

Do Now Activity

Look at the groceries and food items on the front counter before you sit in your assigned seat. With your table partner determine categories to organize the food items based on the system we use at local grocery stores. Why do grocery stores organize food into categories?

Objectives for today- Organizing elements

- 1.) When given an element determine whether the element is a non-metal, metal, or metalloid
- 2.) Define some of the physical and chemical properties of non-metal, metal, or metalloids
- 3.) To code **your** periodic table of elements and create a key to identify the periods and groups of the elements

What we know

1. How to find the element's atomic number
2. How to use the atomic number to determine the number of protons and electrons
3. What is the mass number
4. How we use the atomic mass number to find the number of neutrons

How are elements arranged

- All elements are arranged by the number of protons
- The number of protons in a neutral element is = to the number of electrons
- But there are several trends in the periodic table

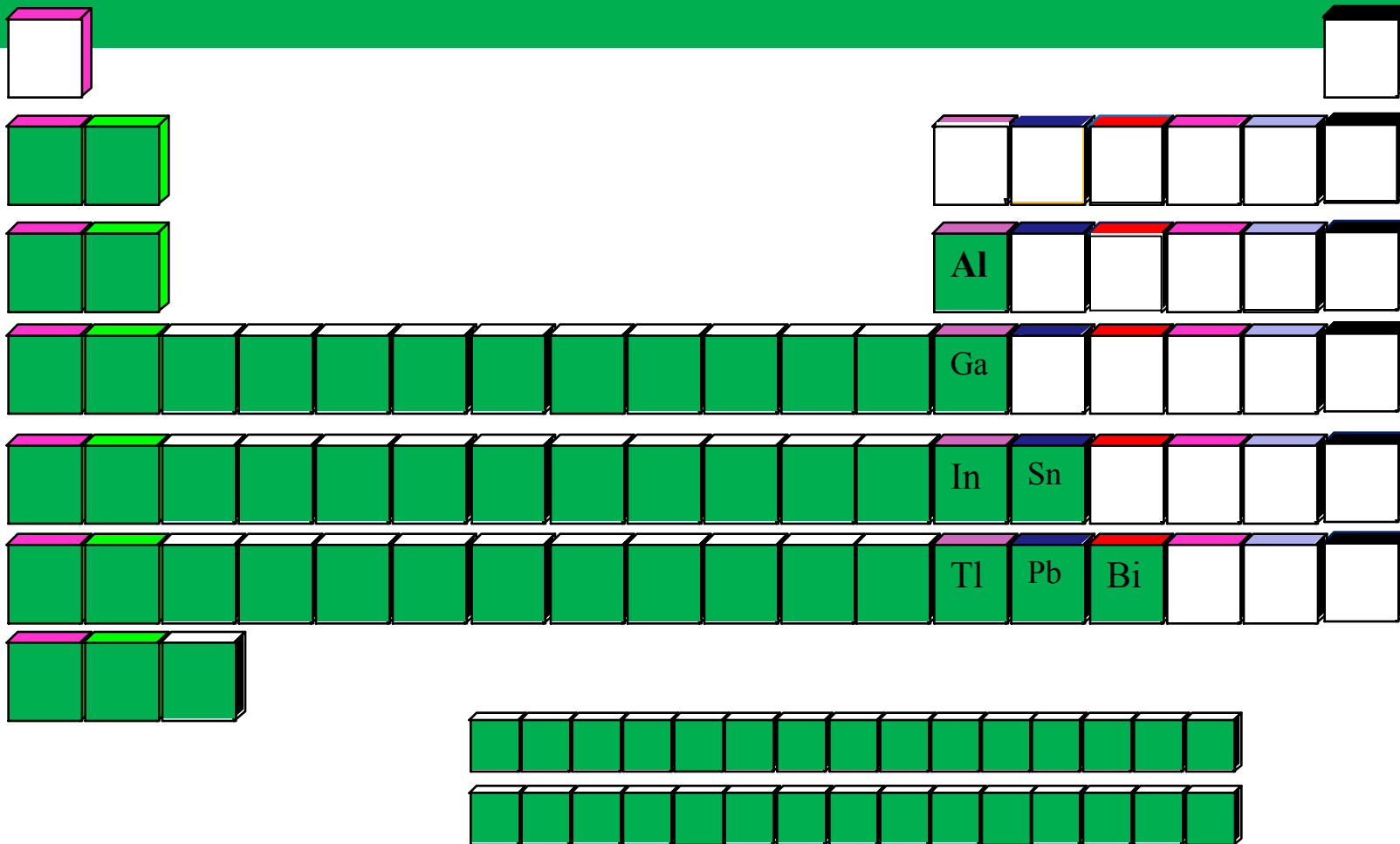
1st Category

Metals, Metalloids, and Nonmetals

Properties of Metals

- Metallic luster (shine)
- Generally solids at room temperature
- Malleable Ductile
- Conduct heat and electricity
- Form positive ions losing electrons Na^+ , Mg^{2+} , and Al^{3+}

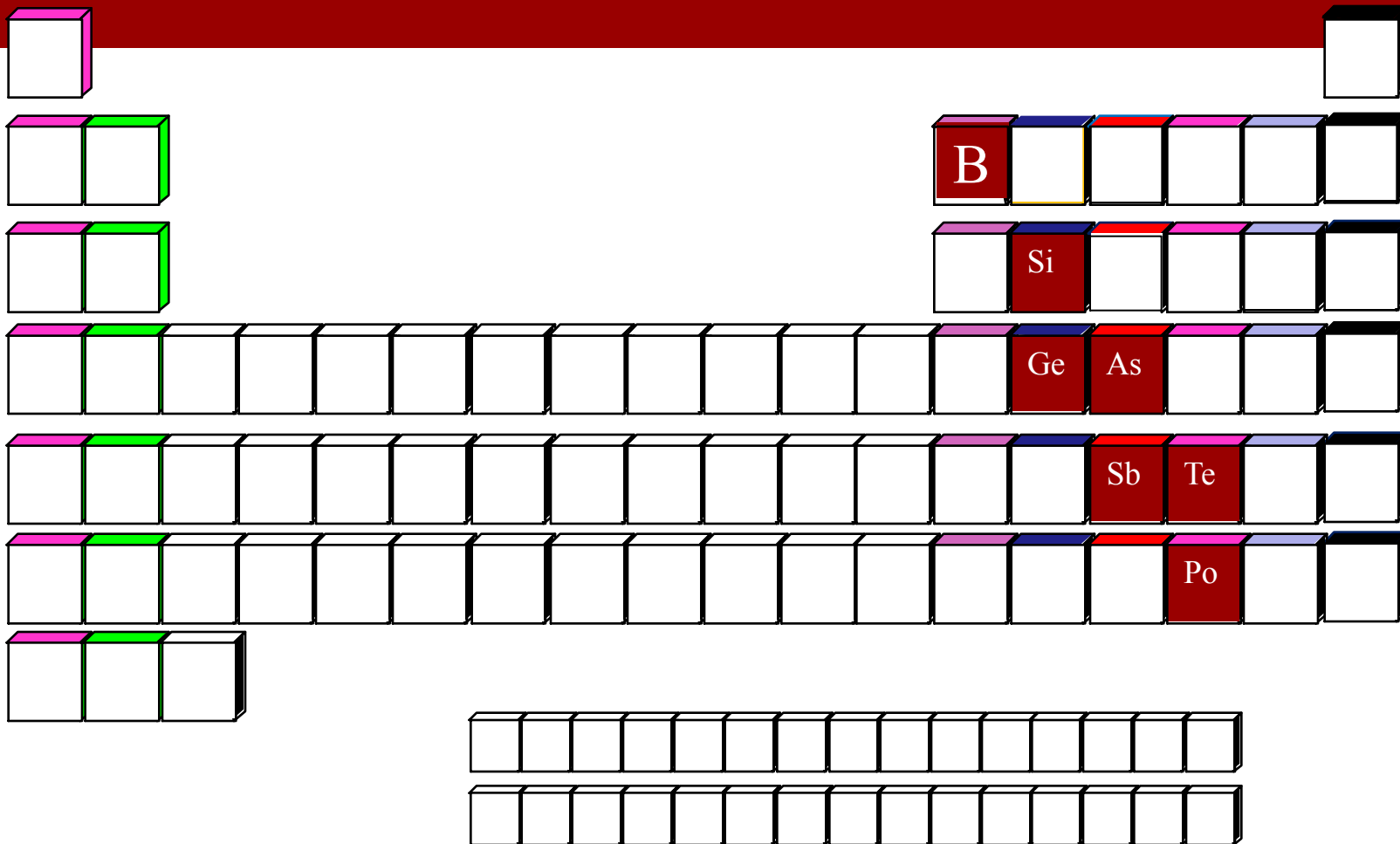
Metals



Properties of Metalloids

- Generally look metallic but are brittle (not malleable or ductile)
- Neither good conductors or insulators

