Periodic Classification of Elements

NCERT IN-TEXT QUESTIONS SOLVED

Q1. *Did Döbereiner's triads also exist in the columns of Newland's Octaves? Compare and find out.*

Ans. Yes, it exists in the Newland's octave. It is Li, Na and K.

Q2. *What were the limitations of Döbereiner's classification?*

Ans. (*a*) All the existing elements were not classified.

(*b*) Döbereiner could identify only three triads from the elements.

Hence this system was not useful.

Q3. *What were the limitations of Newlands' Law of Octaves?*

Ans.
- Newlands' law was applicable only till calcium, after Ca, every eighth element did not possess properties similar to first.
- New elements discovered did not fit into the law.
- Wrong order of arrangement of elements was done, e.g. Co and Ni do not resemble halogen were found together in same slot, Fe being similar to Co and Ni was separated and kept in different slot.

Q4. *Use Mendeleev's Periodic Table to predict the formulae for the oxides of the following elements:*

K, C, Al, Si, Ba

Ans.

Element	*Group No.*	*Formula*
K	1	K_2O
C	4	CO_2
Al	3	Al_2O_3
Si	4	SiO_2
Ba	2	BaO

Q5. *Besides gallium, which other elements have since been discovered that were left by Mendeleev in his Periodic Table?* (any two)

Ans. Besides gallium, germanium and scandium have been discovered.

Q6. *What were the criteria used by Mendeleev in creating his Periodic Table?*

Ans. (*i*) Increasing order of atomic mass of the elements.

(*ii*) All elements in a group with similar properties.

(*iii*) The formula of oxides and hydrides formed by an element.

Q7. *Why do you think noble gases are placed in a separate group?*

Ans. Noble gases are inactive, do not resemble other elements and all of them show same properties, hence they are grouped separately.

Q8. *How could the Modern Periodic Table remove various anomalies of Mendeleev's Periodic Table?*

Ans. Modern Periodic Table is based on the atomic number of elements, therefore
(*i*) problem of isotopes was solved because isotopes have same atomic number
(*ii*) wrong order of Ar, K, Co, Ni was removed.

Q9. *Name two elements you would expect to show chemical reactions similar to magnesium. What is the basis for your choice?*

Ans. Calcium and barium.

Reason : (*i*) Both of them belong to same group as magnesium.

(*ii*) Ba and Ca has same valence electrons as Mg, and will show same properties as of magnesium.

Q10. *Name:*

(*a*) *Three elements that have a single electron in their outermost shells.*

(*b*) *Two elements that have two electrons in their outermost shells.*

(*c*) *Three elements with filled outermost shells.*

Ans.

(*a*)	Li, (2, 1)	Na, (2, 8, 1)	K (2, 8, 8, 1)
(*b*)	Be, (2, 2)	Mg (2, 8, 2)	
(*c*)	He, (2)	Ne, (2, 8)	Ar (2, 8, 8)

Q11. (*a*) *Lithium, sodium, potassium are all metals that react with water to liberate hydrogen gas. Is there any similarity in the atoms of these elements?*

(*b*) *Helium is an unreactive gas and neon is a gas of extremely low reactivity. What, if anything, do their atoms have in common?*

Ans. (*a*) All these metals are highly reactive, they have same valence electrons *i.e.* 1 and can readily loose electrons to become positive ions.

(*b*) Helium and neon have completely filled outermost shell.

Q12. *In the Modern Periodic Table, which are the metals among the first ten elements.*

Ans. Lithium and beryllium are metals.

Q13. *By considering their position in the Periodic Table, which one of the following elements would you expect to have maximum metallic characteristics?*

Ga, Ge, As, Se, Be

Ans. Among the given elements Be will show maximum metallic characteristics as it belongs to extreme left of the Periodic Table.

QUESTIONS FROM NCERT TEXTBOOK

Q1. *Which of the following statements is not a correct statement about the trends when going from, left to right across the periods of the Periodic Table?*

(a) The elements become less metallic in nature.

(b) The number of valence electrons increases.

(c) The atoms lose their electrons more easily.

(d) The oxides become more acidic.

Ans. (*c*) The atoms lose their electrons more easily.

Q2. *Element X forms a chloride with the formula XCl_2, which is a solid with a high melting point. X would most likely be in the same group of the Periodic Table as*

(a) Na *(b) Mg* *(c) Al* *(d) Si*

Ans. (*b*) Mg.

Q3. *Which element has*

(a) two shells, both of which are completely filled with electrons?

(b) the electronic configuration 2, 8, 2?

(c) a total of three shells, with four electrons in its valence shell?

(d) a total of two shells, with three electrons in its valence shell?

(e) twice as many electrons in its second shell as in its first shell?

Ans. (*a*) Ne (2, 8) (*b*) Mg (2, 8, 2)

(*c*) Si (2, 8, 4) (*d*) B (2, 3)

(*e*) C (2, 4)

Q4. (*a*) *What property do all elements in the same column of the Periodic Table as boron have in common?*

(*b*) *What property do all elements in the same column of the Periodic Table as fluorine have in common?*

Ans. (*a*) All other elements have same valence electrons and their valency is 3.

(*b*) All are non-metals, they have same valence electrons *i.e.*, 7 and their valency is 1, all of them gain electrons to form negative ions.

Q5. *An atom has electronic configuration 2, 8, 7.*

(a) What is the atomic number of this element?

(b) To which of the following elements would it be chemically similar?

(Atomic numbers are given in parentheses)

N (7) F(9) P(15) Ar (18)

Ans. (*a*) The atomic number of the element is 17.

(*b*) F(9) (2, 7) will be chemically similar to the given element.

