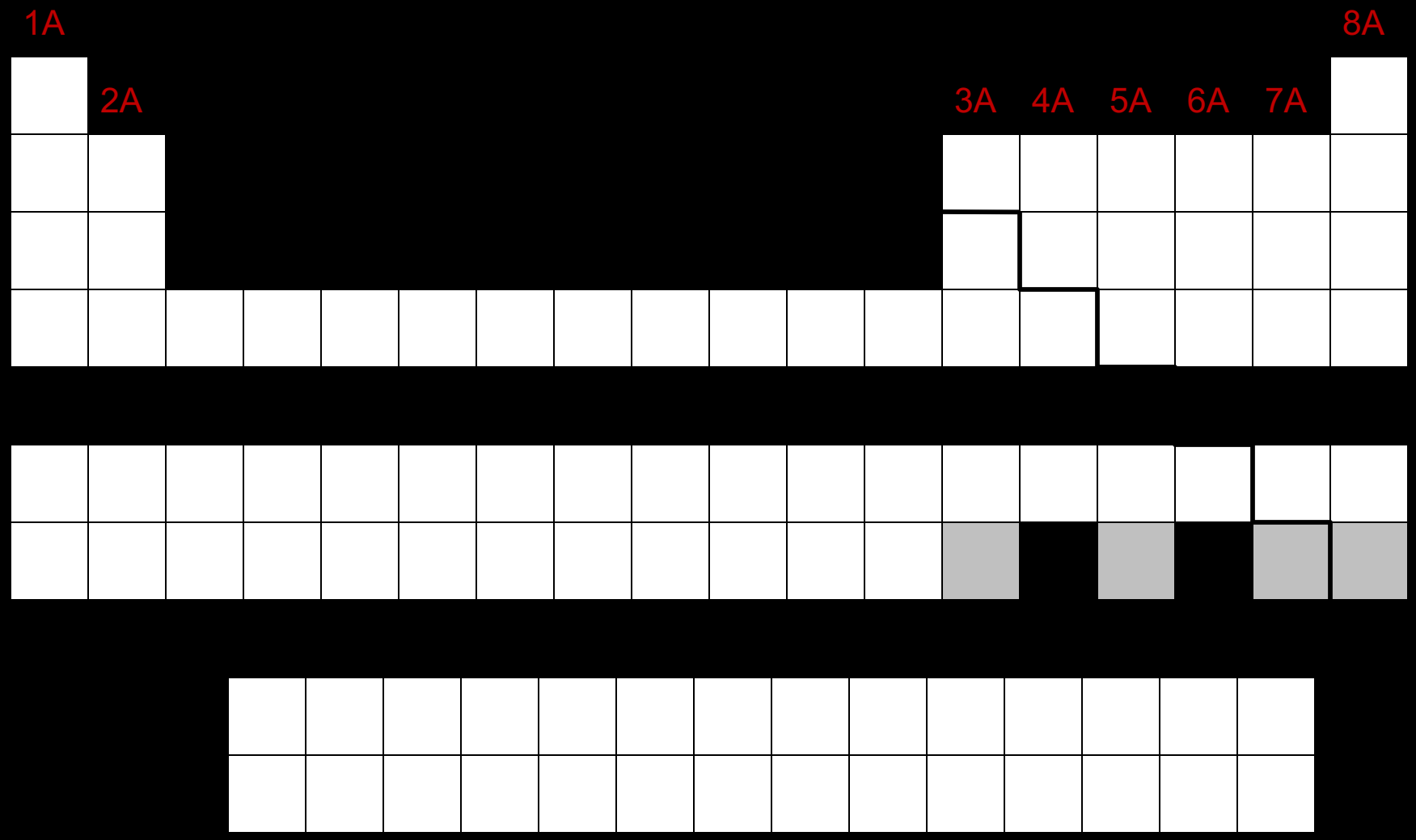
Different periodic tables provide different amounts of info and in different orders

Notice that there are two numbering systems for the families:

