CHAPTER

5 PERIODIC CLASSIFICATION OF ELEMENTS

Syllabus

➢ *Periodic Classification : Need for classification, Early attempts at classification of elements (Dobereiner's Triads, Newlands Law of Octaves, Mendeleev's Periodic Table), modern periodic table, Gradation in properties, valency, atomic number, metallic and non-metallic properties.*

Quick Review

Need for Periodic Classification

- To make the study of these elements easy, these element have been divided into few groups in such a way that elements in the same group have similar properties. Now study of a large number of elements is reduced to a few groups of elements.
- **Dobereiner's Triads :** When elements were arranged in the order of increasing atomic masses, groups of three elements (known as triads), having similar chemical properties are obtained.

The atomic mass of the middle element of the triad was roughly the average of the atomic masses of the order two elements.

Elements	Atomic Mass
Ca	40.1
Sr	87.6
Ba	137.3

Limitations : Only three triads were recognized from the elements known at that time.

Li	Ca	Cl
Na	Sr	Br
K	Ba	I

- Dobereiner could identify only three triads. He was not able to prepare triads of all the known elements.
- **Newlands Law of Octaves :** John Newlands arranged elements in order of increasing atomic mass.

  It states when elements are arranged in increasing order of atomic mass, the properties of the eighth element are a kind of repetition of the first, just like notes of music.
- **Table showing Newlands Octaves :**

Sa (do)	re (re)	ga (mi)	ma (fa)	pa (so)	dha (la)	ni (ti)
H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co & Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zn		

- **Limitations of Newlands law of octaves :**
  - (i) The law was applicable to elements up to calcium (Ca) only.
  - **(ii)** It contained only 56 elements. Further it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.
  - **(iii)** In order to fit elements into the table, Newlands adjusted two elements in the same column as fluorine, chlorine and bromine which have very different properties than these elements. Iron, which resemble cobalt and nickel in properties, has been placed differently away from these elements.
- **Mendeleev's Periodic Table :** Dmitri Ivanovich Mendeleev, a Russian chemist, was the most important contributor to the early development of a periodic table of elements where in the elements were arranged on the basis of their atomic mass and chemical properties.
- **Characteristics of Mendeleev's Periodic Table :**
  - **(i)** Mendeleev arranged all the 63 known elements in increasing order of their atomic masses.
  - **(ii)** The table consists of vertical columns called 'groups' and horizontal rows called 'periods'.
  - **(iii)** The elements with similar physical and chemical properties came under same groups.
- **Mendeleev's Periodic Law :** The properties of elements are the periodic functions of their atomic masses.
- **Merits of Mendeleev's Periodic Table**
  - **(i)** Mendeleev left some blank spaces for undiscovered elements.
  - **(ii)** Mendeleev predicted the discovery of some elements and named them as eka-boron, eka aluminium and eka-silicon.
  - **(iii)** Noble gases discovered later could be placed without disturbing the existing order.
- **Limitations of Mendeleev's periodic table :**
  - **(i) Position of Hydrogen :** Could not assign a correct position to hydrogen as hydrogen resembles alkali metals as well as halogens.
  - **(ii) Position of Isotopes :** Isotopes are places in same position though they have different atomic masses.
  - **(iii)** Separation of chemically similar elements while dissimilar elements are placed in the same group.
- **Modern Periodic Table :** Henry Moseley gave a new property of elements, 'atomic numbers' and this was adopted as the basis of Modern Periodic Table.
- **Modern Periodic Law :** Properties of elements are the periodic functions of their atomic numbers.
- **Position of elements in modern periodic table :**
  - **(i)** The Modern Periodic Table consists of 18 groups and 7 periods.
  - **(ii)** Elements present in any one group have the same number of valence electrons. Also, the number of shells increases as we go down the group.
  - **(iii)** Elements present in any one period, contain the same number of shells. Also, with increase in atomic number by one unit on moving from left to right, the valence shell electron increases by one unit.
  - **(iv)** Each period marks a new electronic shell getting filled.
- **Trends in the Modern Periodic Table :**
  - **(i) Periodicity in Properties :** The properties of elements depend upon the electronic configuration which changes along a period and down a group in the periodic table. The periodicity properties i.e. repetition of properties after a regular interval is due to similarity in electronic configuration.
  - **(ii) Tendency to lose or gain electron :** Chemical reactivity of an element depends upon the ability of its atoms to donate or accept electrons.
  - **(iii) Variations of tendency to lose electron down the group :** Tendency to lose electron goes on increasing down the group.

  Reason : It is due to the increase in the distance between the valence electrons and the nucleus as the atomic size increases down the group, the force of attraction between the nucleus and the valence electrons decreases, therefore, tendency to lose electron also increases down the group.
  - **(iv) Variation of tendency to lose electron along a period :** It goes on decreasing generally along a period from left to right with decrease in atomic size.

  Reason : Due to decrease in the atomic size, the force of attraction between the valence electrons and the nucleus increases and, therefore, electrons cannot be removed easily.
  - **(v) Variation of tendency to gain electron down the group :** It goes on decreasing down the group in general.

  Reason : Due to increase in atomic size, the force of attraction between the nucleus and the electron to be added becomes less.

(vi) Variation of tendency to gain electron along a period : It increases left to right in a period.

Reason : It is due to decrease in the atomic size which leads to an increase in the force of attraction between the nucleus and the electron to be added.