Q6. *The position of three elements A, B and C in the Periodic Table are shown below:*

Group 16	*Group 17*
—	—
—	A
—	—
B	C

(*a*) *State whether A is a metal or non-metal.*

(*b*) *State whether C is more reactive or less reactive than A.*

(*c*) *Will C be larger or smaller in size than B?*

(*d*) *Which type of ion, cation or anion, will be formed by element A?*

Ans. (*a*) 'A' is non-metal.

(*b*) 'C' is less reactive than 'A'

(*c*) 'C' is smaller in size than 'B'

(*d*) 'A' will form negatively charged ion — Anion

Q7. *Nitrogen (atomic number 7) and phosphorous (atomic number 15) belong to group 15 of the Periodic Table. Write the electronic configuration of these two elements. Which of these will be more electronegative? Why?*

Ans. Nitrogen atomic number 7 → 2, 5

Phosphorus atomic number 15 → 2, 8, 5

Nitrogen with two shells will be more electronegative because it can easily gain electron due to its smaller size of atom, the nuclear charge attracts the electron easily to become negative ion.

Q8. *How does the electronic configuration of an atom relate to its position in the Modern Periodic Table?*

Ans. The position of element depends upon its electronic configuration. The number of shells is equal to the period number. The valence electrons decides the group number in which it will be, elements with 1 valence electrons belong to group 1.

Elements with 2 valence electrons belong to group 2.

Q9. *In the Modern Periodic Table, calcium (atomic number 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these have physical and chemical properties resembling calcium.*

Ans. Ca atomic number — 20

Electronic configuration — 2, 8, 8, 2

Elements with atomic number 12 → 2, 8, 2

and atomic number 38 → 2, 8, 18, 8, 2

will resemble calcium as they all have same valence electrons and their chemical properties are also same.

Q10. *Compare and contrast the arrangement of elements in Mendeleev's Periodic Table and the Modern Periodic Table.*

Ans.

Mendleev's Periodic Table	***Modern Periodic Table***
1. It has 8 groups and 6 periods.	It has 18 groups and 7 periods.
2. Transition elements are not separated.	Transition elements are given separate place.
3. The inert gases were not present.	The inert gases are present in separate group.
4. Lanthanides and Actinides were not present.	Lanthanides and Actinides are at the bottom of the Periodic Table.
5. Position of element *i,e.*, group number and period number cannot be predicted.	Group number and period number can be predicted from its electronic configuration.
6. Elements are arranged according to the atomic mass.	Elements are arranged according to the atomic number.

MORE QUESTIONS SOLVED

I. MULTIPLE CHOICE QUESTIONS

1. 14 elements after actinium is called

(*a*) Lanthanides (*b*) Actinides

(*c*) *d*-block elements (*d*) *p*-block elements

2. An element has an atomic number of 15 with which of the following elements will it show similar chemical properties?

(*a*) Be(4) (*b*) Ne(10)

(*c*) N(7) (*d*) O(8)

3. The group number and period number respectively of an element with atomic number 8 is

(*a*) 6, 2 (*b*) 16, 2

(*c*) 6, 8 (*d*) 16, 4

4. An element belongs to period 2 and group 2 the number of valence electrons in the atoms of this element is

(*a*) 2 (*b*) 4

(*c*) 3 (*d*) 1

5. In the third period of the Periodic Table the element having smallest size is

(*a*) Na (*b*) Ar

(*c*) Cl (*d*) Si

6. Electronic configuration of Al^{+3} is

(*a*) 2, 8, 3 (*b*) 2, 8, 8

(*c*) 2, 8 (*d*) 2, 8, 8, 3

7. The increasing order of the atomic radii of elements Na, Rb, K, Mg is

(*a*) Na < K < Mg < Rb (*b*) K < Na < Mg < Rb

(c) Na < Mg < K < Rb (d) Mg < Na < K < Rb

8. Which of the following sets does not belong to a group?

(*a*) Li, Na, K (*b*) B, C, N

(*c*) B, Al, Ga (*d*) O, S, Se

9. An element with atomic number will form a basic oxide _____.

(*a*) 7 (*b*) 17

(*c*) 14 (*d*) 11

10. Element belonging to which of the following atomic numbers 11, 19, 14, 18, 23 belong to the same period?

(*a*) 11, 14, 23 (*b*) 11, 18, 20

(*c*) 11, 14, 18 (*d*) 14, 19, 23

11. The correct order of the increasing radii of the elements Na, Si, Al and P is

(*a*) Si, Al, P, Na (*b*) P, Si, Al, Na

(*c*) Al, Si, P, Na (*d*) Al, P, Si, Na

12. Identify the group which is not a Döbereiner triad

(*a*) Li, Na, K (*b*) Be, Mg, Cr

(*c*) Ca, Sr, Ba (*d*) Cl, Br, I

13. Which is not true about noble gases?

(*a*) They are non-metallic in nature (*b*) They exist in atomic form

(*c*) They are radioactive in nature (*d*) Xenon is the most reactive among these

14. Which of the given elements A, B, C, D, and E with atomic number 3, 11, 15, 18, 19 respectively belong to the same group

(*a*) A, B, C (*b*) B, C, D

(*c*) A, D, E (*d*) A, B, E

15. Identify the wrong sequence of the elements in a group

(*a*) Ca, Sr, Ba (*b*) Cu, Au, Ag

(*c*) N, P, As (*d*) Cl, Br, I

16. Two elements X and Y have —

(*i*) X has 17 protons 18 neutrons

(*ii*) Y has 17 protons and 20 neutrons

Both X and Y are—

(*a*) Isobars (*b*) Isotopes

(*c*) Isotones (*d*) None of the above

17. Mendeleev predicted the existence of two elements and named them as *eka*-silicon and *eka*-aluminium. Identify the elements which took their position at later stage

(*a*) Si and Ge (*b*) Si and Ga

(*c*) Ge and Ga (*d*) Si and Al

18. An element 'X' is placed in group 13 and third period of the Periodic Table. It burns in oxygen to form an oxide which is amphoteric in nature. Identify the chemical formula of its chloride

(*a*) CCl_4 (*b*) BCl_2

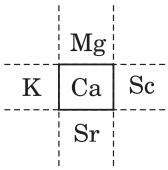
(*c*) $GaCl_3$ (*d*) $AlCl_3$

19. The element with atomic number 3 to 10 belong to the second period. Identify the most electropositive and most electronegative element.

