(20) Name the group containing highly reactive nonmetals only.

Ans. Group 17 contains highly reactive non-metals, namely, fluorine, chlorine, bromine and iodine.

(21) Name the last three elements of the second period in increasing order of atomic number.

Ans. The last three elements of the second period in increasing order of atomic number are oxygen, fluorine and neon.

(22) Name the three nonmetals in the second period of the modern periodic table.

Ans. The three nonmetals in the second period of the modern periodic table are nitrogen, oxygen and fluorine.

Q. 13 Answer the following questions :

(1) State Dobereiner's law of triads giving one example.

Ans. Dobereiner made groups of three elements each, having similar chemical properties and called them triads. He arranged the three elements in a triad in an increasing order of atomic mass and showed that the atomic mass of the middle element was approximately equal to the mean of the atomic masses of the other two elements.

Examples : Lithium (Li), Sodiun (Na), Potassium (K) form Dobereiner's triad.

(2) Give a suitable illustration of Dobereiner's law of triads.

Ans. (1) Lithium, sodium and potassium form Dobereiner's triad. They show similar chemical properties. Their atomic masses are as follows :

Element	Li	Na	K
Atomic mass	6.9	23	39.1

According to Dobereiner's law of triads, the atomic mass of the middle element is approximately arithmetic mean of the atomic masses of the other two elements.

$\frac{6.9+39.1}{2}$ which is approximately the 23.0 atomic mass of sodium.

Thus, the atomic mass of sodium (23) is the average of the atomic masses of lithium (6.9) and potassium 39.1.

(2) Another triad of elements : Calcium (40.1), strontium (87.6) and barium (137.3).

(3) (A, B, C) is a Dobereiner's triad. Complete the following chart and give reason for the answer :

Element	A	B	C
Atomic mass	10.08	12.01	...

Ans.

Element	A	B	C
Atomic mass	10.08	12.01	13.94

Let the atomic mass of C be x. As (A, B, C) is a Dobereiner's triad, $\frac{x+10.08}{2} = 12.01$

$\therefore x = 24.02 - 10.08 = 13.94$

$\therefore$ atomic mass of C = 13.94.

(4) Identify Dobereiner's triads from the following groups of elements having similar chemical properties :

(Can you tell?) (Textbook page 16)

(1) Mg (24.3), Ca (40.1), Sr (87.6)

(2) S (32.1), Se (79.0), Te (127.6)

(3) Be (9.0), Mg (24.3), Ca (40.1)

Ans. Dobereiner's triads :

(1) S (32.1), Se (79.0), Te (127.6)

(2) Be (9.0), Mg (24.3), Ca (40.1)

(5) From the following set of the elements and their atomic masses obtain Dobereiner's triad :

Element	Br	K	I	Cl
Atomic mass	79.9	39	126.9	35.5

Ans. Among the given four elements, the three elements in the increasing order of atomic masses and having similar properties are :

Element	Cl	Br	I
Atomic mass	35.5	79.9	126.9

Hence, the above three elements represent Dobereiner's triad.

(6) State the limitations of Dobereiner's law of triads.

Ans. (1) During Dobereiner's period all elements were not known and also atomic mass was not known accurately.

(2) Dobereiner discovered few triads among all the elements.

(3) He could not classify all known elements into triads.

(7) State Newlands' law of octaves.

Ans. When the elements are arranged in an increasing order of their atomic masses, the properties of the eighth element are similar to those of the first.

It is found that Na is the eighth element from Li and both of them have similar properties.

(8) Illustrate Newlands' law of octaves with a suitable example.

Ans. (1) Newlands' law of octaves states that when the elements are arranged in the order of their increasing atomic masses, every eighth element has properties similar to those of the first.

(2) **Illustration :** If the first 21 elements, except inert gases, are arranged in the order of their increasing atomic masses we have octaves as given below :

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

It is found that Na is the eighth element from Li and both of them have similar properties. Similarly, the elements, in the following pairs show similar properties : C and Si, Na and K, Mg and Ca, F and Cl.

(9) Explain the limitations of Newlands' law of octaves.

Ans. (1) Newlands' law of octaves i.e. applicable to only the first few elements i.e., only up to calcium out of total 56 elements known at that time.

(2) Newlands placed two elements each in some boxes to accommodate all known elements e.g. Co and Ni, Ce and La. He placed some elements with different properties under the same note in the octave. For example, Co and Ni under the note Do along with halogens, while Fe having similarity with Co and Ni away from them along with the nonmetals O and S under the note Ti.

(3) Newlands' octaves did not have provision to accommodate the newly discovered elements.

***(10) Write short note on Mendeleev's periodic law.**

OR

State Mendeleev's periodic law.

Ans. When the elements are arranged in the order of their increasing atomic masses, Mendeleev found that the elements with similar physical and chemical properties repeat after a definite interval. On the basis of these finding Mendeleev stated the periodic law.

The physical and chemical properties of elements are a periodic function of their atomic masses.

(11) Describe the merits of Mendeleev's periodic table.

