

CHEMISTRY • CLASS 11

3

CHAPTER

Classification of Elements and Periodicity in Properties

NCERT SOLUTIONS



EXERCISE SOLUTIONS: 3.1-3.3

3.1 What is the basic theme of organisation in the periodic table?

Answer: Elements are arranged systematically so that similar properties recur at regular intervals. Elements with similar properties are placed in the same group. This makes their study and prediction of properties easier.

3.2 Which property did Mendeleev use to classify elements? Did he always follow it?

Answer: He mainly used increasing atomic mass. He did not follow this order rigidly: chemical similarity took priority when a strict mass order put an element in the wrong group.

3.3 How do Mendeleev's Periodic Law and the Modern Periodic Law differ?

Answer: Mendeleev: physical and chemical properties are periodic functions of atomic masses.
Modern law: they are periodic functions of atomic numbers.
Mendeleev → atomic mass; modern → atomic number.

EXERCISE SOLUTIONS: 3.4

3.4 Use quantum numbers to explain why the sixth period has 32 elements.

Answer: The sixth period involves filling these subshells in the Aufbau sequence. Each orbital holds at most two electrons.

Subshell	l	Orbitals ($2l + 1$)	Capacity
6s	0	1	2
4f	3	7	14
5d	2	5	10
6p	1	3	6

Total orbitals = $1 + 7 + 5 + 3 = 16$

Total electrons = $2 + 14 + 10 + 6 = 32$

Therefore, the sixth period contains 32 elements.

This counts the subshells filled during the period, not all orbitals belonging to the sixth shell.

EXERCISE SOLUTIONS: 3.5-3.8

3.5 Locate the element with $Z = 114$ by period and group.

Answer: Flerovium (Fl): $[\text{Rn}] 5f^{14} 6d^{10} 7s^2 7p^2$

Period 7; group 14; p-block

The highest occupied shell gives the period; four outer-shell electrons place it in this group.

3.6 Give the atomic number of the element in period 3, group 17.

Answer: Chlorine (Cl): $Z = 17$

$[\text{Ne}] 3s^2 3p^5$

3.7 Which names are associated with (i) Lawrence Berkeley Laboratory and (ii) Seaborg's group?

Answer:

(i) Lawrencium (Lr), $Z = 103$; Berkelium (Bk), $Z = 97$

(ii) Seaborgium (Sg), $Z = 106$

These names honour Lawrence, Berkeley and Seaborg, respectively.

3.8 Why do elements of one group show similar physical and chemical properties?

Answer: They have similar valence-shell electronic configurations. Their bonding and chemical behaviour are therefore similar, while physical properties change gradually down the group.

EXERCISE SOLUTIONS: 3.9

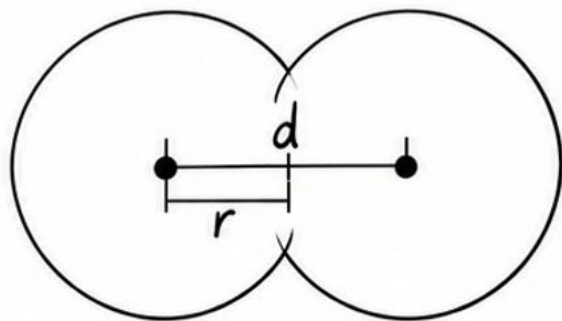
3.9 What do atomic radius and ionic radius mean?

Answer:

Atomic radius measures atomic size. Since an electron cloud has no sharp edge, radius is defined from distances between nuclei.

Covalent radius: half the distance between two identical atoms joined by a single covalent bond.

$$r(\text{covalent}) = \frac{d}{2}$$



Metallic radius: half the nearest-neighbour internuclear distance in a metallic crystal.

Answer:

Ionic radius is the effective size of an ion in an ionic crystal. It is assigned using measured distances between neighbouring ions.

Nearest cation-anion distance $\approx r(\text{cation}) + r(\text{anion})$

A cation is generally smaller than its parent atom.
An anion is generally larger.

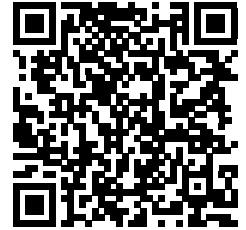


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