

CHAPTER 3

Classification of Elements & Periodicity

CBSE · Chemistry · Class 11

WHAT THIS CHAPTER DOES

Boards prep that builds confidence, not anxiety.

TODAY'S MISSION

Today's Mission

WHY THIS MATTERS

Why this chapter matters

TOPIC

A

Part A — Why classify? From Mendeleeev to Moseley

TOPIC

The road to the modern periodic table

POINT 1

POINT 2

POINT 3

POINT 4

TOPIC

Anatomy of the modern periodic table

TOPIC

IUPAC nomenclature for $Z > 100$

TOPIC

B

Part B — The Four Blocks

WORKED EXAMPLE

Worked Example 1 — Position from configuration

TOPIC

Personality of each block

POINT 1

POINT 2

POINT 3

POINT 4

TRY IT · SOLVE BEFORE YOU PEEK

Quick Test — Identify the block

An element has configuration $[\text{Kr}] 4d^{10} 5s^2 5p^4$. Which block does it belong to?

SOLUTION

ANSWER 1

TOPIC

C

Part C — Atomic & Ionic Radii

TOPIC

Three meanings of 'atomic radius'

POINT 1

POINT 2

POINT 3

POINT 4

TOPIC

Atomic radius — sample trends (pm)

TOPPER TEMPLATE · MARK-BY-MARK

Topper template — Isoelectronic ordering

- 1 CONFIRM
ISOELECTRONIC**
- 2 WRITE Z FOR EACH**
- 3 APPLY THE RULE**
- 4 FINAL ORDER**

TOPIC

D

Part D — Ionisation Enthalpy & Anomalies

WORKED EXAMPLE

Worked Example 2 — Why $IE_1(N) > IE_1(O)$?

TOPIC

Ionisation enthalpies across period 2 (kJ/mol)

TOPIC

E

Part E — Electron Gain Enthalpy & Electronegativit y

TOPIC

Master rules for EGE and EN

WORKED EXAMPLE

Worked Example 3 — Why $\Delta_{\text{egH}}(\text{F})$ is less negative than $\Delta_{\text{egH}}(\text{Cl})$?

PYQ PATTERNS

PYQ patterns — what examiners ask

MARKS DISTRIBUTION

Sub-topic mark distribution

TOPIC

Anomalous 2nd-period + diagonal relationship

POINT 1

POINT 2

POINT 3

POINT 4

TOPPER TEMPLATE · MARK-BY-MARK

Why is IE_1 of N greater than O (2-3 marks)

- | | | |
|----------|---|---|
| 1 | WRITE CONFIGURATIONS
1 m | N ($Z=7$): $1s^2 2s^2 2p^3$ — three 2p electrons singly occupy each of $2p_x$, $2p_y$, $2p_z$ (half-filled). O ($Z=8$): $1s^2 2s^2 2p^4$ — one pair in one 2p orbital, two unpaired. |
| 2 | IDENTIFY THE SOURCE OF ANOMALY
1 m | Half-filled $2p^3$ of N has EXTRA STABILITY due to symmetric distribution and maximum exchange energy. Removing an electron from N requires breaking this stability. |
| 3 | CONCLUSION
1 m | Removing one electron from O ($2p^4$) gives the stable $2p^3$ configuration — energetically favourable. Hence $IE_1(N) = 1402 \text{ kJ/mol} > IE_1(O) = 1314 \text{ kJ/mol}$ despite O having higher Z . |

TOPPER TEMPLATE · MARK-BY-MARK

Explain atomic radius trend across period / down group (3 marks)

- 1 ACROSS A PERIOD — DECREASES**
1 m
Across a period (left → right), nuclear charge Z increases by 1 per element while electrons are added to the SAME shell. Effective nuclear charge Z_{eff} rises; the electron cloud is pulled in. Example: Na (186 pm) → Cl (99 pm) across period 3.
- 2 DOWN A GROUP — INCREASES**
1 m
Down a group (top → bottom), a new principal shell is added with each row. The increase in n outweighs the increase in Z because inner electrons SHIELD outer ones. Example: Li (152 pm) → Cs (262 pm) down group 1.
- 3 DEFINE + NOTE**
1 m
Atomic radius = half the distance between two nuclei in a homonuclear bond (covalent radius). For metals: half of nearest-neighbour distance in crystal (metallic radius). For noble gases: van der Waals radius (always largest of the three types).

TOPPER TEMPLATE · MARK-BY-MARK

Arrange isoelectronic species in order of size (2-3 marks)

**1 IDENTIFY THE SPECIES
+ ELECTRON COUNT**

1 m

Example: O^{2-} , F^- , Na^+ , Mg^{2+} , Al^{3+} . All have 10 electrons (Ne configuration). They are ISOELECTRONIC.

**2 APPLY THE RULE:
HIGHER Z $\rightarrow$ SMALLER
RADIUS**

1 m

Among isoelectronic species, the one with HIGHER nuclear charge pulls the same number of electrons more tightly. Z values: O=8, F=9, Na=11, Mg=12, Al=13.

3 WRITE THE ORDER

1 m

Increasing radius: Al^{3+} (53 pm) < Mg^{2+} (72 pm) < Na^+ (102 pm) < F^- (133 pm) < O^{2-} (140 pm). ✓

PYQ PATTERNS

Top PYQ patterns to drill

#1	Explain anomalous trend: why is ionisation enthalpy of N ($Z=7$) greater than O ($Z=8$)? OR Why is IE_1 of Be > B? (2 marks)	85%
#2	Arrange / explain trend in atomic radius / ionic radius across a period or down a group (3 marks)	80%
#3	Explain trend in electronegativity / electron gain enthalpy across period / group; account for exception (F vs Cl) (3 marks)	65%
#4	Predict block, period, group of an element from its electronic configuration (2 marks)	60%
#5	Anomalous properties of 2nd-period elements + diagonal relationship (Li-Mg, Be-Al, B-Si) (3 marks)	50%

RECAP · MEMORISE THESE

90-second recap

WHAT'S NEXT

Next class



Practice now

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