Development of the Periodic Table

History of the Periodic Table

Early Attempts to Classify the Elements

- **Element arrangement by Atomic mass:**

Before the discovery of subatomic particles (protons, neutrons and electrons), scientists attempted to arrange the elements based on their atomic mass. By focusing mainly on the atomic mass of the element, the chemical properties of some elements were overlooked. This led to inconsistencies, as some elements were placed in the wrong groups.

- **Earlier Periodic models :**

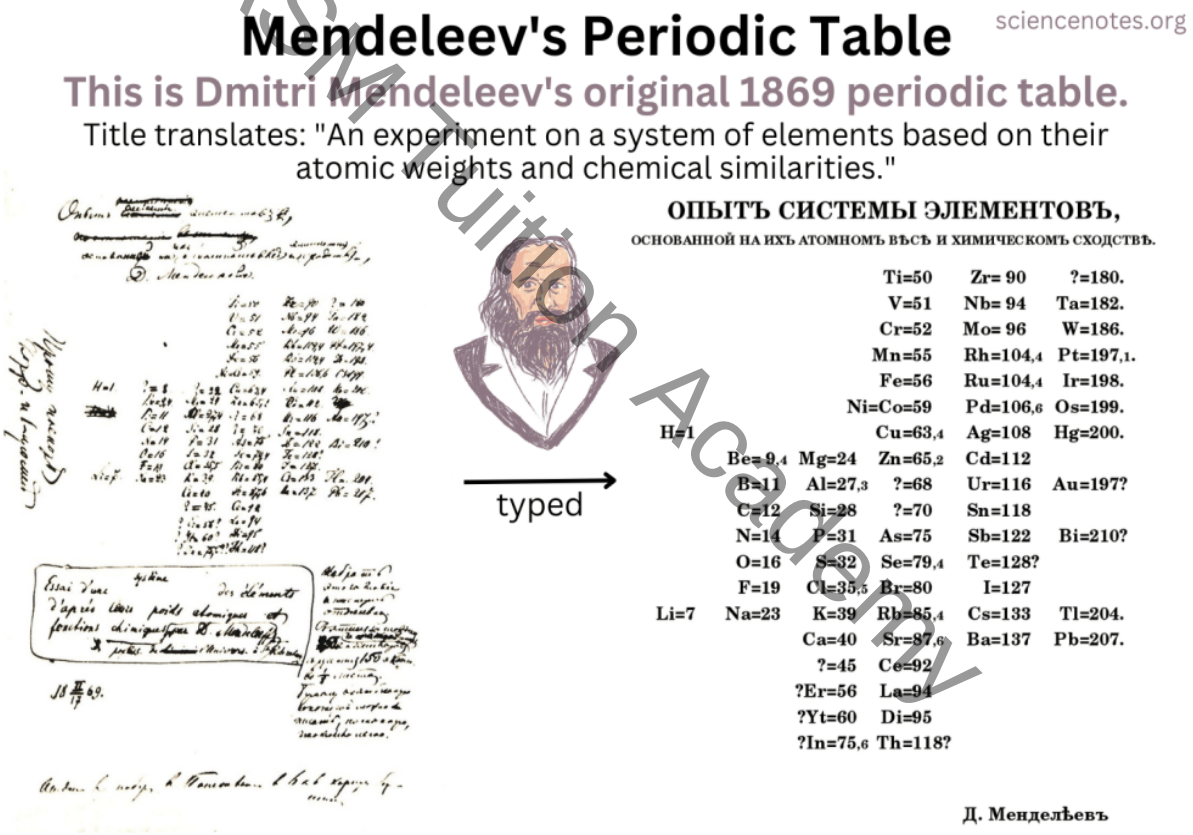
Earlier models of the periodic table had gaps. Scientists sometimes placed elements in the wrong spots when trying to fill these gaps. As a result, the earlier models of the periodic table were very incomplete.

