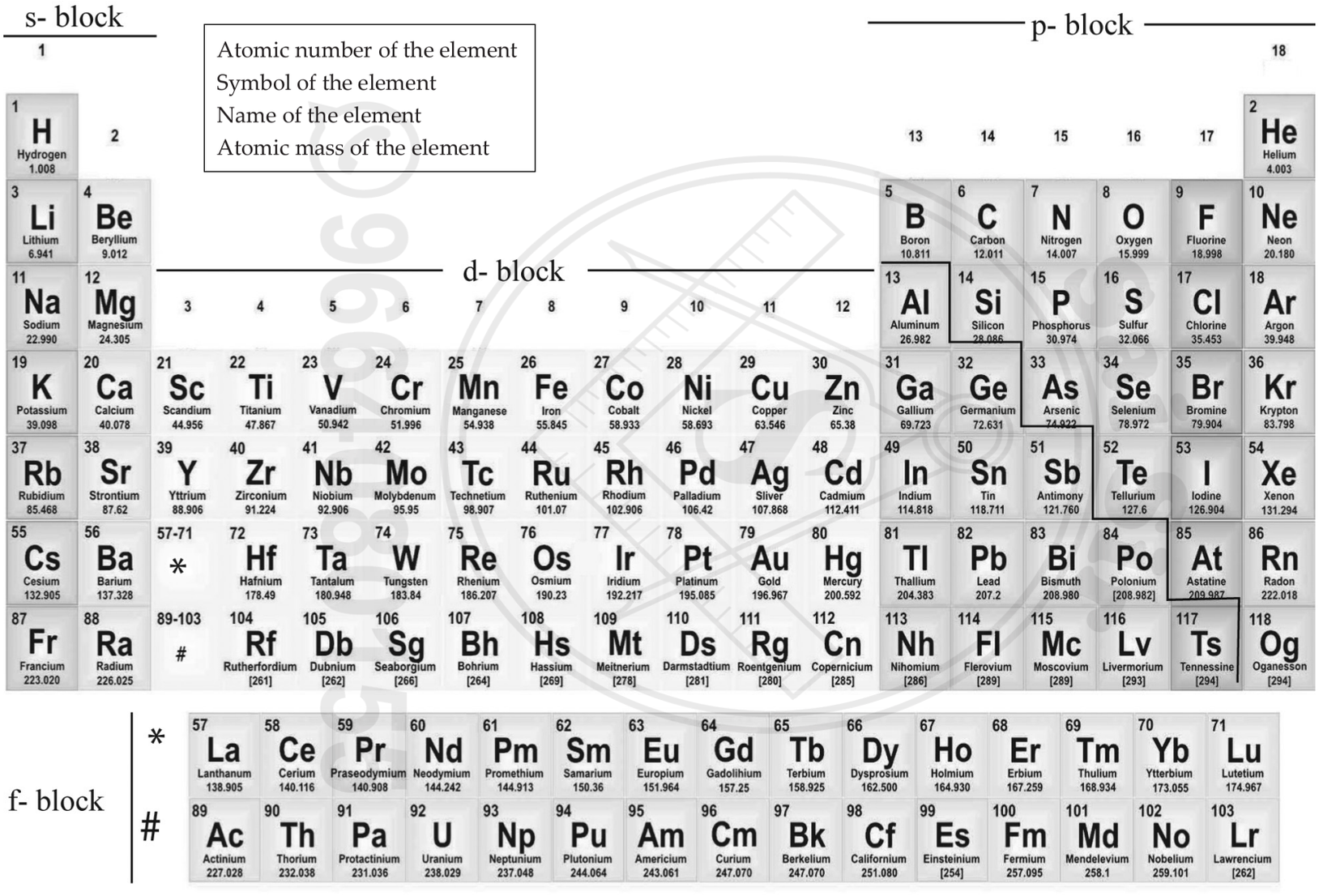

Fig 2.1 Modern Periodic Table

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Q.1. (A) 1. Fill in the blanks and rewrite the complete statement:

(1) The arrangement of elements in a group of three is known as ..... .

(2) The law used by Newlands' to arrange elements is known as ..... .

(3) Mendeleev arranged ..... elements known at that time.

(4) The vertical columns in the periodic table are called ....., while the horizontal rows are called ..... .

(5) The element eka-boron in Mendeleev's periodic table is known as ..... in the Modern Periodic table.

(6) There was no place for ..... in Mendeleev's original periodic table.

(7) Mendeleev created the ..... group without disturbing the original periodic table.

(8) In the Modern Periodic table, the elements are arranged in accordance with their ..... .

(9) Two rows shown separately at the bottom of the Modern Periodic table are called ..... and ..... .

(10) The ..... contains the group 1 and 2 elements.

(11) The d-block elements are called ..... .

(12) Elements showing properties of both metals and non-metals are called ..... .

(13) Newlands could arrange elements upto ..... out of total 56 elements known.

(14) In the family of alkali metals, the number of valence electrons is ..... .

(15) There are seven electrons in the outermost shell of the elements, such elements belong to the family of ..... .

(16) As we go down a group, the number of shells goes on ..... .

(17) In the Modern Periodic table, the elements placed at the bottom of the periodic table are called as ..... elements.

(18) Atomic radius is expressed in the unit .....

(19) Inert gases belong to ..... group.

(20) Elements with atomic numbers 90 to 103 in the Modern Periodic table are called .....

(21) The valency of an element is determined by the number of ..... electrons present in the outermost shell of an atom.

(22) From left to right, the atomic size of an atom ..... .

(23) An element is placed in 2nd period, so it has ..... shells.

(24) Valency across a period ..... gradually.

(25) An atom is said to be a non-metal if it ..... electrons.

(26) ..... is the only element in duplet state.

(27) Elements of group 1A are called ..... .

(28) Group II A elements are called as ..... .

(29) Group VII A elements are called as ..... .

(30) First period contains ..... elements.

(31) Moseley arranged elements according to ..... .

(32) The number of shells ..... down the group.

(33) The formula of chloride of a metal is MCl_2, the metal M belongs to ..... group.

(34) ..... group contains all gases at room temperature.

Ans. *(1) Triads (2) Newlands' Law of Octaves (3) 63 (4) groups, periods (5) Scandium (6) noble gases (7) zero (8) atomic numbers (9) Lanthanide series, Actinide series (10) s-block (11) transition elements (12) metalloids (13) Calcium (Ca) (14) 1 (one) (15) halogens (16) increasing (17) inner transition (18) picometer (19) zero (20) actinides (21) valence (22) decreases (23) 2 (24) varies (25) gains or shares (26) Helium (27) alkali metals (28) alkaline earth metals (29) halogens (30) 2 (31) atomic number (32) increases (33) 2 (II A) (34) 18 or zero*

Q.1. (A) 2. Find the odd word out.

(1) Lithium, Beryllium, Boron, Chlorine

Ans. Chlorine: It belongs to the third period while others are second period elements.

(2) Helium, Radon, Argon, Boron

Ans. Boron: It is a metal while others are inert or noble gases.

(3) Chlorine, Bromine, Iodine, Oxygen

Ans. Oxygen: It is a gas belonging to group 16 while others are halogens belonging to group 17

(4) Sodium, Lithium, Copper, Beryllium

Ans. Copper: Others are normal elements, while copper is a transition element.

(5) Dalton, Dobereiner, Moseley, Newlands

Ans. Dalton: He put forth the Dalton's theory for atomic structure, whereas all others classified elements.

(6) Boron, Silicon, Potassium, Antimony

Ans. Potassium: It is a metal while others are metalloids.

(7) Aluminium, Argon, Xenon, Sodium

Ans. Sodium: It belongs to s-block, whereas others belong to p-block.

(8) Boron, Silicon, Neon, Polonium

Ans. Neon: It is an inert gas, whereas all others are metalloids.

(9) Lithium, Magnesium, Sodium, Potassium

Ans. Magnesium: It belongs to group II A (group 2), whereas others belong to group I A (group 1).

(10) Chlorine, Bromine, Arsenic, Fluorine

Ans. Arsenic: It is a metalloid and others are halogens.

Q.1. (A) 3. Complete the analogy.

(1) Dobereiner: Triad :: Newlands : .....

Ans. Octaves - Doberiner arranged three elements in a triad whereas Newlands arranged the elements in increasing order of their atomic masses. He found that first element and the eighth element had similar properties and called it law of octaves.

(2) Mendeleev's Periodic Table : Atomic mass :: Modern Periodic table : .....

Ans. Atomic number - Atomic mass is the basis for Mendeleev's periodic table whereas the atomic number is the basis for Modern Periodic Table.

(3) Hydrogen : First period :: Lithium : .....

Ans. Second period - The first period contains Hydrogen (1) and Helium (2) Lithium's atomic number is 3, therefore, it is put in the second period.

(4) Fluorine : 2, 7 :: Chlorine : .....

Ans. 2, 8, 7 - Chlorine's atomic number is 17 therefore its electronic configuration is (2, 8, 7)

(5) Group 1: Alkali metals :: ..... : Alkaline earth metals

Ans. Group 2 - The outermost shell of these elements has 2 electrons, therefore, they are put in group 2.

(6) Transition elements : d-block :: Inner transition elements : .....

Ans. f-block - The d-block elements have 2 incomplete outermost shells whereas the f-block elements have 3 outermost shells which are incomplete.

(7) Tellurium : ..... :: Radium : Metal

Ans. Metalloid - Tellurium has properties of both metals and non metals, therefore, it is called a metalloid.

(8) Transition elements : ..... :: Inner transition elements : Three incomplete outermost shells

Ans. Two incomplete outermost shells - The d-block elements have 2 incomplete outer most shells whereas the f-block elements have 3 outermost shells which are incomplete.