Ans. (1) To give the proper place in the periodic table, atomic masses of some elements were revised in accordance with their properties. For example, the previously determined atomic mass of beryllium, 14.09, was changed to the correct value 9.4, and beryllium was placed before boron.

(2) Mendeleev had kept some vacant places in the periodic table for elements that were yet to be discovered. Three of these unknown elements were given the names eka-boron, eka-aluminium and eka-silicon from the known neighbours and their atomic masses were indicated as 44, 68 and 72, respectively. Their properties were also predicted. Later on these elements were discovered subsequently and were named as scandium (SC), gallium (Ga) and germanium (Ge) respectively. The properties of these elements matched well with those predicted by Mendeleev. Due to this success all were convinced about the importance of Mendeleev's periodic table.

Property	Eka-aluminium (E) (Mendeleev's prediction)	Gallium (Ga) (actual)
1. Atomic mass	68	69.7
2. Density (g/cm^3)	5.9	5.94
3. Melting point (°C)	Low	30.2
4. Formula of chloride	ECl_3	$GaCl_3$
5. Formula of oxide	E_2O_3	Ga_2O_3
6. Nature of oxide	Amphoteric oxide	Amphoteric oxide

Actual and predicted properties of gallium.

(3) When noble gases such as helium, neon and argon were discovered, Mendeleev created the 'zero group' without disturbing the original periodic table in which the noble gases were placed very well.

(12) What are the demerits of Mendeleev's periodic table?

Ans. (1) The elements cobalt (Co) and nickel (Ni) have the same whole number atomic mass. As a remit there was an ambiguity regarding their sequence in Mendeleev's periodic table.

(2) Isotopes were discovered long time after Mendeleev put forth the periodic table. A challenge was posed in placing isotopes in Mendeleev's periodic table as isotopes have the same chemical properties but different atomic masses.

(3) The rise in atomic mass does not appear to be uniform when elements are arranged in an increasing order of atomic masses. It was not possible, therefore, to predict how many elements could be discovered between two heavy elements.

(4) Position of hydrogen : Hydrogen shows similarity with halogens (group VII). For example, the molecular formula of hydrogen is H_2 while the molecular formulae of fluorine and chlorine are F_2 and Cl_2, respectively. In the same way, there is a similarity in the chemical properties of hydrogen and alkali metals (group I). There is a similarity in the molecular formulae of the compounds of hydrogen alkali metals (Na, K, etc.) formed with chlorine and oxygen. On considering the above properties it is difficult to decide the correct position of hydrogen whether it is in the group of alkali metals (group I) or in the group of halogens (group VII).

Compounds of H	Compounds of Na
HCl	NaCl
H_2O	Na_2O
H_2S	Na_2S

Similarity in hydrogen and alkali metals

Element (Molecular formula)	Compounds with metals	Compounds with nonmetals
H_2	NaH	CH_4
Cl_2	NaCl	CCl_4

Similarity in hydrogen and halogens

(13) Write the molecular formulae of oxides of the following elements by referring to the Mendeleev's periodic table. Na, Si, C, Rb, P, Ba, Cl, Sn, Ca

(Use your brain power!) (Textbook page 20)

Ans.

Elements	Oxides of Elements	
Na	Na_2O	Sodium oxide
Si	SiO_2	Silicon dioxide
C	CO_2	Carbon dioxide
Rb	Rb_2O	Rubidium oxide (yellow solid)
P	P_2O_5	Phosphorus pentaoxide
Ba	BaO	Barium oxide
Cl	Cl_2O	Chlorine monoxide
Sn	SnO_2	Tin oxide (stannic oxide)
Ca	CaO	Calcium oxide

(14) Write the molecular formulae of the compounds of the following elements with hydrogen by referring to the Mendeleev's periodic table. C, S, Br, AS, F, O, N, Cl

(Use your brain power!) (Textbook page 20)

Ans.

Elements	Compounds (with hydrogen)	
C	CH_4	Methane
S	H_2S	Hydrogen sulphide
Br	HBr	Hydrogen bromide
As	AsH_3	Arsine
F	HF	Hydrogen fluoride
O	H_2O	Water
N	NH_3	Ammonia
Cl	HCl	Hydrogen chloride

(15) Write a short note on : Moseley's contribution and the modern periodic table.

Ans. The English scientist Henry Moseley demonstrated, with the help of the experiments done using X-ray tube, that the atomic number (Z) of an element corresponds to the positive charge on the nucleus or the number of the protons in the nucleus of the atom of that element. He suggested that 'atomic number' is a more fundamental property of an element rather than its atomic mass. On the basis of this research, elements were arranged in the order of their increasing atomic numbers in a more systematic way. Accordingly the statement of the modern periodic law was stated.

(16) State the modern periodic law.

Ans. The chemical and physical properties of elements are a periodic function of their atomic numbers.

(17) What is meant by modern periodic table?

Ans. The classification of elements resulting from an arrangement of the elements in an increasing order of their atomic numbers (Z) is the modern periodic table.