Mendeleev's periodic table

- In 1869, a Russian chemist called Dmitri Mendeleev created the first modern periodic table.
- Mendeleev arranged the elements in order of increasing atomic mass. However, he also took into account the chemical and physical properties of the elements and their compounds.
- Mendeleev identified patterns with chemically similar elements, as they naturally fell into the same columns. This made it easier to predict the properties of new elements.
- He also changed the order of elements when possible to fit the pattern. This made it much easier to find elements with similar properties.
- At that time, protons had not been discovered, so Mendeleev made predictions based on the properties of the known elements.

Gaps in Periodic Table

- Mendeleev left gaps for the elements that had not yet been discovered at that time. He realized that he could predict the properties of the undiscovered elements by looking at trends and the properties of elements near the gap.
    - **For example,** he predicted the properties of **'eka-silicon'**, which is now known as germanium.
- Mendeleev's approach proved to be successful as the discovery of these missing elements confirmed his predictions.



Swapping elements

- Dmitri Mendeleev was flexible when arranging the elements, as he did not always strictly follow the rule of increasing relative atomic mass.
- For example, even though **tellurium (Te)** has a higher relative atomic mass than **iodine (I),** Mendeleev placed iodine after tellurium. This is because iodine's properties aligned more

closely with those of its group elements (chlorine, fluorine, and bromine). Tellurium was placed after sulfur, oxygen, and selenium, which it closely resembled.

Rows	Groups							
	I	II	III	IV	V	VI	VII	VIII
1	H	-	-	-	-	-	-	-
2	Li	Be	B	C	N	O	F	-
3	Na	Mg	Al	Si	P	S	Cl	-
4	K	Ca	?	Ti	V	Cr	Mn	Fe, Co, Ni, Cu
5	(Cu)	Zn	?	?	As	So	Br	-
6	Rb	Sr	Yt	Zr	Nb	Mo	?	Ru, Rh, Pd, Ag