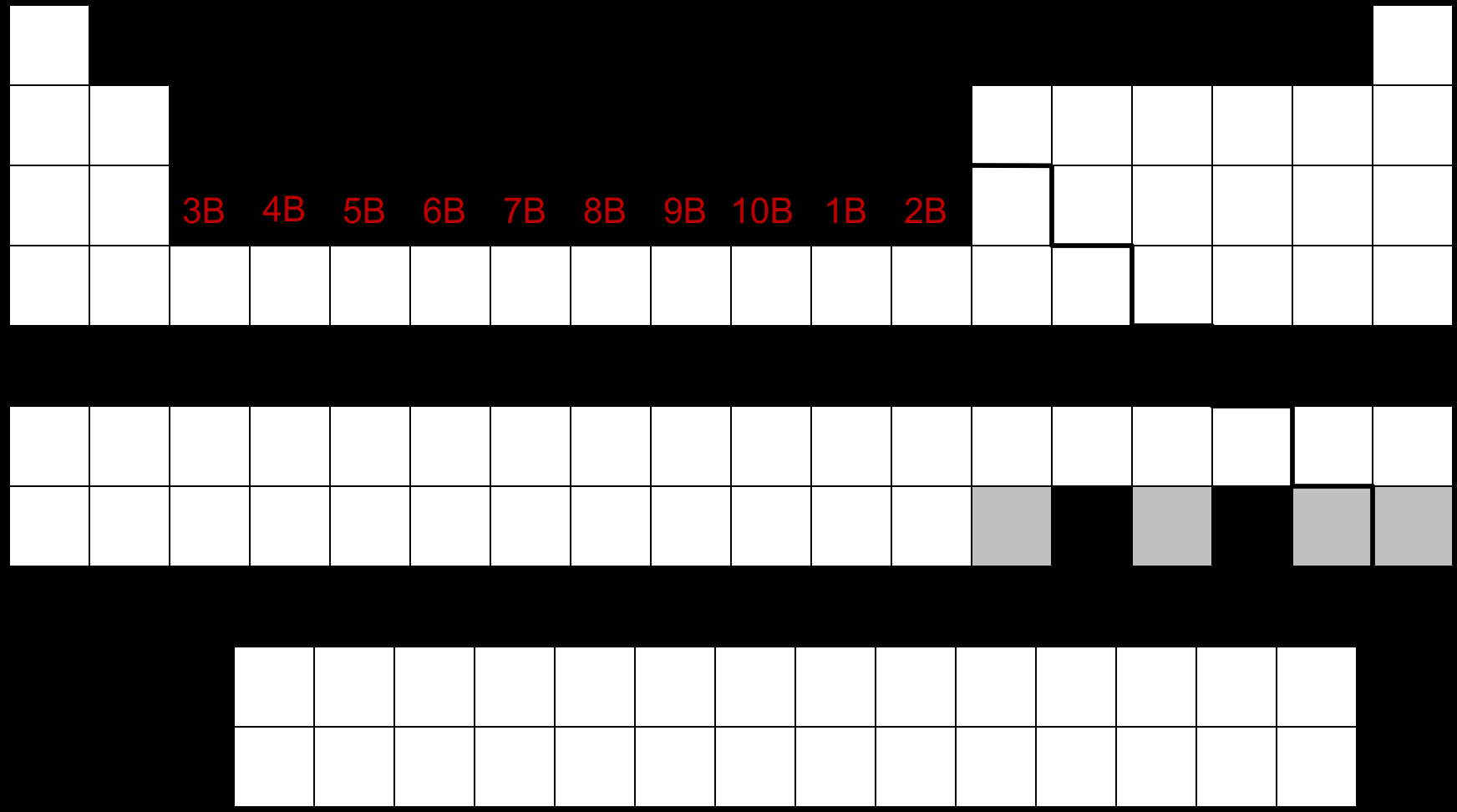
A and B groups distinction

IUPAC consecutive numbering system

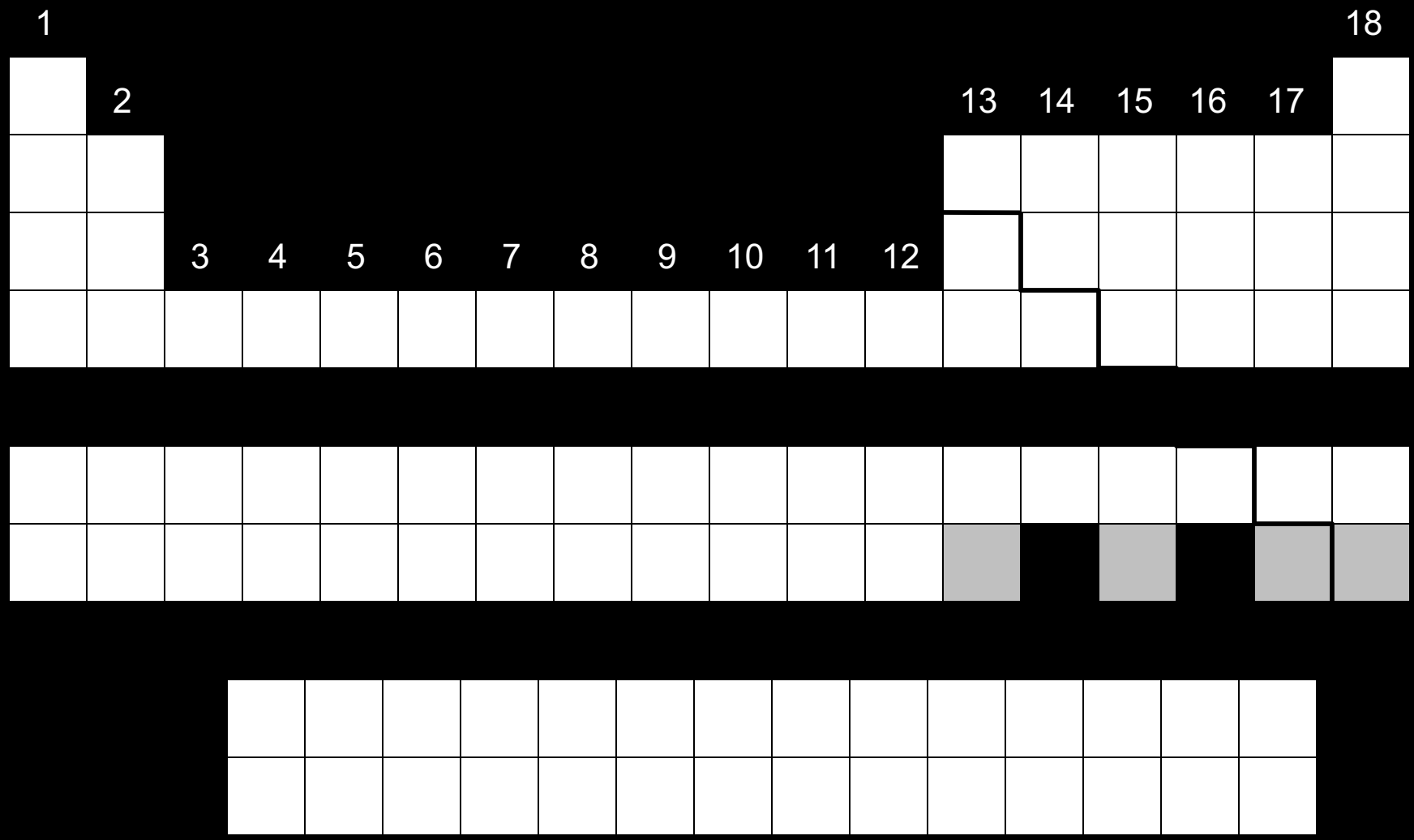
“A” Columns



“B” Columns



IUPAC Consecutive Numbering System



Groups and Families

- Families/Groups are divided into certain columns based on electron configuration and because of their chemical and physical properties
- The column is based on the last energy levels to be filled

Families

- Group 1

Alkaline

- Group 2

Alkali Earth Metals

- Group 3-12

Transition Metals

- Metalloids

Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium, Polonium

Families Continued

Group 17: Halogens

- Halogens means salt former
- Very reactive, never found alone

Group 18: Noble Gases

- Generally do not form compounds

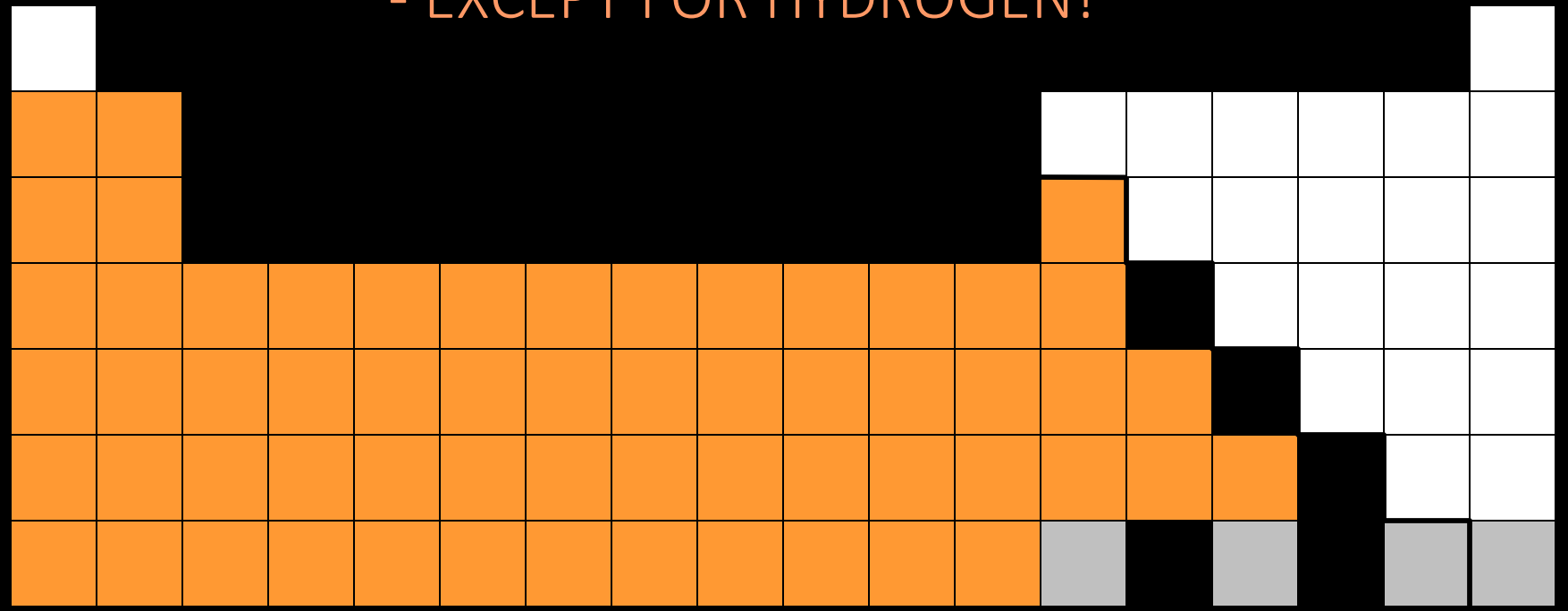
Families Continued

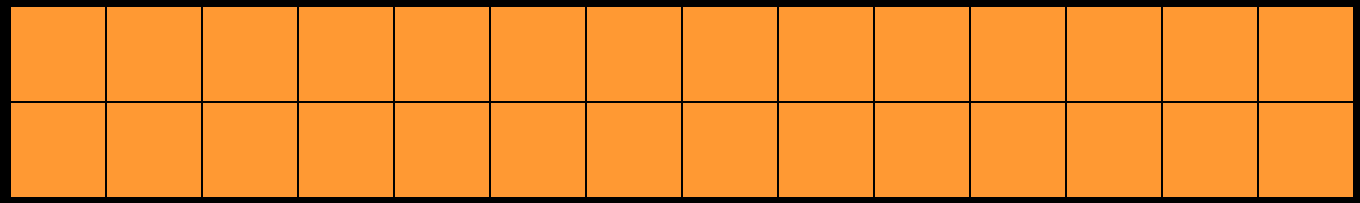
- Lanthanides: Elements 57-71
- Actinides: Elements 89-103
- Most of these are rare
- Many are synthetic (man-made)
- Many are radioactive

There are three types of elements on the periodic table.

Metals

- elements to the left of the stairstep
- EXCEPT FOR HYDROGEN!