(18) Describe the structure of the modern periodic table. *OR*

***Write a note on structure of the modern periodic table.**

Ans. (1) In the modern periodic table, the elements are arranged in the order of their increasing atomic numbers. In the modern periodic table there are seven horizontal rows called periods and the eighteen vertical columns (1 to 18) called groups. The arrangement of the periods and groups results into formation of boxes. Atomic numbers are serially indicated in the upper part of these boxes.

(2) Each box represents the place for one element. Apart from these seven rows, there are two rows of elements placed separately at the bottom of the periodic table. They are lanthanides and actinides series. There are 118 boxes in the periodic table including the two series that means there are 118 places for elements in the modern periodic table. The formation of a few elements was established experimentally very recently and thereby the modern periodic table is now completely filled with 118 elements.

(3) On the basis of the electronic configuration the elements in the modern periodic table are divided into four blocks, viz. *s*-block, *p*-block, *d*-block and *f*-block. The *s*-block constitute the groups 1 and 2. The groups 13 to 18 constitute the *p*-block. The groups 3 to 12 constitute the *d*-block, while the lanthanide and actinide series at the bottom form the *f*-block. The *d*-block elements are called transition elements. A zig-zag line is shown in the *p*-block of the periodic table. This zig-zag line shows the three traditional types of elements, i.e. metals, nonmetals and metalloid. The metalloid elements lie along the border of this zig-zag line. All the metals lie on the left side of the zig-zag line while all the nonmetals lie on the right side.

(19) Give two examples of metalloids.

Ans. Metalloids : Boron (B) and Silicon (Si).

***(20) Write a short note on : Position of isotopes in the Mendeleev's and the modern periodic table.**

Ans. Isotopes were discovered long time after Mendeleev put forth the periodic table. A challenge was posed in placing isotopes in Mendeleev's periodic table, as isotopes have the same chemical properties but different atomic masses. Isotopes do not find separate places in this table.

Moseley found out that atomic number is a fundamental property of an element rather than its atomic mass. The atomic number of any element is increased by one unit (number) from the atomic number of subsequent element. In the modern periodic table, the elements are arranged in the order of their increasing atomic numbers, that time the problem of discrepancy in the pairs of isotopes of elements observed in Mendeleev's periodic table was solved. The isotopes of ${}_{17}Cl^{35}$ and ${}_{17}Cl^{37}$ were placed in the same group as both have the same atomic number.

(21) Write a short note on the zig-zag line in the modern periodic table.

Ans. (1) A zig-zag line is shown in the *p*-block of the periodic table.

(2) The zig-zag line shows the three traditional types of elements is metals, nonmetals and metalloids.

(3) The metalloid elements lie along the border of this zig-zag line.

(4) All the metals lie on the left side of the zig-zag line.

(5) All the nonmetals lie on the right side of the zig-zag line.

(22) Classify the following elements into group 1, 16 and 17 :
Chlorine, Hydrogen, Oxygen, Bromine.

Ans. Group 1 : Hydrogen.
Group 16 : Oxygen
Group 17 : Chlorine and Bromine.

(23) Classify the following elements into– Alkali metals, Halogens, Alkaline earth metals : (Cl^- Br^- I^-), (Ca, Sr, Mg), (Li, Na, K).

Ans. Alkali metals : (Li, Na, K)
Halogens : (Cl^- Br^- I^-).
Alkaline earth metals : (Ca, Sr, Mg).

(24) Classify the following elements into– Metals, Nonmetals, Metalloids : (P, C, N), (Ca, Fe, Al), (Si, Ge, Sn), (K, Mg, Na).

Ans. Metals : (Ca, Fe, Al), (K, Mg, Na).
Nonmetals : (P, C, N).
Metalloids : (Si, Ge, Sn).

(25) Identify the electronic configuration of the inert gas elements, third row elements, seventeen group elements, second group elements :
(i) (2, 8, 2) (ii) (2, 8, 8) (iii) (2, 8, 1) (iv) (2, 7) (v) (2, 2) (vi) (2, 8) (vii) (2, 8, 7)

Ans. Inert gas elements : (2, 8, 8), (2, 8).
Third row elements : (2, 8, 2), (2, 8, 7), (2, 8, 8).
Second group elements : (2, 8, 2), (2, 2).
Seventeen group elements : (2, 7), (2, 8, 7).

[Note : (1) The outermost shell of all noble gases contain 8 electrons (except He). (2) Atoms of all 3rd row elements contain 3 shells. Out of which first shell contains 2 and 2nd shell contains 8 electrons. (3) The elements of group 17 contains 7 electrons in the outermost shell. (4) The elements of group 2 contains 2 electrons in the outermost shell.]

(26) Define : (1) Group (2) Period.

Ans. (1) **Group :** The vertical column of elements in the periodic table of elements is called a group.

(2) **Period :** The horizontal row of the elements in the periodic table of the elements is called a period.

(27) Write the numbers of vertical columns (groups) and horizontal rows (periods) in the long form of the periodic table.

Ans. There are 18 vertical columns or groups and seven horizontal rows or periods of the elements in the long form of the periodic table.

(28) Depending on electronic configuration the properties of the elements vary in different groups. Explain why?