- **Metallic and non-metallic character :** Group 1 to 12 are metals. Group 13 to 18 comprises non-metals, metalloids and metals.
- **Properties of Metals :**
  - **(i)** They are malleable.
  - **(ii)** They are ductile.
  - **(iii)** They are good conductors of heat and electricity.
  - **(iv)** They have generally 1 to 3 valence electrons.
  - **(v)** They have the same or less number of electrons in their outermost shell than the number of shells.
  - **(vi)** They are mostly solids.
- **Properties of Non-metals :**
  - **(i)** They exist in solid, liquid or gaseous state.
  - **(ii)** Non-metals are generally brittle.
  - **(iii)** They are non-conductors.
  - **(iv)** They have 4 to 8 valence electrons.

Know the Terms

- **Mendeleev's Periodic Law :** This law states that the properties of elements are the periodic function of their atomic masses.
- Anomalies in arrangement of elements based on increasing atomic mass could be removed when the elements were arranged in order of increasing atomic number, a fundamental property of the element discovered by Moseley in 1913.
- **Modern Periodic Law :** According to this law, the properties of elements are periodic function of their atomic number.
- The 18 vertical columns in modern periodic table are known as groups whereas 7 horizontal rows in modern periodic table are called periods.
- **Periodicity :** When the elements are arranged in order of increasing atomic numbers, elements with similar chemical properties are repeated at definite intervals. This is known as periodicity.
- **Atomic Radius :** Atomic radius is defined as the distance from the centre of the nucleus of an atom to the outermost shell of electrons.
- **Covalent Radii :** It is defined as half of the distance between the centre of nuclei of two atoms (bond length) bonded by a single covalent bond *e.g.,* bond length in case of H—H is 74 pm.

  Covalent radius : $\frac{1}{2} \times 74 = 37$ pm

  It can be measured in case of diatomic molecules of non-metals.
- **Metallic Radii :** It is defined as half of the internuclear distance between the two metal ions in a metallic crystal.
- **Metalloids :** Those elements which resemble both metals and non-metals are called metalloids. They are also called semi-metals. *e.g.,* Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium and Polonium.
- **Isotopes :** Elements which have same atomic number but different mass number are called isotopes.

  Example : ${}^{35.5}_{17}Cl$, ${}^{37.5}_{17}Cl$, or ${}^{1}_{1}H$, ${}^{2}_{1}H$, ${}^{3}_{1}H$.

Periodic Table of Elements

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	1 H Hydrogen 1.0079	Atomic # Symbol Name Atomic Mass																2 He Helium 4.0026	K
2	3 Li Lithium 6.941	4 Be Beryllium 9.0122											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180	K L
3	11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminium 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulphur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948	K L M
4	19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.867	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.64	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.798	K L M N
5	37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.905	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.96	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.91	46 Pd Palladium 106.42	47 Ag Silver 107.87	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.71	51 Sb Antimony 121.76	52 Te Tellurium 127.60	53 I Iodine 126.90	54 Xe Xenon 131.29	K L M N O
6	55 Cs Caesium 132.91	56 Ba Barium 137.33	57-71 La-Lu Lanthanide	72 Hf Hafnium 178.49	73 Ta Tantalum 180.95	74 W Tungsten 183.21	75 Re Rhenium 186.21	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.97	80 Hg Mercury 200.59	81 Tl Thallium 204.38	82 Pb Lead 207.2	83 Bi Bismuth 209.98	84 Po Polonium 208.98	85 At Astatine (210)	86 Rn Radon (222)	K L M N O P
7	87 Fr Francium (223)	88 Ra Radium (226)	89-103 Ac-Lr Actinide	104 Rf Rutherfordium (267)	105 Db Dubnium (268)	106 Sg Seaborgium (271)	107 Bh Bohrium (272)	108 Hs Hassium (277)	109 Mt Meitnerium (276)	110 Ds Darmstadtium (281)	111 Rg Roentgenium (280)	112 Cn Copernicium (285)	113 Uni Ununtrium	114 Fi Flerovium	115 UuP Ununpentium	116 Lv Livermorium (291)	117 Uus Ununseptium	118 Uno Ununoctium	K L M N O P Q

C Solid
Hg Liquid
H Gas
Rf Unknown

Metals: Alkali metal; Alkaline earth metal; Lanthanoids; Actinoids; Transition; Poor metals
Non-metals: Other non-metals; Noble gases

For elements with no stable isotopes, the mass number of the isotope with the longest half-life is in parentheses.

58 Ce Cerium 140.12	59 Pe Praseodymium 140.91	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.93	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93	68 Er Erbium 167.26	69 Tm Thulium 168.93	70 Yb Ytterbium 173.05	71 Lu Lutetium 174.97
90 Th Thorium 232.04	91 Pa Protactinium 231.04	92 U Uranium 238.03	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No NObelium (259)	103 Lr Lawrencium (262)

Atomic radii increase down the group.