(*a*) F, Li (*b*) Li, F

(*c*) Li, Ne (*d*) Ne, Li

20. In the Modern Periodic Table calcium (Z = 20) is surrounded by the elements with atomic numbers 12, 19, 21, and 38 which of the following will have physical and chemical properties resembling calcium.



(*a*) 12, 20, 38 (*b*) 12, 19, 20, 38

(*c*) 19, 20, 38 (*d*) 12, 19, 20

21. An element X (2, 8, 2) combines separately with $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. The chemical formulae of the compounds are

(*a*) X_2SO_4 : $X_3(PO_4)_2$ (*b*) XSO_4 : $X_3(PO_4)_2$

(*c*) $X(SO_4)_2$: $X_2(PO_4)_3$ (*d*) XSO_4 : $X_3(PO_4)_3$

22. Two elements X and Y belong to group 1 and 2 respectively in the same period. The formulae of this oxides are

(*a*) XO, YO (*b*) X_2O, YO

(*c*) X_2O, Y_2O (*d*) XO, YO_2

23. In the Modern Periodic Table, the metals among the first ten elements are—

(*a*) Be, Na (*b*) Li, Be

(*c*) Be, Li, Na (*d*) Li, Na

24. Which of the following has maximum non-metallic character?

(*a*) F (*b*) Br

(*c*) Cl (*d*) I

25. Arrange the following elements into the increasing order of their metallic character along a period.

(*a*) S < Si < P < Al (*b*) S < P < Si < Al

(*c*) Si < P < S < Al (*d*) Si < S < P < Al

26. Which of the following is not the characteristics of isotopes of an element?

Isotopes of an element

(*a*) show same atomic mass

(*b*) show same atomic number

(*c*) occupy same position in the Periodic Table

(*d*) show same chemical properties

Answers

1. (*b*)	**2.** (*c*)	**3.** (*a*)	**4.** (*a*)	**5.** (*b*)	**6.** (*c*)	**7.** (*c*)
8. (*b*)	**9.** (*d*)	**10.** (*c*)	**11.** (*b*)	**12.** (*b*)	**13.** (*c*)	**14.** (*b*)
15. (*b*)	**16.** (*b*)	**17.** (*c*)	**18.** (*d*)	**19.** (*b*)	**20.** (*a*)	**21.** (*b*)
22. (*b*)	**23.** (*d*)	**24.** (*a*)	**25.** (*b*)	**26.** (*a*)		

II. VERY SHORT ANSWER TYPE QUESTIONS (*1 Mark*)

Q1. *Give one example of Döbereiner's Triad.*

Ans.

Li,	Na,	K
7	23	39

Q2. *How many triads could Döbereiner identify from the existing elements then?*

Ans. Döbernier could identify only three triads.

Q3. *What is the limitation of Döbereiner triads?*

Ans. He failed to arrange all the elements in triads having same chemical properties.

Q4. *What was the basis of classification of elements made by Newlands?*

Ans. Newlands arranged the elements in the order of increasing atomic masses.

Q5. *Give two limitations of Newlands' law of Octaves.*

Ans. Two limitations of Newlands' law of octaves are:

(*i*) The law was applicable only upto calcium.

(*ii*) In order to fit elements into his table, Newlands adjusted two elements in wrong slot, and grouped unlike elements in same groups.

Q6. *On what basis did Mendeleev classified the element?*

Ans. Mendeleev arranged the elements on the basis of their increasing atomic mass and similarity of chemical properties.

Q7. *Which two chemical properties were considered by Mendeleev for grouping of elements?*

Ans. The two chemical properties are:

(*a*) The nature of compounds formed by elements with oxygen.

(*b*) The nature of compounds formed by elements with hydrogen.

Q8. *State Mendeleev's Periodic Law.*

Ans. The properties of elements are the Periodic Function of their atomic masses.

Q9. *Define 'groups and periods'.*

Ans. The vertical columns in a Periodic Table are called groups and the horizontal rows are called periods.

Q10. *What is the formula of oxide and hydride of Group I elements?*

Ans. Oxide formula $\rightarrow R_2O$

Hydride formula $\rightarrow$ RH.

'R' represents element.

Q11. *Name three elements discovered later, which filled gaps left by Mendeleev for them.*

Ans. Scandium, gallium and germanium.

Q12. *What are isotopes?*

Ans. Isotopes are the atoms of same element having same atomic number but different mass number.

e.g., $^{12}_{6}C$ $^{14}_{6}C$

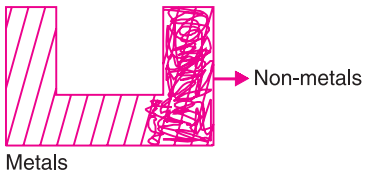
$^{1}_{1}H$ $^{2}_{1}H$ $^{3}_{1}H$

Q13. *How many groups and periods are present in the Modern Periodic Table?*

Ans. Modern Periodic Table has 18 groups and 7 periods.

Q14. *What is the location of metals and non-metals in the Modern Periodic Table?*

Ans. Metals are placed on the left side and non-metals are placed on the right side of the Periodic Table.



Q15. *State Modern Periodic Law.*

Ans. 'Properties of elements are a periodic function of their atomic number'.