Ans. (1) There are 18 vertical columns in the modern periodic table and are called groups. These groups are 1 and 2, 13 to 18 and 3 to 12.

(2) The number of valence electrons in all these elements from the group 1, i.e. the family of alkali metals, is the same. Similarly, the elements from any other group, the number of their valence electrons to be the same. For example, the elements beryllium (Be), magnesium (Mg) and calcium (Ca) belong to the group 2, i.e. the family of alkaline earth metals. There are two electrons in their outermost shell the number of valence electrons are 2. Similarly, there are seven electrons in the outermost shell of the elements such as fluorine (F) and chlorine (Cl) from the group 17, i.e. the family of halogens the number of valence electron is 1. As a result all elements belonging to the same group have the same valence electrons and show similar chemical properties.

(3) While going from top to bottom within any group, one electronic shell gets added at a time. Atomic radius and atomic size increases and hence, shows gradation of properties of the elements down the group. From this, the electronic configuration of the outermost shell is characteristic of a particular group.

(29) Go through the modern periodic table and write the names one below the other of the elements of group 1.

(Can you tell?) (Textbook page 22)

Ans. Four elements of group 1 : Hydrogen (H)
Lithium (Li)
Sodium (Na)
Potassium (K)

(30) Write the electronic configuration of first four elements in this group.

(Can you tell?) (Textbook page 22)

Ans.

Elements	Electronic configuration
Hydrogen	1
Lithium	2, 1
Sodium	2, 8, 1
Potassium	2, 8, 8, 1

(31) Which similarity do you find in their configuration?

(Can you tell?) (Textbook page 22)

Ans. The similarity is observed in valence electrons of these elements. The valence electron in these elements is one.

(32) How many valence electrons are there in each of these elements?

(Can you tell?) (Textbook page 22)

Ans. There is one valence electron in all these elements.

(33) Depending on electronic configuration the properties of elements vary in different periods. Explain why?

Ans. (1) In modern periodic table there are seven horizontal rows called periods.

(2) In a period, change in valency of an elements varies electronic configuration.

(3) The number of valence electrons is different in these elements. However, the number of shells is the same. In a period, while going from left to right, the atomic number increases by one at a time and the number of valence electrons also increases by one at a time. In a period, there is gradation in properties of elements.

(4) The elements with the same number of shells occupied by electrons belong to the same period. The elements in the second period, namely, Li, Be, B, C, N, O, F and Ne have electrons in the two shells, K and L. The elements in the third period, namely, Na, Mg, Al, Si, P, S, Cl and Ar have electrons in the three shells; K, L and M.

(5) The chemical reactivity of an element is determined by the number of valence electrons in it and the shell number of the valence shell. In a period, while going from left to right, the atomi number increases by one at a time as a result atomi radius gradually decreases. Hence, atomic siz decreases.

(34) On going through the modern periodic table it is seen that the elements Li, Be, B, C, N, O, F and Ne belong to the period-2. Write down electronic configuration of all of them.

(Can you tell?) (Textbook page 23)

Ans.

Elements	Electronic configuration
Li	2, 1
Be	2, 2
B	2, 3
C	2, 4
N	2, 5
O	2, 6
F	2, 7
Ne	2, 8

(35) Is the number of valence electrons same for all these elements?

(Can you tell?) (Textbook page 23)

Ans. The number of valence electrons is different for all these elements.

(36) Is the number of shells the same in these?

(Can you tell?) (Textbook page 23)

Ans. The number of shells is the same.

(37) The elements in the third period, namely, Na, Mg, Al, Si, P, S, Cl and Ar have electrons in the three shells, K, L, M. Write down the electronic configuration of these elements.

(Textbook page 24)

Ans.

Elements	K Shell	L Shell	M Shell	Electronic Configuration
Na	2	8	1	2, 8, 1
Mg	2	8	2	2, 8, 2
Al	2	8	3	2, 8, 3
Si	2	8	4	2, 8, 4
P	2	8	5	2, 8, 5
S	2	8	6	2, 8, 6
Cl	2	8	7	2, 8, 7
Ar	2	8	8	2, 8, 8

(38) What is meant by periodic trends in the modern periodic table?

Ans. When the properties of elements in a period or a group of the modern periodic table are compared, certain regularity is observed in their variations. It is called the periodic trends in the modern periodic table. The periodic trends is observed in properties of elements, namely, valency, atomic size and metallic-nonmetallic character.

(39) What is meant by valency?

Ans. The valency of an element is determined by the number of electrons present in the outermost shell of its atoms, i.e. valence electrons.

(40) Define atomic size. How does it vary in a period and a group?

Ans. (1) The distance between the centre of the atom and the outermost shell of the atom is called the atomic radius. The size of an atom is indicated by its radius. Atomic radius is expressed in unit picometre (pm). (1 pm = 10^{-12} m). The size of atom depends on number of shells, more the number of shells larger is the atomic size.

(2) In a group, while going down a group the atomic size goes on increasing, because while going down a group newer shells are successively added. This increases the distance between the outermost electron and the nucleus. Hence, the nuclear attraction on these electrons goes on decreasing. Thus in a group atomic size increases.