Atomic number	Elements	Symbol electrons	Electronic configuration	Valence electrons	Valency
1	Hydrogen	H	(1)	1	1
2	Helium	He	(2)	2	0
3	Lithium	Li	(2, 1)	1	1
4	Beryllium	Be	(2, 2)	2	2
5	Boron	B	(2, 3)	3	3
6	Carbon	C	(2, 4)	4	4
7	Nitrogen	N	(2, 5)	5	3
8	Oxygen	O	(2, 6)	6	2
9	Fluorine	F	(2, 7)	7	1
10	Neon	Ne	(2, 8)	8	0
11	Sodium	Na	(2, 8, 1)	1	1
12	Magnesium	Mg	(2, 8, 2)	2	2
13	Aluminium	Al	(2, 8, 3)	3	3
14	Silicon	Si	(2, 8, 4)	4	4
15	Phosphorus	P	(2, 8, 5)	5	3
16	Sulphur	S	(2, 8, 6)	6	2
17	Chlorine	Cl	(2, 8, 7)	7	1
18	Argon	Ar	(2, 8, 8)	8	0
19	Potassium	K	(2, 8, 8, 1)	1	1
20	Calcium	Ca	(2, 8, 8, 2)	2	2

TOPIC-1

Periodic Laws and their Limitations

Very Short Answer Type Questions (1 mark each)

R Q. 1. **State modern periodic law of classification of elements. [Board Term II, Set-AI, 2013]**

Ans. It states "Properties of elements are periodic function of their atomic number." 1

R Q. 2. **Write the number of horizontal rows in the modern periodic table. What are these rows called ? [Board Term II, Delhi Set II, 2014]**

Ans. There are seven horizontal rows in the modern periodic table. These rows are called periods. ½ + ½

R Q. 3. **Write the number of vertical columns in the modern periodic table. What are these columns called ? [Board Term II, Delhi Set I, 2014]**

Ans. There are 18 vertical columns in the modern periodic table and these are known as groups. ½ + ½

R Q. 4. **Write the total number of periods in modern periodic table.**

[Board Term II, Set GFUTB86, 2015]

Ans. The total number of periods in modern periodic table is seven. **[CBSE Marking Scheme, 2015]** 1

R Q. 5. **Write down three elements that show Dobereiner's triad. [DDE 2017]**

Ans. Lithium, Sodium, Potassium. 1

A Q. 6. **Why was the system of classification of elements into triads not found suitable ?**

[Board Term II, Delhi, Set C 2009]

Ans. It is because all the elements discovered at that time could not be classified into triads. 1

R Q. 7. **Write down two drawbacks of Newlands law of Octaves. [DDE 2017]**

Ans. (i) The Law was applicable to elements up to Calcium (Ca) only.

(ii) Properties of new discovered elements did not fit into the law of octave. ½+½

U **Q. 8. What was the need for classification of elements ?** **[DDE 2017]**

Ans. To make the study of these elements easy, these elements have been divided into few groups in such was that elements in the same group have similar properties. **1**

A **Q. 9. Lithium, sodium and potassium form a Dobereiner's triad. The atomic masses of lithium and potassium are 7 and 39 respectively. Predict the atomic mass of sodium.**

[Board Term II, (Set A1, 2009) 2012]

Ans. Atomic mass of Na $= \frac{7+39}{2} = \frac{46}{2} = 23$ **1**

A **Q. 10. Which important property did Mendeleev used to classify the elements in his periodic table ?**

[DEE 2017]

Ans. His table is based on the chemical properties of elements.

U **Q. 11. What do you mean by valency ?** **[DDE 2017]**

Ans. The combining capacity of an element is known as Valency. **1**

R **Q. 12. Write the formula used to determine the maximum numbers of electrons which a shell in an atom can accommodate.**

[Board Term II, Foreign Set III, 2014]

Ans. $2n^2$, where n is the number of shell. **1**

R **Q. 13. Name the elements and its valency having electronic configuration 2, 8, 3. [DDE 2017]**

Ans. Name of the element is Aluminium (Al).
Its Valency is 3.

U **Q. 14. Write two reasons responsible for late discovery of noble gases.**

[Board Term II, Delhi Set III, 2013]

Ans. (i) They are unreactive.
(ii) They have zero valency. ½ + ½

U **Q. 15. Why hydrogen should be placed in group I ?**

[Board Term II, Set (2024), 2012]

Ans. Hydrogen should be placed in group I, since it has only one electron in its outermost shell.

[CBSE Marking Scheme, 2012] 1

A **Q. 16. Give reason why noble gases are placed in separate group in modern periodic table.**

[Board Term II, Foreign Set III, 2013]

Ans. It is because they resemble with each other but do not resemble with other group elements. **1**

Short Answer Type Questions-I

(2 marks each)

R **Q. 1. State Mendeleev's periodic law. Write two achievements of Mendeleev's periodic table.**

[Board Term II, (Set A1-2009) 2012]

Ans. Mendeleev's Periodic Law : "Properties of elements are the periodic function of their atomic masses."

Achievements :

(i) It could classify all the elements discovered at that time.

(ii) It helped in discovery of new elements.

(iii) It helped in correction of atomic mass of some of the elements. **(Any two) 1+½+½**

U **Q. 2. Write two limitations of Mendeleev's Periodic Table.** **[DDE 2017]**

Ans. Two limitations of Mendeleev's Periodic Table are :

(i) Position of isotopes could not be explained.