(9) Lanthanides : Ce to Lu :: Actinides: .....

Ans. Th to Lr - Ce to Lu are called Lathanides and Th to Lr are called Actinides.

(10) Ca : Alkaline earth metal :: Cs : .....

Ans. Alkali metal - Cs has one electron in its outermost shell and Ca has 2 electrons in its outermost shell.

(11) Fe : Electropositive :: Cl : .....

Ans. Electronegative - Fe has a tendency to form a cation by losing its valence electrons and it is called electropositive property whereas Cl has a tendency to gain electron and it is called electronegative property.

(12) (Li, Na, K) : ..... :: (F, Cl, Br) : Group 17

Ans. Group 1 - Li, Na, K have one electron in their outermost shell whereas F, Cl, Br have 7 electrons in their outermost shell.

(13) Valency of Na (2,8,1) : 1 (One) :: Valency of P(2,8,5) : .....

Ans. 3 (Three) - Na loses 1 electron to get the configuration of He (2b) and P requires 3 electrons to get a configuration 2, 8, 8. (Ar). Therefore, the valency of P is 3.

Q.1. (A) 4. Match the columns:

***(1)**

Column A		Column B		Column C	
(i)	Triad	(a)	Lightest and negatively charged particle in all the atoms.	(1)	Mendeleev
(ii)	Octave	(b)	Concentrated mass and positive charge	(2)	Thomson
(iii)	Atomic number	(c)	Average of the first and the third atomic mass	(3)	Newlands
(iv)	Period	(d)	Properties of the eighth element similar to the first	(4)	Rutherford
(v)	Nucleus	(e)	Positive charge on the nucleus	(5)	Dobereiner
(vi)	Electron	(f)	Sequential change in molecular formulae	(6)	Moseley

Ans. *(i – c – 5), (ii – d – 3), (iii – e – 6), (iv – f – 1), (v – b – 4), (vi – a – 2)*

(2)

Column A		Column B	
(1)	Sodium	(a)	Non-metal
(2)	Sulphur	(b)	Lanthanide
(3)	Manganese	(c)	Metal
(4)	Cerium	(d)	Transition metal

Ans. *(1 – c), (2 – a), (3 – d), (4 – b)*

(3)

Column A		Column B	
(1)	Alkali metals	(a)	Valency 4
(2)	Alkaline earth metals	(b)	Valency 0
(3)	Argon	(c)	Divalent
(4)	Carbon	(d)	Monovalent

Ans. *(1 – d), (2 – c), (3 – b), (4 – a)*

(4)

Column A		Column B	
(1)	Atomic size in a period from left to right	(a)	Atomic mass
(2)	Atomic size in a group from top to bottom	(b)	Increases
(3)	Modern Periodic Law	(c)	Atomic number
(4)	Mendeleev's Periodic Law	(d)	Decreases

Ans. *(1 – d), (2 – b), (3 – c), (4 – a)*

(5)

Column A		Column B	
(1)	Alkali metals	(a)	Group 2
(2)	Alkaline earth metals	(b)	Group 1
(3)	Halogens	(c)	Group 18
(4)	Noble gases	(d)	Group 17

Ans. *(1 – b), (2 – a), (3 – d), (4 – c)*

Q.1. (A) 5. State whether the following statement is 'True' or 'False'. If false; write the correct statement for the same.

(1) Lithium, Potassium and Sodium are elements forming Dobereiner's triad.

(2) According to Mendeleev's periodic law, the properties of elements are a periodic function of their atomic numbers.

(3) Periods are the horizontal rows of elements.

(4) Group 17 elements are known as Noble gases.

(5) Silicon is a metalloid.

(6) As we move from left to right in a period of Modern Periodic table, atomic size of the elements gradually increases.

(7) Group 1 elements in Modern Periodic table are referred as "alkali metals".

(8) Argon is not an inert gas.

(9) The d-block elements are called transition elements.

(10) Upto Calcium, the law of octaves was found to be applicable.

(11) Metals are electronegative and non-metals are electropositive.

(12) Eka-aluminium was discovered and named as Gallium (Ga).

(13) Atomic number is the number of protons or electrons present in the nucleus.

(14) Eka boron is known as Germanium.

(15) Tellurium, Polonium are metalloids.

(16) Isotopes have same atomic masses.

(17) Isotopes have similar chemical properties.

(18) La stands for Lutetium.

(19) f-block elements are metalloids.

(20) In an atom of an element, extra-nuclear electrons take part in the chemical reaction.

Ans. *(1) False. Lithium, Sodium and Potassium are elements forming Dobereiner's triad. (2) False. According to Mendeleev's periodic law, the properties of elements are a periodic function of their atomic masses. (3) True (4) False. Group 17 elements are known as Halogens. (5) True (6) False. As we move from left to right in a period of the Modern Periodic table, atomic size of the elements gradually decreases. (7) True (8) False. Argon is an inert gas, belongs to group 18. (9) True (10) True (11) False. Metals are electropositive and non-metals are electronegative. (12) True (13) True (14) Eka-boron is known as Scandium. (15) True (16) False. Isotopes are atoms of the same element having same atomic number but different atomic masses. (17) True (18) False. La stands for Lanthanum. (19) False. f-block elements are metals. (20) True*

Q.1. (A) 6. Answer the following.

*(1) Write the name and symbol of the elements from the description.

(i) The atom having the smallest size.

Ans. Helium (He).

(ii) The atom having the smallest atomic mass.

Ans. Hydrogen (H).

(iii) The most electronegative atom.

Ans. Fluorine (F).

(iv) The noble gas with the smallest atomic radius.

Ans. Helium (He).

(v) The most reactive nonmetal.

Ans. Fluorine (F).

*(2) Write the names from the description.

(i) The period with electrons in the shell, K, L and M.

Ans. Period 3.

(ii) The group with valency zero.

Ans. Group 18

(iii) The family of non-metals having valency one.

Ans. Halogens.

(iv) The family of metals having valency one.

Ans. Alkali metals.

(v) The family of metals having valency two.

Ans. Alkaline Earth metals.

(vi) The metalloids in the second and third periods.

Ans. Boron and Silicon.

(vii) Non-metals in the third period.

Ans. Phosphorus, Sulphur, Chlorine and Argon.

(viii) Two elements having valency 4.

Ans. Carbon, Silicon.

Q.1. (A) 7. Name the following:

*(1) Three elements having a single electron in their outermost shell.

Ans. (i) Lithium (Li) (2,1) (ii) Sodium (Na) (2, 8 1) (iii) Potassium (K) (2,8,8,1).

*(2) Three elements with filled outermost shell.

Ans. (i) Helium (2) (ii) Neon (2,8) (iii) Krypton (2,8,18,8).

*(3) Three elements having 7 electrons in their outermost shell.

Ans. (i) Fluorine (2,7) (ii) Chlorine (2,8,7) (iii) Bromine (2,8,18,7).

(4) Three elements which are metalloids.

Ans. (i) Boron (B) (ii) Silicon (Si) (iii) Germanium (Ge).

(5) Three alkaline earth metals with electronic configuration.

Ans. (i) Beryllium (Be) (2,2) (ii) Magnesium (Mg) (2,8,2) (iii) Calcium (Ca) (2,8,8,2).

(6) Two pairs of Dobereiner's triad.

Ans. (i) Lithium (Li), Sodium (Na), Potassium (K) (ii) Chlorine (Cl), Bromine (Br), Iodine (I).

(7) The scientist who classified elements on the basis of atomic mass.

Ans. Dmitri Mendeleev.

(8) The scientist who classified elements on the basis of atomic number.

Ans. Henry Moseley.

(9) The 3 elements which were predicted by Mendeleev for which he left blank spaces in the periodic table.

Ans. Eka-Boron, Eka-Silicon, Eka-Aluminium.

(10) Series of 14 elements placed below the periodic table having atomic no. from 58 to 71 [Ce to Lu]

Ans. Lanthanides.

(11) Series of 14 elements placed below the periodic table having atomic no. from 90 to 103 [Th to Lr]

Ans. Actinides.

Q.1. (B) Choose and write the correct options:

*(1) The number of electrons in the outermost shell of alkali metals is .....

(a) 1 (b) 2 (c) 3 (d) 7

*(2) Alkaline earth metals have valency 2. This means that their position in the Modern Periodic table is in .....

(a) Group 2 (b) Group 16

(c) Period 2 (d) d-block

*(3) Molecular formula of the chloride of an element X is XCl. This compound is a solid having high melting point. Which of the following elements be present in the same group as X.

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

*(4) In which block of the Modern Periodic table are the non-metals present?

(a) s-block (b) p-block
(c) d-block (d) f-block

(5) ..... triad does not follow Dobereiner's law of triad.

(a) Li, Na, K (b) Ca, Sr, Ba
(c) Mg, Ca, Sr (d) Cl, Br, I

(6) ..... resembles alkali metals as well as halogens.

(a) Lithium (b) Sodium
(c) Hydrogen (d) Silicon

(7) First period consists of ..... elements.

(a) 1 (b) 8 (c) 2 (d) 4

(8) Electronic configuration of Mg is .....

(a) (2, 8, 4) (b) (2, 8, 1)
(c) (2, 8, 3) (d) (2, 8, 2)

(9) ..... is in liquid state at room temperature.

(a) Fluorine (b) Chlorine
(c) Bromine (d) Iodine

(10) Atomic radius of Lithium is ..... pm.

(a) 41 (b) 151 (c) 152 (d) 157

Ans. *(1) (a) 1 (2) (a) Group 2 (3) (a) Na (4)(b) p-block (5) (c) Mg, Ca, Sr (6) (c) Hydrogen (7) (c) 2 (8) (d) (2, 8, 2) (9) (c) Bromine (10) (c) 152*

Q.2.1. Solve the following:

(1) X, Y and Z are the elements of a Dobereiner's Triad. If the atomic mass of X is 7 and that of Z is 39, what should be the atomic mass of Y?