Q16. *In Modern Periodic Table what is common among all the elements in a group.*

Ans. All elements in same group shows same valence electrons and same chemical properties.

Q17. *Fluorine (F) atomic number 9 and chlorine (Cl) atomic number = 17 are placed in group number17, what are the number of valence electrons present in them.*

Ans. Fluorine atomic number 9 = 2, 7

Chlorine atomic number 17 = 2, 8, 7

Both of them show 7 valence electron.

Q18. *What is common among all the elements present in one period?*

Ans. All the elements in same period show same number of shells e.g., all elements in period 3, show 3 electron shells each.

Q19. *How many elements are present in first, second, third and fourth period?*

Ans.

Period number	***Shell***	***Formula***	***Max. Electron in valence shell***	***Elements in a period***
1.	K	$2n^2$	2	2
2.	L	$2n^2$	8	8
3.	M	$2n^2$	8	8
4.	N	$2n^2$	8	18

Q20. *What is atomic size?*

Ans. The radius of an atom, *i.e.*, the distance between the centre of the nucleus and the outermost shell of an atom is called atomic size.

The atomic radius is measured in picometre. (1 pm = 10^{-12} m)

Q21. *What happens to the size of atom as we move from left to right in a period.*

Ans. The atomic size in a period decreases as we move from left to right.

Q22. How does the tendency to lose electrons will change in a period.

Ans. The tendency to lose electrons will decrease across a period as the effective nuclear charge acting on the valence shell electrons increases.

Q23. How do you think the tendency to lose electrons will change in a group?

Ans. Down the group, the effective nuclear charge experienced by valence electrons decreases, hence they can easily lose electrons.

Q24. *How was the anomaly in arrangement of elements in the Mendeleev's Periodic Table removed?*

Ans. When elements were arranged in the increasing order of atomic number. The anomalies of Mendeleev's Periodic Table were removed.

Q25. *What are noble gases/inert gases?*

Ans. The element which is inactive, does not react with any other element and it has its outermost shell completely filled are called inert gases or noble gases.

e.g., He, Ne, Ar, Xe.

Q26. *Name two alkali metals present in Group I.*

Ans. Alkali metals are Li, Na, K.

Q27. *An element 'X' belongs to II group and 2nd period. Write the atomic number and name of element.*

Ans. K L ∴ Atomic Number = 4

2, 2 Element = Beryllium

Q28. *An element 'A' has atomic number 11, name the period and group number to which it belongs.*

Ans. 'A' — atomic number = 11

Electronic configuration = K L M

2, 8, 1

∴ Period number = Shell No. = 3

Group number = Valence electron = 1

Q29. *An element 'P' belongs to group = 2 and period = 3, state whether it is a metal or non-metal and nature of its oxides.*

Ans. Group 2 = Metals

Nature of oxide = Basic oxide

Q30. *The electronic configuration of an atom is 2, 8, 7. Give its atomic number, nature of oxide.*

Ans. Electronic configuration = 2, 8, 7

∴ Atomic number = 17

Nature of oxide = Acidic oxide

Q31. *An element belongs to group 13 and period 3, name the element and give its valency.*

Ans. The element is Aluminium.

The valency = 3

Q32. *What are metalloids? Give 2 examples.*

Ans. The elements which show some properties of metal and some properties of non-metal are called semi-metals or metalloids. Example — Boron, Silicon, Germanium, Arsenic.

Q33. An element X belongs to group 17 and element Y belongs to group 1. What type of bond will they form?

Ans.

	X	Y
Group Number	17	1
Valency	1 (Non-metal)	1 (Metal)

Both of them will form ionic bond with the formula XY.

Q34. *The following elements belong to same period arrange them in order.*

	X	Y	Z
Atomic Radius →	231	262	242

Ans.

Y	Z	X
262	242	231

The atomic size decreases in a period.

Q35. *What is the valency of magnesium with atomic number 12 and nitrogen with atomic number 7?*

Ans. Magnesium, atomic number = 12

Electronic configuration = 2, 8, 2

∴ Valency = 2

Nitrogen, atomic number = 7

Electronic configuration = 2, 5

∴ Valency = 3

Q36. *How many shells are present in all the elements that belong to period 3?*

Ans. All elements in period 3 contain 3 shells in which the electrons are distributed (K, L, M).

Q37. *What happens to the electropositive character of elements as we move from left to right of the period in the Periodic Table?*

Ans. On moving from left to right in a period, the electropositive character decreases as the tendency to lose electrons decreases.

Q38. *Fluorine, chlorine, bromine belong to same group. What is common between them?*

Ans. All three elements *i.e.* fluorine, chlorine, bromine, have same number of valence electrons and same valency.

Q39. *What are halogens? Where are they located in the Periodic Table?*

Ans. Halogens are those elements which react with metals to form salts. They are present in 17th group of the Periodic Table.

Q40. Atomic number of 4 elements is given below which element will belong to the group of Helium.

W	*X*	*Y*	*Z*
8	15	36	20

Ans. Element Y, with atomic number 36 will belong to the same group as He.

Both are inert gas.

atomic number of Y 36 = 2, 8, 18, 8

atomic number of helium 4 = 2, 2

III. SHORT ANSWER TYPE QUESTIONS (*2 or 3 Marks*)

Q1. *Why Mendeleev could not assign fixed position to hydrogen in the table?*

Ans. (*a*) Hydrogen resembles alkali metal, *i.e.* like alkali metals it combines with halogen, oxygen and sulphur to form compounds with similar formula as alkalis.

(*b*) Like halogen, hydrogen also exists as diatomic molecule and combine with metal and non-metals to form covalent compounds.