(ii) No fixed position for hydrogen. **1+1**

R **Q. 3. (i) What were the limitations of Dobereiner's triad ?**

(ii) Why did Mendeleev leave some gaps in his periodic table ? [NCERT, Board Term II 2012, (Set A1-2009)]

Ans. (i) Dobereiner's system of classification failed to arrange all the elements in the form of triads having similar chemical properties. Dobereiner could identify only three triads from the elements known at that time. **1**

(ii) Mendeleev left some gaps in his periodic table for the elements yet to be discovered. He even predicted the properties of these elements by studying the properties of the neighbouring elements. **1**

R **Q. 4. Why He, Ne and Ar are called inert gases ?**

[DDE 2017]

Ans. He, Ne and Ar are called inert gases because their outermost shell is complete and they do not lose or gain electrons in their outermost shell, hence they have zero valency. **2**

R **Q. 5. State the modern periodic law for classification of elements. How many (a) groups and (b) periods are there in the modern periodic table ?** **[Delhi 31/1/1, 2017]**

[Board Term II, Delhi 2012]

Ans. "Properties of elements are the periodic function of their atomic number."

(i) There are 18 groups.

(ii) There are 7 periods in the modern periodic table.

[CBSE Marking Scheme, 2012] 1 + ½ + ½

U **Q. 6. State two main properties of elements on which Mendeleev's periodic classification was based. Why position of hydrogen is not fixed in his periodic table ?**

[Board Term II, (Set C-2009), 2012]

Ans. (i) Physical properties of elements are periodic function of their atomic masses.

(ii) Similar formula of oxides and hydrides formed by elements of same group was selected as chemical property as basis of classification.

The atomic number of hydrogen is 1 and hence it should occupy the first position in group 1 of the periodic table. But because of its chemical similarity with elements of group 1 and 17, the position of hydrogen in the periodic is not fixed. 2

A **Q. 7. How does the electronic configuration of an atom of an element relate to its position in the modern periodic table ? Explain with one example. [Board Term II, Delhi 2012]**

Ans. The position of elements depends upon number of valence electrons which depend upon electronic configuration. Those elements which have same valence electrons, occupy same group.

Those elements which have one valence electron belong to group 1. **1**

Elements which have two valence electrons belong to group 2.

Period number is equal to the number of shells.

Example : Atomic number of sodium (Na) is 11, so electronic configuration will be 2, 8, 1. Sodium has one valence electron in valence shell so it belongs to group 1. As sodium has three shells, so it belongs to 3^{rd} period.

R **Q. 8. Why is the position assigning to hydrogen in the periodic table considered anomalous ?**

[DDE 2017]

Ans. Electronic configuration of Hydrogen resembles that of alkali metals. Like alkali metals, hydrogen combines with halogens, oxygen and sulphur to form compounds having similar formulae. On the other hand, just like halogens, hydrogen also exists as diatomic molecules and it combines with metals and non-metals to form covalent compounds. So, no fixed position can be given to hydrogen in the Periodic Table. 2

A **Q. 9. The atomic number of an element is 17. To which group and period does their element belong ? Determine its valency.**

[31/1/3 Comptt. Delhi 2017]

Ans. It belongs to 17th Group and 3rd Period.

Its valency is 1. **1+1**

A **Q. 10. An element 'M' has atomic number 11.**

(i) Write its electronic configuration.

(ii) State the group to which 'M' belongs.

(iii) Is 'M' a metal or a non-metal ?

(iv) Write the formula of its chloride. [DDE 2017]

Ans. (i) 2, 8, 1

(ii) Group 1

(iii) Metal

(iv) MCl ½+½+½+½

Short Answer Type Questions-II

(3 marks each)

R **Q. 1. (i) Who proposed Modern Periodic Law ?**

(ii) What was the basis of arranging the elements in it ?

(iii) State the Modern Periodic Law.

[Board Term II, Set-8XSVH2LC, 2014]

Ans. (i) Henry Moseley

(ii) Atomic number

(iii) Modern Periodic Law : Properties of elements are the periodic functions of their atomic numbers.

[CBSE Marking Scheme, 2014] 1 + 1 + 1

U **Q. 2. State the main aim of classifying elements. Which is the more fundamental property of elements that is used in the development of Modern Periodic Table ? Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids ?**

[Borad Term II, Foreign Set I 2016]

Ans. (i) Aim of classification : Systematic study of the known elements.

(ii) Basic property : Atomic number.

(iii) Properties of the elements are a periodic function of their atomic numbers.

(iv) Metals on the left.

(v) Non–metals on the right.

(vi) Metalloids at the border of metals and beginning of non-metals.

[CBSE Marking Scheme, 2016] 6 × ½ = 3

R **Q. 3. (a) Which two criteria did Mendeleev use to classify the elements in his periodic table ?**

(b) State Mendeleev's periodic law.

(c) Why is it not possible to give a fixed position to hydrogen in Mendeleev's periodic table ?

[KVS-2014]

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

(ii) The formulae and nature of hydrides and oxides formed by elements was treated as basic chemical properties for its classification.

(b) Mendeleev's Periodic Law : The properties of elements are the periodic function of their atomic masses.

(c) It is because it resembles both with alkali metals as well as halogens. **1 + 1 + 1**

R **Q. 4. Write the main aim of classifying elements. Name the basic property of elements used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non-metals ?**

[Board Term II, Delhi II 2015]

Ans. (i) For systematic and simplified study of elements and their compounds. ½

(ii) Basic property : Atomic Number. ½

(iii) Modern periodic Law : The properties of elements are a periodic function of their atomic number. ½

(iv) Metals are found on the left side and centre of the Modern Periodic Table. ½

(v) Metalloids are found in a zig-zag manner between the metals and the non-metals. ½

(vi) Non-metals are found on the right side of the Modern Periodic Table. ½

[CBSE Marking Scheme, 2015]

R **Q. 5. (i) What are metalloids ?**

(ii) Name any four metalloids ?