Ans. Atomic mass of X = 7

Atomic mass of Z = 39

∴ According to Dobereiner's Triad, atomic mass of Y

$= \frac{X + Z}{2} = \frac{7 + 39}{2} = \frac{46}{2} = 23$

∴ Atomic mass of Y = 23

(2) Two elements X and Y have atomic number 12 and 16 respectively. Write the electronic configuration for these elements. To which period of the Modern Periodic table do these two elements belong?

Ans.

Element	Atomic number	Electronic configuration
X	Z = 12	2, 8, 2
Y	Z = 16	2, 8, 6

Both these elements belong to third period.

***(3) Identify Dobereiner's triads from the following groups of elements having similar chemical properties?** *[Can you tell?; Textbook Page 16]*

(i) Mg (24.3), Ca (40.1), Sr (87.6)
(ii) S (32.1), Se (79.0), Te (127.6)
(iii) Be (9.0), Mg (24.3), Ca (40.1)

Ans.

(i) (a) Mg (24.3), (b) Ca (40.1), (c) Sr (87.6)

$\therefore$ mean of $\frac{a + c}{2} = \frac{111.90}{2} = 55.95$

which is not approximately equal to the atomic mass of middle element (Ca). Therefore, it does not form Dobereiner's triads.

(ii) (a) S (32.1), (b) Se (79.0), (c) Te (127.6)

$\therefore$ mean of $\frac{a + c}{2} = \frac{159.70}{2} = 79.85$

which is approximately equal to atomic mass of Se. Hence, it forms Dobereiner's triads.

(iii) (a) Be (9.0), (b) Mg (24.3), (c) Ca (40.1)

$\therefore$ mean of $\frac{a + c}{2} = \frac{49.10}{2} = 24.55$

which is approximately equal to atomic mass of Mg. Hence, it forms Dobereiner's triads.

Q.2.2. State the laws / Define:

(1) Newlands' Law of Octaves:

Ans. Newlands' Law of Octaves states that "When the elements are arranged in an increasing order of their atomic masses, the properties of every eighth element are similar to those of the first."

(2) Mendeleev's Periodic law:

Ans. Mendeleev's Periodic law states that "properties of elements are periodic function of their atomic masses."

(3) Modern Periodic Law:

Ans. Modern Periodic law states that "properties of elements are periodic function of their atomic numbers."

(4) Dobereiner's Triad

Ans. When elements with similar chemical properties are arranged in increasing order of their atomic mass in group of three called as triads, the atomic mass of the middle element is approximately equal to the mean of the atomic masses of the other two elements.

(5) Periods

Ans. The Horizontal rows of elements in the periodic table are called periods.

(6) Groups

Ans. The Vertical columns of elements in the periodic table are called groups.

(7) Normal Elements

Ans. The elements in which only last shell is incompletely filled are called as normal elements.

(8) Lanthanide Series

Ans. The series of fourteen elements from Cerium [Ce (58)] to Lutetium [Lu (71)] is called Lanthanides Series.

(9) Actinide Series

Ans. The series of Fourteen elements from Thorium [Th (90)] to Lawrencium [Lr (103)] is called Actinide Series.

(10) Transition elements

Ans. The elements in which last two shells are incompletely filled are called Transition elements. They belong to d-block of Modern Periodic Table.

(11) Inner Transition elements

Ans. The f-block elements are placed at the bottom of the periodic table and they have last three shells incompletely filled. These elements are called Inner Transition Elements.

(12) Atomic radius

Ans. For an isolated atom, atomic radius is the distance between the centre of the nucleus of an atom to its outermost shell.

(13) Valency

Ans. The number of electrons accepted, donated or shared by an atom so as to complete the octet in its outermost shell is called valency.

OR

Valency is the combining capacity of an element.

(14) Inert elements

Ans. Elements present in group 18 on the extreme right of the Modern Periodic table are called Inert elements or Noble gases. They have all shells including the outermost shell completely filled.

(15) Isotopes

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

(16) Metalloids

Ans. Elements which show the properties of both metals and non-metals are called as metalloids. e.g. Silicon (Si), Arsenic (As), Tellurium (Te).

Q.2.3. Answer the following questions in one or two sentences:

(1) What is meant by periodicity?

Ans. The repetition of same properties after certain interval is called periodicity.

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

Ans. Tendency to gain electrons increases from left to right in a period because atomic size goes on decreasing and effective nuclear charge increases.

(3) Why was Dobereiner's classification of elements not useful?

Ans. Dobereiner's Triad was not useful for classification of elements because he could identify only some triads from the known elements as other triads did not obey Dobereiner's rule.

(4) In the periodic table where are the metalloids placed?

Ans. The metalloids are elements which lie along the border of the zig zag line which separates metals placed on the left side from non-metals placed on the right side.

(5) Elements of which group are called as alkali metals?

Ans. Elements of group 1 are called alkali metals.

(6) Which is the incomplete period in the Modern Periodic table?

Ans. Since the Modern Periodic table is complete there is no incomplete period.

(7) Which law was modified into Modern Periodic law?

Ans. Mendeleev's Periodic law was modified into Modern Periodic law.

(8) What are periodic properties?

Ans. The properties which show gradual variation in a group and in a period and they repeat themselves after a certain interval of atomic number are called periodic properties.

(9) What are normal elements?

Ans. Elements of group 1, 2 and 13 to 17 are called normal elements. These elements have only the outermost shell incompletely filled.

(10) On what basis is Potassium (Z = 19) placed in 4^{th} period and group 1?

Ans. The electronic configuration of potassium is (2, 8, 8, 1). It has four shells so it belongs to the period 4 . The period 4 has elements with the 4th shell being filled. Potassium has 1 electron in its valence shell. Hence, it is placed in group 1. Group 1 has elements with 1 electron in the valence shell.

(11) How will you differentiate between metals and non-metals by the number of valence electrons?

Ans. Elements which have 1, 2 or 3 valence electrons are metals and those which have 4, 5, 6 or 7 valence electrons are non-metals.

***(12) What are the types of matter?** *(Can you recall?; Textbook Page 16)*

Ans. There are three types of matters viz elements, compounds and mixtures.

***(13) What are the types of elements?** *(Can you recall?; Textbook Page 16)*

Ans. The three types of elements are metals, non-metals and metalloids.

***(14) What are the smallest particles of matter called?** *(Can you recall?; Textbook Page 16)*

Ans. The smallest particles of matter are called atoms and molecules.

***(15) What is the difference between the molecules of elements and compounds?** *(Can you recall?; Textbook Page 16)*

Ans. Molecules of elements contain atoms of the same element where as molecules of compounds contain atoms of two or more different elements.

***(16) What are the values of 'n' for the shells K, L and M?** *(Can you recall?; Textbook Page 24)*

Ans. K - 1 L - 2 M - 3

***(17) What is the maximum number of electrons that can be accommodated in a shell? Write the formula.** *(Can you recall?; Textbook Page 24)*

Ans.

Shell	$2n^2$	Electron Capacity
K	$2 \times 1^2 = 2$	2
L	$2 \times 2^2 = 8$	8
M	$2 \times 3^2 = 18$	18
N	$2 \times 4^2 = 32$	32

***(18) Deduce the maximum electron capacity of the shells K, L and M?** *(Can you recall?; Textbook Page 24)*

Ans. K - 2 $(2n^2 = 2 \times 1^2 = 2)$

L - 8 $(2n^2 = 2 \times 2^2 = 2 \times 4 = 8)$

M - 18 $(2n^2 = 2 \times 3^2 = 2 \times 9 = 18)$

***(19) There are some vacant places in 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.

Predicted atomic mass	Group	Period	Predicted Name	Present Names
44	III	4	Eka boron	Scandium
68	III	5	Eka aluminium	Gallium
72	IV	5	Eka silicon	Germanium

***(20) Due to uncertainty in the names of some of the elements, a question mark is indicated before the symbol in the Mendeleev's periodic table. What are such symbols?** *(Think about it; Textbook Page 19)*

Ans. Mendeleev arranged the elements in the increasing order of atomic masses. In some places the atomic mass of elements would not be in right order to put them in the correct group. Tellurium is heavier than Iodine, but he put Iodine after Tellurium because Iodine has similar properties like F, Cl, Br. He placed the elements according to their properties and put a question mark to indicate that the atomic mass needs to be checked. for e.g. ?Yt = 88 in Mendeleev's periodic table was corrected as Yt = 88.906 in Modern Periodic table.

Q.2.4. Write short notes on:

***(1) Mendeleev's Periodic law:**

Ans.

(i) The Russian scientist Dmitri Mendeleev developed the periodic table of elements during the period 1869 to 1872 A.D.

(ii) Mendeleev's periodic table is the most important step in the classification of elements.

(iii) Mendeleev considered the fundamental property of elements, namely the atomic mass as standard and arranged 63 elements known at that time in an increasing order of their atomic masses.

(iv) Then, he transferred this into the periodic table of elements in accordance with the physical and chemical properties of these elements.

(v) He organized the periodic table on the basis of the chemical and physical properties of the elements.

(vi) These were the molecular formulae of hydrides and oxides of the elements, melting points, boiling points and densities of the elements and their hydrides and oxides.

(vii) Mendeleev found that the elements with similar physical and chemical properties repeat after a definite interval.

(viii) On the basis of this finding, Mendeleev, stated the following periodic law "Properties of elements are periodic function of their atomic masses".

***(2) Structure of the Modern Periodic table.**

Ans.

(i) The Modern Periodic table contains seven horizontal rows called the periods 1 to 7.

(ii) Similarly, eighteen vertical columns are the groups 1 to 18.