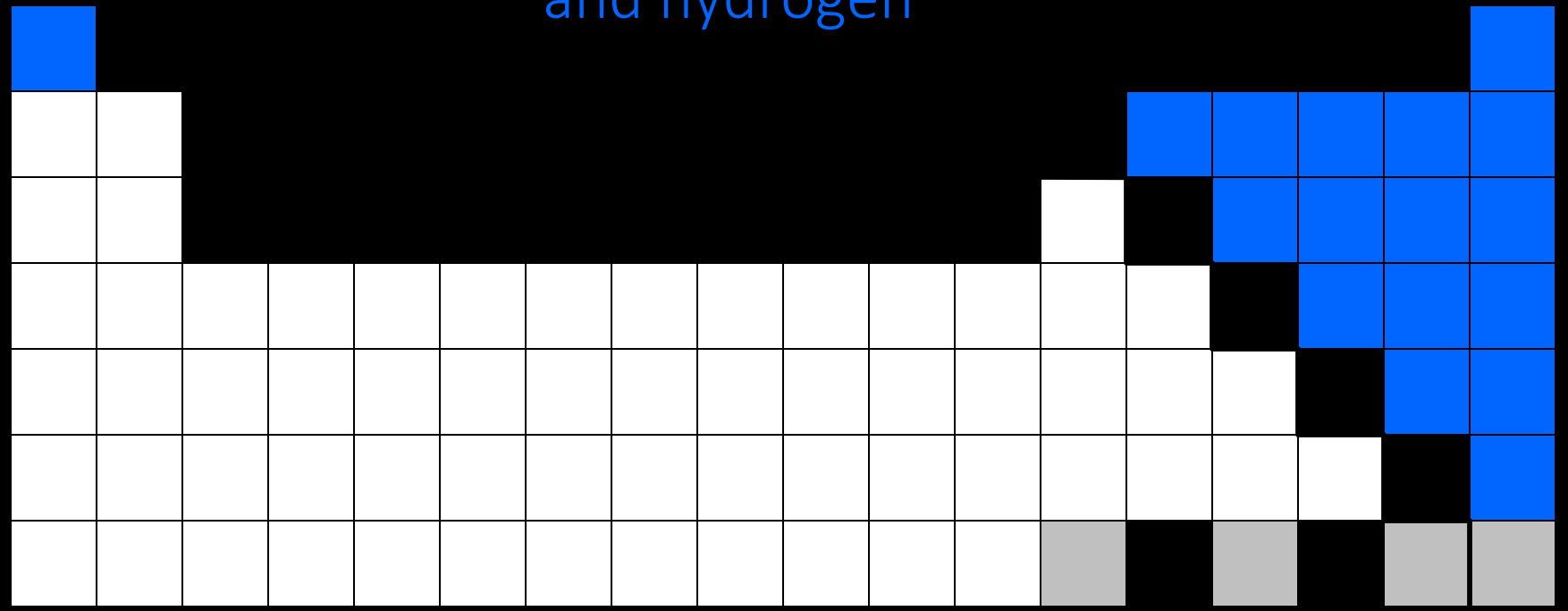


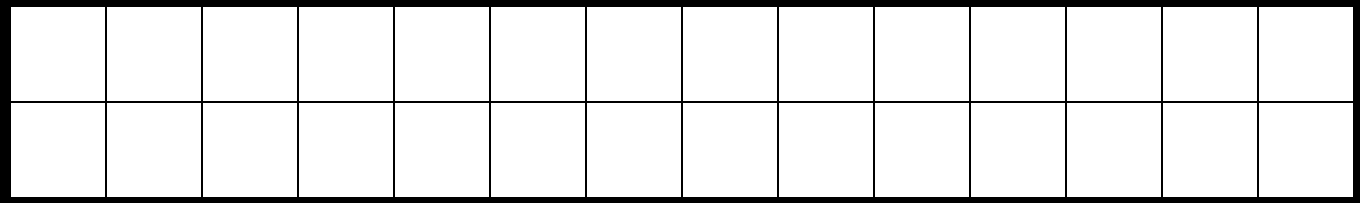


Properties of Metals

- Lustrous
- Conduct electricity
- Ductile (can be drawn into wires)
- Malleable (can be pounded into sheets)
- High boiling/melting points
- Usually solids

Nonmetals - elements to the right of the stairstep and hydrogen

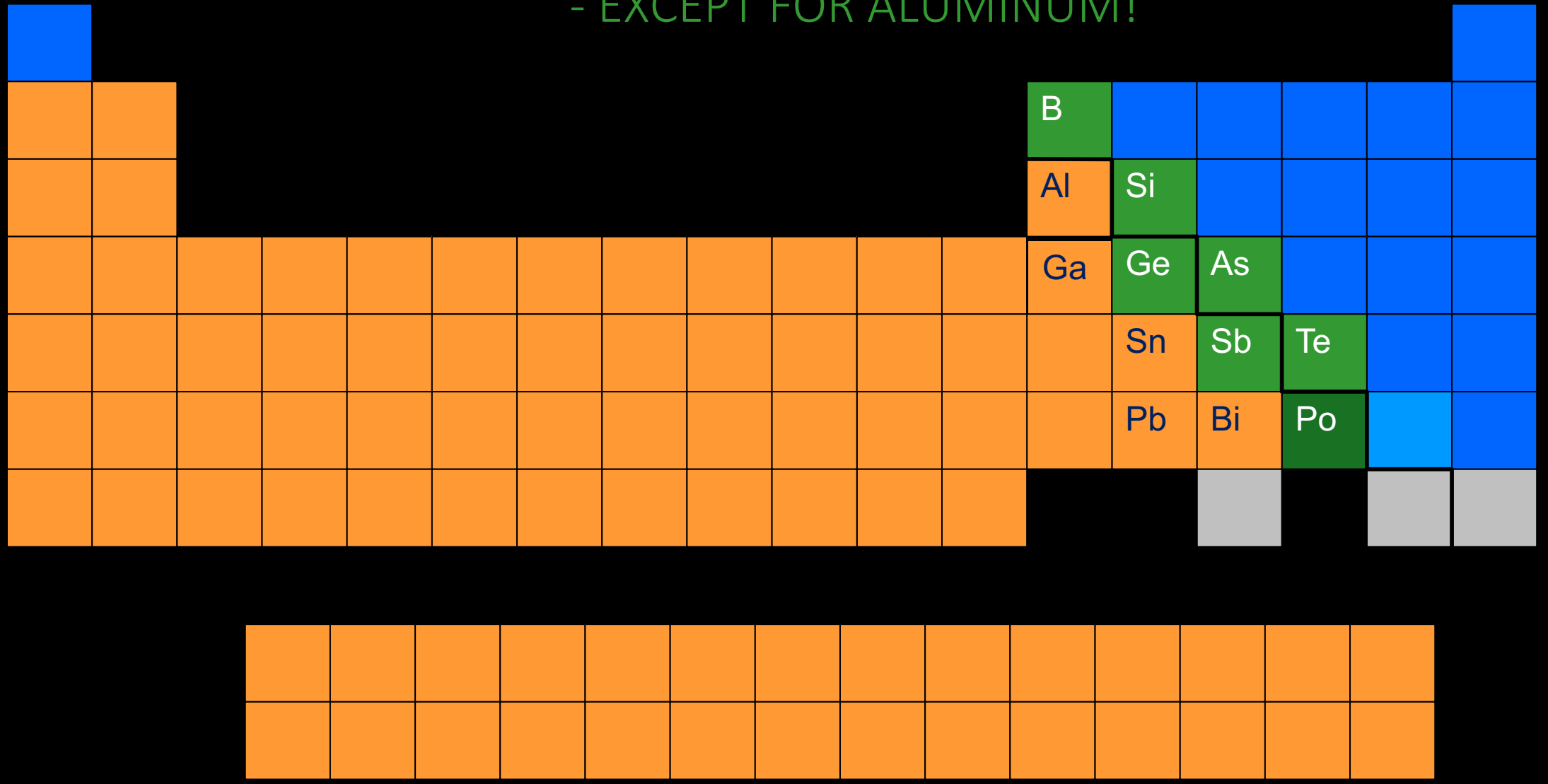




Properties of Nonmetals

- Dull appearance
- Non or poor conductors of electricity
- Usually gases or liquids
- Not malleable or ductile

Metalloids - elements ON the stairstep - EXCEPT FOR ALUMINUM!