[Board Term II, Foreign Set II, 2014]

Ans. (i) Borderline elements which are intermediate in properties between metals and non-metals are called metalloids.

(ii) Boron, silicon, germanium and arsenic.

1 + ½ + ½ + ½ + ½

R **Q. 6. Give an account of the process adopted by Mendeleev for the classification of elements. How did he arrive at "Periodic Law" ?**

[NCERT Exemplar]

Ans. (i) When Mendeleev started his work, 63 elements were known. He studied the compounds of these elements with oxygen and hydrogen. He selected hydrogen and oxygen as they are very reactive and formed compounds with most elements. The formulae of the hydrides and oxides formed by an element were treated as one of the basic properties of an element for its classification.

(ii) Elements with similar properties were arranged in a group.

(iii) Mendeleev observed that elements were automatically arranged in the order of increasing atomic masses. **1 + 1 + 1**

U **Q. 7. How does the tendency of the elements to lose electrons change in the Modern Periodic Table in (i) a group, (ii) a period and why ?**

[Board Term II, Foreign Set III, 2016]

Ans. (i) Increases down a group. ½

Reason : At each succeeding element down a group the number of shells increases, so the distance of the valence shell from the nucleus increases, the effective nuclear force of attraction decreases on the last shell, so it becomes easy for the atom to lose electrons. **1**

(ii) Decreases in a period from left to right. ½

Reason : As the effective nuclear charge on the valence electron increases, the attraction between the valence electron and nucleus increases, so it becomes difficult to lose electrons.

[CBSE Marking Scheme, 2016] 1

A **Q. 8. (i) In Mendeleev's Periodic Table, the elements were arranged in the increasing order of atomic masses. However, cobalt with atomic mass of 58.93 a.m.u. was placed before nickel having an atomic mass of 58.71 a.m.u. Give reason for the same.**

(ii) Write the formula of chlorides of Eka-silicon and Eka-aluminium, the elements predicted by Mendeleev. [NCERT Exemplar]

Ans. (i) It was because elements with similar properties were grouped together and increasing order of atomic mass could not be followed. **1**

(ii) Germanium is Eka-silicon. The formula is $GeCl_4$.

Gallium is Eka-aluminium. The formula is $GaCl_3$.

1 + 1

U **Q. 9. An element 'M' has atomic number 12.**

(i) Write its electronic configuration and valency.

(ii) Is 'M' a metal or a non-metal ? Give reason in support of your answer.

(iii) Write the formula and nature (acidic/basic) of the oxide of M. **(Delhi 31/1/2017 Comptt.)**

Ans. (i) Electronic Configuration — 2, 8, 2

Valency — 2.

(ii) Metal

There are two electrons in its outermost shell and it easily loses them to form a positive ion.

(iii) M O

2 2

$M_2O_2 = MO$

It is a basic oxide. **1+1+1**

R **Q. 10. Write the electronic configuration of two elements P (atomic number 17) and Q (atomic number 19) and determine their group numbers and period numbers in the Modern Periodic Table.** **(OD Comptt 31/1 2017)**

Ans. Electronic Configuration of 'P' — 2, 8, 7

Group number — 17

Period number — 3rd Period

Electronic Configuration of 'Q' — 2, 8, 8, 1

Group number — 1

Period number — 4th Period

[CBSE Marking Scheme, 2017] 1 + 1

U **Q. 11. An element 'X' with electronic configuration (2, 8, 2) combines separately with two radicals, $(NO_3)^-$ and $(SO_4)^{2-}$.**

(i) Is 'X' a metal or a non-metal ? Write the nature of its oxide.

(ii) Write the formula of the compounds of 'X' formed by the combination of these radicals. Are these compounds covalent or electrovalent ?

(OD Comptt. 2017)

Ans. (i) X is a metal. Nature of its Basic.

(ii) $X(NO_3)_2$, XSO_4

These compounds are Ionic/electrovalent. **1+1+1**

U **Q. 12. Consider the following elements (atomic numbers are given in parenthesis)**

Ca(20); K(19); F(9); Be(4) (OD Comptt 31/3 2017)

(a) Select :

(i) the element having one electron in the outermost shell.

(ii) two element of the same group. Write the number of this group.

(b) Write the formula of the compound formed by the union of Ca(20) and the element X(2, 8, 7).

Ans. (a) (i) K (Potassium — 2, 8, 8, 1)

(ii) Be and Ca in same group because both have same number of valence electrons in their outermost shell.

(b)

	Ca	X
Valency	2	1

$Ca_1X_2 = CaX_2$ **1+1+1**

U **Q. 13. (i) Predict which of the following elements will form cation and will form anions ?**

(i) Na, **(ii)** Al, **(iii)** Cl, **(iv)** O.

(ii) Name two elements that are inert in nature.

[Board Term II, Set GFUTB86, 2015]

Ans. (i) Cations are Na and Al (Sodium and Aluminium)
Anions are Cl and O (Chlorine and Oxygen)

(ii) Inert elements are He and Ne (Helium and Neon)

[CBSE Marking Scheme, 2015] 1 + 1 + 1

R **Q. 14. Give an example of :**

(i) A metal that is liquid at room temperature.