(3) While going from left to right within a period, atomic radius goes on decreasing and the atomic number increases one by one, that means positive charge on the nucleus increases by one unit at a time. However, the additional electron gets added to the same outermost shell. Due to the increased nuclear charge the electrons are pulled towards the nucleus to a greater extent, as a result, the size of the atom decreases.

(41) Discuss the trends in the variation of metallic and nonmetallic properties in a period and in a group.

Ans. (1) Metals have a tendency to loose the valence electrons to form cations having a stable noble gas configuration. This tendency of an element is called electropositivity is the metallic character of that element.

(2) Nonmetals have a tendency to accept the valence electrons to form anions having a stable noble gas configuration. This tendency of an element is called electronegativity is the nonmetallic character of that element.

(3) In a group, while going down a group a new shell gets added, resulting in an increase in the distance between the nucleus and the valence electrons. This results in lowering the effective nuclear charge and thereby lowering the attractive force on the valence electrons. As a result of this the tendency of the atom to lose electrons increases. Also the penultimate shell becomes the outermost shell on losing valence electrons. The penultimate shell is a complete octet. Therefore, the resulting cation attains special stability. The metallic character of an atom is its tendency to lose electrons. Therefore, the following trend is observed : The metallic character of elements increases while going down the group.

(4) While going from left to right within a period the outermost shell remains the same. However, the positive charge on the nucleus goes on increasing while the atomic radius goes on decreasing and thus the effective nuclear charge goes on increasing. Therefore, valence electrons are held with greater attractive force. This is called electronegativity. As a result of this the tendency of atom to lose valence electrons decreases within a period from left to right, i.e., electronegativity increases. Thus, nonmetallic character of elements increases within a period from left to right.

(42) Name the elements, group, formulae and physical state belonging to the halogen family.

Ans.

Group	Elements	Formula	Physical state
17	Fluorine	F_2	Gas
	Chlorine	Cl_2	Gas
	Bromine	Br_2	Liquid
	Iodine	I_2	Solid

(43) There are some vacant places in the Mendeleev's periodic table. In some of these places the atomic masses are seen to be predicted. Enlist three of these predicted atomic masses along with their group and period.

(Think about it) (Textbook page 19)

Ans.

Atomic mass	Group	Period
44	III	4
72	IV	5
100	VII	6

(44) Due to uncertainty in the names of some of the elements, a question mark is indicated before the symbol in the Mendeleev's period table. What are such symbols?

(Think about it) (Textbook page 19)

Ans. Symbols : Yt, Di, Ce, Er, La.

(45) Chlorine has two isotopes, viz. Cl-35 and Cl-37. Their atomic msses are 35 and 37 respectively. Their chemical properties are same. Where should these be placed in Mendeleev's periodic table? In different places or in the same place?

(Use your brain power!) (Textbook page 19)

Ans. Isotopes, viz. Cl-35 and Cl-37 do not find separate places in Mendeleev's periodic table.

(46) How is the problem regarding the position of cobalt (^{59}Co) and nickel (^{59}Ni) in Mendeleev's periodic table resolved in modern periodic table?

(Use your brain power!) (Textbook page 21)

Ans. Mendeleev arranged the elements in their increasing order of atomic masses. But some elements with higher atomic masses are placed before those having lower atomic masses, e.g. cobalt (Co) with atomic mass 58.93 is placed before nickel (Ni) having atomic mass 58.71. Modern periodic table was prepared on the basis of the atomic number of elements. The atomic number of Co is 27 and that of Ni is 28. So nickel is placed after cobalt.

(47) How did the position of $^{35}_{17}$Cl and $^{37}_{17}$Cl get fixed in the modern periodic table?

(Use your brain power!) (Textbook page 21)

Ans. In Mendeleev's periodic table, the difference between atomic masses of two consecutive elements is not the same ^{35}Cl and ^{37}Cl. Moseley found out the atomic number of the elements. The atomic number of any element is increased by one unit (number) from the atomic number of subsequent element.

Isotopes $^{35}_{17}$Cl and $^{37}_{17}$Cl occupy the same position in the modern periodic table. Both isotopes have the same atomic number.

In the modern periodic table, the elements are arranged in the order of their increasing atomic numbers, that the problem of discrepancy in the pairs of isotopes elements observed in Mendeleev's periodic table was solved. The isotopes of $^{35}_{17}$Cl and $^{37}_{17}$Cl were placed in the same group as both have the same atomic number.

(48) Can there be an element with atomic mass 53 or 54 in between the two elements, chromium $^{52}_{24}$Cr and manganese $^{55}_{25}$Mn?

(Use your brain power!) (Textbook page 21)

Ans. In Mendeleev's periodic table, the difference between atomic masses of two consecutive elements is not the same (^{52}Cr and ^{55}Mn). Moseley found out the atomic number of the elements. The atomic number of any element is increased by one unit (number) from the atomic number of subsequent element. $^{52}_{24}Cr \longrightarrow {}^{55}_{25}Mn$ that means in between two elements (Cr and Mn), element with mass 53 or 54 do not exist.