Q2. *Name the group number of the following elements, halogens, alkali metals, inert gases, hydrogen, in the Modern Periodic Table.*

Ans. Halogens — group No. 17

Alkali metals — group No. 1

Inert gases — group No. 18

Hydrogen — group No. 1

Q3. *State two characteristics of groups.*

Ans. All the elements in a group have the following characteristics:

(*a*) All element in a group show same number of valence electrons, hence show similar properties.

(*b*) As we move top to bottom in a group the atomic radius goes on increasing and there is a slight gradation in properties.

Q4. *What happens to the valency of elements as we move from left to right in a Periodic Table?*

Ans. As we move from left to right in a Periodic Table the valency first increases till 4 and then again decreases.

L → R	Valency → in a period	1	2	3	4	3	2	1	0

Q5. *The number of electrons goes on increasing in the outer shell as we move from left to right in a period, why does the atomic size goes on decreasing?*

Ans. In a period all elements have same number of shells. As we move from left to right in a period the number of electrons goes on increasing at the same time the number of protons also goes on increasing therefore attraction force of nucleus increases and pulls the valence electrons i.e. the outermost shell towards the nucleus and hence the size of atom goes on decreasing.

◯ ◯ ◯ ○ ○

Size of atom decrease from L → R in a period.

Q6. *What happens to the metallic character as we move from top to bottom in a group?*

Ans. The metallic character increases as we move from top to bottom as the tendency to lose electrons increases.

Q7. *What happens to the non-metallic character as we move from top to bottom in a group?*

Ans. The non-metallic character decreases as we move from top to bottom in a group as the tendency to gain electrons decreases down the group.

Q8. *The atomic number of 'X' is 17. Predict its (a) valency, (b) formula of halide, (c) type of ion formed, (d) reactivity with respect to the other members of same group.*

Ans. 'X' has atomic number 17

$\therefore$ Electronic configuration $\rightarrow$ 2, 8, 7

(*a*) Valency = 1

(*b*) Formula of halide = HX

(*c*) Type of ion formed = Negative ion (Anion).

(*d*) Reactivity = Most reactive among those elements which lie below X in a group.

Q9. *Why are noble gases placed in a separate group?*

Ans. All noble gases show same valency *i.e.* '0', all of them are inert gases, the chemical properties are same and hence they are placed in same group.

Q10. *Given below are 3 elements W, X, Y and Z the atomic numbers are 9, 10, 16, 17. Predict the following:*

(a) Two elements lying in same group.

(b) Element in second period.

Ans.

Element	***Atomic Number***	***Electronic Configuration***	***Group No.***	***Period No.***
W	9	2, 7	17	2
X	10	2, 8	18	2
Y	16	2, 8, 6	16	3
Z	17	2, 8, 7	17	3

(*a*) Two elements in same group — W and Z

(*b*) Element in second period — W and X

Q11. *State the difference between Modern Periodic Table and Mendeleev's Periodic Table.*

Ans.

Mendeleev's Periodic Table	***Modern Periodic Table***
1. It is based on atomic mass.	1. It is based on atomic number.
2. It has 8 groups and 7 periods.	2. It has 18 groups and 7 periods.
3. No place for isotopes.	3. Isotopes were not considered.

Q12. *Write all the elements present in third period of the Periodic Table and give their electronic configuration.*

Ans. Elements of third period are

	Na	Mg	Al	Si	P	S	Cl	Ar
3rd Period	KLM	KLM	KLM	KLM	KLM	KLM	KLM	KLM
	2, 8, 1	2, 8, 2	2, 8, 3	2, 8, 4	2, 8, 5	2, 8, 6	2, 8, 7	2, 8, 8

Q13. *How does electronic configuration helps us to locate the position of element in the Periodic Table?*

Ans. The electronic configuration of an atom conveys the valence electrons and number of shells. Valence electrons helps in detecting the group number.

Number of shells in an atom tells the period to which it belongs.

Q14. *What are the merits of Mendeleev's Periodic Table?*

Ans. Merits of Mendeleev's Periodic Table are:

(*i*) Mendeleev left some gaps in his table. Predicted the chemical properties of these 3 elements which were discovered later and had same properties as predicted by Mendeleev, they were gallium, germanium and scandium.

(*ii*) He arranged the elements very systematically in periods and groups.

Q15. *Why does the reactivity of metals increases and that of non-metals decreases as we move down the group?*

Ans. Reactivity of metals depends on the tendency to lose electrons. If the atomic size increases, the valence electrons are easily removed thereby forming positive ion. In case of metals the atomic size increases as we move down the table. Reactivity of non-metals depends on the tendency to gain electrons. As we move down the group, the tendency to gain electrons decreases because the atomic size increases, the nuclear force decreases.

Q16. *List the elements present in 2nd period. Write their atomic number and electronic configuration.*

Ans.

Elements →	Li	Be	B	C	N	O	F	Ne
Atomic No. →	3	4	5	6	7	8	9	10
Electronic configuration →	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6	2, 7	2, 8

Q17. *For the following given elements predict the;*

(*a*) *Valency*

(*b*) *Period number*

(*c*) *Group number*

Na (11), Al(13), Cl(17), K(19)

Ans.

Element	***Atomic Number***	***Valency***	***Period Number***	***Group Number***	***Electronic configuration***
Na	11	1	3	1	2, 8, 1
Al	13	3	3	13	2, 8, 3
Cl	17	1	3	17	2, 8, 7
K	19	1	4	1	2, 8, 8, 1

Q18. *Elements of group 1 are given below with their atomic number:*

Li (3) *Na (11)* *K (19)*

(*a*) *Give their atomic size.*

(*b*) *Reactivity.*

Ans.

Group 1	*Atomic Number*	*Electronic Configuration*
Li	3	2, 1
Na	11	2, 8, 1
K	19	2, 8, 8, 1

(*a*) The atomic size goes on increasing as new shell is added in each element as we move from top to bottom. So it is Li < Na < K.