(ii) A non-metal that is liquid at room temperature.

(iii) An inert gas (At. no < 20)

[Board Term II, Set FF7NBE6, 2015]

Ans. (i) Mercury

(ii) Bromine

(iii) Helium or Neon or Argon. **(Any one) 1 + 1 + 1**

[CBSE Marking Scheme, 2015]

U **Q. 15. (i) How does the electronic configuration of an atom relates to its position (period and group) in the modern periodic table ?**

[Board Term II, Foreign Set-II, 2014]

(ii) Would you place the two isotopes of chlorine, Cl – 35 and Cl – 37, in different slots because of their different atomic masses or in the same slot because their chemical properties are the same ? Justify your answer. **[Board Term II, 2012]**

Ans. (i) In the periodic table, elements are placed according to their electronic configuration. If an element has only one shell in its electronic configuration, it is placed in the first period. If the element has two shells then it is placed in the second period, and so on. Vertical columns in the periodic table are called groups.

There are eighteen groups and in a group, all the elements have same number of valence electrons. **1 + 1**

(ii) They will be placed at the same slot as their atomic number is same, valence electron and valency are same and have same chemical properties. **1**

[CBSE Marking Scheme, 2012]

U **Q. 16. An element P (atomic number 20) reacts with an element Q (atomic number 17) to form a compound. Answer the following questions giving reason :**

Write the position of P and Q in the Modern Periodic Table.

Ans.

Position of P	Group-2	Because it has 2 valence electrons/ 2, 8, 8, 2
	Period-4	Because it has 4 shells/2, 8, 8, 2
Position of Q	Group-17	Because it has 7 valence electrons/ 2, 8, 7
	Period-3	Because it has 3 shells/ 2, 8, 7
Formula	PQ_2	Because valency of P is 2 and that of Q is 1

[CBSE Marking Scheme, 2017] 3

U **Q. 17. The atomic number of an element is 20.**

(a) Write its electronic configuration and determine its valency.

(b) It it is metal or a non-metal ?

(c) Write the formula of its chloride ?

(d) Is it more reactive or less reactive than Mg (atomic number 12) ? Give reason for your answer. **(Foreign Set 31/2/1 2017)**

Ans. (a) $X_{(20)}$-2, 8, 8, 2
Valence electrons- 2
Hence valency is 2 ½+½

(b) It is a metal ½

(c) XCl_2 ½

(d) It is more reactive than Mg as reactivity increases down the group Mg- III Period ½
And X_{20} (Ca)- IV Period ½

R **Q. 18. How could the Modern Periodic Table remove various anomalies of Mendeleev's Periodic Table?**

Ans. Modification in Mendeleev's Periodic Table : With the adoption of atomic number as the basis of classification of elements, some of the anomalies in the Mendeleev's Periodic Table now disappeared. These are :

(i) Position of Hydrogen : The atomic number of hydrogen is 1 and hence, it should occupy the first position in group 1 of the periodic Table. But because of its chemical similarity with elements of group 1 and group 17, the position of hydrogen in the periodic table is still not confirmed.

(ii) Position of Isotopes : As the isotopes of an element have the same atomic number, they should occupy the same place in the periodic table.

(iii) Position of Anomalous Pairs : The position of anomalous pairs of elements *i.e.,* pairs of elements in which the element with the higher atomic mass proceeds the element with lower atomic mass, is also decided. When these elements are arranged according to their atomic number, they occupy their right places in the periodic table. **1 + 1 + 1**

U **Q. 19. How does the electronic configuration of an atom related to its position in the modern periodic table ?**

Ans. (i) The group number of elements having up to two valence electrons is equal to the number of valence electrons.

(ii) The group number of elements having more than two valence electrons is equal to the number of valence electrons plus 10.
For example :

Number of Valence Electrons	Group number in Periodic Table
1 2	1, 2 } Group number = number of electron.
3 4	3 + 10 = 13 4 + 10 = 14 } Group number = number of electrons + 10.

(iii) For those elements, which do not have the same number of valence electrons but same number of shells, the number of shells is equal to the period number to which they belong in the periodic table.
For example :

2nd Period :

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

1 + 1 + 1

R **Q. 20. What were the limitations of Newlands law of Octaves ?**

Ans. The limitations of Newlands Law of Octaves are :

(i) The law was applicable to elements up to calcium (Ca) only.

(ii) It contained only 56 elements. Further it was assumed by Newlands that only 56 elements existed in nature and no more elements would be discovered in the future.

(iii) In order to fit elements into the table, Newlands adjusted two elements in the same column as fluorine, chlorine and bromine which have very different properties than these elements. Iron, which resembles cobalt and nickel in properties, has been placed differently away from these elements.