(49) What do you think? Should hydrogen be placed in the group 17 of halogens or group 1 of alkali metals in the modern periodic table?

(Use your brain power!) (Textbook page 21)

Ans. (1) Hydrogen is placed in group 1 and in group 17 as it resembles alkali metals as well as halogens. Thus, no fixed position was given to hydrogen in Mendeleev's periodic table.

(2) On the other hand, hydrogen easily donates the electron and forms a stable cation (H^+), but it

does not easily form a stable anion (H^-, hydride ion). Hence, it is better placed in group 1 rather than in group 17 in the modern periodic table.

(50) The elements in the second period : Li, Be, B, C, N, O, F and Ne have electrons in the two shells K and L. Write down the electronic configuration of these elements.

(Textbook page 24)

Ans.

Element	Electronic configuration	
	K shell	L shell
Li	2	1
Be	2	2
B	2	3
C	2	4
N	2	5
O	2	6
F	2	7
Ne	2	8 Octet complete

(51) The elements in the third period : Na, Mg, l, Si, P, S, Cl and Ar have electrons in the third ell K, L and M. Write down the electronic nfiguration of these elements.

(Textbook page 24)

ns. For reference see the answer to Q. 11 (37).

52) What is the relationship between the ctronic configuration of an element and its ency? (Think about it) (Textbook page 24)

ns. The valency of an element is determined by number of electrons in the outermost shell.

3) The atomic number of beryllium is 4, e that of oxygen is 8. Write down the ronic configuration of the two and deduce alency from the same.

(Think about it) (Textbook page 24)

s.

ment	Atomic number	Electronic configuration	Valency
lium (Be)	4	2, 2	2
n (O)	8	2, 6	2

(54) The table given below is based on modern periodic table. Write in it the electronic configuration of the first 20 elements below the symbol and write the valency (as shown in a separate box)

(Think about it) (Textbook page 24)

Ans.

↓ Group	1	2	13	14	15	16	17	18
1	H 1 1							He 2 0
2	Li 2, 1 1	Be 2, 2 2	B 2, 3 3	C 2, 4 4	N 2, 5 3	O 2, 6 2	F 2, 7 1	Ne 2, 8 0
3	Na 2, 8, 1 1	Mg 2, 8, 2 2	Al 2, 8, 3 3	Si 2, 8, 4 4	P 2, 8, 5 3	S 2, 8, 6 2	Cl 2, 8, 7 1	Ar 2, 8, 8 0
4	K 2, 8, 8, 1 1	Ca 2, 8, 8, 2 2						

(55) What is the periodic trend in the variation of valency while going from left to right within a period? Explain your answer with reference to the period 2 and period 3.

Ans. **(Think about it) (Textbook page 24)**

2	Li 2, 1	Be 2, 2	B 2, 3	C 2, 4	N 2, 5	O 2, 6	F 2, 7	Ne 2, 8
3	Na 2, 8, 1	Mg 2, 8, 2	Al 2, 8, 3	Si 2, 8, 4	P 2, 8, 5	S 2, 8, 6	Cl 2, 8, 7	Ar 2, 8, 8

(1) In a period, change in valency of an element varies electronic configuration. The number of valence electrons is different in these elements. However, the number of shells is the same.

(2) In a period, while going from left to right, the atomic number increases by one at a time and the number of valence electrons also increases by one at a time.

(3) In periods 2 and 3, while going from left to right, valency varies.

(4) Which of the above elements have the biggest and the smallest atom?

Ans. The biggest atom : Cs

The smallest atom : Li

(5) What is the periodic trend observed in the variation of atomic radii down a group?

Ans. While going down a group, atomic number increases, atomic radius increases. Therefore atomic size gradually increases.

(57) Look at the elements of third period. Classify them into metals and nonmetals.

(Use your brain power!) (Textbook page 26)

Ans. Third row : Na, Mg, Al, Si, P, S, Cl, Ar

Metals : Na, Mg, Al

Nonmetals : P, S, Cl, Ar

(58) On which side of the period are the metals? Left or right?

(Use your brain power!) (Textbook page 26)

Ans. Left side of the period are the metals.

(59) On which side of the period did you find the nonmetals?

(Use your brain power!) (Textbook page 26)

Ans. Right side of the period are the nonmetals.

(60) What is the cause of nonmetallic character of elements?

(Use your brain power!) (Textbook page 27)

Ans. The tendency of an element to form anion or electronegativity is the nonmetallic character of element.

(61) What is the expected trend in the variation of nonmetallic character of elements from left to right in a period?

(Use your brain power!) (Textbook page 27)

Ans. In a period, as the atomic number increases from left to right, electronegativity increases, nonmetallic character increases. This is due to a decrease in the atomic size.

(62) What would be the expected trend in the variation of nonmetallic character of elements down a group?

(Use your brain power!) (Textbook page 27)

Ans. In a group as the atomic number increases, electropositivity increases while electronegativity decreases, nonmetallic character decreases.