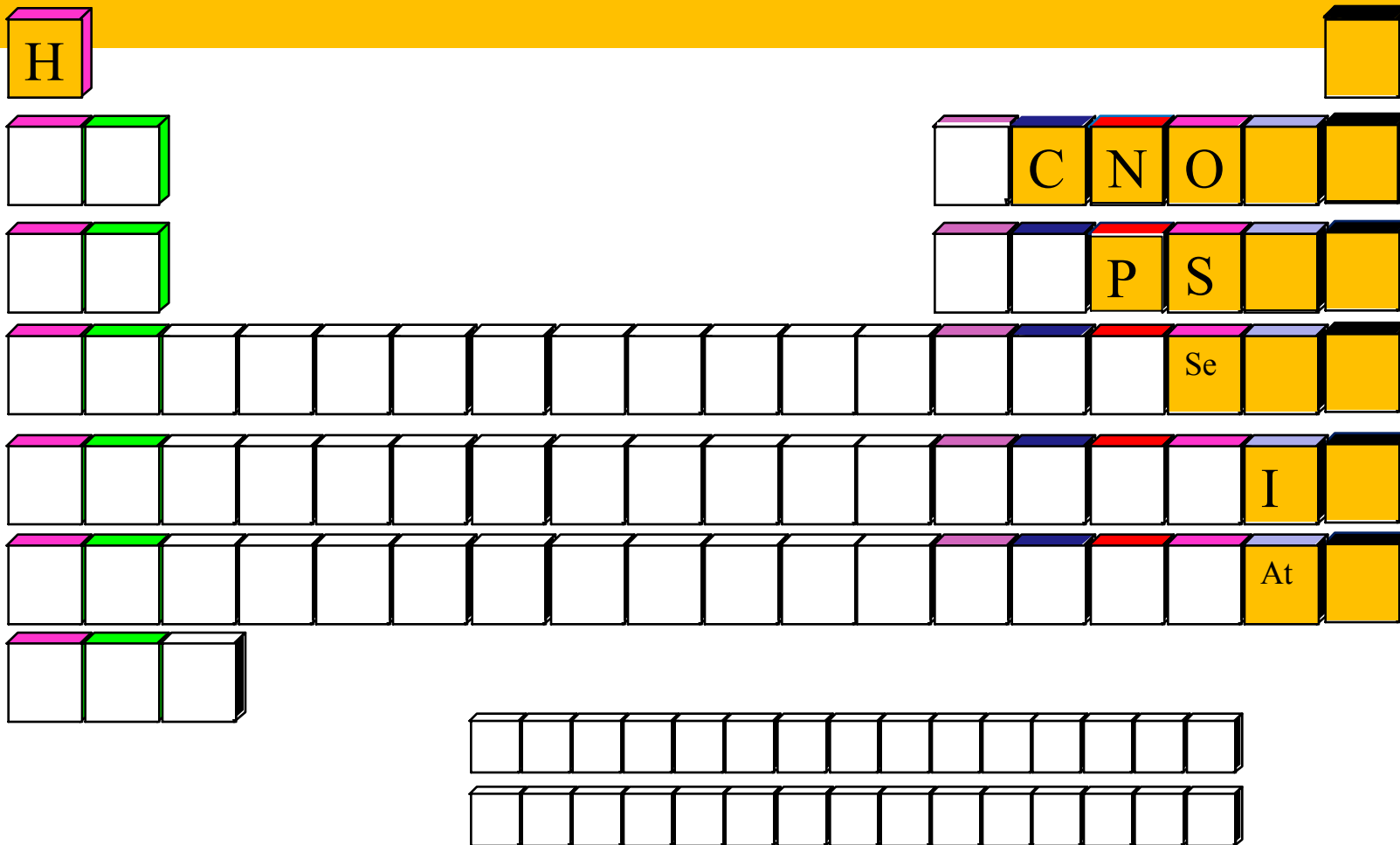
Metalloids



Properties of Non Metals

- brittle, not malleable or ductile
- poor conductors of both heat and electricity
- tend to gain electrons in chemical reactions.
- Tend to be liquid or gas.

Non-Metals



Categorize as either metal,
metalloid, or non-metal

Calcium

Oxygen

Fluorine

Manganese

Categorize as either metal, metalloid, or non-metal

Calcium

Oxygen

Fluorine

Manganese

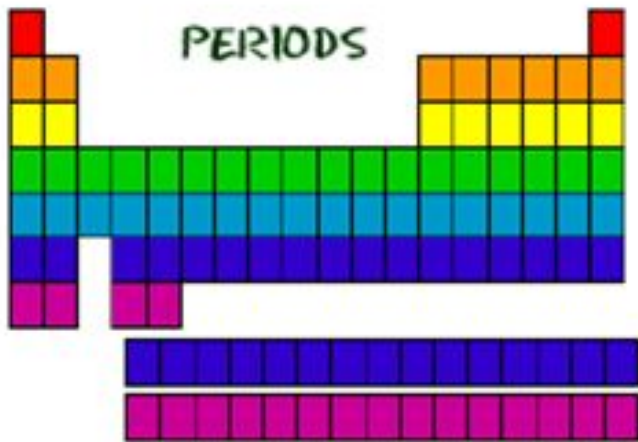
Metal

Non-Metal

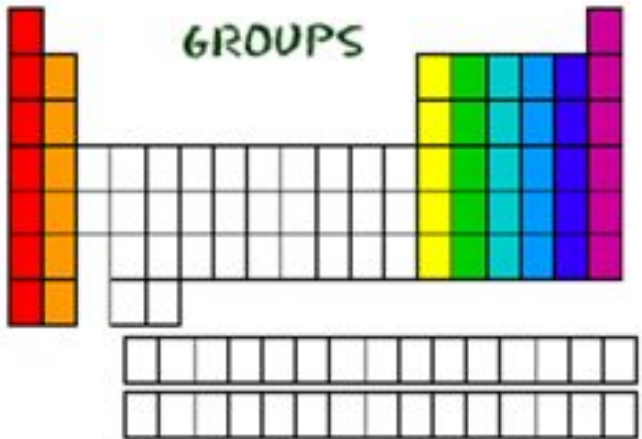
Non-Metal

Metal

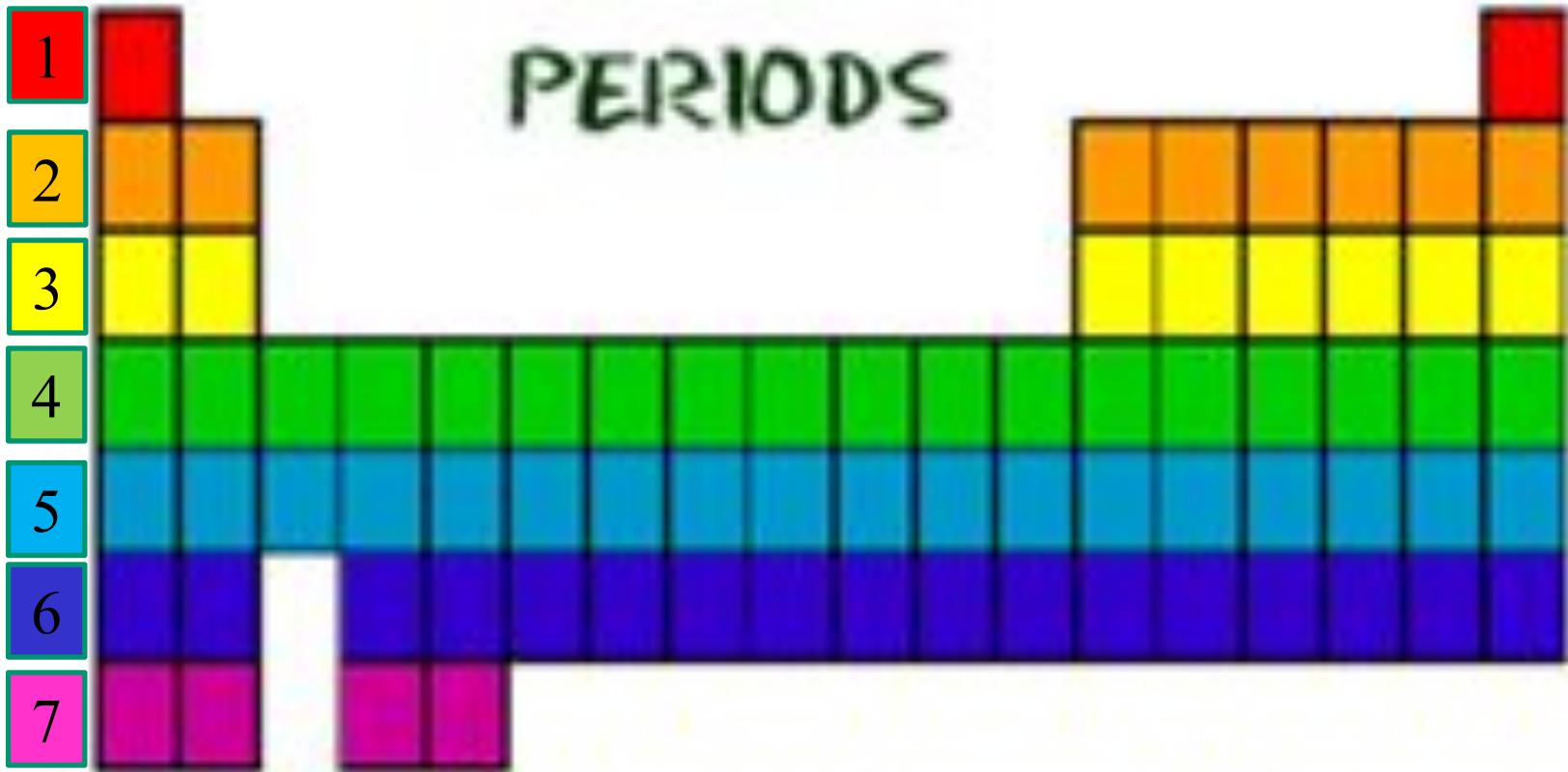
Navigating the Periodic Table



- The rows are the “periods”
 - Each period starts a new shell of electrons
 - The periods are numbered starting with 1 at the top
- The columns are the “groups”
 - Each group has similar chemical properties
 - The groups are numbered starting with 1 at the left