(*b*) The reactivity increases as it is easy to lose electrons if the size of atom is big, the nuclear force decreases K is more reactive than Na and Li.

Q19. *Lithium, sodium potassium belong to same group called alkali metals. Why?*

Ans. Lithium, sodium and potassium have same valence electron *i.e.* 1, hence they belong to same group. The group is called alkali metals group because all these elements form oxides which dissolve in water to form alkali.

Q20. *Carbon with atomic number 6 and silicon with atomic number 14 belong to same group although carbon is non-metal and silicon is semi-metal.*

Ans. Carbon with atomic number 6, shows electronic configuration 2, 4. Silicon with atomic number 14 shows electronic configuration 2, 8, 4.

Both the elements have same valence electrons, hence they are placed in same group.

Q21. *What physical and chemical properties of elements were used by Mendeleev in creating his Periodic Table? List two observations which posed a challenge to Mendeleev's Periodic Law.* (CBSE 2008)

Ans. The physical property used was the atomic mass of an element.

The chemical property used was the nature of oxide and hydride formed *i.e.* similarity in chemical properties were used by Mendeleev. The two observations that posed challenge in Mendeleev Periodic Law were:

(*i*) Arranging elements according to the increasing order of atomic mass could not be maintained. Chemical properties do not depend on atomic mass.

(*ii*) Isotopes were not given any place in the table as they have different atomic mass but same chemical properties.

Q22. *Table given below shows a part of the Periodic Table.*

H							He
Li	Be	B	C	N	O	F	Ne
Na	Mg	Al	Si	P	S	Cl	Ar

Using this table explain why?

(*a*) *Li and Na are considered as active metals.*

(*b*) *Atomic size of Mg is less than that of Na.*

(*c*) *Fluorine is more reactive than chlorine.* (CBSE 2008 F)

Ans. (*a*) Li and Na can readily lose electrons due to bigger size of atom.

(*b*) Mg has more number of protons than Na which attracts the electrons thereby reducing the size of Mg.

(*c*) Fluorine readily accepts/gains electrons to become F^- ion due to its small atom size as compared to chlorine.

Q23. *The position of three elements A, B and C in the Periodic Table are shown below:*

Group VI	*Group VII*
—	—
—	A
—	—
B	C

Giving reasons, explain the following:

(*a*) *Element A is a non-metal.*

(*b*) *Element B has a larger atomic size than element C*

(*c*) *Element C has a valency of 1.* (CBSE 2008 F)

Ans. (*a*) A is a non-metal because it can gain electrons easily, it has 7 valence electrons and form negative ions to become stable.

(*b*) The atomic number of B is less than C, it has less nuclear charge, less force of attraction between protons in the nucleus and valence electrons, hence its size is bigger than C.

(*c*) Element 'C' has 7 valence electrons, it can gain 1 electron to become stable so its valency is 1.

Q24. *The position of three elements A, B and C in the Periodic Table are shown below:*

Period	*Group I*	*II*	*III*
1	—	—	—
2	—	—	B
3	A	C	—

Giving reason, explain the following:

(*a*) *Element A is a metal.*

(*b*) *Element C has a larger size than B.*

(*c*) *Element B has a valency of 3.* (CBSE 2008 F)

Ans. (*a*) 'A' is a metal because its valence electron is 1, it can readily loose electron to became stable.

(*b*) Element 'C' belongs to 3rd period it has 3 shells whereas 'B' has only 2 shells, it belongs to 2nd period, distance between nucleus and valence electrons is more in C, hence its size is bigger than B.

(*c*) 'B' belongs to III group, has 3 valence electrons, it can loose 3 electrons to become stable hence its valency is 3.

Q25. *The position of 3 elements A, B and C in the Periodic Table is shown below:*

Group →	I	VI	VII
Period ↓			
1	B		
2			A
3		C	

Giving reasons, explain the following:

(a) Element A is a non-metal.

(b) Atom of element C has larger size than A.

(c) Element B has a valency of 1.

Ans. (*a*) A belongs to 7th group, has 7 valence electron, it can gain 1 electron to become stable. So it is a non-metal as it forms negative ion.

(*b*) 'C' has 3 shells 'A' has 2 shells so C is bigger than A.

(*c*) 'B' has one valence electron, it can loose this electron to become stable. So its valency is 1.

Q26. *The elements of the second period of the Periodic Table are given below:*

Li Be B C N O F

(a) Give reason to explain why atomic radii decreases from Li to F.

(b) Identify the most

(i) Metallic and (ii) Non-metallic element. [AI CBSE 2008 F]

Ans. (*a*) In a period on moving from left to right, the atomic number increases, the number of shells remains the same, nuclear charge increases the force of attraction of electrons towards the centre increases. The valence electrons are pulled at the centre, hence atomic radii decreases from Li to F.

(*b*) (*i*) Most metallic element → Li

(*ii*) Most non-metallic element → F.

Q27. *The elements of the third period of the Periodic Table are given below:*

Group	I	II	III	IV	V	VI	VII
	Na	Mg	Al	Si	P	S	Cl

(a) Which atom is bigger — Na or Mg? Why?

(b) Identify the most

(i) Metallic and (ii) Non-metallic element in period 3.

Ans. (*a*) Na atom is bigger in size this is because as we move from Na to Cl, the atomic number goes on increasing and the nuclear charge also increases. It pulls/attract the valence electrons at the centre and thus the atomic size decreases.

(*b*) (*i*) Most metallic — Na

(*ii*) Most non-metallic — Cl

Q28. *(a) What is meant by periodicity in properties of elements with reference to the Periodic Table?*

(b) Why do all the elements of the same group have similar properties?