***(63) Write down the electronic configuration of the following elements from the given atomic numbers. Answer the following question with explanation.**

(1) $_{3}Li$, $_{14}Si$, $_{2}He$, $_{11}Na$, $_{15}P$. Which of these elements belong to the period 3?

Ans.

Elements	Electronic configuration
(i) $_{3}Li$	2, 1
(ii) $_{14}Si$	2, 8, 4
(iii) $_{2}He$	2
(iv) $_{11}Na$	2, 8, 1
(v) $_{15}P$	2, 8, 5

Elements belong to the 3rd period : $_{14}Si$, $_{11}Na$ and $_{15}P$.

(2) $_{1}H$, $_{7}N$, $_{20}Ca$, $_{16}S$, $_{4}Be$, $_{18}Ar$. Which of these elements belong to the second group?

Ans.

Elements	Electronic configuration
(i) $_{1}H$	1
(ii) $_{7}N$	2, 5
(iii) $_{20}Ca$	2, 8, 8, 2
(iv) $_{16}S$	2, 8, 6
(v) $_{4}Be$	2, 2
(vi) $_{18}Ar$	2, 8, 8

Elements belongs to the 2nd group : $_{4}Be$ and $_{20}Ca$.

(3) $_{7}N$, $_{6}C$, $_{8}O$, $_{5}B$, $_{13}Al$. Which is the most electronegative element among these?

Ans.

Elements	Electronic configuration
(i) $_{7}N$	2, 5
(ii) $_{6}C$	2, 4
(iii) $_{8}O$	2, 6
(iv) $_{5}B$	2, 3
(v) $_{13}Al$	2, 8, 3

Among these, $_{8}O$ is the most electronegative element.

(4) $_4Be$, $_6C$, $_8O$, $_5B$, $_{13}Al$. Which is the most electropositive element among these?

Ans.

Elements	Electronic configuration
(i) $_4Be$	2, 2
(ii) $_6C$	2, 4
(iii) $_8O$	2, 6
(iv) $_5B$	2, 3
(v) $_{13}Al$	2, 8, 3

Among these, $_{13}Al$ is the most electropositive element.

(5) $_{11}Na$, $_{15}P$, $_{17}Cl$, $_{14}Si$, $_{12}Mg$. Which of these has largest atoms?

Ans.

Elements	Electronic configuration
(i) $_{11}Na$	2, 8, 1
(ii) $_{15}P$	2, 8, 3
(iii) $_{17}Cl$	2, 8, 7
(iv) $_{14}Si$	2, 8, 4
(v) $_{12}Mg$	2, 8, 2

$_{11}Na$ has the largest atomic size.

(6) $_{19}K$, $_3Li$, $_{11}Na$, $_4Be$. Which of these atoms has smallest atomic radius?

Ans.

Elements	Electronic configuration
(i) $_{19}K$	2, 8, 8, 1
(ii) $_3Li$	2, 1
(iii) $_{11}Na$	2, 8, 1
(iv) $_4Be$	2, 2

$_4Be$ has smallest atomic radius.

(7) $_{13}Al$, $_{14}Si$, $_{11}Na$, $_{12}Mg$, $_{16}S$. Which of the above elements has the highest metallic character?

Ans.

Elements	Electronic configuration
(i) $_{13}Al$	2, 8, 3
(ii) $_{14}Si$	2, 8, 4
(iii) $_{11}Na$	2, 8, 1
(iv) $_{12}Mg$	2, 8, 2
(v) $_{16}S$	2, 8, 6

$_{11}Na$ has the highest metallic character.

(8) $_6C$, $_3Li$, $_9F$, $_7N$, $_8O$. Which of the above elements has the highest nonmetallic character?

Ans.

Elements	Electronic configuration
(i) $_6C$	2, 4
(ii) $_3Li$	2, 1
(iii) $_9F$	2, 7
(iv) $_7N$	2, 5
(v) $_8O$	2, 6

$_9F$ has the highest nonmetallic character.

Q. 14 Write scientific reasons :

***(1) Atomic radius goes on decreasing while going from left to right in a period.**

Ans. (1) In a period while going from left to right atomic radius goes on decreasing and the atomic number increases one by one, that means positive charge on the nucleus increases by one unit at a time.

(2) However, the additional electron gets added to the same outermost shell. Due to the increase nuclear charge the electrons are pulled towards the nucleus to a greater extent, as a result the size of atom decreases i.e., atomic radius decreases.

***(2) Metallic character goes on decreasing while going from left to right in a period.**

Ans. (1) Metals have a tendency to loose the valence electrons to form cations. This tendency of an element is called the metallic character of the element.

(2) While going from left to right within a period the outermost shell remains the same and electrons are added to the same shell. However, the positive charge on the nucleus goes on increasing while the atomic radius goes on decreasing and thus the effective nuclear charge goes on increasing. As a result of this the tendency of atom to lose electrons decreases, i.e., electropositivity decreases. Thus metallic character goes on decreasing within a period from left to right.

***(3) Atomic radius goes on increasing down a group.**

Ans. The size of an atom is indicated by its radius. (2) While going down a group a new shell is added. Therefore, the distance between the

outermost electron and the nucleus goes on increasing. These electrons experience lesser pull from the nucleus. Thus, atomic radius goes on increasing down a group.