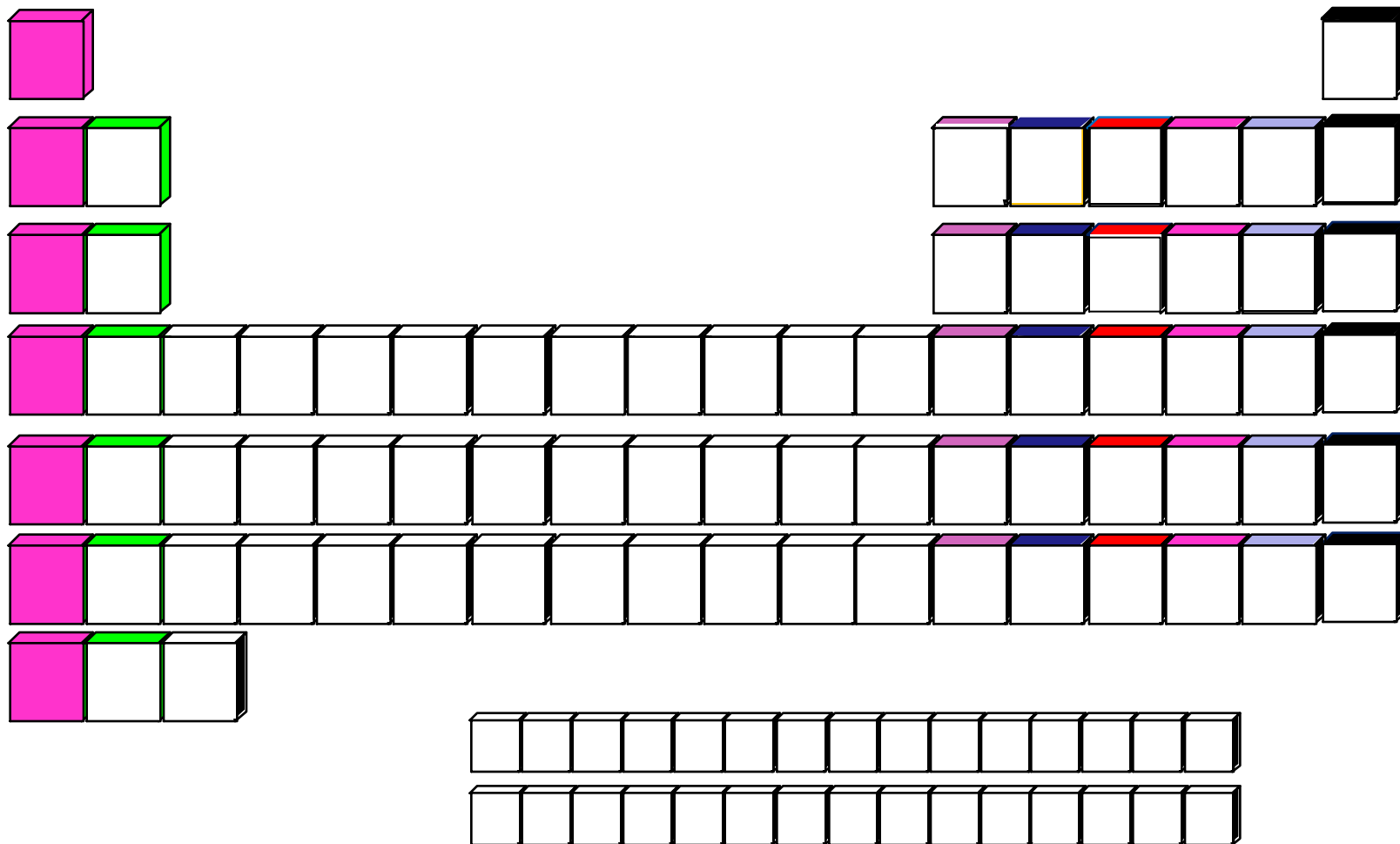


PERIODS

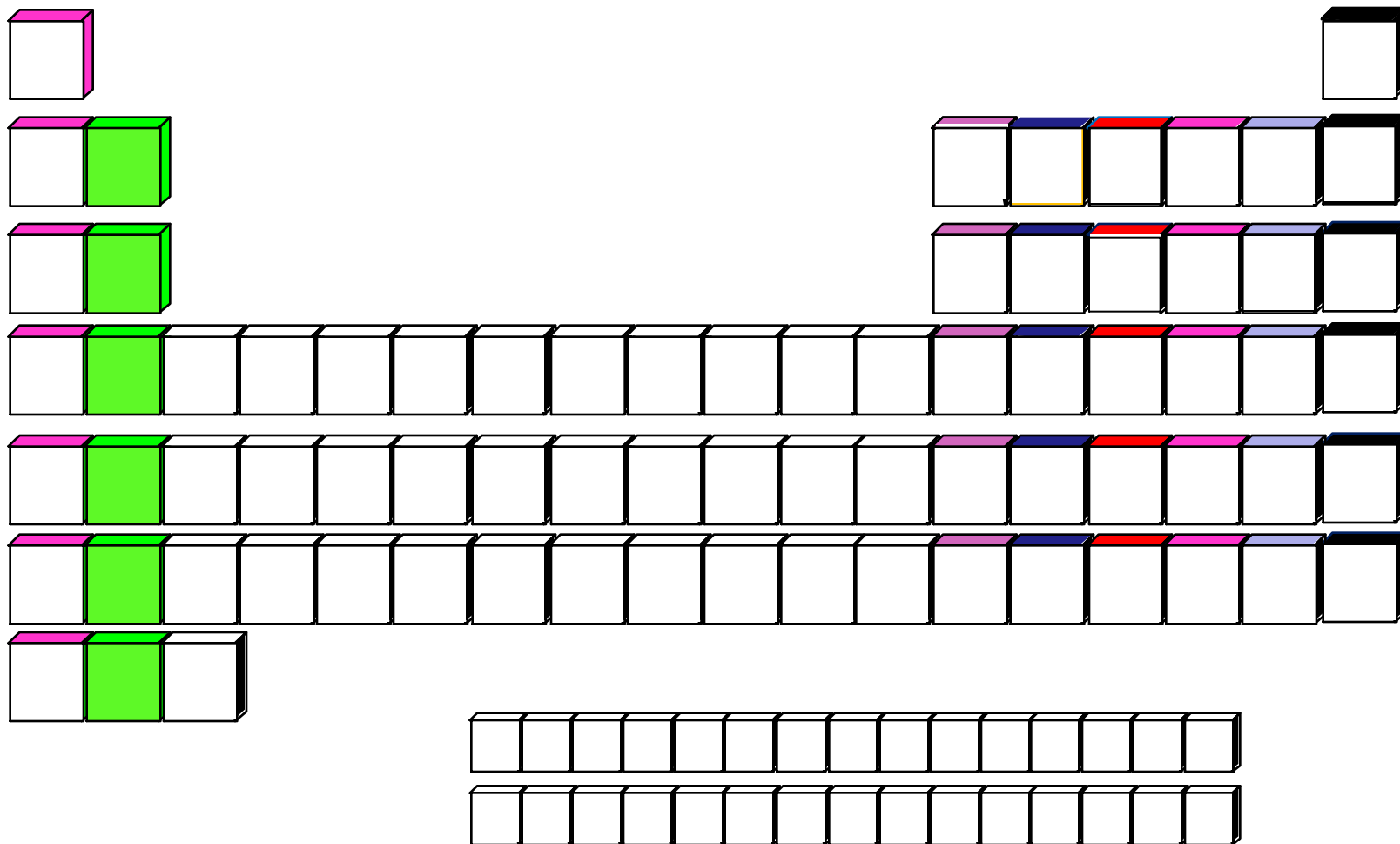


Subcategorize Metals

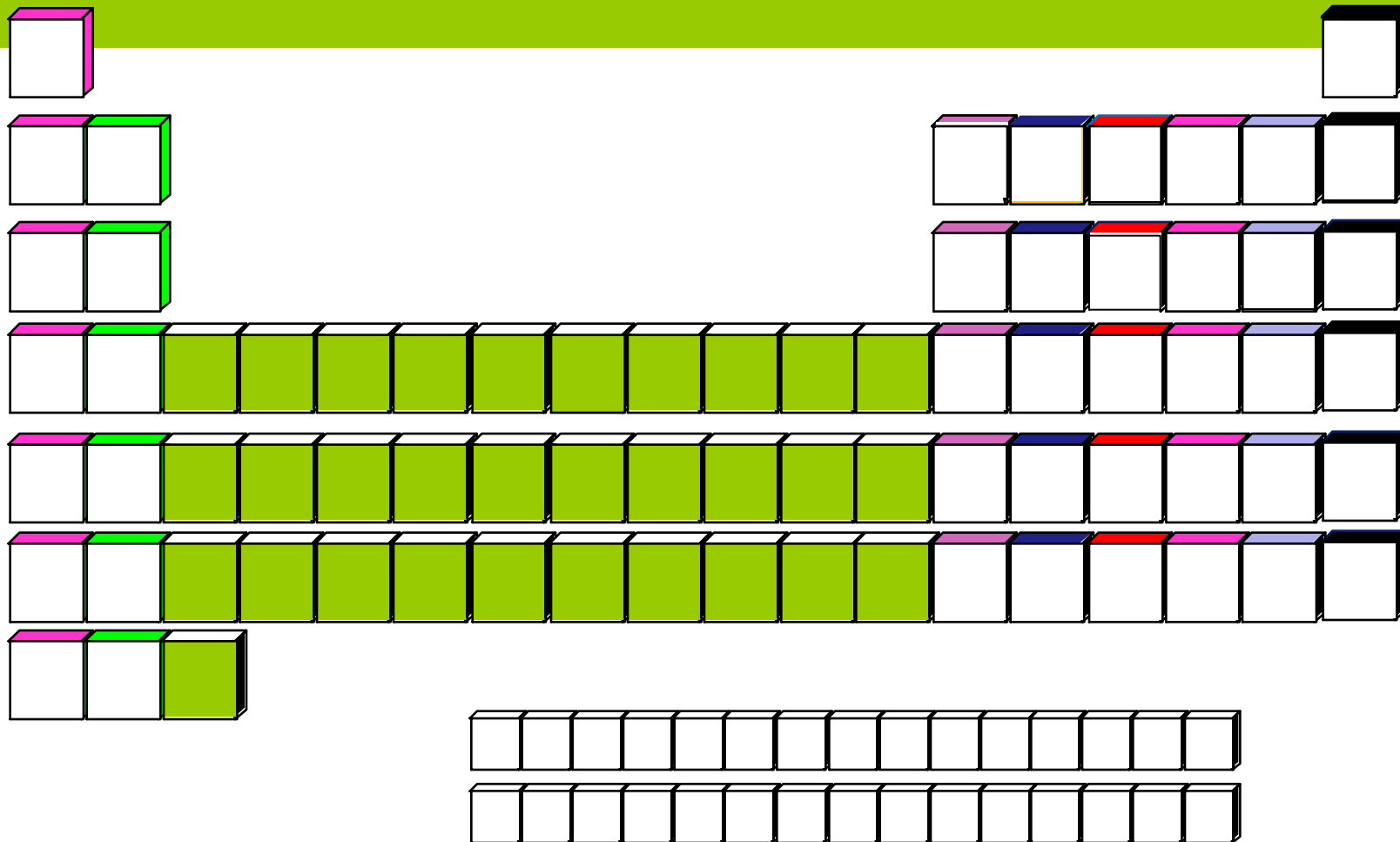
Alkali Metals



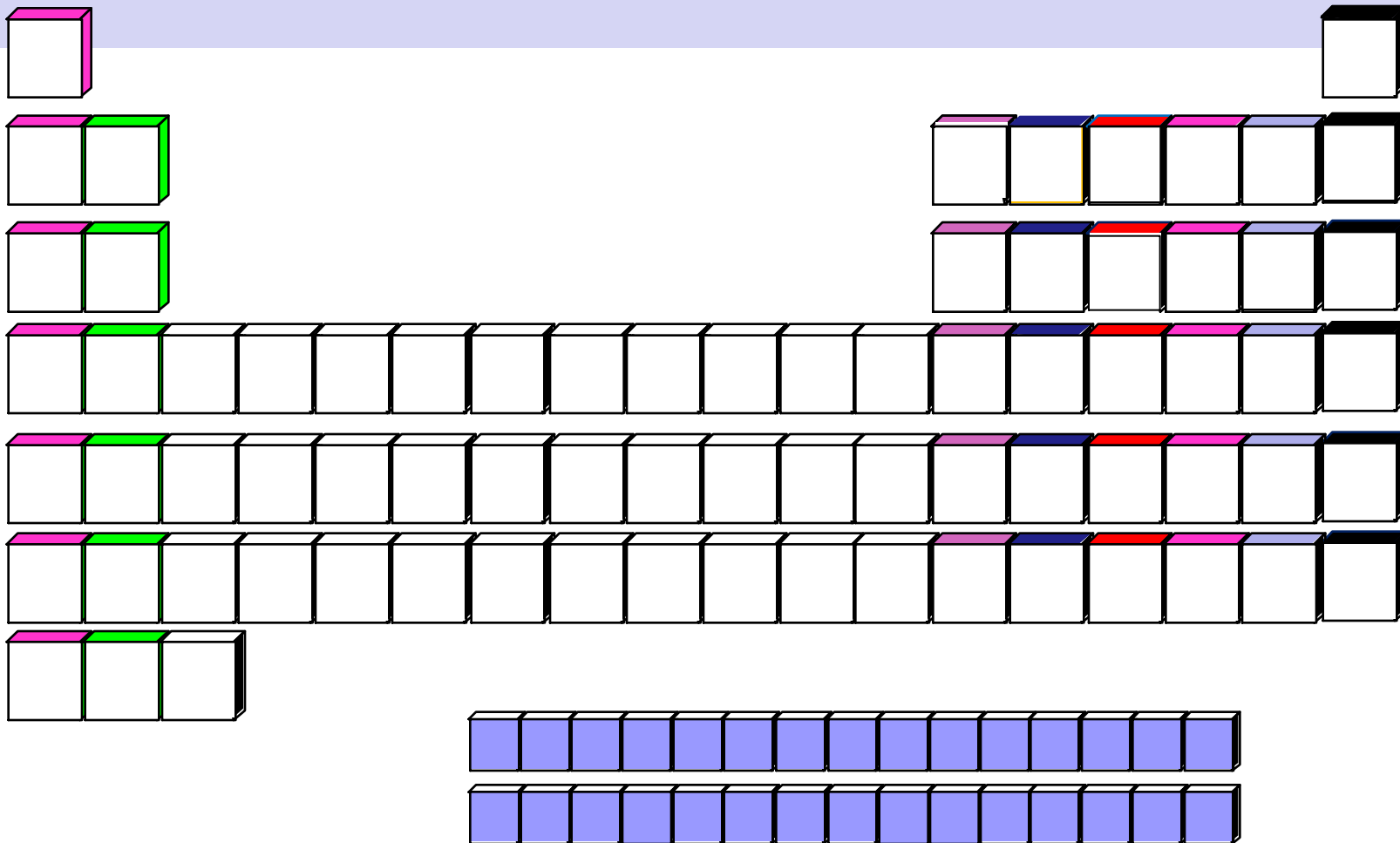
Alkali Earth Metals



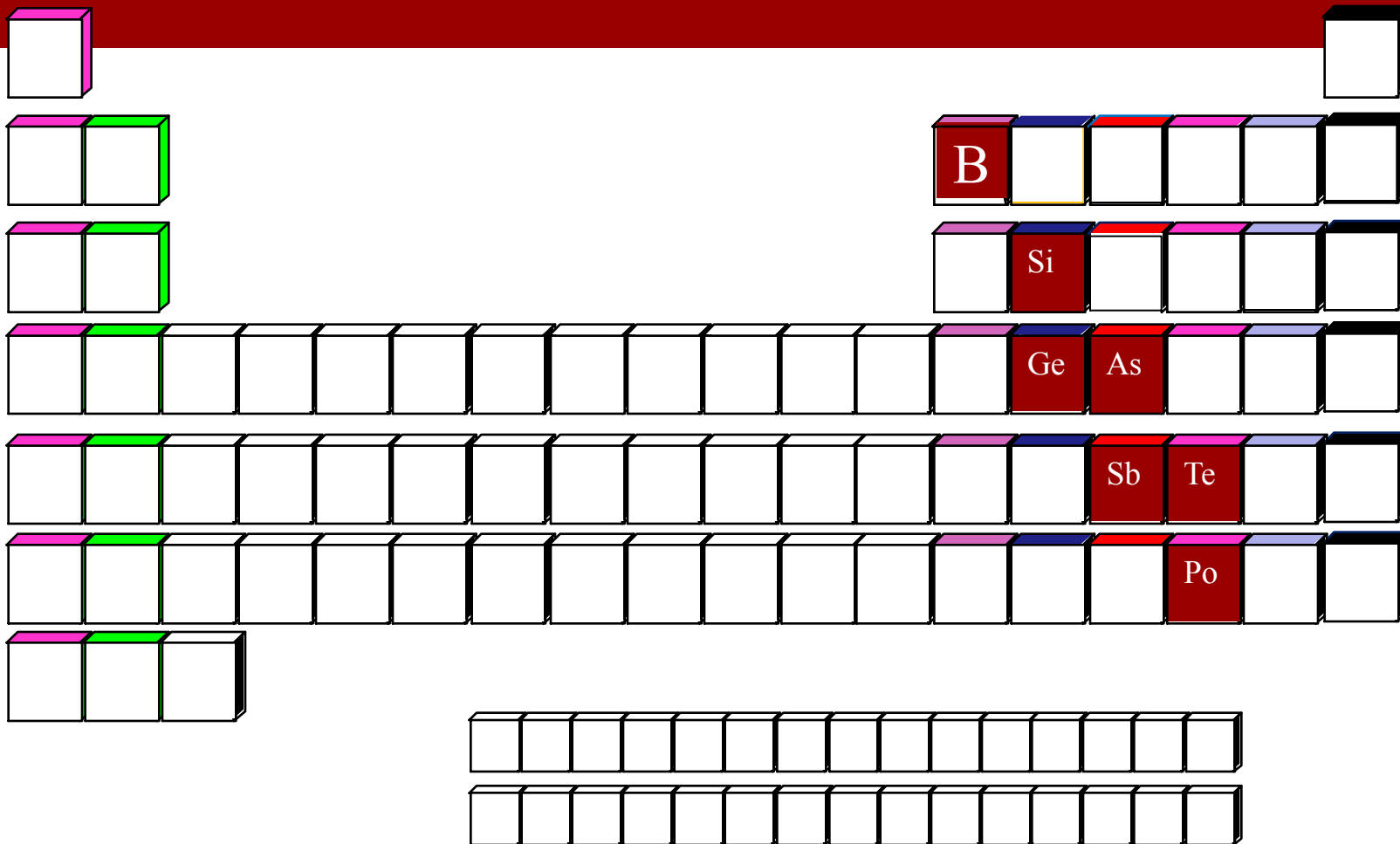
Transition Metals



Rare Earth Metals

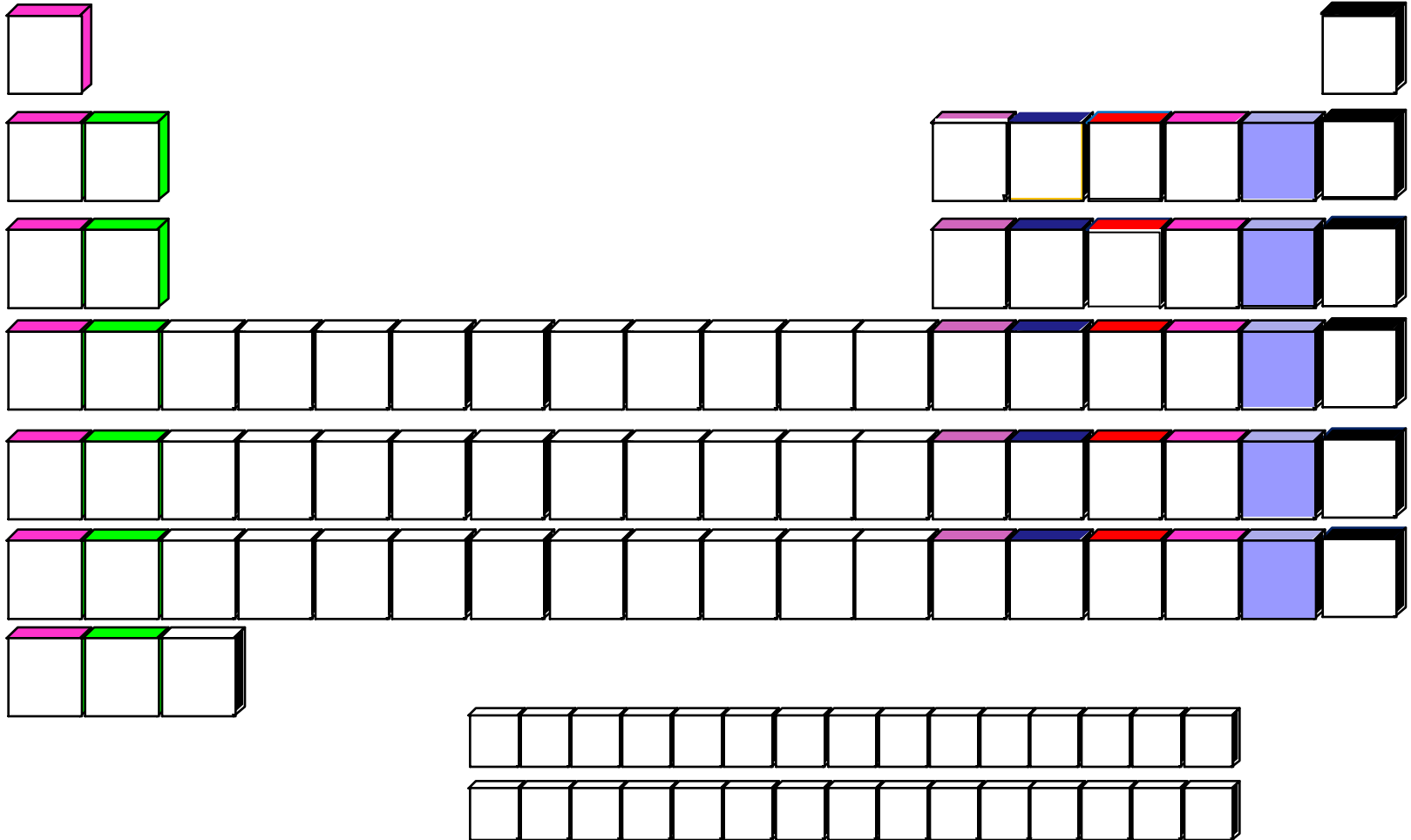