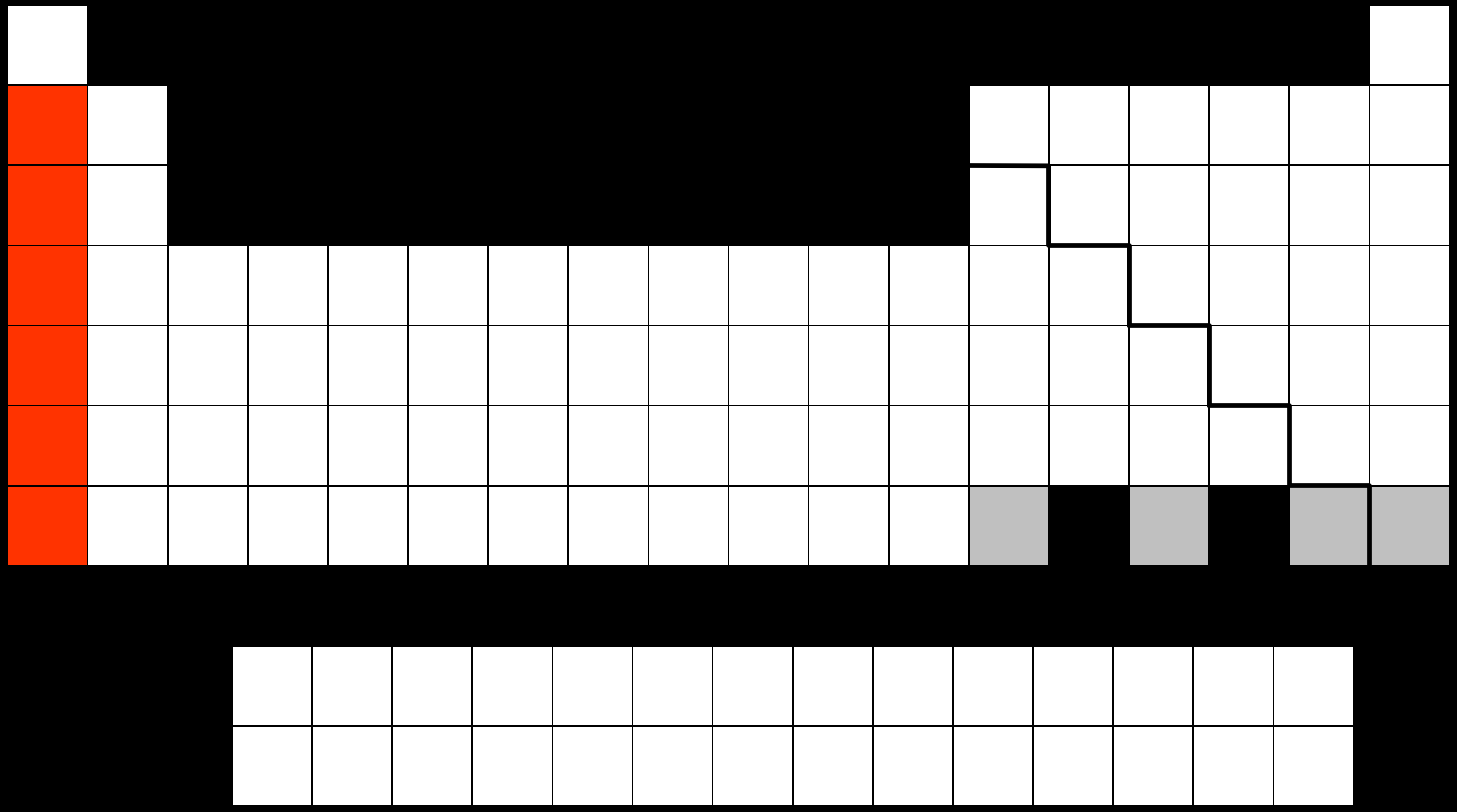
Properties of Metalloids

Properties are more variable.

Properties are intermediate between those of metals and those of nonmetals.

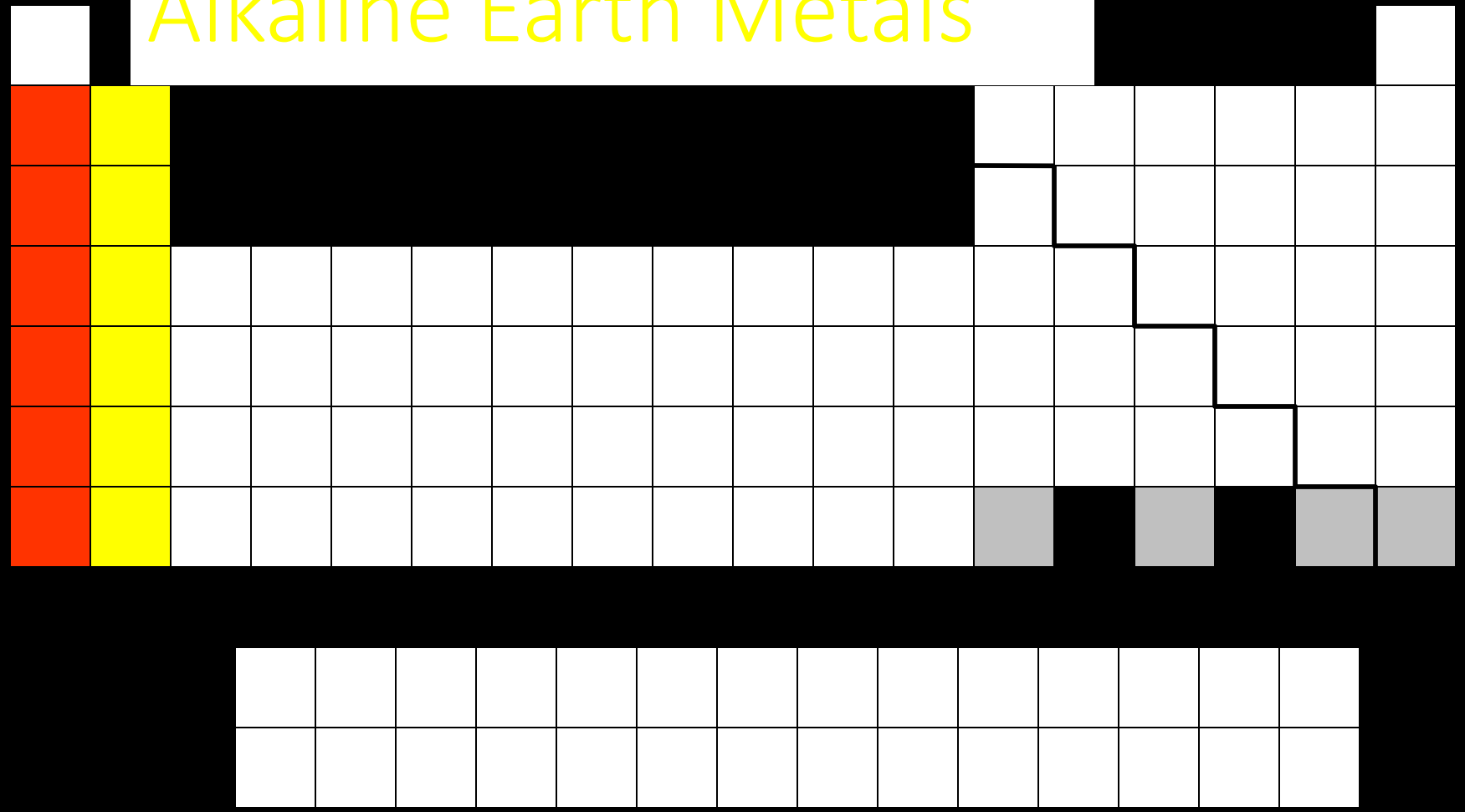
Know the names of the following regions on the periodic table