1 + 1 + 1

Long Answer Type Questions

(5 marks each)

U **Q. 1. (i) Why do we classify elements ?**
(ii) What are the two criteria used in the development of Modern Periodic Table ?
(iii) State the position of (a) metals, (b) non-metals and (c) metalloids in the periodic table.
(iv) Would you place two isotopes of chlorine; Cl–35 and Cl–37 in different slots of the periodic table because of their different atomic masses or in the same slot because their chemical properties are same ? Justify your answer.
[Board Term II, Set BI, 2011]

Ans. (i) To study the properties of elements and to keep the elements with similar properties together. **1**
(ii) Chemical properties of elements and atomic number. **1**
(iii) Metals lies on extreme left, metalloids lie in the middle and non-metals lie on the right side. **2**
(iv) They should be placed in the same slot. Since they have same numbers of electrons.
[CBSE Marking Scheme, 2011] 1

R **Q. 2. (a) Why did Mendeleev have gaps in his periodic table ?**
(b) State any three limitations of Mendeleev's classification ?
(c) How does electronic configurations of atoms change in a period with increase in atomic number ? **[Board Term II, Delhi 2009]**

Ans. (a) Gaps were left for undiscovered elements in the periodic table.
(b) (i) Position of hydrogen was not justified.
(ii) Increasing order of atomic mass could not be maintained.
(iii) Isotopes have similar chemical properties but different atomic masses, they cannot be given separate places.
(c) Number of shells remains the same, number of valence electrons goes on increasing from left to right in a period till octet is complete. *e.g.,*

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

1 + 3 + 1

A **Q. 3. Write down five major differences between Mendeleev's. Periodic table and Modern Periodic Table.** **(DDE 2017)**

Ans.

S. No.	Mendeleev's Period Table	Modern Periodic Table
(i)	Elements have been arranged in increasing order of atomic masses.	Element have been arranged in increasing order of their atomic number.
(ii)	It consists of 8 groups.	It consists of 18 groups.
(iii)	All the groups from I to VIII are divided into two sub-groups	No sub-groups.
(iv)	He left some gaps in the table for undiscovered elements	All elements are filled in increasing order of atomic number. No gaps left in periodic table.
(v)	Isotopes were placed in different groups.	Isotopes were placed in same group.

1 + 1 + 1 + 1 + 1

R **Q. 4. (a) Which two criteria did Mendeleev use to classify the elements in his periodic Table ?**
(b) State Mendeleev's Periodic Law
(c) Why could no fixed position be given to hydrogen in Mendeleev's Periodic Table ?
(d) How and why does the atomic size vary as you go
(i) from left to right along a period
(ii) down a group ?

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

(ii) The formulae and nature of hydrides and oxides formed by elements was treated as basic chemical property for its classification.

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

(c) It is because it resembles both with alkali metals as well as halogens.

(d) (i) Atomic size goes on decreasing from left to right because one proton and one electron is being added successively therefore, force of attraction between valence electrons and nucleus increases, therefore, atomic size decreases.

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

1 + 1 + 1 + 2

TOPIC-2
Periodic Elements and Periodic Properties

Very Short Answer Type Questions (1 mark each)

U **Q. 1. State one reason for placing Mg and Ca in the same group of the periodic table.**

[Board Term II, Set FF7NE6, 2015]

Ans. Due to the presence of 2 electrons in the valence shell and similar chemical properties.

[CBSE Marking Scheme, 2015] 1

A **Q. 2. The atomic numbers of three elements A, B and C are 12, 18 and 20 respectively. State giving reason, which two elements will show similar properties.**

[Board Term II, Outside Delhi Set III, 2014]

Ans. A and C will show similar properties because they have same number of valence electrons. **1**

R **Q. 3. Give the number of elements in 2^{nd} and 5^{th} period in Modern Periodic Table.**

[Board Term II, 2013]

Ans. 2^{nd} period has 8 elements, 5^{th} Period has 18 elements. ½ + ½

A **Q. 4. An element has atomic number 3. To which period of the periodic table does it belong ?**

Ans. Second period. **1**

U **Q. 5. Name any two elements that have two electrons in their valence shell.**

Ans. (i) Magnesium : 2, 8, 2 ½

(ii) Calcium : 2, 8, 8, 2. ½

U **Q. 6. There are 7 electrons in the outermost 'L' shell of an element . Predict the period and group in the periodic table this element belongs to.**

[KVS-2014]

Ans. Period – 2, Group – 17. **1**

(Electronic configuration of element = 2, 7)

U **Q. 7. The electronic configuration of two elements X and Y are 2,8,7 and 2,8,8,3 respectively. Write atomic numbers of X and Y.**

[Board Term II, Foreign Set 2013]

Ans. Atomic number of X = 2, 8, 7 = 17

Atomic number of Y = 2, 8, 8, 3 = 21 ½ + ½

U **Q. 8. Write any one difference between the electronic configuration of group-1 and group-2 elements.**

[Board Term II, Delhi Set III, 2014]

Ans. Group 1 elements have 1 valence electron while Group 2 elements have 2 valence electrons. ½+½

R **Q. 9. Write the atomic numbers of two elements 'X' and 'Y' having electronic configuration 2, 8, 2 and 2, 8, 6 respectively.**

[Board Term II, Outside Delhi Set II, 2014]

Ans. Atomic number of X = 2 + 8 + 2 = 12

Atomic number of Y = 2 + 8 + 6 = 16 ½+½

A **Q. 10. The atomic number of three element X, Y and Z are 3, 11 and 17 respectively. State giving reason which two elements will show similar chemical properties. [Outside Delhi Set II, Set AI 2013]**

Ans. X and Y will show similar chemical properties as these have same valence electrons.

X = 2, (1)

Y = 2, 8, (1) ½ + ½

R **Q. 11. Name two elements of first period in modern periodic table. [Board Term II, 2012, 2009]**

Ans. Hydrogen and Helium. ½+½

[CBSE Marking Scheme, 2012]

R **Q. 12. On which side of the periodic table do you find (i) metals, (ii) non-metals ?**

[Board Term II, Set (2025), 2012]

Ans. Metals are placed on the left side while non-metals are placed on the right side of the periodic table.

