

Introduction to the Periodic Table

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Key concepts, historical background, structure, and practical uses

1. What Is the Periodic Table?

- **Definition:** A systematic arrangement of all known chemical elements according to their atomic number, electron configurations, and recurring chemical properties.
 - **Purpose:** Provides a visual map that predicts how elements behave, how they combine, and where new elements might fit.
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2. Historical Development

Year	Scientist(s)	Milestone
1869	Dmitri Mendeleev	First widely accepted table; organized by atomic mass and grouped elements with similar properties. Predicted gaps for undiscovered elements.
1913	Henry Moseley	Discovered that atomic number (Z) – the number of protons – is the proper ordering principle.
1940? 1950s	Glenn T. Seaborg	Added the actinide series and expanded the table to include trans-actinide elements.
2016	IUPAC	Officially recognized elements 113, 115, 117, and 118, completing the seventh period.

3. Layout of the Modern Table

3.1 Periods (Rows)

- **Definition:** Horizontal rows numbered 1–7.
- **Trend:** Each period adds one electron shell; atomic size generally increases down a group, but decreases across a period due to increasing nuclear charge.

3.2 Groups (Columns)

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- **Definition:** Vertical columns numbered 1-18 (IUPAC system).
- **Key families:**
 - **Alkali metals** (Group 1) – highly reactive, one valence electron.
 - **Alkaline earth metals** (Group 2).
 - **Halogens** (Group 17) – very reactive non-metals, seven valence electrons.
 - **Noble gases** (Group 18) – inert gases with full valence shells.
 - **Transition metals** (Groups 3-12) – d-block elements with variable oxidation states.
 - **Lanthanides** (57-71) & **Actinides** (89-103) – f-block series placed below the main table.

3.3 Blocks

- **s-block:** Groups 1-2 + He; valence electrons in s orbital.
 - **p-block:** Groups 13-18; valence electrons in p orbital.
 - **d-block:** Transition metals; valence electrons in d orbital.
 - **f-block:** Lanthanides & actinides; valence electrons in f orbital.
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4. Periodic Trends

Property	Across a Period (left → right)	Down a Group (top → bottom)
Atomic radius	Decreases (greater nuclear pull)	Increases (additional shells)
Ionization energy	Increases (tighter hold on electrons)	Decreases (outer electrons farther from nucleus)
Electronegativity	Increases (stronger attraction for electrons)	Decreases
Metallic character	Decreases (more non-metallic)	Increases
Electron affinity	Becomes more negative (more exothermic)	Slightly less negative

5. How to Read an Element's Box

Section	Information
Atomic number (Z)	Number of protons; defines the element.

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Section

Information

Element symbol One? or two?letter abbreviation