(c) How will the tendency to gain electrons change as we go from left to right across a period? Why? (AI CBSE 2009)

Ans. (a) The repetition of same properties after definite interval is called periodicity in properties.

(b) All elements in group have same valence electrons.

(c) Tendency to gain electrons increases from L → R in the period because the atomic size goes on decreasing and nuclear charge increases, which can attract the nearby electron.

IV. LONG ANSWER TYPE QUESTIONS (*5 Marks*)

Q1. *The atomic number of element X is 17 predict its*

(a) Physical state.

(b) Name of element.

(c) Formulae of its compound with hydrogen.

(d) Metal or Non-metal.

(e) Formulae of its molecule.

Ans. Atomic number of X = 17.

Electronic configuration = 2, 8, 7

(a) Physical state → Gas

(b) Chlorine

(c) HCl

(d) Non-metal

(e) Cl_2

Q2. *Two elements A and B belong to group 1 and 2 respectively in the same period. Compare them with respect to:*

(a) Valency *(b) Size of atom* *(c) Formula of oxide*

(d) Nature of oxide *(e) Metallic character*

Ans.

Group	1	2
Elements	A	B

(a) Valency A → 1, B → 2

(b) Size of atom → A is bigger atom than B.

(c) Formula of oxide → A_2O, BO

(d) Nature → Basic

(e) Metallic character → A is more metallic than B.

Q3. *Give all characteristics of group.*

Ans. Characteristics of a group:

(*a*) Valence electrons → All elements show same valence electrons in a group.

(*b*) Valency → Valency of all the elements remains the same in a group.

(*c*) Atomic size → The atomic size goes on increasing down the group.

(*d*) Metallic character → In case of metals the metallic character increases down the group.

(*e*) Non-metallic character → In case of non-metals the non-metallic character decreases down the group.

Q4. *Give the characteristics of a period.*

Ans. In a period as we go from left to right:

(*a*) Valence electrons → Goes on increasing

1, 2, 3, 4, 5, 6, 7, 8.

(*b*) Valency → Valency first increases and then decreases

1, 2, 3, 4, 3, 2, 1, 0.

(*c*) Size of atom → Size of atom goes on decreasing

(*d*) Metallic character → Decreases

(*e*) Non-metallic character → Increases

Q5. *You are given five elements with some description of each element, place them in the Modern Periodic Table.*

(a) Essential for breathing and burning.

(b) Inactive, two electrons in the outermost shell.

(c) Atom has same number of protons, electrons and neutrons, used in fertilizer industry.

(d) Number of neutrons, protons are same used in building our bones.

(e) This element form the hardest naturally occurring substance as allotrope.

Ans.

Element	Period	Group
(*a*) Oxygen	2	16
(*b*) Helium	1	18
(*c*) Nitrogen	2	15
(*d*) Calcium	4	2
(*e*) Carbon	2	14

Q6. *Name the following elements*

(a) Two shells, both of which are completely filled.

(b) Three shells with 2 valence electrons.

(c) Group 1, two shells.

(d) Group 17, period 3.

(e) Metal, with valency 3 group number 13 period 3.

Ans. (*a*) Two shells → K L

Filled → 2, 8

Atomic number → 10

∴ Element — Neon.

(*b*) Three shells → K, L, M
2 Valence electron → 2, 8, 2
Atomic number →12 ∴ Element = Magnesium

(*c*) Group 1
2 shells → K L
Electronic configuration → 2, 1
Atomic number → 3 ∴ Element = Lithium

(*d*) Group 17
Period → 3, K L M
Electronic configuration → 2, 8, 7
Atomic number → 17, ∴ Element = Chlorine

(*e*) Group → 13
Valency → 3
Period → 3 K L M
Electronic configuration → 2, 8, 3
∴ Atomic number → 13, ∴ Element = Aluminium.

Q7. *(a) What are 'groups' and 'periods' in the Periodic Table?*

(b) Two elements M and N belong to groups I and II respectively and are in the same period of the Periodic Table. How do the following properties of M and N vary?

(i) Sizes of their atoms.

(ii) Their metallic characters.

(iii) Their valencies in forming oxides.

(iv) Molecular formulae of their chlorides. (CBSE 2009 F)

Ans. (*a*) The vertical column in the Periodic Table are called 'groups', the horizontal rows in the table are called periods.

(*b*) (*i*) 'M' and 'N' belong to the same period but group I and II respectively. N is smaller than M as the atomic size decreases on moving from left to right across the Periodic Table.

(*ii*) M is more metallic than 'N' because metallic character decreases from left to right as tendency to lose electrons decreases due to decrease in atomic size.

(*iii*) The valencies of M and N are 1 and 2 respectively, valency across the period first increases then decreases.

(*iv*) MCl and NCl_2.

Q8. *On the baiss of the table of Mendeleev's Periodic Table* (AI CBSE 2008)

(a) Name the element which is in

(i) I group and 3rd period. *(ii) VII group and 2nd period.*

(b) Suggest the formula for the following:

(i) Oxide of nitrogen *(ii) Hydride of oxygen*

(c) In group VIII of Periodic Table, why does cobalt with atomic mass 58.93 appear before nickel having atomic mass 58.71?

(d) Besides gallium, which two other elements have since been discovered for which Mendeleev had left gaps in his Periodic Table?

(*e*) *Using atomic masses of Li, Na and K, find the average atomic mass of Li, and K and compare it with the atomic mass of Na. State the conclusion drawn from this activity.*

Ans. (*a*) (*i*) Sodium (*ii*) Fluorine

(*b*) (*i*) N_2O_5 (*ii*) H_2O

(*c*) Co resembles with Rh and Ir whereas 'Ni' resembles with Pd and Pt.