(iii) The arrangement of the periods and groups results into formation of boxes.

(iv) Atomic numbers are serially indicated in the upper part of these boxes.

(v) Each box corresponds to the place for one element.

(vi) Apart from these seven rows, two separate rows are placed at the bottom of the periodic table.

(vii) These are called Lanthanide series and Actinide series respectively.

(viii) There are 118 boxes in the periodic table including the two series.

(ix) It means that there are 118 places for elements in the Modern Periodic table.

(x) The Modern Periodic table is now completely filled, means all the 118 elements are now discovered.

(xi) The entire periodic table is divided into four blocks, viz, s-block, p-block, d-block and f-block.

(xii) The s-block contains the groups 1 and 2 elements.

(xiii) The groups 13 to 18 constitute the p-block elements.

(xiv) The groups 3 to 12 constitute the d-block elements. The d-block elements are called transition elements.

(xv) The lanthanide and actinide series at the bottom form the f-block elements.

(xvi) A zig-zag line can be drawn in the p-block of the periodic table.

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

(xviii) All the metals lie on the left side of the zig-zag line, while all the non-metals lie on the right side.

***(3) Position of isotopes in the Mendeleev's and the Modern Periodic table.**

Ans.

(i) Different atoms of the same element having same atomic number but different atomic mass number are called isotopes.

(ii) Isotopes were discovered long time after Mendeleev put forth the periodic table.

(iii) As isotopes have the same chemical properties but different atomic masses, a challenge was posed in placing them in Mendeleev's periodic table.

(iv) Based on chemical properties, they were to be placed in same group, while based on atomic masses they were to be placed in different groups.

(v) Hence, there was no definite place for isotopes.

(vi) This anomaly arose in Mendeleev's periodic table because the elements were arranged in an increasing order of their atomic masses.

(vii) In 1913 A.D., Henry Moseley revealed that atomic number is a more fundamental property of an element than its atomic mass.

(viii) Hence, he modified Mendeleev's Periodic Table and arranged the elements in an increasing order of their atomic number in the Modern Periodic Table.

(ix) By doing so, the anomaly of Mendeleev's Periodic Table regarding isotopes was removed.

(x) Therefore, in the Modern Periodic Table the isotopes could be placed in the same group and the radioactive isotopes were placed in two separate series below at the bottom of the periodic table.

(4) Halogens or group 17 elements.

Ans.

(i) The second last column in the periodic table is group 17 (VII – A) which contains halogens.

(ii) The members of this group from top to bottom are as given in the following table:

Group 17 elements	Symbol	Atomic Number (Z)	Electronic configuration	Valency
Fluorine	F	9	2, 7	1
Chlorine	Cl	17	2, 8, 7	1
Bromine	Br	35	2, 8, 18, 7	1
Iodine	I	53	2, 8, 18, 18, 7	1
Astatine	At	85	2, 8, 18, 32, 18, 7	1

(iii) The valence shell of a halogen contains seven electrons.

(iv) Thus, it needs one electron to complete its octet.

(v) The halogen complete their octet and attain the stable inert gas configuration by gaining one electron.

(vi) Hence, the valency of halogens is one, i.e. they are monovalent.

(vii) All of them have general formula X_2. Fluorine (F_2) and Chlorine (Cl_2) are gases. Bromine (Br_2) is a liquid, while Iodine (I_2) is a solid.

(5) Transition Elements.

Ans.

(i) Elements present in groups 3 to 12 in the middle of the periodic table are called transition elements.

(ii) Their last two outermost shells are incomplete.

(iii) They belong to d-block of Modern Periodic table.

(iv) All these elements are solid metals at room temperature (except Mercury and Gallium).

(6) Inner-Transition Elements.

Ans.

(i) Elements placed in two separate rows at the bottom of the periodic table are called inner transition elements.

(ii) They include two series of elements: Lanthanide series and Actinide series. They belong to f-block elements of Modern Periodic table.

(iii) 14 elements with atomic number 58 to 71 (Cerium to Lutetium) are called lanthanides. These elements are placed along with lanthanum (La = 57) in group 3 and period 6 because of very close resemblance in properties between them.

(iv) 14 elements with atomic number 90 to 103 (Thorium to Lawrencium) are called actinides. These elements are placed along with actinium (Ac = 89) in group 3 and period 7 because of very close resemblance in their properties.

(v) They have last three shells incompletely filled.

(vi) All these elements are metals.

(7) Metallic and Non-metallic properties

Ans.

(i) Metals show tendency to lose electrons. Therefore, they are said to be electropositive.

(ii) Non-metals show the tendency to accept electrons or share electrons with another atoms. Therefore, they are said to be electronegative.

(iii) Across the period from left to right, metallic character decreases and non-metallic character increases.

(iv) This is because the atomic size decreases due to greater nuclear pull because of which valence electrons cannot be easily removed.

(v) Down the group-metallic character increases and non-metallic character decreases from top to bottom in a group.

(vi) As atomic number increases from top to bottom in a group, newer shells get added which in turn increases its atomic size. Thus nuclear pull decreases due to addition of newer shells and thus the valence electrons present in outermost shell can be easily removed from the atom.

(vii) The three types of elements can be easily shown in the Modern Periodic table with the help of zig-zag line.

(viii) The metalloid elements lie along the border of the zig-zag line. All the metals lie on the left side of zig-zag line while all the non-metals lie on the right side.

Q.2.5. Distinguish between:

(1) Mendeleev's Periodic table and Modern Periodic table.

Ans.

Mendeleev's Periodic Table	Modern Periodic Table
(i) This table is based on the atomic mass of the elements.	(i) This table is based on the atomic number of the elements.
(ii) Elements are arranged in increasing order of their atomic mass.	(ii) Elements are arranged in increasing order of their atomic number.
(iii) Mendeelev's Periodic table consists of only 63 elements.	(iii) Modern Periodic table consists of 118 elements.
(iv) Mendeelev's Periodic table is based on Mendeleev's Periodic Law, 'Properties of element are a periodic function of their atomic masses.'	(iv) Modern Periodic table is based on Modern Periodic Law,'Properties of elements are periodic function of their atomic number.'
(v) There was no space for inert gases and radioactive isotopes.	(v) The table contains all elements including inert gases and radioactive isotopes.

(vi) Some elements having similar properties were placed in different groups. Some elements in different groups were found to have similar properties.	(vi) All elements placed in the same group have similar properties.
(vii) Elements could not be divided into four blocks.	(vii) Elements are divided into four blocks – i.e. s, p, d and f blocks.

(2) Transition elements and Inner transition elements

Ans.

Transition elements	Inner transition elements
(i) Elements placed in groups 3 to 12 in the middle of the Modern Periodic table are called transition elements.	(i) Elements placed in two separate rows at the bottom of the Modern Periodic table are called inner transition elements.
(ii) These elements have last two incompletely filled outermost shells.	(ii) These elements have last three incompletely filled outermost shells.
(iii) They belong to the d-block in the Modern Periodic table.	(iii) They belong to the f-block in the Modern Periodic table.

(3) Inert gases and Normal Elements

Ans.

Inert gases	Normal Elements
(i) In the atoms of inert gases all the shells are completely filled including the outermost shell.	(i) In the atoms of normal elements, all shells are completely filled except the outermost shell.
(ii) They are stable and chemically inert (i.e. chemically non-reactive)	(ii) They are unstable and are chemically reactive.
(iii) They are included in the p-block of the Modern Periodic table.	(iii) They are included in the s-block as well as p-block of the Modern Periodic table.
(iv) They are placed in zero group (Group 18) of the Modern Periodic table.	(iv) These elements are placed in groups 1, 2 and 13 to 17 of the Modern Periodic table.

(4) Groups and Periods of Modern Periodic Table

Ans.

Groups	Periods
(i) Vertical columns of elements in the Modern Periodic table are called Groups.	(i) Horizontal rows of elements in the Modern Periodic table are called periods.
(ii) There are 18 groups in the Modern Periodic table.	(ii) There are 7 periods in the Modern Periodic table.
(iii) The group number indicates the valence electrons in the outermost shell.	(iii) The period number indicates the number of shells in the atoms of an element.
(iv) The elements in the same group have similar chemical properties.	(iv) The elements in a period exhibit gradual change in properties from left to right.

(5) Metallic character and Non-metallic character

Ans.

Metallic character	Non-metallic character
(i) It is the tendency of an atom to lose electrons.	(i) It is the tendency of an atom to accept or share electrons.
(ii) Metallic character decreases from left to right in a period.	(ii) Non-metallic character increases from left to right in a period.

(iii) In a group, metallic character increases from top to bottom.	(iii) In a group, non-metallic character decreases from top to bottom.
(iv) Elements having metallic character are said to be electropositive.	(iv) Elements having non-metallic character are said to be electronegative.

(6) s-block elements and p-block elements

Ans.

s-block elements	p-block elements
(i) Elements in group 1 and 2 are called s-block elements including hydrogen.	(i) Elements in group 13 to 17 and zero group are called p-block elements.
(ii) They contain 1 or 2 electrons in the outermost shell.	(ii) They contain 3 to 8 electrons in the outermost shell.
(iii) They are all metals (except hydrogen).	(iii) They are metals, non-metals and metalloids.

(7) Alkali metals and Alkaline earth metals

Ans.

Alkali metals	Alkaline earth metals
(i) In the Modern Periodic Table, elements in Group 1 are alkali metals.	(i) In the Modern Periodic Table, elements in Group 2 are alkaline earth metals.
(ii) Atoms of these elements have one electron in the valence shell.	(ii) Atoms of these elements have two electrons in their valence shell.
(iii) They are monovalent.	(iii) They are divalent.
(iv) Their oxides and hydroxides dissolve readily in water.	(iv) Their oxides and hydroxides dissolve slightly in water.

