

NCERT solutions for Class 10

Chemistry

Chapter – 5 Periodic Classification of Elements

Intext Exercise -1

1. Did Dobereiner's triads also exist in the columns of Newlands' Octaves? Compare and find out.

Ans: In the Dobereiner's triads, the middle element atomic mass is equal to the average atomic mass of the first and third element. Only one Dobereiner's triad exists in the columns of Newlands' Octaves.

Dobereiner's triads

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

Newlands' Octaves

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ba	Cr	Ti	Mn	Fe

2. What were the limitations of Dobereiner's classification?

Ans: Limitation of Dobereiner's Classification:

Only a few elements can be arranged in the Dobereiner's triads. It depends on their properties. F, Cl, Br will not show the triads but Cl, Br, I will show.

3. What were the limitations of Newlands' Law of Octaves?

Ans: Limitations of Newlands' law of octaves:

- It was applicable up to lighter elements (Calcium only).
- The properties after calcium do not have any resemblance to the properties of the above element.
- Co and Ni are transition elements but they were placed in the group of F, Cl.

(iv) Iron properties are similar to the cobalt and nickel but placed in different columns.

Intext Exercise -2

1. Use Mendeleev's Periodic Table to predict the formula for the oxides of the following elements: K, C, Al, Si, Ba.

Ans: Potassium is in group 1. The oxide will be K_2O .

Carbon is in group 4. The oxide will be CO_2 .

Aluminium is in group 3. The oxide will be Al_2O_3 .

Silicon is in group 4. The oxide will be SiO_2 .

Barium is in group 2. The oxide will be BaO .

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

Ans: Gallium(Ga) and Scandium(Sc)

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

Ans: Mendeleev's periodic table was based on the atomic masses of the elements. The properties of the elements are the periodic function of their atomic masses. Elements are arranged in the increasing atomic mass and their properties reoccur after regular intervals.

4.

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?

Ans: Yes, all the three elements lithium, sodium, and potassium have one electron in the valence shells.

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: Helium (He) and neon (Ne) are inert gas. Their outermost shells are completely filled. Helium has a duplet in its K shell, while neon has an octet in its K, L shell.

5. In the Modern Periodic Table, which are the metals among the first ten elements?

Ans: Lithium (Li) and beryllium (Be) are metals among the first ten elements.

6. By considering their position in the Periodic Table, which one of the following elements would you expect to have maximum metallic characteristic? Ga, Ge, As, Se and Be.

Ans: Be and Ga are expected to be more metallic but Metallic character increases when we go from top to bottom. Due to its larger size for gallium, it is the most metallic among the given elements.

NCERT Exercises

1. 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.

(In this period, the atom's size decreases so it is difficult to lose their electrons.)

2. Element X forms a chloride with the formula XC_{12} , 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

Ans: Valency of X in the given compound is 2. But Na is in group 1 in the periodic table. Hence, it does not form the given compound with chloride.

b) Mg

Ans: Valency of X in the given compound is 2. Mg is in the group 2 in the periodic table.

c) Al

Ans: Valency of X in the given compound is 2. But Al is in the group 3A in the periodic table. Hence, it does not form the given compound with chloride.

d) Si

Ans: Valency of X in the given compound is 2. But the valence of Si is 4.

Hence, it does not form the given compound with chloride.

3. Which element has

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

Ans: Neon has two shells, both of which are completely filled with Electrons.

b) The electronic configuration 2, 8, 2?

Ans: Magnesium electronic configuration is 2, 8, 2.

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

Ans: Silicon has three shells, with four electrons in its valence shell.

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

Ans: Boron has two shells, with three electrons in its valence shell.

e) Twice as many electrons in its second shell as in its first shell?

Ans: Carbon has twice as many electrons in its second shell as in its first shell.

4.

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

Ans: All the elements have the same number of valence electrons and the valency is equal to 3.

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

Ans: All the elements have the same number of valence electrons and they all have valency equal to 1.

5. An atom has electronic configuration 2, 8, 7.

a) What is the atomic number of this element?

Ans: Atomic number of the given configuration is 17.

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: Fluorine electronic configuration is 2, 7. same number of valence electrons in the outermost shell.

6. 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 nonmetal.

Ans: A is a non-metal.

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

Ans: C is less reactive than A. Reactivity decreases down the group in halogens.

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

Ans: When we move from left to right, the atomic size decreases so C is smaller than B.

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

Ans: A is in group 17 so the valence electrons will be 7. It would form an anion and accept an electron to complete the octet.

7. Nitrogen (atomic number 7) and phosphorus (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: The electronic configuration of the group 15 elements.

Element	Atomic number	K, L, M
Nitrogen (N)	7	2, 5
Phosphorous (P)	15	2, 8, 5

Electronegativity is the tendency of an atom of an element in a molecule to attract the shared pair of electrons present between bonded atoms towards itself. When we move from left to right electronegativity increases and when we move

from top to bottom the electronegativity decreases. In case of group 15, the electronegativity decreases. Nitrogen is more electronegative than phosphorus.

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

Ans: In the modern periodic table, the period number of an element is equal to the number of shells in its atom. The group number of an element having up to two valence electrons is equal to the number of valence electrons. If more than two valence electrons is equal to the number of valence electrons plus 10.

9. 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:

Atomic number	Electronic configuration
Calcium(20)	2, 8, 8, 2
12	2, 8, 2
19	2, 8, 8, 1
21	2, 8, 8, 3
38	2, 8, 8, 18, 2

Elements with atomic number 12 and 38 have the same chemical properties as that of calcium. Because both of them have the same number of valence electrons.

10. Compare and contrast the arrangement of elements in Mendeleev's periodic Table and the Modern Periodic Table.

Ans:

Mendeleev's periodic Table	Modern Periodic Table
Properties of the elements are periodic function of their increasing atomic mass	Properties of the elements are periodic function of their increasing atomic numbers
There are a total 7 groups (columns) and 6 periods (rows)	There are total 18 groups (columns) and 7 periods (rows)
Elements having similar properties were placed directly under one another	Elements having the same valence shell are present in the same period while elements having the same number of valence electrons are present in the same group

Position of the hydrogen	Hydrogen is placed in 1 st group
No difference in the position of metals and non-metals.	Metals are present at the left side and non-metals are present at the right hand side.
This table is given by Mendeleev.	This table is given by Henry Moseley.