Metalloids



Sub Category Non-Metals

Halogens



Trends

Electron Configurations & Trends in Periodic Properties

1. **atomic radius**- size of atom ($1/2$ the distance between identical atoms bonded together)

2. **Ionization Energy**- energy required to remove an electron from a neutral atom of an element

3. **Electron Affinity** - the energy change that occurs when an electron is acquired by a neutral atom

4. **Ionic Radii** - size of ion

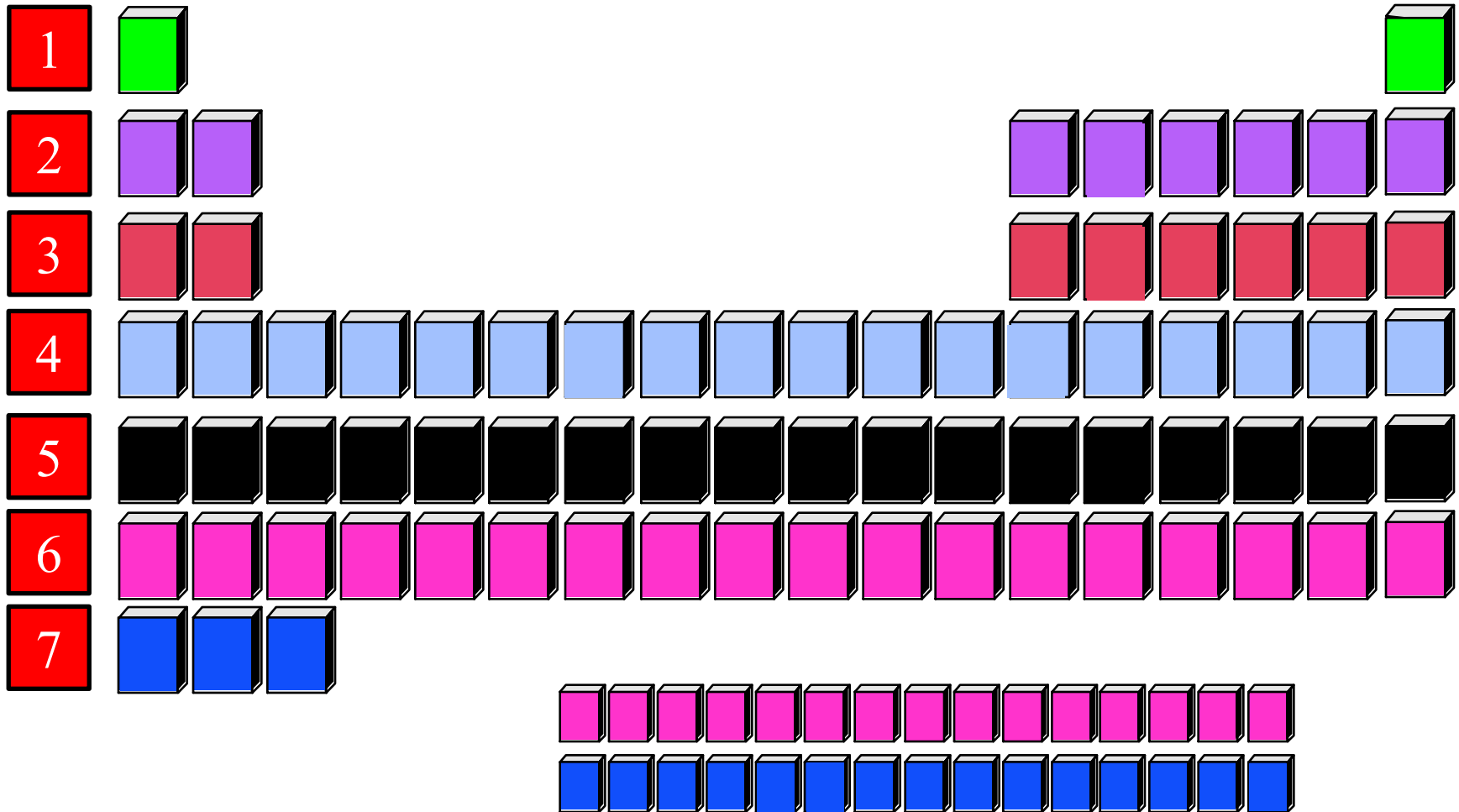
5. **Electronegativity**, tendency of an atom to attract electrons

Periodic Trends

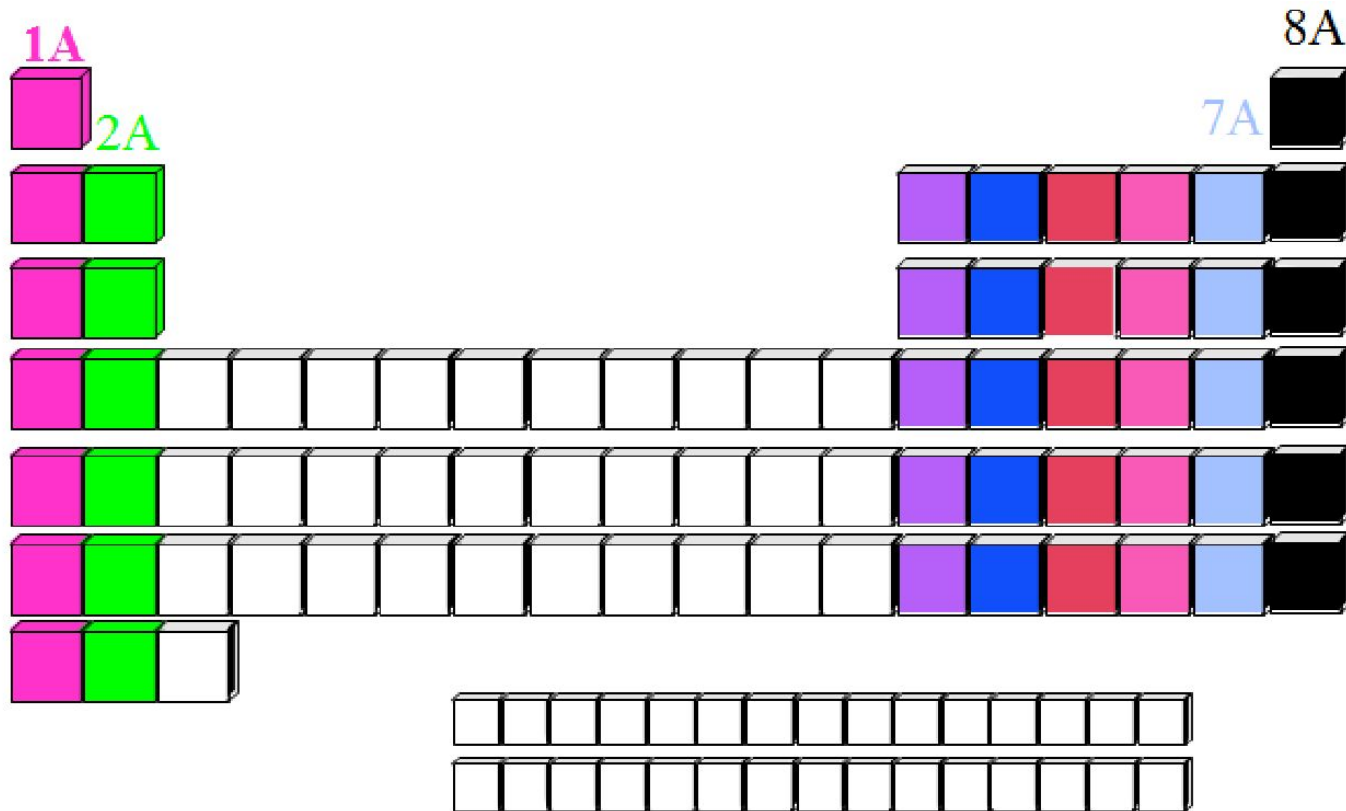
1. First look at the period
2. Then look at the group