Q.2.6. Give Scientific Reasons:

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

Ans.

(i) Atomic radius is the distance between the centre of the atom and its outmost shell.

(ii) Atomic radius decreases across a period.

(iii) This is because valence electrons are being added to the same outermost shell or to the same energy level because of which the electrons added experience greater pull from the nucleus.

(iv) This results in the electrons moving closer to the nucleus. Hence, the atomic radius goes on decreasing while going from left to right in a period.

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

Ans.

(i) Metallic character is the tendency of an atom to lose electrons.

(ii) In a period, electrons are added to the same shell and hence, these electrons experience greater pull from the nucleus. As a result outermost shell comes closer to nucleus, atomic size decreases.

(iii) Thus it becomes difficult to remove an electron from the outermost shell of an atom. Hence, metallic character decreases from left to right in a period.

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

Ans.

(i) Atomic radius is the distance between the centre of the atom to its outermost shell.

(ii) New shells are added to the atoms of the elements as we go down from top to bottom in a group.

(iii) The outermost electrons go further and further away from the nucleus, extending the radius and ultimately increase in the size of the atom. Hence, atomic radius goes on increasing down a group.

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

Ans.

(i) Valency is the number of electrons donated, accepted or shared by the atoms of an element so as to complete the octet in the outermost orbit.

(ii) Valency is dependent upon the number of valence electrons present in the outermost shell of an atom called valence electrons.

(iii) Elements in the same group have same number of valence electrons, irrespective of the number of orbits. Hence, elements in the same group have the same valency.

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

Ans.

(i) Period 3 of the periodic table consists of elements whose atom has three shells occupied by electrons.

(ii) As per the electron holding capacity of shells, 2 elements are present in the first period, and 8 elements in the second period.

(iii) The third period also contain only eight elements due to the law of electron octet and also electrons will fill orbitals in increasing order of energy, i.e. the lowest energy orbital first.

(6) Atomic number is a more fundamental property of an element than its atomic mass.

Ans.

(i) The atomic number of an element indicates the number of protons in the nucleus or the number of electrons in the atom.

(ii) All the atoms of an element have the same atomic number.

(iii) The number of electrons present in the outermost shell of an atom is responsible for the formation of compounds either by sharing, accepting or donating electrons.

(iv) The chemical properties of an element are decided by its atomic numbers. Hence, atomic number is a more fundamental property of an element than its atomic mass.

(7) Alkali metals are placed in Group 1.

Ans.

(i) The group number indicates the number of valence electrons present in the outermost shell of an atom of an element.

(ii) All alkali metals have one electron in their outermost shell. Hence, they are placed in Group 1.

(8) Inert gases exist in the form of free atoms.

Ans.

(i) Formation of molecules is based on the electronic configuration of the combining elements.

(ii) In the case of inert gases, all the shells, including the outermost shell are completely filled.

(iii) They have electronic configuration with complete duplet or complete octet.

(iv) Due to their stable electronic configuration, atoms of these elements do not lose, gain or share electrons with other atoms. Hence, inert gases exist in the form of free atoms.

***Q.3.1. Answer the following:**

(1) An element has its electronic configuration as 2, 8, 2. Now answer the following questions:

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

Ans. Electronic configuration of this element is (2, 8, 2)

$\therefore$ The atomic number of this element is 12.

(ii) What is the group of this element?

Ans. Atomic number of element is 12 and its electronic configuration is (2, 8, 2). As it has 2 valence electrons, this element belongs to group 2 and its name is Magnesium (Mg).

(iii) To which period does this element belong?

Ans. Atomic number of this element is 12 and its electronic configuration is (2, 8, 2). It has 3 shells. The number of shells indicates the period number. Hence it belongs to period 3.

(iv) With which of the following elements would this element resemble? (Atomic numbers are given in the brackets) N (7), Be (4), Ar (18), Cl (17)

Ans. The atomic number of the given element is 12 and this element is Magnesium which belongs to group 2 and Period 3.

Electronic configuration of Mg (12) = (2, 8, 2)
Electronic configuration of N (7) = (2, 5)
Electronic configuration of Be (4) = (2, 2)
Electronic configuration of Ar (18) = (2, 8, 8)
Electronic configuration of Cl (17) = (2, 8, 7)

Number of valence electrons in this element (Magnesium) is 2. Similarly the number of valence electron in Be is 2. As they have same number of valence electrons they belong to same group i.e. group 2 and will resemble in some of their properties.

(2) Write down the electronic configuration of the following elements from the given atomic numbers. Answer the following questions with explanation.

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

Ans.

Name of the element	Atomic Number	Electronic Configuration		
		K	L	M
Lithium (Li)	3	2	1	
Silicon (Si)	14	2	8	4
Helium (He)	2	2		
Sodium (Na)	11	2	8	1
Phosphorous (P)	15	2	8	5

As the elements Silicon (Si), Sodium (Na) and Phosphorous (P) have electrons in the three shells; K, L and M, therefore these elements belong to period 3 as the number of shells indicates the period number.

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

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration			
			K	L	M	N
Hydrogen	H	1	1			
Nitrogen	N	7	2	5		
Calcium	Ca	20	2	8	8	2
Sulphur	S	16	2	8	6	
Beryllium	Be	4	2	2		
Argon	Ar	18	2	8	8	

From the above electronic configurations, elements Calcium (Ca) and Beryllium (Be) have same number of valence electrons, i.e. 2, therefore Calcium and Beryllium belong to group 2. We can infer from this that the group follows the trend of same valence electrons.

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

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration		
			K	L	M
Nitrogen	N	7	2	5	
Carbon	C	6	2	4	
Oxygen	O	8	2	6	
Boron	B	5	2	3	
Aluminium	Al	13	2	8	3

Among the elements given, Nitrogen, Carbon, Oxygen and Boron belong to the second period. As we know in a period from left to right, the electronegativity increases. Electronegativity means the tendency of an element to form anion by accepting the electrons. Therefore, Oxygen is the most electronegative element, since it is present at the extreme right amongst the given elements of period 2.

(iv) $_{4}Be$, $_{6}C$, $_{8}O$, $_{5}B$, $_{13}Al$. Which is the most electropositive element among these?

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration		
			K	L	M
Beryllium	Be	4	2	2	
Carbon	C	6	2	4	
Oxygen	O	8	2	6	
Boron	B	5	2	3	
Aluminium	Al	13	2	8	3

Tendency of atoms of an element to lose electrons and form positive ion, cation, is known as electropositivity. These elements lose valence electrons to form cations having a stable noble gas configuration. It is the metallic character of that element. Electropositivity decreases as we move from left to right in a period. Among the elements given, Beryllium, Carbon, Oxygen and Boron belong to the second period. As Beryllium is the left most element, it will show high electropositive characteristic. Therefore, Beryllium is the most electropositive element.

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

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration		
			K	L	M
Sodium	Na	11	2	8	1
Phosphorous	P	15	2	8	5
Chlorine	Cl	17	2	8	7
Silicon	Si	14	2	8	4
Magnesium	Mg	12	2	8	2

Atomic size or radius is the distance between the nucleus of an atom and its outermost shell. Atomic size gradually decreases from left to right across a period. All the above elements belong to period 3, having electrons in the three shells. Atomic size decreases across a period, because valence electrons get added to the same outermost shell. Electrons added experience greater pull from the nucleus. Due to the increased nuclear charge, the electrons are pulled towards the nucleus to a greater extent and thereby, the size of the atom decreases.

In case of sodium, third shell is having only 1 electron. There is less force of attraction for the valence electron towards the nucleus and therefore, size of the atom is larger as compared to remaining elements. Hence, Na is the largest atom.

(vi) $_{19}K$, $_{3}Li$, $_{11}Na$, $_{4}Be$. Which of these atoms has smallest atomic radius?

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration			
			K	L	M	N
Potassium	K	19	2	8	8	1
Lithium	Li	3	2	1		
Sodium	Na	11	2	8	1	
Beryllium	Be	4	2	2		

From the above elements, potassium, lithium and sodium belong to group 1. As we know, atomic radius increases down a group or from top to bottom. This is because while going down a group, a new shell is added. Therefore, the distance between the outermost electron and the nucleus goes on increasing. Hence, Element Lithium in group 1 and Beryllium in group 2 have the smallest atomic radius as they have only two shells. In period: compared to Lithium, Beryllium has the smallest radius.

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

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration		
			K	L	M
Aluminium	Al	13	2	8	3
Silicon	Si	14	2	8	4
Sodium	Na	11	2	8	1
Magnessium	Mg	12	2	8	2
Sulphur	S	16	2	8	6

All the elements given belong to period 3. Metallic character of an element can be defined as how readily an atom can lose electron. From left to right across a period, metallic character decreases. This is because, electrons are added to the same shell, and hence, these electrons experience greater pull from the nucleus, thus atomic size decreases, and it becomes difficult to remove an electron from the atom. As in Sodium (2,8,1), only one electron is present in the outermost orbit. So, it easily loses this one electron because of weaker nuclear attraction, hence, it possesses highest metallic character.

(viii) $_{6}C$, $_{3}Li$, $_{9}F$, $_{7}N$, $_{8}O$. Which of the above elements has the highest non-metallic character?

Ans.

Name of the element	Symbol	Atomic Number	Electronic Configuration	
			K	L
Carbon	C	6	2	4
Lithium	Li	3	2	1
Fluorine	F	9	2	7
Nitrogen	N	7	2	5
Oxygen	O	8	2	6

All the elements given above belong to second period. While going from left to right in a period, non-metallic character increases. The tendency of an element to form anion or the electronegativity is the non-metallic character of an element. As Fluorine is present in extreme right of period 2, it will also possess highest non-metallic character and also Fluorine has 7 electrons in its outermost shell, that means 1 electron is less to complete its octet.