Alkali Metals



Alkali Metals

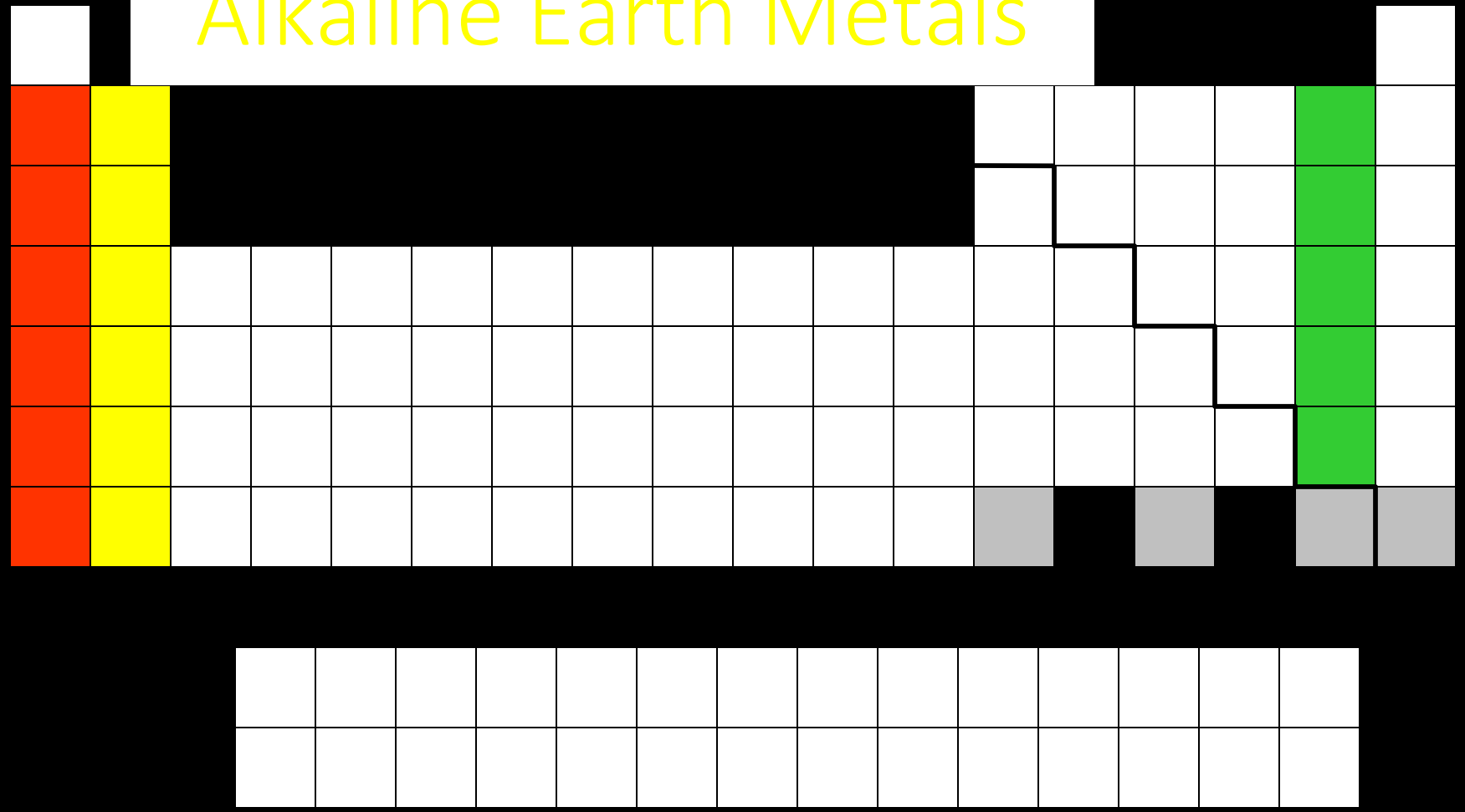
Alkaline Earth Metals



Alkali Metals

Halogens

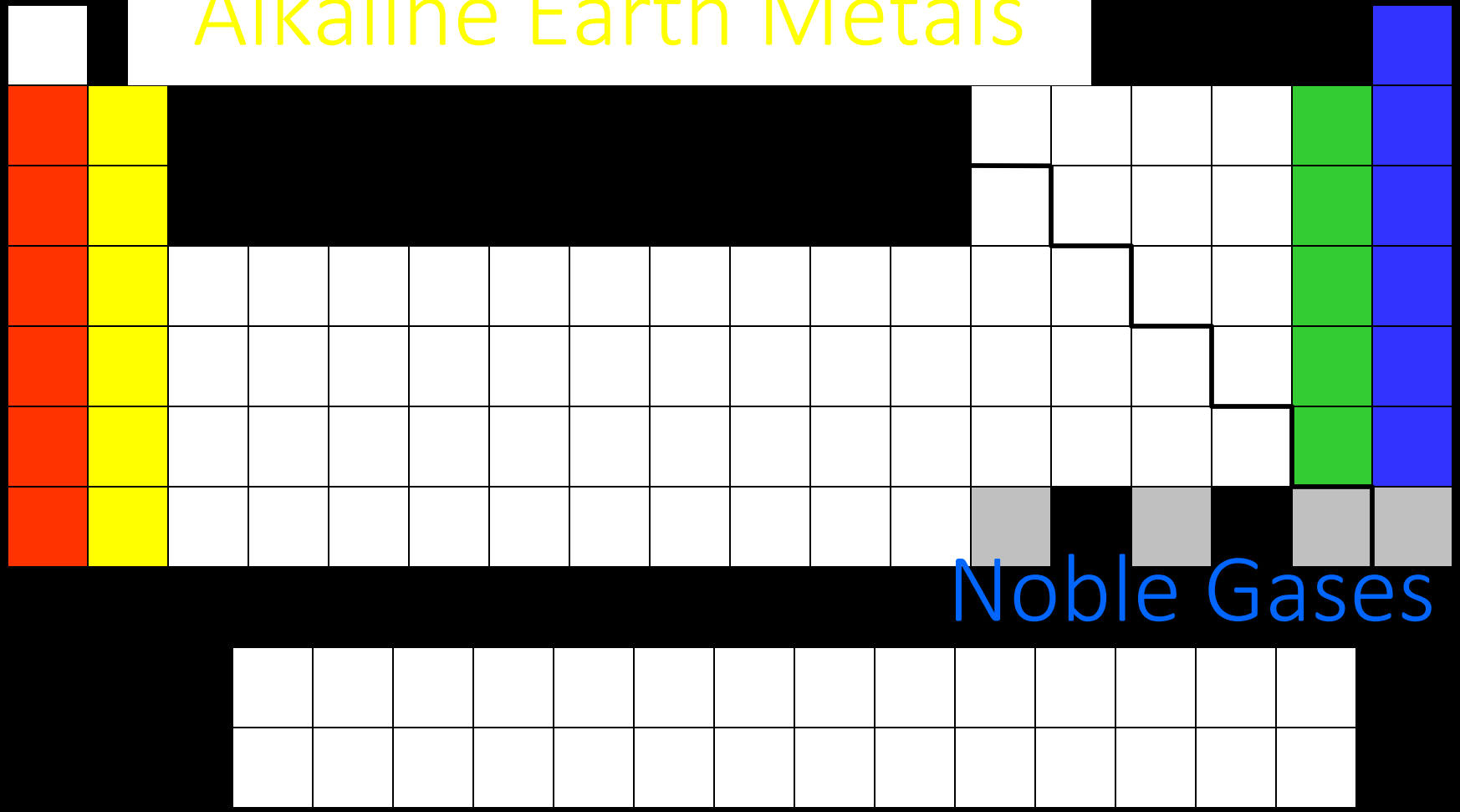
Alkaline Earth Metals



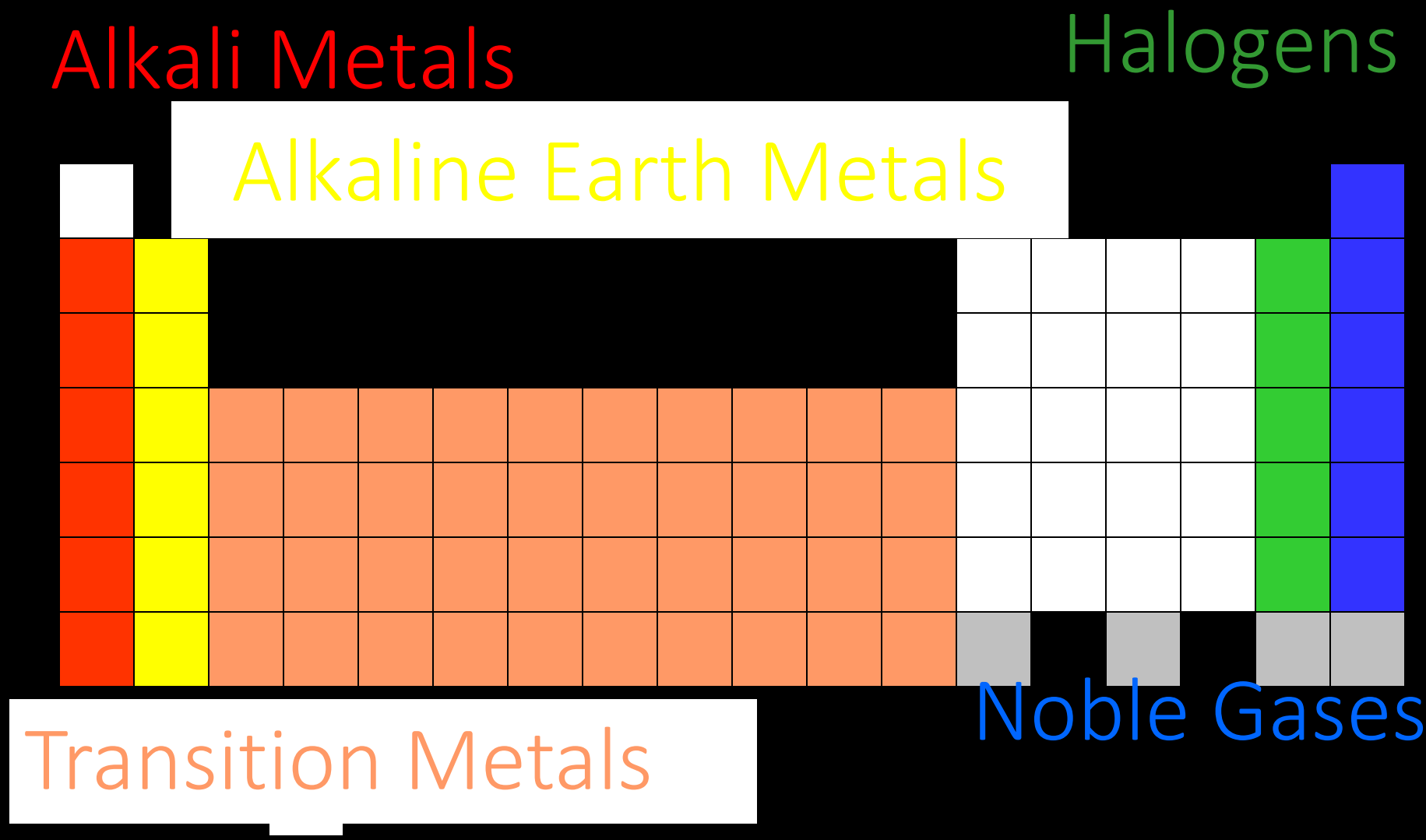
Alkali Metals

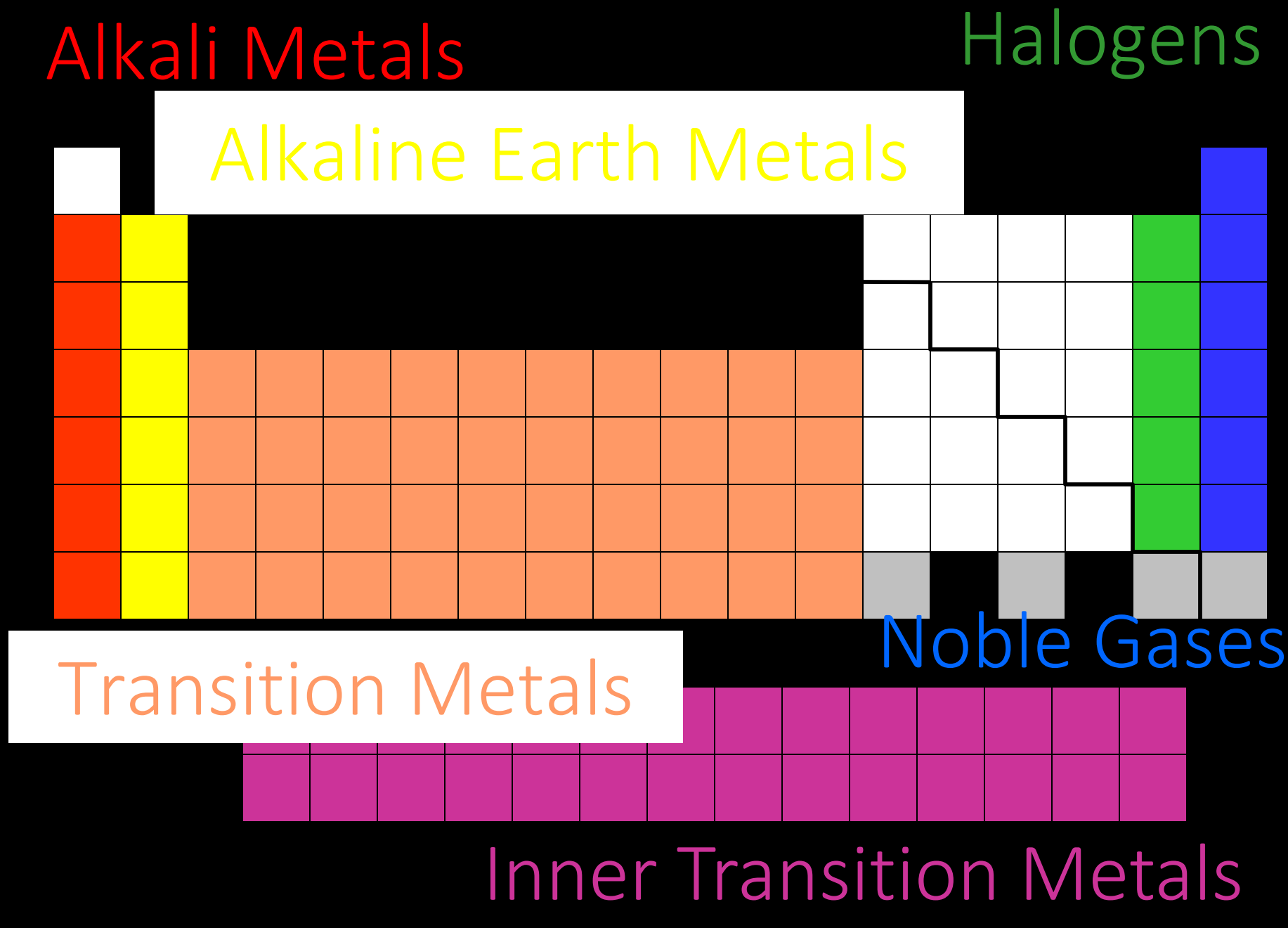
Halogens

Alkaline Earth Metals



Noble Gases


Alkali Metals
Halogens