Horizontal rows are called periods

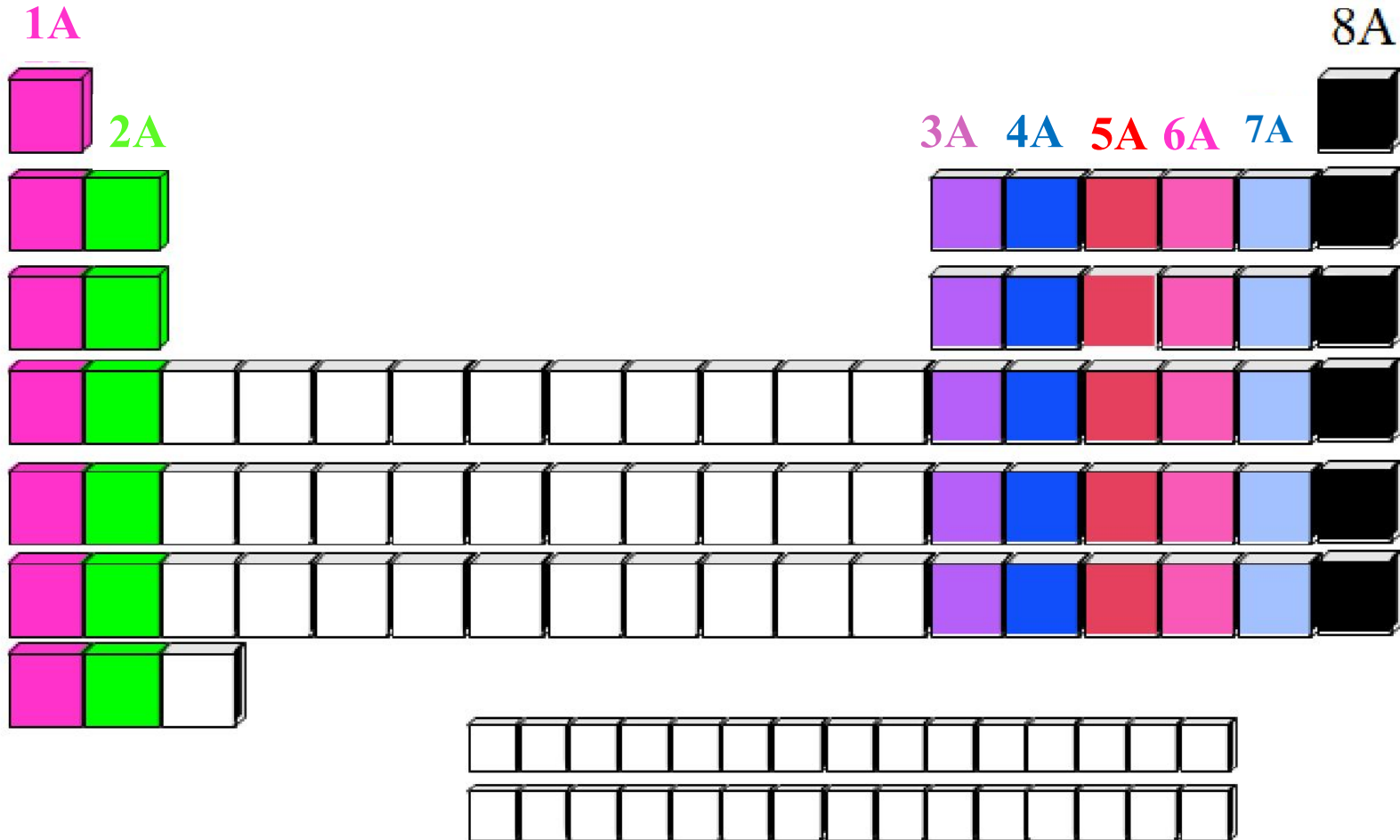
There are 7 periods



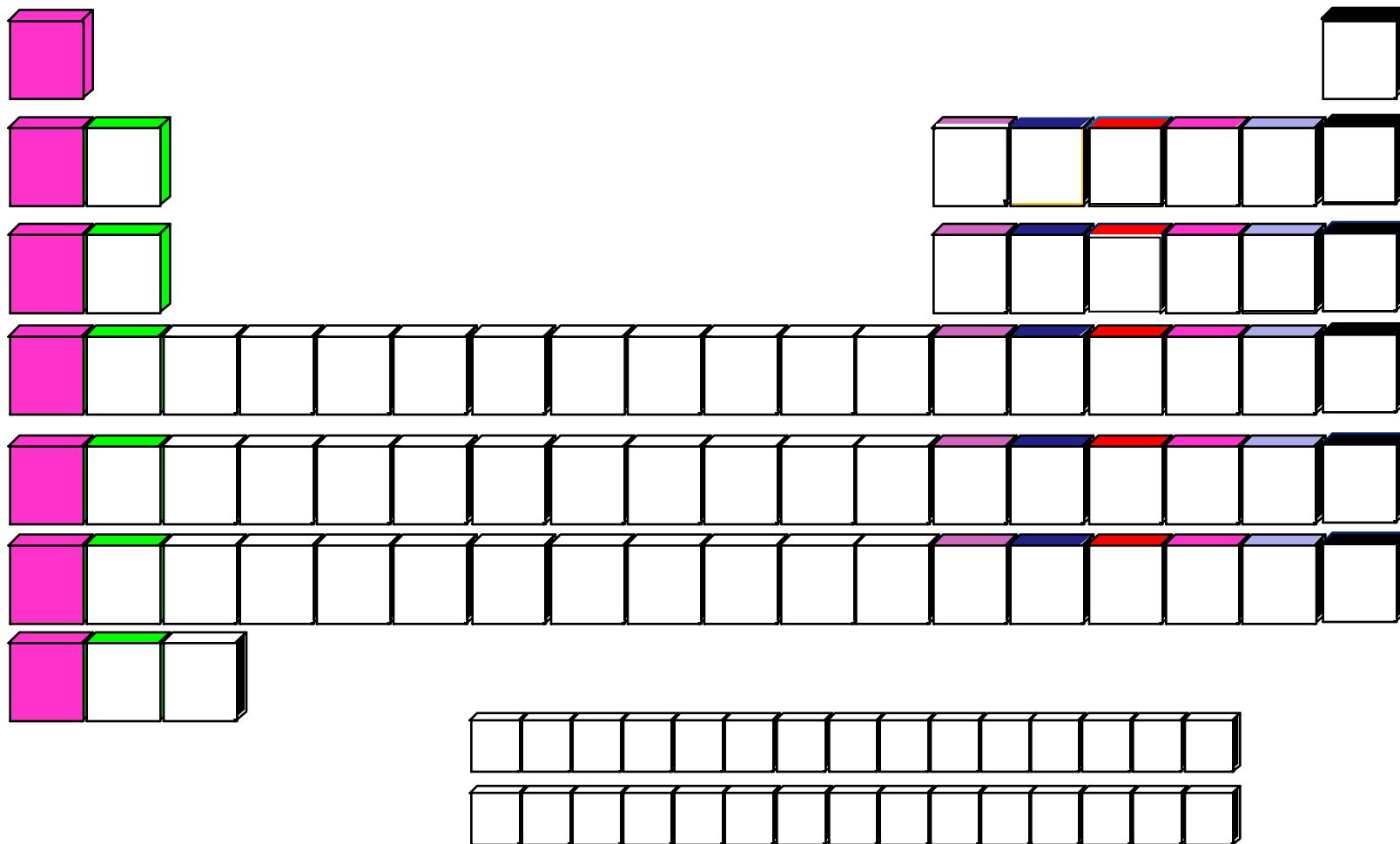
Vertical columns called groups
Elements are placed in columns
by similar properties
Also called families



The elements in the A groups are called the representative elements.
outer s or p filling