***(4) Elements belonging to the same group have the same valency.**

Ans.

(1) The valency of an element is determined by the number of valence electron in the outermost shell of an atom of an element.

(2) All the elements in a group have the same number of valence electrons. Therefore, elements in the same group should have the same valency. For example, the elements of group I contain only one valence electron; the valency of elements of group I is one. Similarly for group II, the valency is two.

(5) Zero group elements (inert gases) are called noble gases.

Ans. (1) In the atoms of the inert gas elements (zero group elements), all the electronic shells, including the outermost shell, are completely filled.

(2) The electronic configuration is stable, and these elements do not lose or accept electrons. These elements do not take part in chemical reactions. These elements are gases. Hence, they are called noble gases.

(6) While going down the second group, the reactivity of the alkaline earth metals increases.

Ans. The reaction of alkaline earth metal with water is $M + 2H_2O \rightarrow M(OH)_2 + H_2$. While going down the second group as $Be \rightarrow Mg \rightarrow Ca \rightarrow Sr \rightarrow Ba$, the gradation in this chemical property of the alkaline earth metals is seen. While going down the second group the reactivity of the alkaline earth metals goes on increasing thereby the ease with which this reaction takes place also goes on increasing. Thus, Beryllium (Be) does not react with water. Mg (Magnesium) reacts with steam. Whereas calcium (Ca), strontium (Sr) and barium (Ba) reacts with water at room temperature with increasing rates.

***(7) The third period contains only eight elements even though the electron capacity of the third shell is 18.**

Ans. (1) In the modern periodic table, there are seven horizontal rows called periods. In a periods elements are arranged in an increasing order of their atomic numbers. The third row contains 8 elements and the electron capacity of the third shell is 18.

(2) In the third period, while moving from left to right, atomic number increases, number of electrons increases in the shell. The number of elements present in 3rd period is decided on the basis of electronic configuration and octet rule.

Atomic number	11	12	13	14	15	16	17	18
Elements	Na	Mg	Al	Si	P	S	Cl	Ar

Argon (Ar) is the last element of the third period and has a capacity of maximum 18 electrons. Its octet of electrons is completed and as argon belongs to zero group, the third shell contains 18 electrons.

(8) Fluorine is the most reactive among the halogens.

Ans. (1) Fluorine has the electronic configuration (2, 7). (2) It requires only one electron to complete the octet. (3) The atomic size of flourine is the smallest among the halogens. Hence, the nuclear attraction on the outermost electrons is maximum. Hence, fluorine is the most reactive among the halogens.

(9) Sodium is more metallic than aluminium.

Ans. (1) Metals give electrons. Sodium has electronic configuration (2,8,1). It has only one electron in the outermost shell. (2) It can easily give the single electron in the outermost shell. Hence Sodium is a strong metal. (3) Aluminium ha electronic configuration (2,8,3). It has three electron in the outermost shell. (4) Donation of thre electrons is more difficult than the donation of o electron. Hence, sodium is more metallic th aluminium.

Q. 15 Distinguish between :

(1) Mendeleev's periodic table and Mod periodic table (2) Groups and Peri (3) *s*-block elements and *p*-block elements.

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Ans.

(1) Mendeleev's periodic table	Modern periodic table
1. In this table, the elements are arranged in the order of their increasing atomic weights.	1. In this table, the elements are arranged in the order of their increasing atomic number.
2. In this table, the position of an element is based on its properties and atomic weight.	2. In this table, the position of an element is based on its electronic configuration.
3. There are 8 groups in this table.	3. There are 18 groups in this table.
4. In this table, some elements having similar properties are found in different groups, while those having different properties are sometimes found in the same group.	4. In this table, the elements belonging to the same group show similar chemical properties.
5. Isotopes do not find separate places in this table.	5. Isotopes of an element can be placed at the same place as their atomic number is the same.

(2) Groups	Periods
1. The vertical columns of elements in the modern periodic table are called groups.	1. The horizontal rows of elements in the modern periodic table are called periods.
2. The group number indicates the number of electrons in the outermost shell of an atom of an element belonging to that group.	2. The period number indicates the number of electronic shells present in an atom of an element belonging to that period.
3. The elements in the same group show similar chemical properties	3. The elements in the same period do not show similar properties, but their chemical properties gradually change from left to right in a period.

(3) *s*-block elements	*p*-block elements
1. The groups IA (1) and IIA (2) elements together with hydrogen constitute the *s*-block.	1. The group IIIA (13)–VII A (17) and the zero group (18) elements constitute the *p*-block.
2. They have one or two electrons in the outermost shell.	2. They have three to eight electrons in the outermost shell.
3. The elements of the *s*-block, except hydrogen, are all metals.	3. The elements of the *p*-block include a few metals, all metalloids and all nonmetals.

PROJECTS

*1. Find out the applications of all the inert gases, prepare a chart and display it in the class.
2. Find out the properties and uses of group 1 and group 2 elements.
3. Find out the properties and uses of period 2 and period 3 elements.