Alkaline Earth Metals
Noble Gases
Transition Metals

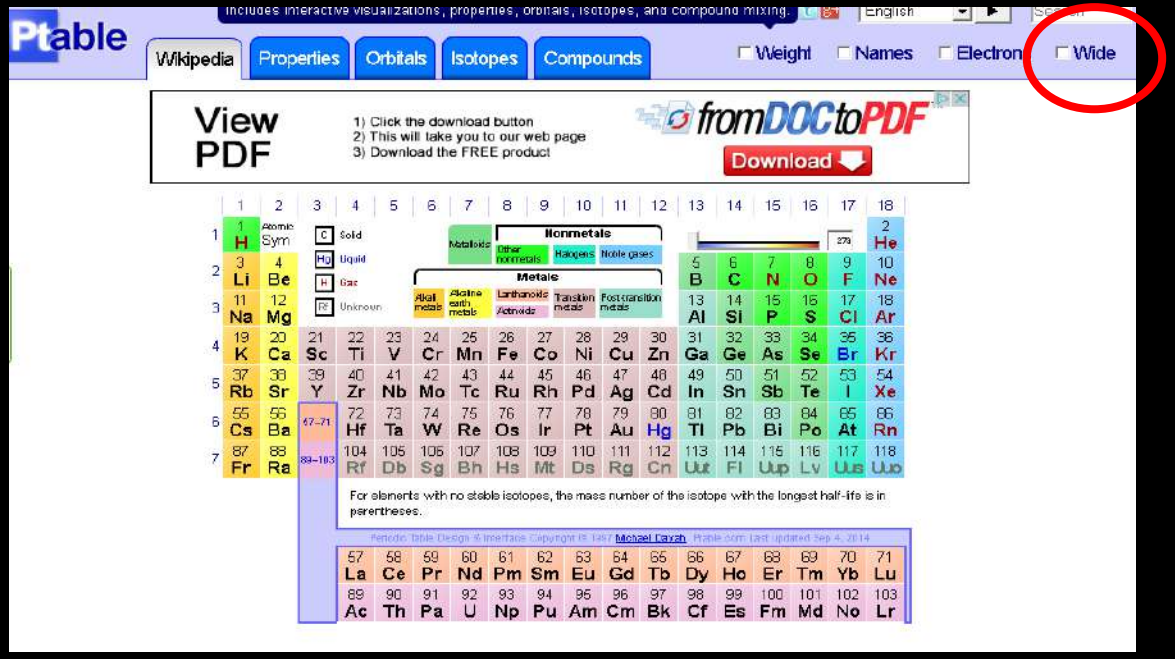

Alkali Metals
Halogens
Alkaline Earth Metals
Noble Gases
Transition Metals
Inner Transition Metals

Please note: The inner transition metals ARE part of the periodic table.

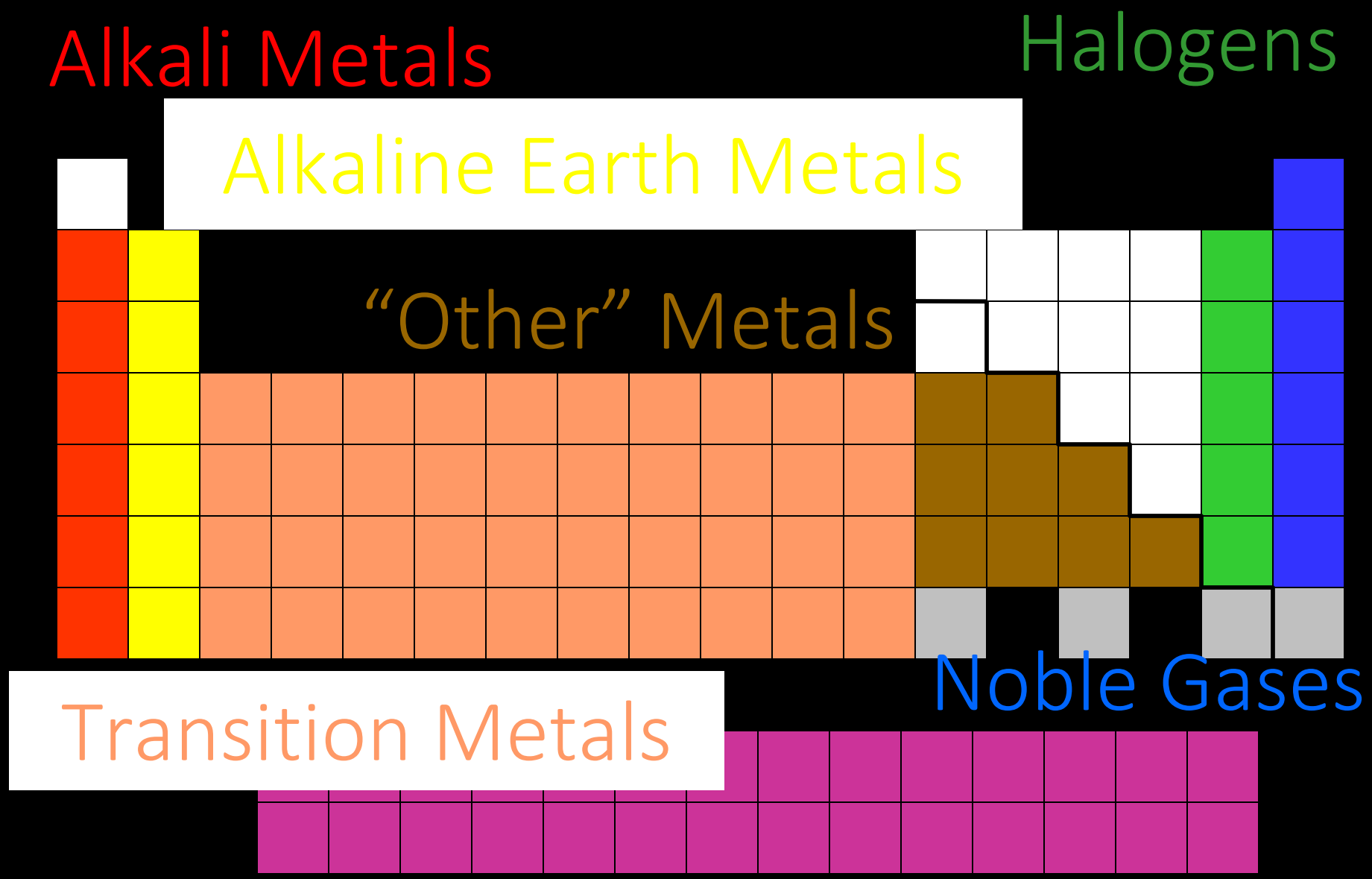
To see where they fit in, look at the atomic numbers.