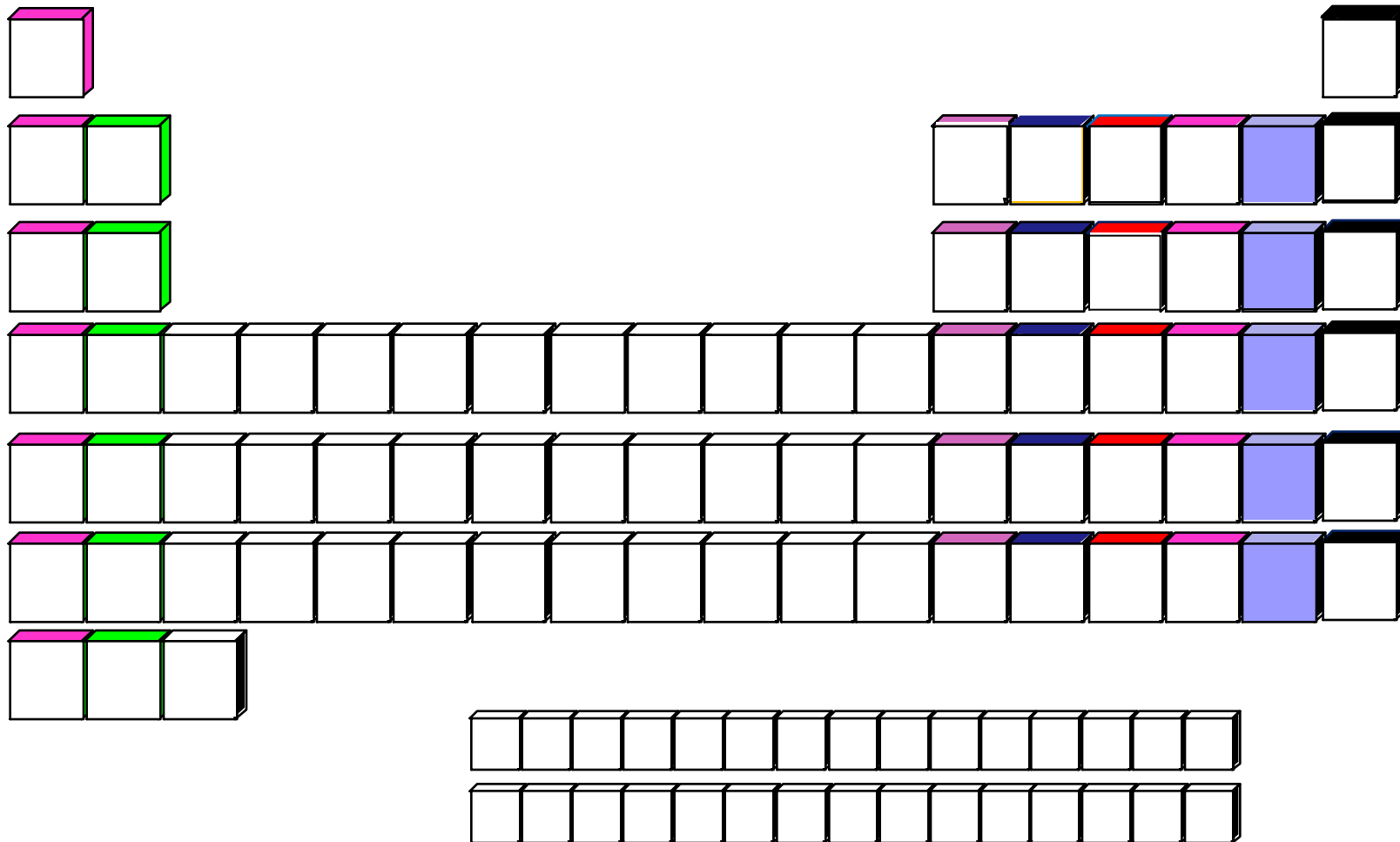
Group 1A – Alkali Metals



Group 1A – Alkali Metals

- The alkali metals exhibit many of the physical properties common to metals.
- Although their densities are lower than those of other metals. **Alkali metals have one electron in their outer shell, which is loosely bound.**
- This gives them the largest atomic radii of the elements in their respective periods.
- Their low ionization energies result in their metallic properties and are **highly reactive**
- **They react readily with nonmetals, particularly halogens.**

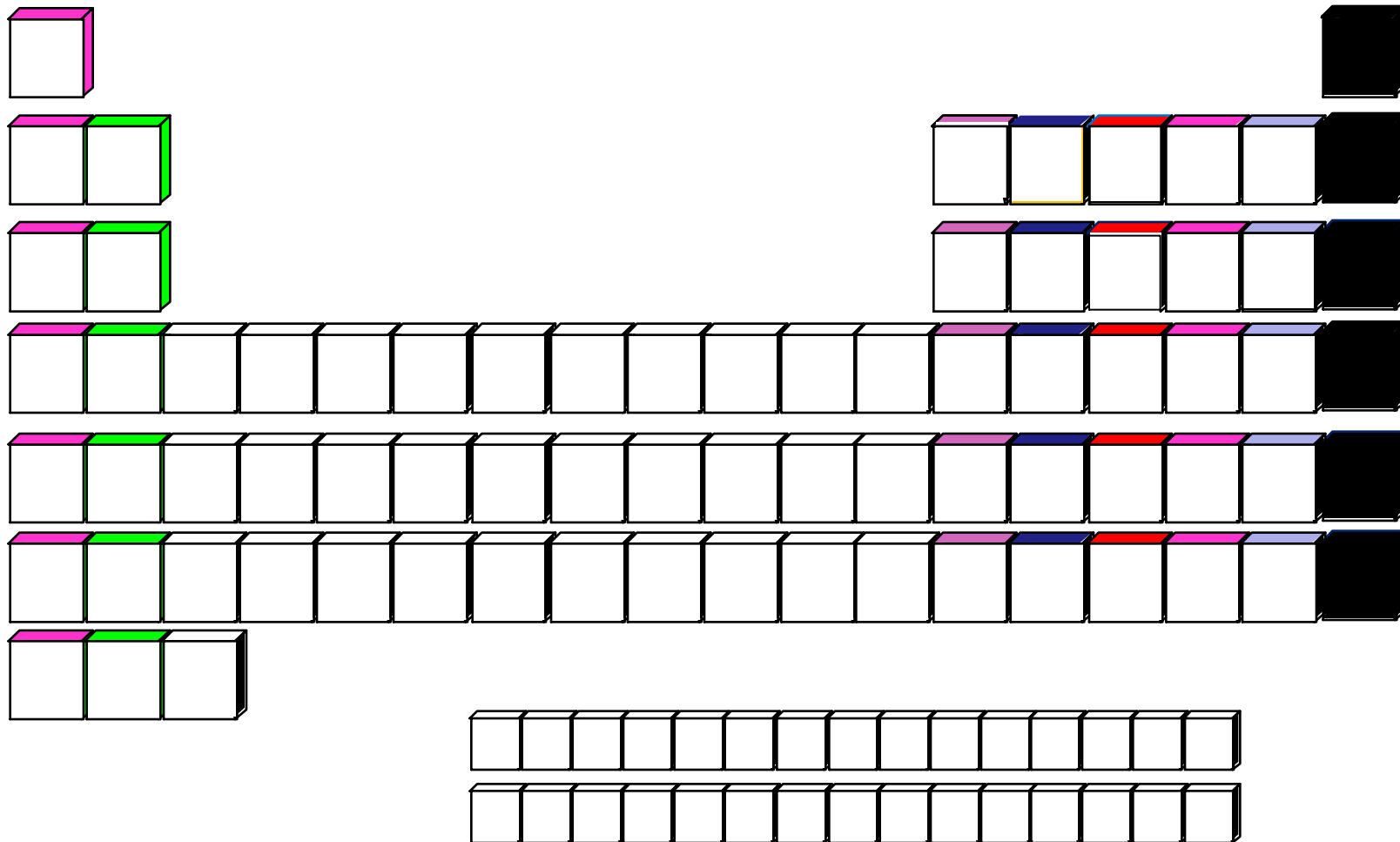
Group 7A - Halogens



Group 7A – Halogens

- Halogens are highly reactive
- This high reactivity is due to the atoms being highly electronegative
- They can gain an electron by reacting with atoms of other elements.