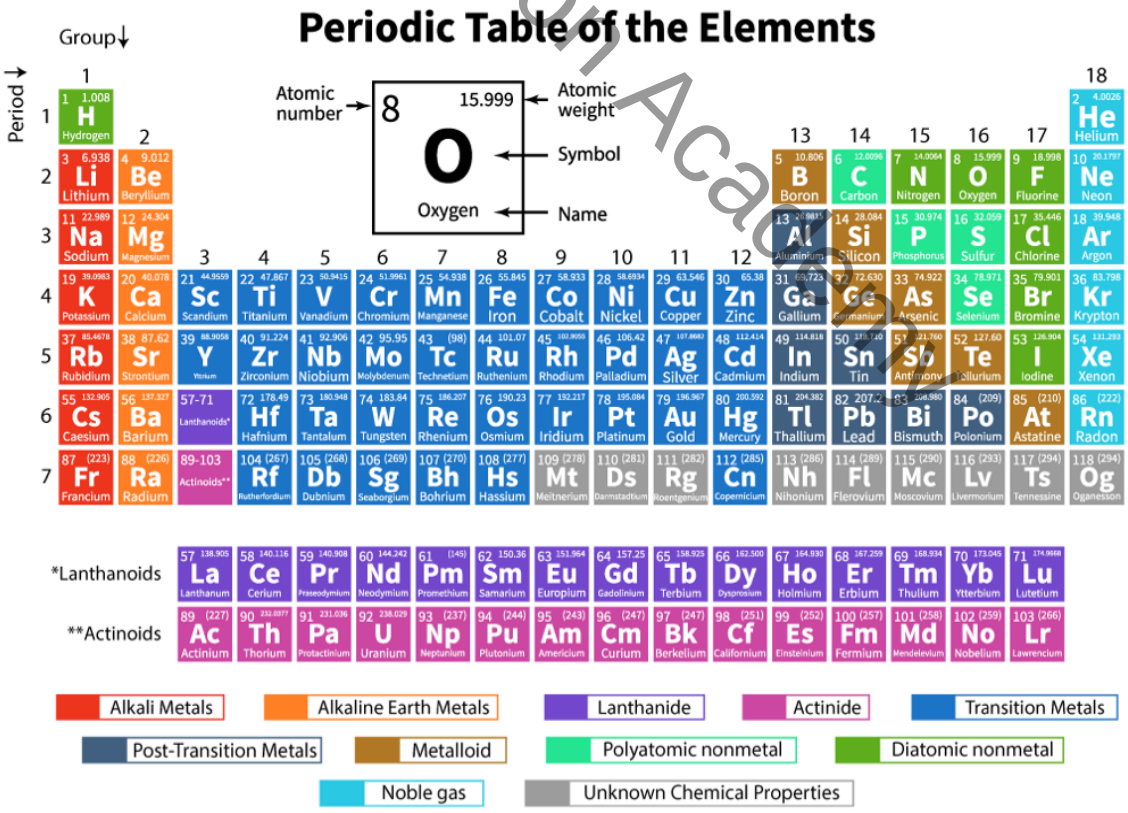
The Modern Periodic Table

➢ Structure of periodic Table same as Mendeleeves periodic table:

The periodic table organizes elements into columns and rows. It generally keeps the same structure as Mendeleev's original design, but it is ordered by atomic number rather than relative atomic mass.

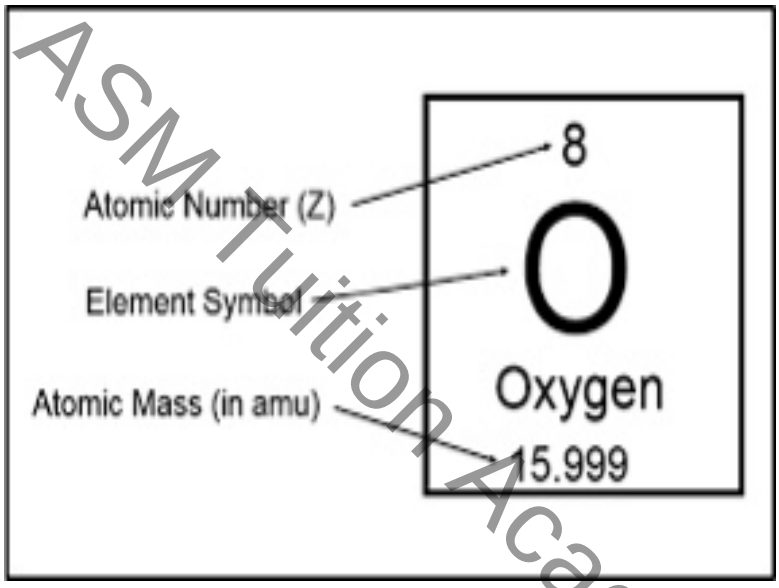
➢ Arrangement of Element by Atomic number:

The arrangement of elements, from top left to bottom right, is based on their increasing atomic number. For example, hydrogen is positioned first with an atomic number of 1, followed by helium with an atomic number of 2. The vertical columns, known as groups, contain elements that have similar chemical properties.



➢ Representations of Elements in Periodic Table:

Each cell (box) in the periodic table displays the element's symbol, atomic number and relative atomic mass. For example, Oxygen has an atomic number of 8 and a relative atomic mass of about15.999.



➢ Categorising Elements

Elements in the periodic table can be categorised in two main ways:

I. **Groups**
II. **Periods**

I- Groups

➢ Elements with similar chemical behaviours are organised within the same group (vertical columns).

- Some groups have specific names; for example, group 7, containing elements like fluorine and chlorine, is known as the halogens.

II- Periods

- The seven horizontal rows are called periods, and this organization is based on the elements' electronic configurations, which indicates the number of electron shells occupied by electrons.

- In other words, the organization is based on the elements' atomic numbers (the number of protons they have.

- For example, iron (Fe), cobalt (Co) and nickel (Ni) have atomic numbers of 26, 27 and 28 respectively, and are placed in the same period because they have electrons in four different energy levels or electron shells.

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Periods are horizontal rows in the periodic table	Groups are vertical columns in the periodic table
Elements within a period have the same highest principal energy level	Elements within a group share the same number of valence electrons
Typically have a variable number of elements, with the first period having only 2 elements and subsequent periods having up to 32 elements	Generally have a more consistent number of elements (usually 8 or 18)
Has 7 periods	Has 18 groups
Properties of elements gradually change when moving from left to right across a period	Elements within the same group have similar chemical and physical properties