C1.2
The Periodic Table

The Structure of the Periodic Table

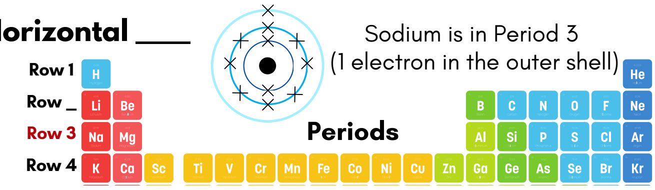
Periods

Named for the regular ________ at which properties ______, a result of _______ arrangement.

Elements are arranged in order of increasing ______ number

Horizontal ____

Sodium is in Period 3
(1 electron in the outer shell)



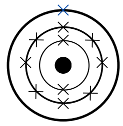
Show the number of electron _____ an atom has
Numbered 1 – 7 (e.g., elements in Period 3 have three shells)

Groups

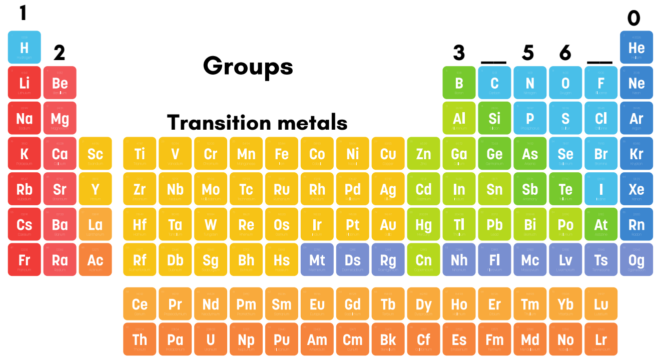
Vertical __________

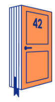
Numbered 1–7 & 0
(0 instead of Group 8)

Show the number of ______ electrons



Sodium is in Group 1
(1 electron in the outer shell)





How Electronic Structure Relates to the Periodic Table

Feature	Periodic Table Connection	Example: Chlorine (2, 8, 7)
Number of shells	Period	3 - Period 3
Number of electrons in outer shell	________	7 outer electrons - Group 7
Total number of electrons	________ number	___

Elements in the same group have similar ________ properties because they have the same number of valence (outer shell) electrons.

Metals vs. Non-Metals

Metals: ___ and _____ of the table.
Non-Metals: _____-hand side.
Metalloids: Border between metals and non-metals.

Property	Metals	Non-Metals
Electrical Conductivity	______________	Poor conductor
Heat Conductivity	Good conductor	______________
Appearance	Shiny	______________
Density	High	Low
Malleability	______________	Brittle
Bonding	____ electrons (form positive ions)	____/share electrons (form negative ions)

Development of the Periodic Table

Early Attempts

Scientists originally arranged elements by atomic __________.

- This method led to errors because __________ were not known.
- Some elements ended up in the wrong _________.

Dmitri Mendeleev

💡Contribution

- Arranged elements by atomic weight while maintaining group properties.
- Left _____ for _____________ elements, predicting their properties.
- Grouped elements with similar __________ properties for better classification.
- Recognised periodic _______, forming the basis for the modern periodic table.

Limitations

- Ordered by atomic weight instead of atomic number, causing some misplacements.
- Lacked knowledge of ___________, affecting atomic weight ordering accuracy.
- Couldn't fully explain periodic trends due to limited understanding of ___________ particles.

The Modern Periodic Table

💡The discovery of protons, neutrons, and electrons led to:

- Ordering elements by atomic _________ (not weight).
- Explanation of "pair __________" due to isotopes.
- Fixing incorrect placements (e.g., Tellurium & Iodine).

In Mendeleev's Periodic Table, Iodine (I) was ordered before Tellurium (Te). The modern table orders them by atomic number, placing Iodine (___ protons) after Tellurium (___ protons).

52 Te Tellurium 127.6	53 I Iodine 126.90447

C1.2 Groups in the Periodic Table

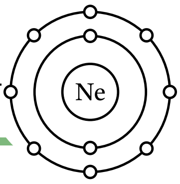
Group 0: Noble Gases

Properties
- Non-_______ and do not easily form _________.
- ____ outer shell of electrons → Very _____ and unreactive (_______)
- Exist as monatomic gases (______ atoms).

Why are Noble Gases Unreactive?

Their outermost shell is full (Helium: 2 electrons, others: 8 electrons).

Since they do not need to _____, _____, or_______ electrons, they do not readily react.