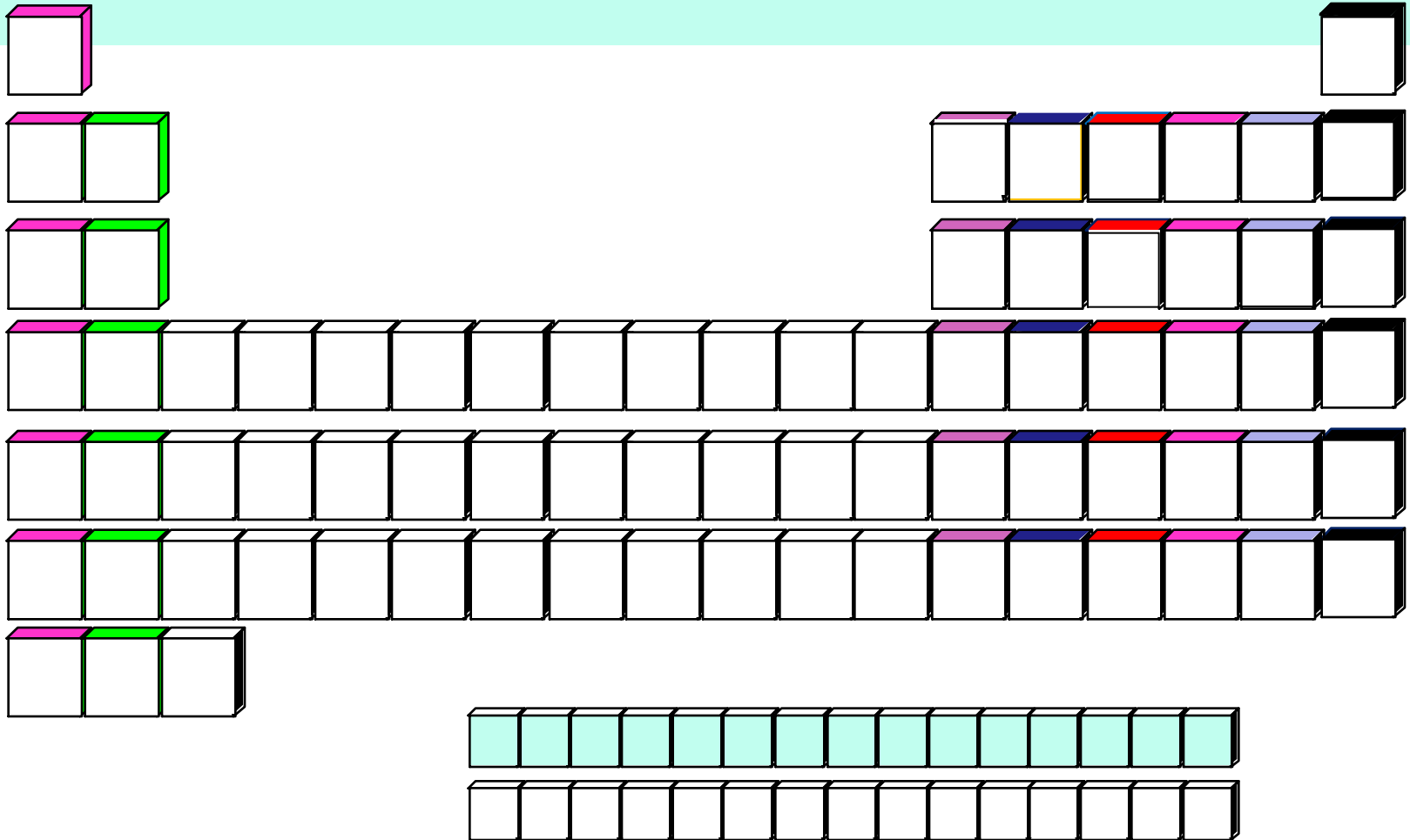
Group 8A Nobel Gasses



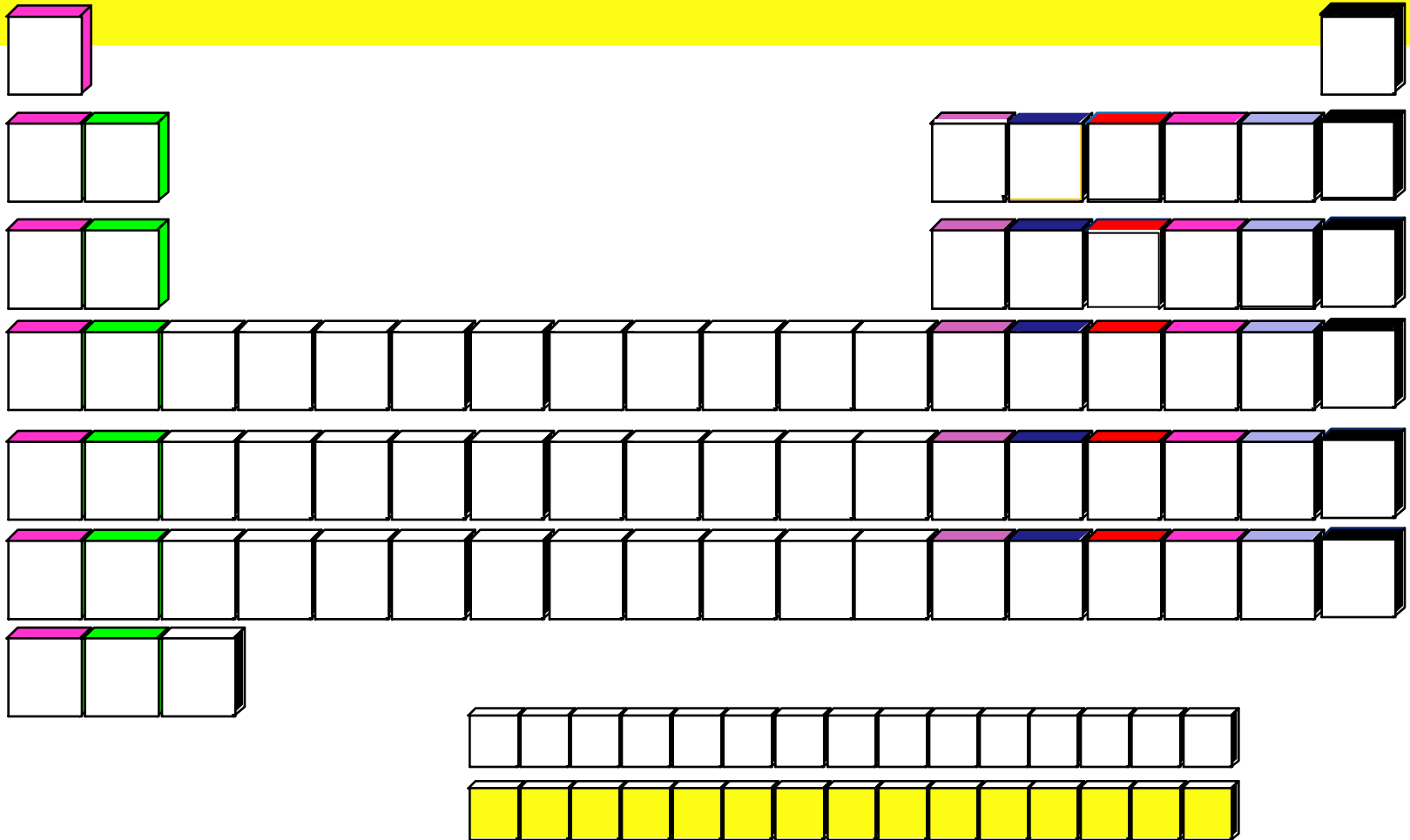
Group 8A Nobel Gasses

- they are all odorless, colorless, monatomic gases
- with very low chemical reactivity.

Lanthanides



Actinides



Summary of trends

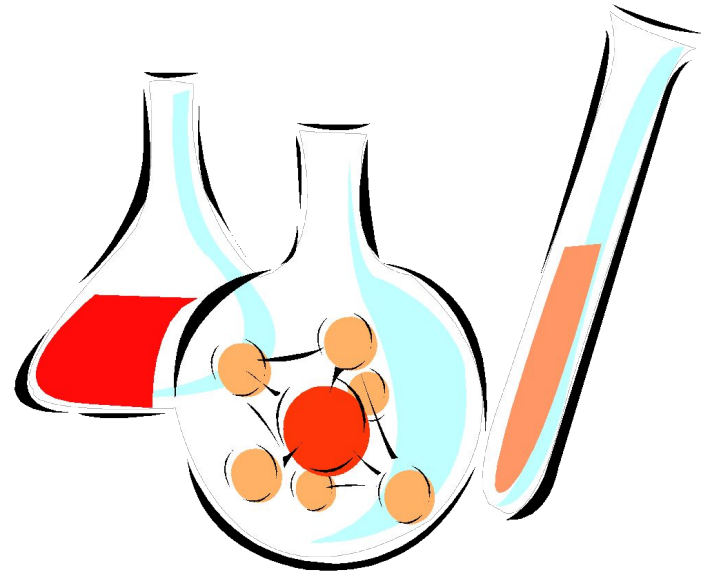
| Trends of | Top to Bottom in a group | Left to right in a period |
|---------------------------------|-----------------------------|------------------------------|
| Atomic radius | Increases | Decreases |
| Ionization potential | Decreases | Increases |
| Electron affinity | Decreases | Increases |

Who developed the first periodic table?

- Dobereiner (Germany, 1817) noticed that atomic mass of Sr was closely related to the atomic mass of Ca and Ba.
- He called this grouping a triad.
- Several other triads were created based on his system but eventually there were not enough triads to make the system useful.

Who developed the modern periodic table?

- Dmitri Mendeleev (Russia) and Lothar Meyer (Germany) both published almost identical systems of classifying elements.
- They arranged the elements in order based on their physical and chemical properties and atomic weight.

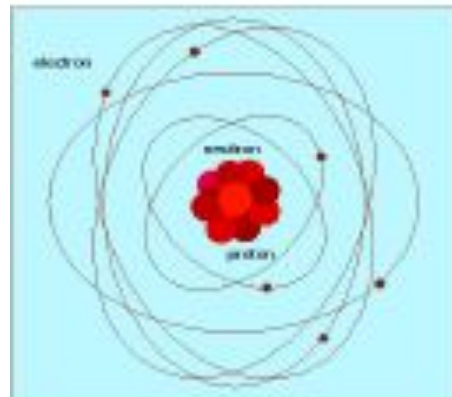


Why was Mendeleev credited with the periodic table?

- He insisted that elements be grouped together by properties and thus by family.
- He left blank spaces in the table for elements that had not been discovered.
- He also predicted the properties of the undiscovered elements.

Periodic Law

- Mendeleev stated that the physical and chemical properties of elements vary periodically with increasing atomic mass.

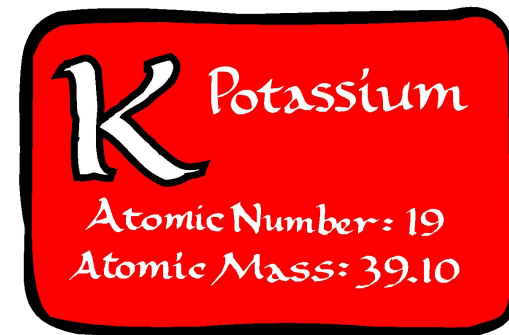


How were the table and atomic numbers proven?

- Two years after Rutherford created his atomic model, Robert Moseley developed the concept of atomic numbers.
- He bombarded elements with high energy electrons and measured the frequency of x-rays given off.
- Then he arranged the elements in order according to the frequency given off. It was then concluded that as the atomic mass of the elements increased the frequency also increased.
- Moseley then assigned a unique whole number to each element and called it the atomic number.

How did this change the Mendeleev's Periodic Table?

- This allowed elements such as Argon, which has a greater atomic mass, to be placed before Potassium.
- It also allowed others to determine fully the number of “holes” in the periodic table.



Glenn Seaborg and Actinoid Series



- After discovering U, Th, Pa, Seaborg was advised to revise the periodic table.
- After examining the properties of the elements, Seaborg was convinced that the elements were part of the inner transition elements because they behaved similarly to these elements.
- Instead of creating a new system, he integrated the elements into a new section called the actinoid series, which is part of the inner transition elements.

Modern Periodic Law

- Elements are placed on the table according to increasing atomic number.
- Trends and properties are a result of the similar atomic structure in a family.



Dmitri
Mendeleev

Moseley