(3) The following table shows the position of six elements A, B, C, D, E and F in the periodic table. *(Activity Based)*

Groups / Periods	1	2	3 to 12	13	14	15	16	17	18
2	A					B			C
3		D			E				F

Using the above table, answer the following questions:

(i) Which element is a metal with valency 2?

Ans. D

(ii) Which element is a non-metal with valency 3?

Ans. B

(iii) Out of D and E, which one has a bigger atomic radius and why?

Ans. D, because the atomic size decreases along a period from left to right.

(iv) Write a common name for the family of elements C and F?

Ans. Noble gases

Q.3.2. Explain the following

***(1) Chlorine has two isotopes, viz, Cl - 35 and Cl - 37. Their atomic masses are 35 and 37. 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. Mendeleev arranged the elements in increasing order of atomic mass. Since the atomic masses of the isotopes of chlorine are 35 and 37, they should be kept in different positions in the Mendeleev Periodic table.

(2) Write the molecular formulae of oxides of the following elements by referring to the Mendeleev's periodic table. *(Use your brain power; Textbook Page 20)*

Ans.

Element		Oxides
(i)	Na	Na_2O
(ii)	Ca	CaO
(iii)	Rb	Rb_2O
(iv)	Ba	BaO
(v)	Sn	SnO_2
(vi)	Si	SiO_2
(vii)	C	CO_2
(viii)	P	P_2O_5
(ix)	Cl	ClO, ClO_2

***(3) Write the molecular formula of the compounds of the following elements with hydrogen. (C, S, Br, As, F, O, N, Cl)** *(Use your brain power; Textbook Page 20)*

Ans.

Elements	Compound formed with H	Elements	Compound formed with H
C	CH_4	S	H_2S
Br	HBr	As	AsH_3
F	HF	O	H_2O
N	NH_3	Cl	HCl

(4) A metal M forms an oxide having the formula M_2O_3. It belongs to 3rd period in the Modern Periodic table. Write the atomic number and valency of the metal.

Ans. Atomic number = 13

Electronic configuration = (2, 8, 3)

Valency = 3

***(5) What is the relationship between the electronic configuration of an element and its valency?** *(Think about it; Textbook Page 24)*

Ans. From electronic configuration, we come to know the number of valence electrons, i.e. the number of electrons in the outermost shell. The valency of an element is determined from valence electrons. That is, how many electrons it has to lose or gain or share to complete its outermost orbit.

***(6) The atomic number of beryllium is 4 while that of oxygen is 8. Write down the electronic configuration of the two and deduce their valency from the same.** *(Think about it; Textbook Page 24)*

Ans. Atomic number of Beryllium = 4

Electronic configuration = (2, 2)

Atomic number of Oxygen = 8

Electronic configuration = (2, 6)

Valency of Beryllium is 2,

Valency of Oxygen is = 8 – 6 = 2

Q.3.3. Answer the questions based on Modern Periodic table.

***(1) Use your brain power; Textbook Page 25**

Element	O	B	C	N	Be	Li
Atomic radius (pm)	66	88	77	74	111	152

(i) By referring to the Modern Periodic table find out the period to which the above elements belong?

Ans. Elements O, B, C, N, Be, Li belong to period 2.

(ii) Arrange the above elements in a decreasing order of their atomic radii.

Ans. The above elements in the decreasing order of their atomic radii are as follows:

Elements	Li	Be	B	C	N	O
Atomic radii	152	111	88	77	74	66

(iii) Does this arrangement match with the pattern of the second period of the Modern Periodic table.

Ans. Yes. As we move from left to right within a period the atomic number increases one by one, meaning the positive charge on the nucleus increases by one unit at a time, but the electrons are added to the same orbit, thereby, increasing the pull towards the nucleus which decreases the size of the atom.

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

Ans. Li has the biggest atom and O has the smallest atom.

(v) What is the periodic trend observed in the variation of atomic radius while going from left to right within a period?

Ans. Atomic radius decreases from left to right within a period.

***(2)**

Element	K	N	Rb	Cs	Li
Atomic radius	231	186	244	262	152

(i) By referring to the Modern Periodic table find out the group to which above elements belong?

Ans. Above elements belong to group 1.

(ii) Arrange the above elements vertically downwards in an increasing order of atomic radii.

Ans. The above elements vertically downwards in an increasing order of atomic radii are as follows:

Ans.

Li	152
Na	186
K	231
Rb	244
Cs	262

(iii) Does this arrangement match with the pattern of the group 1 of the Modern Periodic table?

Ans. Yes. As we go down a group number of shells increases, therefore the atomic radii also increases.

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

Ans. 'Cs' has the biggest atom and 'Li' has the smallest atom.

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

Ans. Atomic radii increases down a group, as number of shells are added one at a time.

***(3) Use your brain power; Textbook Page 26**

(i) Classify the elements of the third period into metals and non - metals.

Ans. Elements of third period are:

Na Mg Al — Metals; Si — Metalloid; P S Cl Ar — Non - Metals

(ii) On which side of the period are the metals? Left or Right?

Ans. Left.

(iii) On which side of the period did you find the Non - metals?

Ans. Right.

***(4) Use your brain power; Textbook Page 27.**

(i) What is the cause of non - metallic character of element?

Ans. When any element shows tendency to accept or share electrons and forms a negative charge, they are said to be electronegative. Non-metals are electronegative.

(ii) What is the expected trend in the variation of non-metallic character of element from left to right in a period?

Ans. Non-metallic character increases from left to right in a period.

(iii) What would be the expected trend in the variation of non-metallic character of elements down a group?

Ans. Non-metallic character decreases as we move down a group.

***(5) Can you tell; Textbook Page 22**

(i) Go through the Modern Periodic table (fig 2.1) and write the names one below the other of the elements of group 1.

Ans. H - Hydrogen
Li - Lithium
Na - Sodium
K - Potassium
Rb - Rubidium
Cs - Caesium
Fr - Francium
are the elements of group 1.

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

Ans.

Element	**Atomic No.**	**Electronic configuration**			
		K	**L**	**M**	**N**
H	1	1			
Li	3	2	1		
Na	11	2	8	1	
K	19	2	8	8	1

(iii) What similarity do you find in their electronic configuration?

Ans: The outermost shell contains one electron in all these elements.

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

Ans: Number of valence electrons in each of the these elements is 1.

***(6) Can you tell; Textbook Page 23**

(i) On going through the Modern Periodic table (fig 2.1) it is seen that the elements Li, Be, B, C, N, O, F and Ne belong to the period-2. Write down the electronic configuration.

Ans.

Element	Atomic no.	Electronic configuration			
		K	L	M	N
Li	3	2	1		
Be	4	2	2		
B	5	2	3		
C	6	2	4		
N	7	2	5		
O	8	2	6		
F	9	2	7		
Ne	10	2	8		

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

Ans. No, they are not the same.

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

Ans. Yes, the number of shells are the same. Each one of this has 2 shells.

***Q.3.4. Write answers with explanation:**

(Use your brain power; Textbook Page 21)

(1) 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?

Ans.

(i) According to Mendeleev's periodic law, elements are arranged in the order of their increasing atomic masses.

(ii) When Co and Ni were put in the group on the basis of their chemical properties it was found that Co having higher mass of 58.9 comes first and Nickel with slightly lower atomic mass of 58.7 comes later.

(iii) Modern Periodic table resolved this problem. According to the Modern Periodic law, elements are arranged in their increasing order of atomic number.

(iv) The atomic number of Cobalt is 27 comes first and Nickel with atomic number 28 comes next even if their atomic masses are in the reverse order.

(2) How did the position of $^{35}_{17}$Cl and $^{37}_{17}$Cl get fixed in the Modern Periodic table?

Ans.

(i) Modern Periodic table is based on atomic numbers, So, the position of isotopes of elements was decided by arranging the elements in the ascending order of their atomic numbers.

(ii) As isotopes have the same atomic number they do not need to be given different positions (slots).

(3) 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?

Ans. It is not possible. Since their atomic numbers are continuous, there cannot be an element between Chromium and Manganese.

(4) 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?

Ans.

(i) Hydrogen fits in its current position in the periodic table (group 1) much better than in group 17 (though is not a perfect position). For example Hydrogen forms oxide (H_2O) just like oxides of alkali metals (Na_2O, K_2O). It has the same common charge (+ 1) as all alkali metals.

(ii) It resembles halogens in forming diatomic molecules H_2, Cl_2, F_2, Br_2.

(iii) It does not behave like halogens, being mainly in the +1 oxidation state. It does not happen to be like halogens, the most stable compounds of halogens have either -1 or a very high oxidation state like -7 or +5.)

(iv) Hydrogen has one electron in the outermost shell and it is placed in top of group/based on atomic number.

Q.3.5. Activity Based Questions:

(1) Consider isotopes of oxygen ^{16}O and ^{18}O. Would you be able to place them in Mendeleev's Periodic Table?

Ans. No, we cannot place ^{16}O and ^{18}O in Mendeleev's Periodic Table.

(2) Find resemblance between hydrogen and alkali metals by writing compounds of both with chlorine, sulphur and oxygen.

Ans. Alkali metals are : Li, Na, K, Rb, Cs, Fr.

H_2O, Na_2O, H_2S, Na_2S, HCl, NaCl

Hydrogen and alkali metals form similar formulae with oxygen, sulphur and chlorine.

(3) How are isotopes of different elements placed in the Modern Periodic Table?

Ans. Isotopes have same atomic number, but different

atomic mass. In Modern Periodic table the elements are arranged in the increasing order of their atomic numbers. So, all isotopes of an element can be given the same position.

(4) What should be the position of Hydrogen in the Modern Periodic Table? Why?