Uses

- _________ — Balloons, cooling superconductors (lighter than air, non-flammable)

- _________ — Used in welding (inert atmosphere)
- _________ — Lights (glows when electricity passes through)

- _________ and _________ — Flash photography, car headlights

Trends in Physical Properties

Boiling points ________ down the group due to larger atom size and mass, resulting in __________ forces that require more __________ to overcome.

Element	Boiling Point (˚C)
Helium (He)	-269
Neon (Ne)	-246
Argon (Ar)	-186
Krypton (Kr)	-153
Xenon (Xe)	-108
Radon (Rn)	-61

Group	Key Features	Trends in Reactivity
Group 0 (Noble Gases)	Unreactive, full outer shell, low boiling points	No trend (inert gases)
Group 1 (Alkali Metals)	Very reactive, soft, low density, low melting points	Increases down the group
Group 7 (Halogens)	Reactive non-metals, form -1 ions, diatomic	Decreases down the group

Group 1: Alkali Metals

Properties
- _____ metals that can be cut with a knife
- _____ melting points; _________ down the group.
- Low ________ (Lithium, Sodium, and Potassium are less ______ than water).
- 1 electron in outer shell → Very _______

Trends in Physical Properties

Reactivity increases down a group due to additional electron ________, which position outer electrons _______ from the _________. This distance _________ the attraction from the nucleus, making it ______ to _____ outer electrons and thus increasing reactivity.

Element	Density	Melting Point (˚C)	Reactivity
Lithium (Li)	0.53 g/cm³	181˚C	Least reactive
Sodium (Na)	0.97 g/cm³	98˚C	More reactive
Potassium (K)	0.86 g/cm³	63˚C	Even more reactive
Rubidium (Rb)	1.53 g/cm³	39˚C	Highly reactive
Caesium (Cs)	1.93 g/cm³	28˚C	Extremely reactive
Francium (Fr)	Unstable	~27˚C	Most reactive (rare and radioactive)

Reactions of Halogens

With Metals → Forms _____ metal halides (_____).
Equation: Metal + Halogen → Metal Halide
Example: $2Na + Cl_2 \rightarrow$ ______ (sodium chloride).

With Hydrogen → Forms hydrogen halides (covalent)
Equation: $H_2 + X_2 \rightarrow$ ______
Example: $H_2 + Cl_2 \rightarrow$ _______ (hydrogen chloride)

Displacement Reactions: A more reactive halogen displaces a less reactive halogen from its salt solution
Reactivity Order: $Cl_2 > Br_2 > I_2$.
Examples:
$Cl_2 + 2KBr \rightarrow$ ___________
- Chlorine displaces bromine

$Br_2 + 2KI \rightarrow$ ___________
- Bromine displaces iodine

Reactions of Alkali Metals

With Water → Produces hydrogen gas & a metal hydroxide (alkaline solution).
Equation: $2M\ (s) + 2H_2O\ (l) \rightarrow$ _____ (aq) + ____ (g)
Observations:
- Lithium: Fizzes _______, moves slowly.
- Sodium: More ________, forms a ball, dissolves _______.
- Potassium: _________ reaction, lilac flame, may explode

With Oxygen → Forms metal oxides.
Equation: $4M\ (s) + O_2\ (g) \rightarrow$ _____ (s)
Observation: Forms a dull oxide coating when exposed to _____.

With Chlorine → Forms metal chlorides (white solids).
Equation: $2M\ (s) + Cl_2\ (g) \rightarrow$ _____ (s)
Observation: The reaction becomes more _________ down the group.

Group 7: Halogens

Properties
- Can be toxic and are highly _______.
- Non-metals with __ electrons in the outer shell.
- Exist as ___atomic molecules (e.g., Cl_2, Br_2).
- Reactivity __________ down the group.

Trends in Physical Properties

Melting and boiling points _______ down the group due to larger atoms leading to _________ intermolecular forces, which require _____ energy to overcome.

Element	State at Room Temperature	Colour	Boiling Point (˚C)
Fluorine (F_2)	Gas	Pale yellow	-188˚C
Chlorine (Cl_2)	Gas	Green	-35˚C
Bromine (Br_2)	Liquid	Red-brown	59˚C
Iodine (I_2)	Solid	Dark grey	184˚C
Astatine (At_2)	Solid	Black	302˚C

Reactivity _________ down the group due to:
- More electron _______, placing the outer shell further from the _________.
- ________ attraction for an extra electron.
- _________ is the most reactive; iodine and astatine are the least reactive.