To see an “intact” periodic table, go to

Then click on the box beside “Wide”



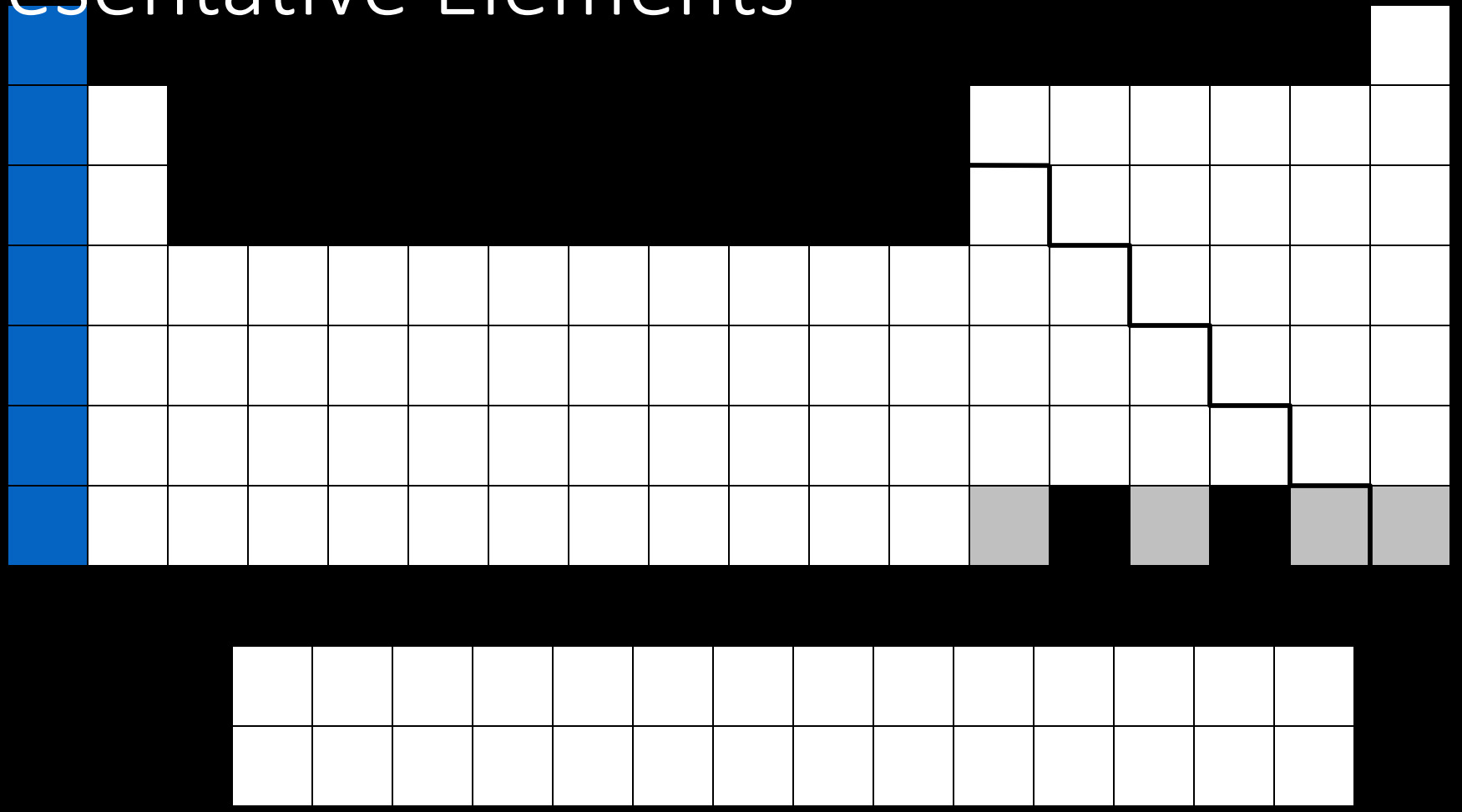
One reason the periodic table is drawn with the inner transition metals separate is so the table fits better onto a single piece of paper.


Alkali Metals
Halogens
Alkaline Earth Metals
“Other” Metals
Noble Gases
Transition Metals
Inner Transition Metals

Some Elements are referred to as “Representative Elements”

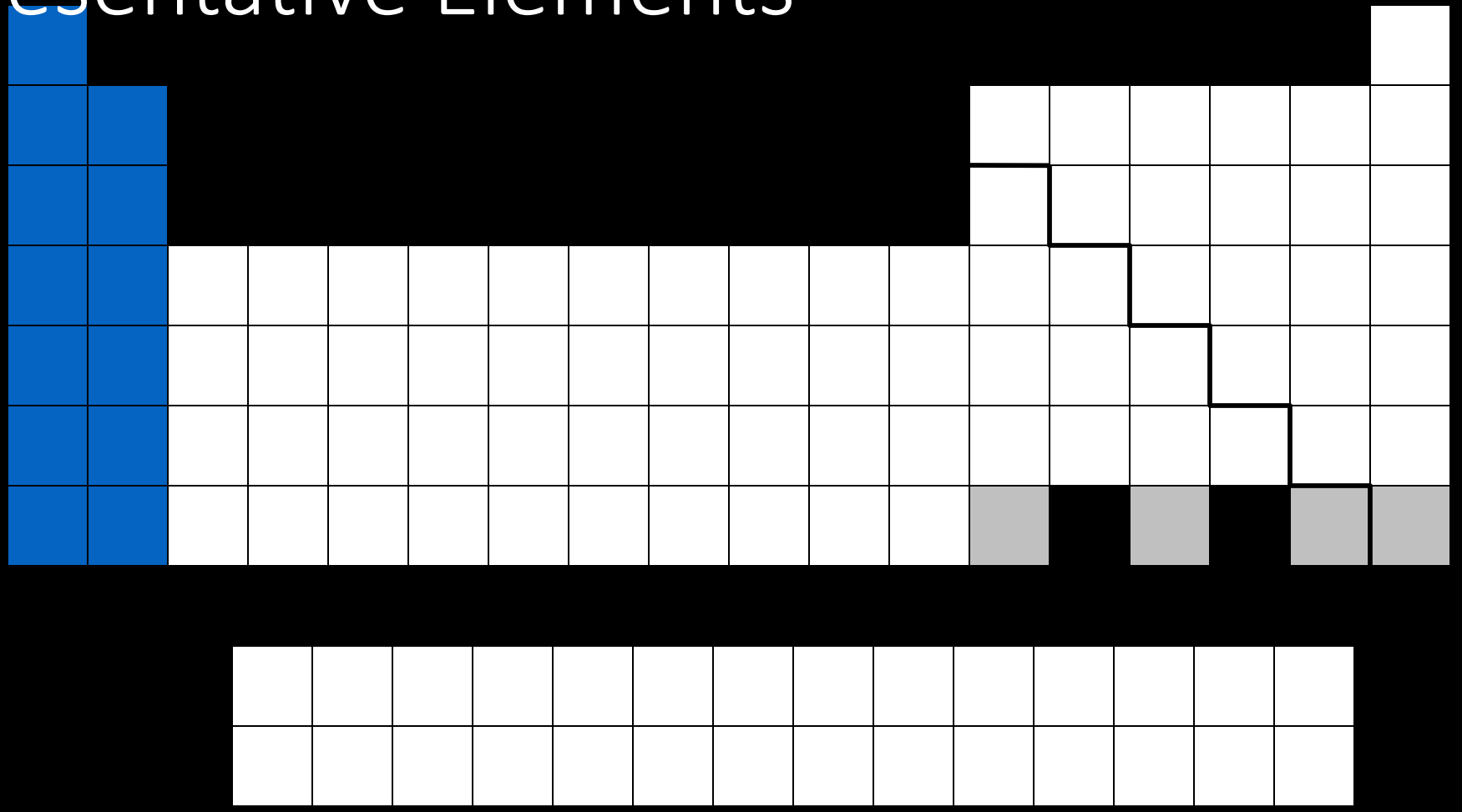
- Most of the A-Group Elements
- Their properties very clearly illustrate the periodic law

Representative Elements



All of Column 1.