(*d*) Germanium and scandium

(*e*)

Li	Na	K	Average atomic mass of Na
6.939	22.99	39.102	$= \frac{6.939 + 39.102}{2} = 23.0205$

The atomic mass of Na is the average atomic mass of Li and K and these elements resemble with each other.

Q9. (*a*) *Why do we classify elements?* (AI CBSE 2008)

(*b*) *What were the two criteria used by Mendeleev in creating his Periodic Table?*

(*c*) *Why did Mendeleev leave some gaps in his Periodic Table?*

(*d*) *In Mendeleev's Periodic Table, why was there no mention of Noble gases like Helium, Neon and Argon?*

(*e*) *Would you place two isotopes of chlorine Cl-35 and Cl-37 in different slots because of their different atomic masses or in the same slot because their chemical properties are the same? Justify your answers.*

Ans. (*a*) Classification is done to study the properties of elements conveniently.

(*b*) Increasing order of atomic mass and similarity in chemical properties i.e. the nature of oxide and hydride formed.

(*c*) The gaps were left for undiscovered elements then.

(*d*) Noble gases were not invented at that time.

(*e*) Cl-35 and Cl-37 will be kept in the same slot as their chemical properties are same.

Q10. (*a*) *Which 2 criteria did Mendeleev use to classify the elements in his table.*

(*b*) *State Mendeleev's Periodic law.*

(*c*) *Why could no fixed position be given to hydrogen in Mendeleev's Periodic Table.*

(*d*) *How and why does the atomic size vary as you go*:

(*i*) *From left to right along a period*

(*ii*) *Down a group?* (CBSE 2009)

Ans. (*a*) (*i*) Increasing order of atomic mass and similarities in chemical properties of elements.

(*ii*) The formula of oxides and hydrides formed by elements.

(*b*) Mendeleev's Periodic Law → Properties of elements are periodic functions of their atomic masses.

(*c*) Hydrogen had no fixed position in Mendeleev's Periodic table because it resembles alkali metal by forming positive ions and resembles halogens by forming diatomic molecule.

(*d*) (*i*) Atomic size decreases from left to right, as the valence electrons are attracted by the nucleus due to increase in the nuclear force.

(*ii*) The atomic size increases from top to bottom in a group because the number of shells keep on increasing therefore distance between nucleus and valence electrons increases.

Q11. (*a*) *Why did Mendeleev left gaps in his Periodic Table?* (CBSE 2009)

(*b*) *State any 3 limitations of Mendeleev's classification.*

(*c*) *How does electronic configuration of atoms change in period with increase in atomic number?*

Ans. (*a*) Mendeleev left some gaps for undiscovered elements, because he predicted that there would be such elements which will fit in the gaps in future. He also predicted the properties of these elements.

(*b*) 3 limitations are:

(*i*) Position of hydrogen was not justified.

(*ii*) Increasing order of atomic mass could not be maintained.

(*iii*) Isotopes were not given separate place as they have different atomic mass.

(*c*) In a period the valence electrons goes on increasing from left to right as the number of shells is same.

TEST YOUR SKILLS

Q1. *An element 'X' belongs to Group I and 3rd period.*

(i) Give its electronic configurations.

(ii) Formula when it combines with oxygen.

(iii) Formula when it combines with hydrogen.

(iv) State its nature.

(v) Give its valency.

Q2. *An element belongs to 3rd period and 17th group of the Periodic Table, find out*

(i) The electronic configuration of element on its left side and right side.

(ii) Its valence electrons.

(iii) Its size with in comparison with its neighbouring elements.

Q3. *An element X from group I combines with an element Y from group 17 to form a compound. Both X and Y belong to II period.*

(a) Give the formula of the compound formed.

(b) Will the compound be ionic or covalent?

(c) Give its electron dot structure.

Q4. *The position of A, B, C is given in the Periodic Table*

Group II	***Group 17***
A	*B*
	C

(i) Which element is more electropositive?

(ii) Name the element that is electronegative in nature.

(iii) *What will be the formula of A and B after reaction?*

(iv) *Which element will be more reactive in group 17 and why?*

Q5. *An element has electronic configuration.*

2, 8, 8, 7

(i) *What type of ion will it form?*

(ii) *Name the unit to measure its atomic radius.*

(iii) *Give the electronic configuration of an element that lies above this element.*

(iv) *Give the electronic configuration of an element that belongs to same period but in 17th group.*

Q6. *Identify the following elements:*

(a) *Element with 4 valence electrons in L shell.*

(b) *Element with 2 valence electrons in K shell.*

(c) *Element with 7 valence electrons in M shell.*

(d) *Element with 1 valence electrons in K shell.*

Q7. *Name two alkali metals present in Group I.*

Q8. *An element 'X' belongs to II group and 2nd period. Write the atomic number and name of element.*

Q9. *An element 'Y' belongs to group = 2 and period = 3, State the nature of oxide and type of element.*

Q10. *What is atomic size?*

Q11. *Name two isotopes of carbon.*

Q12. *What happens to the valence electrons and valency as we move left to right in a period and top to bottom in a group?*

Q13. *The atomic number of 'X' is 17, predict its*

(a) *valency.*

(b) *formula of its halide.*

(c) *type of ion formed.*

(d) *reactivity with respect to the other numbers of same group.*

Q14. *State three points of difference between Mendeleev's Periodic Table and Modern Periodic Table.*

Q15. *For the following given elements predict the*

(a) *valency.*

(b) *period number.*

(c) *group number.*

Na (11), Al (13), Cl (17).

Q16. *Give the characteristics of a period in Periodic Table.*

Q17. *Name the following elements:*

(a) *Two shells, both of which are completely filled.*

(b) *Three shells with 2 valence electrons.*

(c) *Metal with valency 3, group number 13 and period 3.*