Ans. In the Modern Periodic Table, elements are arranged in the increasing order of their atomic number, so Hydrogen must be the first element in the Modern Periodic Table, because it has the least atomic number.

(5) How do you calculate valency of an element from its electronic configuration?

Ans.

(i) Electronic configuration tells about the valence electrons. If the number of valence electrons are 1, 2 or 3, then such elements will donate 1, 2 or 3 electrons. Their valency is also 1, 2 or 3 respectively.

(ii) If an element has 4 valence electrons, it shares all 4 electrons, so the valency is 4. If the number of valence electrons are 5, 6 or 7 electrons, then such elements accept 3, 2 or 1 electrons respectively, thus their valency is 3, 2 or 1.

(iii) When the valence electrons are 2 (for only one shell) or 8 then it is a stable electronic configuration. Thus, the valency is zero.

(6) What is the valency of elements with atomic number 8, 14, 17 and 20?

Ans.

Atomic number	Electronic configuration	Valency
8	(2, 6)	2
14	(2, 8, 4)	4
17	(2, 8, 7)	1
20	(2, 8, 8, 2)	2

Q.3.6. Paragraph Based Questions:

(1) Read the following paragraph and answer the questions given below:

Dmitri Ivanovich Mendeleev was the first to classify elements on the basis of their fundamental property, the atomic mass, and also on the similarity of chemical properties. When Mendeleev started his work, 63 elements were known. He examined the relationship between the atomic masses of the elements and their physical and chemical properties. Among chemical properties Mendeleev concentrated on the compounds formed by the elements with oxygen and hydrogen. He selected hydrogen and oxygen as they were very reactive and formed compounds with most elements. The formulae of the hydrides and oxides formed were treated as one of the basic properties of an element for its classification. He sorted out the elements with similar properties and pinned the cards together on a wall. He observed that most of the elements got a place in the periodic table and were arranged in the order of their increasing atomic masses. It was also observed that there occurs a periodic recurrence of elements with similar physical and chemical properties. On this basis Mendeleev formulated a periodic law which states that "The properties of the elements are the periodic function of their atomic masses".

(i) What was the basis of Mendeleev's classification?

Ans. Mendeleev's classification was based on the fundamental property of atomic mass and also on the similarity of chemical properties.

(ii) What type of relationship of elements was examined by Mendeleev?

Ans. Mendeleev examined the relationship between the atomic masses of the elements and their physical and chemical properties.

(iii) How many elements were known when Mendeleev started his work?

Ans. 63 elements were known when Mendeleev started his work.

(iv) What is meant by periodicity according to Mendeleev?

Ans.

(i) Mendeleev observed that elements with similar physical and chemical properties reoccur when elements were arranged in the increasing order of their atomic masses.

(ii) So according to Mendeleev, the recurrence of elements with similar physical and chemical properties when they are arranged in an increasing order of their atomic masses, is called periodicity.

(iii) What is Mendeleev's Periodic Law?

Ans. Mendeleev's Periodic Law is "The properties of elements are the periodic function of their atomic masses".

(2) Read the following paragraph and answer the questions given below:

> In the Modern Periodic table, the elements are arranged in the increasing order of their atomic numbers. This arrangement is based on the Modern Periodic law, which states that the properties of elements are a periodic function of their atomic numbers. In the Modern Periodic table, each column is called a group and each row is called a period. Elements within the same group show similarity and gradation in properties. This is due to the same number of electrons in the outermost shell.

(i) State the law on which modern periodic table is based.

Ans. Modern periodic table is based on modern periodic law which states that 'Properties of elements are a periodic function of their atomic numbers'.

(ii) How many groups are there in the modern periodic table?

Ans. There are 18 groups in Modern periodic table.

(iii) What is the number of valence electrons in an element of group 1 and group 18 respectively?

Ans. The number of valence electrons in an element of group 1 is 1 and the number of valence electrons in an element of group 18 is 8.

(iv) What is the trend in the variation of valency while going down a group?

Ans. All elements in a group have the same number of electrons in the outermost shell. Therefore, down the group, valency remains the same. Valency of group 1 elements is 1 and that of group 2 elements is 2. The valency of group 18 elements is zero because they are noble gases with completed outermost shell.

(v) Which pair of elements do you think will have similar properties?

(a) Sodium and Argon

(b) Sodium and Potassium

(c) Potassium and Neon

Ans. The pair of elements having similar properties are, (b) Sodium and Potassium as they belong to the same group i.e. group 1 of Modern periodic table.

Q.4.1. Answer in detail:

(1) State the merits of Mendeleev's Periodic Table.

Ans.

(i) Atomic masses of some elements were revised so as to give them proper place in the periodic table 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.

(ii) Mendeleev kept vacant spaces in the periodic table for elements not discovered till then. 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. Not only this but their properties were also predicted. Later on these elements were discovered and named as scandium (Sc), gallium (Ga) and germanium (Ge) respectively. The properties of these elements matched well with those predicted by Mendeleev.

(iii) There was no place reserved for noble gases in Mendeleev's original periodic table. However, when noble gases such as helium, neon and argon were discovered towards the end of the nineteenth century, Mendeleev created the 'zero' group without disturbing the original periodic table in which the noble gases were fitted very well.

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

Ans.

(i) No fixed position could be given to hydrogen which resembles alkali metals and halogens in the periodic table.

(ii) Isotopes have different atomic masses but same chemical properties. Based on chemical properties, they were to be placed in same group, while based on atomic masses, they were used to be placed in different groups. Hence, there was no definite place for isotopes.

(iii) In certain places, elements with higher atomic mass were placed before elements of lower mass e.g. Co (At. Mass 58.93) was placed before Ni (At. Mass 58.71)

(iv) Some elements with different properties were placed in the same group. e.g. (Mn) Manganese was placed with halogens which totally differ in properties.

(3) Merits of Modern Periodic table over Mendeleev's periodic table.

Ans. In Modern Periodic table elements were arranged on the basis of their atomic number.

(i) All isotopes of the same element have different masses but same atomic number. Therefore, they occupy same position in the Modern Periodic table.

(ii) When the elements are arranged according to their atomic numbers, the anomaly regarding certain pairs of elements in Mendeleev's periodic table disappears. e.g. atomic numbers of Cobalt and Nickel are 27 and 28 respectively. Therefore, Cobalt will come first and then Nickel, although its atomic mass is greater.

(iii) Elements are classified according to their electronic configuration into different blocks.

***(4) Think about it; Textbook Page 24**

(i) What is the relationship between the electronic configuration of an element and its valency?

Ans. Electronic configuration means the arrangement of electrons in their respective shells including valence shell. The number of electrons in the valence shell determines its valency.
Thus, electronic configuration in a way determines the valency of an element.

(ii) The atomic number of beryllium is 4 while that of oxygen is 8. Write down the electronic configuration of the two and deduce their valency from the same.

Ans. Atomic number of Beryllium is 4
∴ Its electronic configuration is 2, 2
Atomic number of oxygen is 8
∴ Its electronic configuration is 2, 6
Valency of Beryllium is 2
and valency of Oxygen is also 2.

(iii) Write the Electronic configuration and valency of first 20 elements.

Ans.

Elements/ Symbol	Atomic No.	Electronic Configuration				Valency
		K	L	M	N	
Hydrogen **H**	1	1				1
Helium **He**	2	2				0
Lithium **Li**	3	2	1			1
Beryllium **Be**	4	2	2			2
Boron **B**	5	2	3			3
Carbon **C**	6	2	4			4
Nitrogen **N**	7	2	5			3
Oxygen **O**	8	2	6			2
Fluorine **F**	9	2	7			1
Neon **Ne**	10	2	8			0
Sodium **Na**	11	2	8	1		1
Magnesium **Mg**	12	2	8	2		2
Aluminium **Al**	13	2	8	3		3
Silicon **Si**	14	2	8	4		4
Phosphorous **P**	15	2	8	5		3
Sulphur **S**	16	2	8	6		2
Chlorine **Cl**	17	2	8	7		1
Argon **Ar**	18	2	8	8		0
Potassium **K**	19	2	8	8	1	1
Calcium **Ca**	20	2	8	8	2	2

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

Ans. Period 2

Elements	Li	Be	B	C	N	O	F	Ne
Valency	1	2	3	4	3	2	1	0

Period 3

Elements	Na	Mg	Al	Si	P	S	Cl	Ar
Valency	1	2	3	4	3	2	1	0

For periods 2 and 3, on going from left to right, the valency increases from 1 to 4, then starts decreasing upto 0.

(v) What is the periodic trend in the variation of valency while going down a group? Explain the answer with reference to group 1, group 2 and group 18.

Ans.

(i) All the elements in a group have the same number of electrons in the outermost shell. Therefore, down the group, valency remains the same.

(ii) Valency of group 1 elements is 1 and that of group 2 elements is 2.

(iii) The valency of group 18 elements is zero because they are noble gases with completed outermost shell.

(5) Comparative study of all the four-blocks of Modern Periodic table.

Ans. Comparative study of blocks

	s-block	p-block	d-block	f-block
No. of shells incomplete/ valence electrons	Outermost shell incomplete (1 or 2 valence electrons).	Outermost shell incomplete except zero group elements that have completely filled shells (3 to 8 valence electrons).	Last two shells are incomplete.	Last three shells are incomplete.
Position	Group 1, Group 2 and Hydrogen	Group 13 to Group 17 and zero group	Group 3 to Group 12	Lanthanides series and actinides series placed separately at the bottom of periodic table.
Includes	All metals except hydrogen.	Metals, non-metals, metalloids, zero group elements.	Metals.	Metals.
Types of elements	Normal elements	Normal and inert elements.	Transition elements	Inner-transition elements.

(6) How could the Modern Periodic Table remove various anomalies of Mendeleev's table?