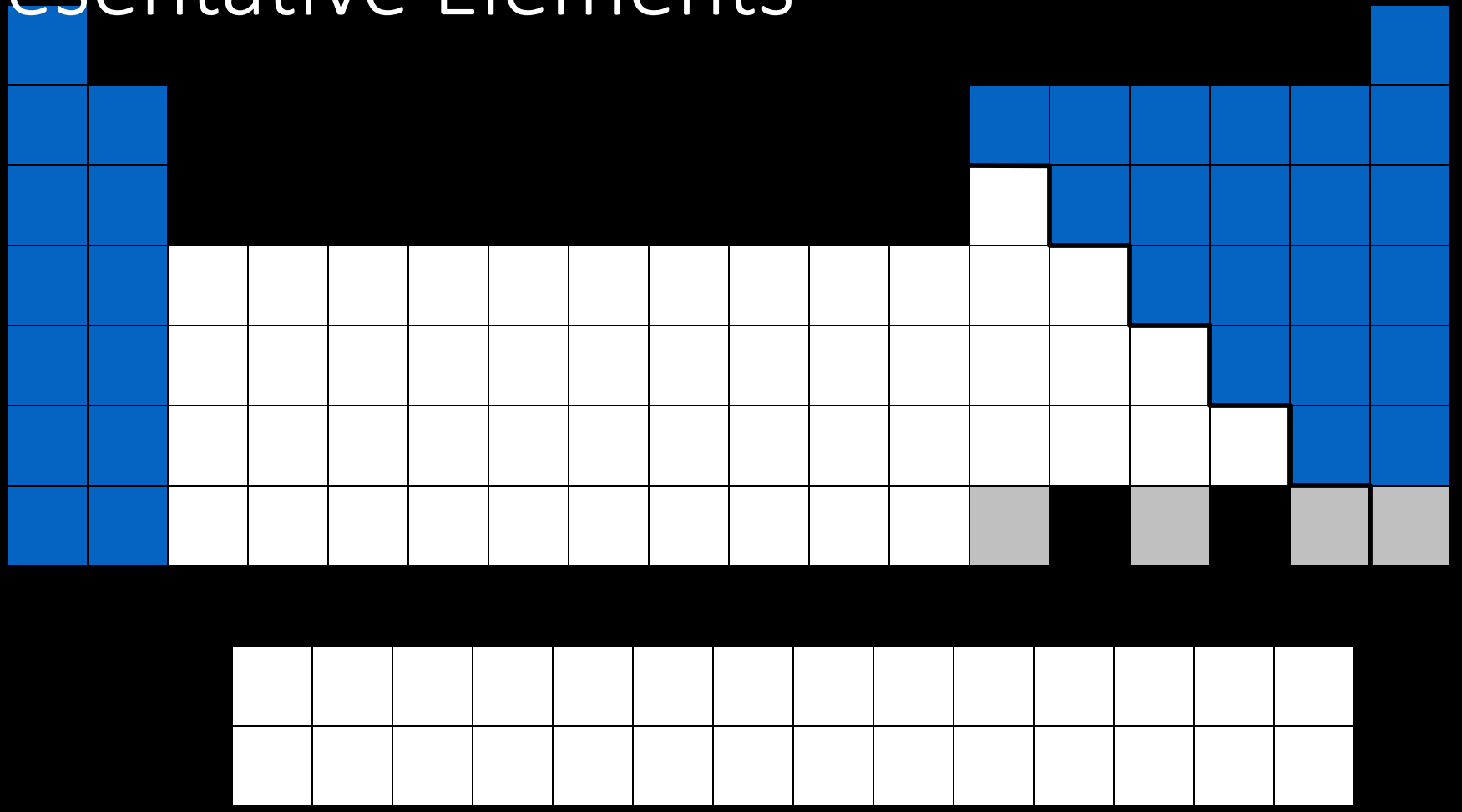
Representative Elements



All of Column 1.

All of Column 2.

Representative Elements

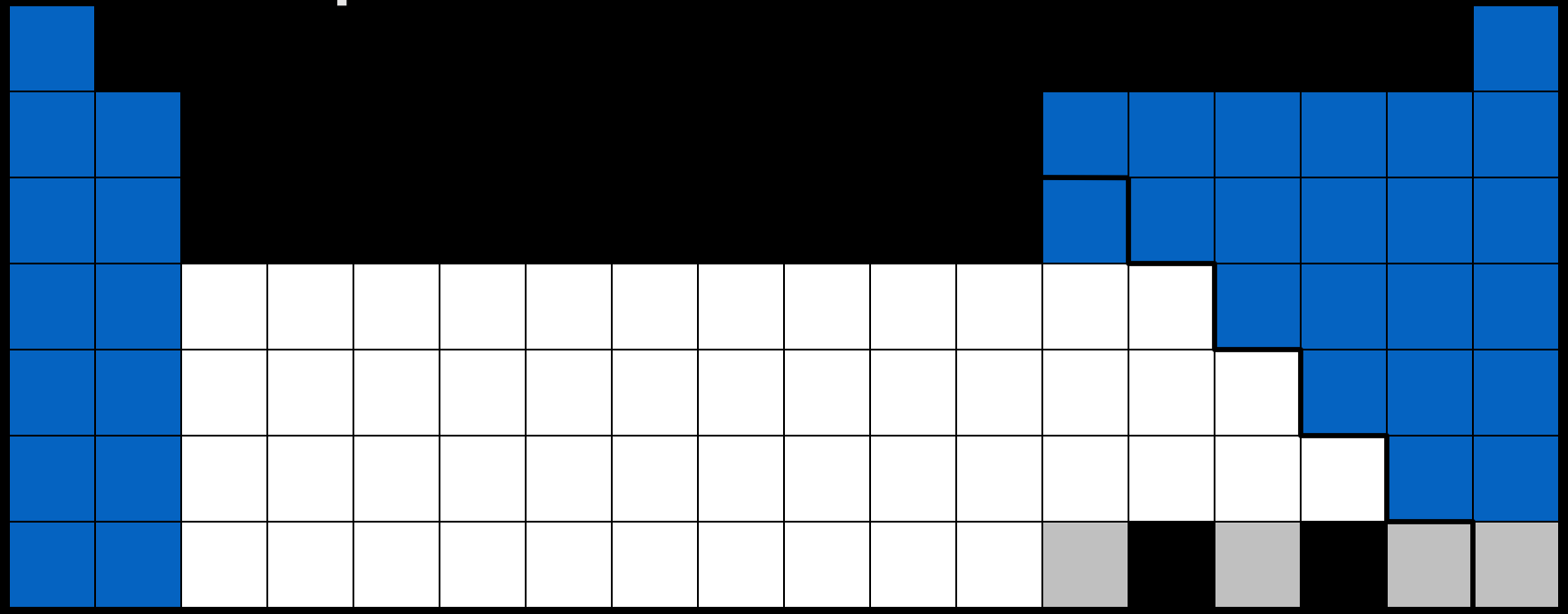


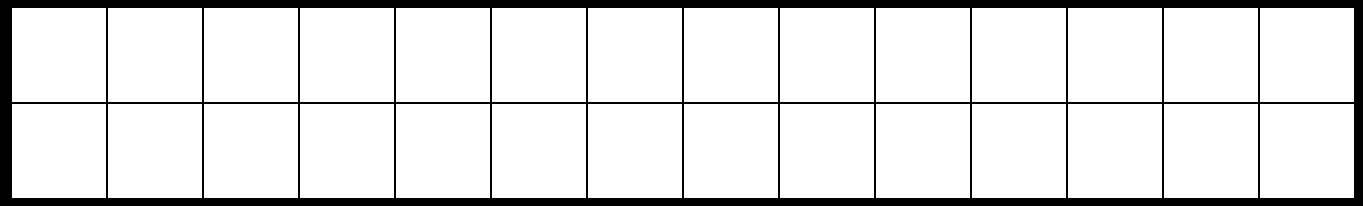
All of Column 1.

All of Column 2.

All the nonmetals.

Representative Elements





All of Column 1.

All of Column 2.

All the nonmetals.

And Aluminum.

Properties of Metals and Nonmetals	
Metals	Nonmetals
Bright metallic luster	Non-lustrous, various colors
Solids are easily deformed (ductile & malleable)	Solids may be hard or soft, usually brittle
Good conductors of heat & electricity	Poor conductors of heat and electricity
Loosely held valence electrons	Tightly held valence electrons
Form positive ions	Form negative ions
Like to lose electrons	Like to gain electrons

Why the name?

Properties of elements change as you move across a period. The same pattern of properties repeats when you move from one period to the next.

So the properties occur “periodically”.

Elements with similar physical and chemical characteristics end up in same family.

Ex: Group 1A elements are all very reactive with water.