Ans.

(i) The Modern Periodic Table was classified on the basis of atomic number. All isotopes of the same elements have different masses but same atomic number. Therefore, they occupy the same position in the Modern Periodic table.

(ii) When elements are arranged according to their atomic numbers, the anomaly regarding certain pairs of elements in Mendeleev's Periodic Table disappears e.g. atomic number of cobalt and nickel are 27 and 28 respectively. Therefore, cobalt will come first and then nickel, although atomic mass of cobalt is greater.

(iii) Elements are classified according to their electronic configuration into different blocks.

(iv) Hydrogen has one electron in the outermost shell. It is placed on top of the group 1 with alkali metals which have one electron in the outermost shell. This is because in the Modern Periodic Table elements are arranged on the basis of electronic configuration.

Q.4.2.

(1) Answer the questions based on the given data.

Elements	K	Na	Rb	Cs	Li
Atomic radius (pm)	231	186	244	262	152

(i) To which group do the elements belong? What is the family called?

Ans. The elements belong to group 1. The family is called as alkali metals.

(ii) Arrange the above elements in an increasing order of atomic radii. Does this arrangement match with the pattern of the group in the above answer?

Ans. The above elements in an increasing order of atomic radii are as follows.

Elements	Li	Na	K	Rb	Cs
Atomic radius (pm)	152	186	231	244	262

This arrangement match with the pattern of the group in the above answer (i.e. group 1)

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

Ans. The element with biggest atom is Caesium (Cs) and the element with smallest atom is Lithium (Li).

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

Ans. While going down the group the atomic radii goes on increasing, this is because new shells are added to the atoms of the elements as we go down from top to bottom in a group. The outermost electron go further and further away from the nucleus, extending the radius and

ultimately increasing the size of the atom inspite of the increased nuclear charge.

(2) In the following table, seven elements P, Q, R, S, T, U and V (here letters are not the usual symbols of the elements) of the modern periodic table with their atomic numbers are given.

3	4	5	6	7	8	9	10
P					T		V
11	12	13	14	15	16	17	18
Q	R		S			U	

(i) Which of these is an inert gas? Name it.

Ans. Element 'V' is an inert gas. It is Neon (Ne).

(ii) Which of these is a halogen? Name it.

Ans. Element 'U' is a halogen. It is Chlorine (Cl).

(iii) Which of these are metals? Name them.

Ans. Elements P, Q and R are metals. Element P is Lithium metal. Element Q is Sodium metal. Element R is Magnesium metal.

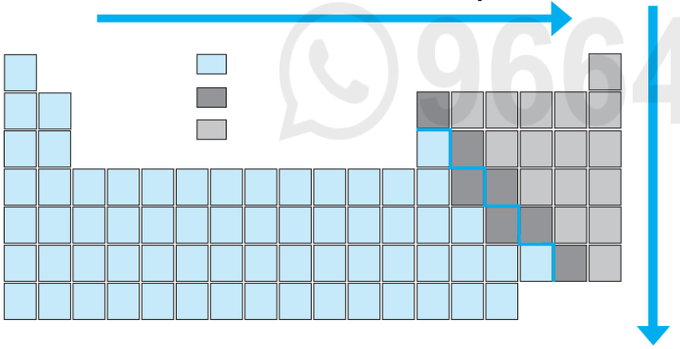
(iv) If Q combines with U, what would be the formula of the compound formed? If Q and U are replaced by their respective metal what will be the formula of the compound formed.

Ans. If Q combines with U the formula of the compound formed is QU. If Q and U are replaced by their respective metal and non - metal. Element Q is sodium (Na). Element U is chlorine (Cl). The formula of the compound formed is NaCl.

(v) Write the electronic configuration of R and T, and the type of bond formed by their combination.

Ans. Electronic configuration of : R is (2, 8, 2) and T is (2, 6). They combine with each other forming Ionic bond.

(3) Write the answers of the questions with reference to the structure of the periodic table.



(i) Which points are considered for the arrangement of the Modern Periodic table?

Ans. In the Modern Periodic table, the elements are arranged in the order of their increasing atomic number. In the Modern Periodic table there are seven horizontal rows called periods and 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.

(ii) How are blocks indicated?

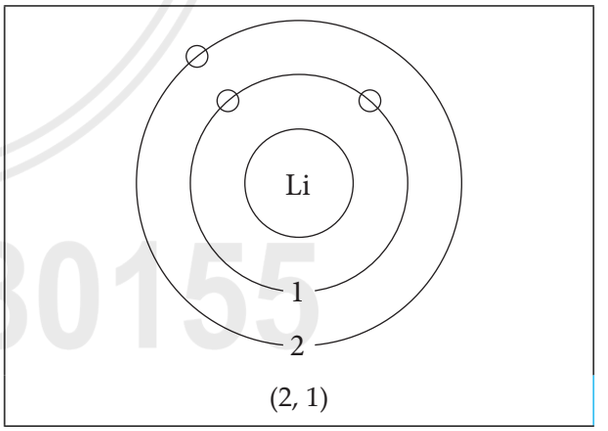
Ans. On the basis of the electronic configuration, the elements in the Modern Periodic table are divided into four blocks, viz, s - block, p - block, d - block and f - block. The s - block constitutes the groups 1 and 2. Groups 13 to 18 constitute the p - block. Groups 3 to 12 constitute the d - block, 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.

(iii) Which elements are present near the zig zag line?

Ans. The zig-zag line shows the three traditional types of elements, i.e. metals, non-metals and metalloids. The metalloid elements lie along the border of the zig-zag line. All the metals lie on the left side of the zig-zag line while all the non - metals lie on the right side.

(iv) Draw the electronic configuration of the period 2 elements of first group in the periodic table.

Ans. The electronic configuration of the second period element of the first group in the periodic table is shown below:



(4) A part of periodic table is shown in the following figure.

	1							18
1		2	13	14	15	16	17	
2		P			Q	R		
3						S		T
4								

(i) Write the symbol of the element 'Q'.

Ans. Symbol of the element 'Q' is N (Nitrogen)

(ii) Will elements 'R' and 'S' have same number of valence electrons?

Ans. Yes elements 'R' and 'S' will have the same number of valence electrons (six electrons) as they belong to the same group i.e. group 16.

(iii) Arrange elements 'P', 'Q' and 'R' in increasing order of their metallic character.

Ans. The elements in the increasing order of their metallic character are as follows: P > Q > R

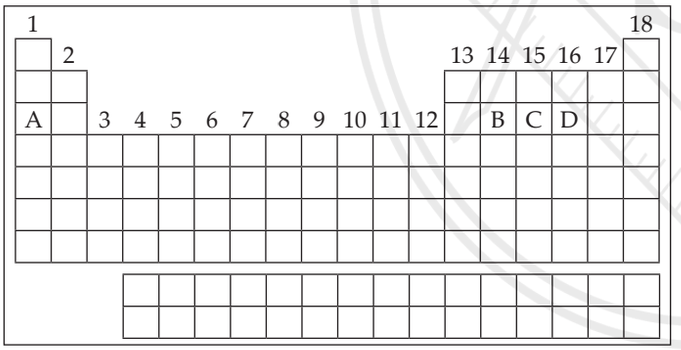
(iv) What is the number of electrons in L shell of element T?

Ans. Element T is in the 3rd period of periodic table, hence it has three shells K, L and M. As it also belongs to 18th group i.e., Zero group all it's shells are completely filled. Therefore number of electrons in it's L shell will be 8.

(v) Name any two elements that will have properties similiar to that of element 'P'.

Ans. The two elements that will have properties similar to that of element 'P' are Magnesium (Mg) and Calcium (Ca) as they also belong to group 2 of the modern periodic table.

(5) Study the below given periodic table in which four elements are indicated by alphabets: A, B, C and D



(i) Which element is a metalloid? Name this element and also mention the metalloids in modern periodic table.

Ans. Element 'B' is a metalloid. This element is Silicon (Si). The metalloids in periodic table are : Boron (B), Silicon (Si), Germanium (Ge), Arsenic (As), Antimony (Sb), Tellurium (Te) and Polonium (Po).

(ii) Among 'A' and 'C' which element has larger atomic radius? Why?

Ans. Element A and C belong to the same period. So according to the periodic trends in the modern periodic table, the atomic radius goes on decreasing while going from left to right within a period. Therefore atomic size of element 'A' is larger than atomic size of element 'B'.

(iii) Identify element 'D' and write its electronic configuration. Also write the electronic configuration of the elements above and below 'D' in the same group.

Ans. Element 'D' is sulphur (S) and its electronic configuration is (2, 8, 6). The electronic configuration of element above 'D' in the same group will be (2, 6) and the electronic configuration of element below 'D' in the same group will (2, 8, 18, 6)

(6) A scientist was studying reactions of metals and non-metals. He knew group 1 and 2 elements are metals while group 17 elements are non-metals. So, he chooses different elements from group 1, group 2 and group 17.

(i) What is the valency of magnesium?

Ans. As Magnesium belongs to group 2, its valency is 2.

(ii) Name the element in group 17 which forms a diatomic molecule and exists in solid state at room temperature.

Ans. The element in group 17 which forms a diatomic molecule and exists in solid state at room temperature is Iodine.

(iii) Name the element in group 17 which belongs to the same period as sodium.

Ans. The element in group 17 which belongs to the same period as sodium (Na) is chlorine (Cl).

(iv) Write the formula of compound formed in the reaction between lithium and bromine.

Ans. The formula of compound formed in the reaction between lithium (Li) and bromine (Br) is LiBr (Lithium bromide).

(v) Write the formula of compound formed in the reaction between calcium and fluorine.

Ans. The formula of compound formed in the reaction between Calcium (Ca) and fluorine (F) is CaF_2 (Calcium Fluoride).

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