[CBSE Marking Scheme, 2012] ½+½

R **Q. 13. What is the similarity in the valency of all the elements of group 1 in the modern periodic table? [Board Term II, Set (2036) 2012]**

Ans. Valency is same *i.e.* 1. **1**

[CBSE Marking Scheme, 2012]

R **Q. 14. How does the electronegativity changes as we move from left to right across a period ?**

[Board Term II, Set (2045) 2012]

Ans. Electronegativity increases across a period. 1
[CBSE Marking scheme, 2012]

U **Q. 15. How does metallic character of a metal depend on the size of atom ?**

Ans. The metallic character of a metal increases with increase in the size of its atom. 1

A **Q. 16. State the similarity in the electronic configuration of all the elements present in group 1 of the periodic table.**

Ans. Elements in a group have similar electronic configuration so all of them have 1 valence electron. 1

R **Q. 17. List any two properties of the elements belonging to the first group of the modern periodic table.**
[Board Term II, Outside Delhi Set I, 2014]

Ans. First group elements are also known as alkali metals. They possess following properties :

(i) These elements exhibit + 1 valency.

(ii) These are very reactive as they are not found freely in nature. ½+½

A **Q. 18. The atomic numbers of three elements X, Y and Z are 3, 11 and 17, respectively. State giving reason which two elements will show similar chemical properties.[Outside Delhi Set-II, 2013]**

Ans. The two elements X and Y will show same chemical properties because they have same number of valence electrons in group. They form positively charged ions by losing one electron. ½+½

Short Answer Type Questions-I

(2 marks each)

R **Q. 1. Elements in the periodic table show periodicity of properties. List any four such properties.**
[Board Term II, Set (2007), 2012]

Ans. (i) Atomic size ½
(ii) Valency or combining capacity ½
(iii) Metallic property ½
(iv) Non-metallic property. ½
[CBSE Marking Scheme, 2012]

R **Q. 2. In the Modern Periodic Table how does the metallic trend of the elements change as we move**
(i) from left to right in a period, and
(ii) down a group ? [Delhi Comptt. 31/1/2 2017]

Ans. (i) Decreases
(ii) Increases **[CBSE Marking Scheme, 2017]** 1+1

Detailed Answer :

(i) On moving across a period, nuclear pull increases due to the increases in atomic number and thus the atomic size decreases. Hence, elements cannot lose electrons easily. The metallic nature decreases across a period, moving from left to right.

(ii) On moving down a group, the atomic size increases and the nuclear charge also increases. The effect of an increased atomic size is greater as compared to the increased nuclear charge. Therefore, metallic nature increases as one moves down a group.

R **Q. 3. The elements Li (Z = 3), Na (Z = 11) and K (Z = 19) belong to group 1.**
(i) Predict the periods they belong.
(ii) Which one of them is least reactive ?
(iii) Which one of them has the largest atomic radius ? Give reason to justify. [KVS 2017]

Ans. (i) The Period number to which these elements belong are
Li = 2nd Period
Na = 3rd Period
K = 4th Period

(ii) In a Group the chemical reactivity of metals from top to bottom increases. Lithium is least reactive.

(iii) Down the group the number of shells increases, So the atomic radius also increases. The element with largest atomic radius is Potassium. ½+½+1

R **Q. 4. How does the metallic character of the elements vary (i) in a group, (ii) in a period of the modern periodic table ? [Board Term II, Set (2017), 2012]**

Ans. (i) From top to bottom in group - metallic character increases. 1
(ii) From left to right in a period - metallic character decreases. **[CBSE Marking Scheme, 2012]** 1

U **Q. 5. Mention any two trends exhibited by elements when we go from left to right across the period of periodic table.[Board Term II, Set (2007) 2012]**

Ans. (i) Atomic radius decreases. 1
(ii) Metallic character decreases. 1
[CBSE Marking Scheme, 2012]

R **Q. 6. How would the tendency to lose electrons change as you go :**
(i) from left to right across a period ?
(ii) down a group ? [Board Term II, Set (2022) 2012]

Ans. Tendency to lose electrons :
(i) Decreases with increase in atomic number in a period from left to right. 1
(ii) Will increase down a group. 1
[CBSE Marking Scheme, 2012]

R **Q. 7. How does the atomic radius change as we go :**
(i) from left to right across a period
(ii) down a group in the periodic table ?
[Board Term II, Set (2023) 2012]

Ans. On going :
(i) From left to right across a period, atomic radius decreases as one proton and one electron are added continuously, therefore effective nuclear charge increases. 1

(ii) down a group in the periodic table, atomic radius increases because number of shells goes on increasing, therefore distance between nucleus and valence shell increases. 1

[CBSE Marking Scheme, 2012]

R **Q. 8. Four elements P, Q, R and S have atomic number 12, 13, 14 and 15 respectively. Answer the following :**

(a) What is the valency of Q ?

(b) Classify these element as metals and non-metals.

(c) Which of these elements will form the most basic oxide ? (DDE 2017)

Ans. (a) The valency of Q is 3.

(b) Elements P and Q are metals.

Elements R and S are non-metals.

(c) P and Q elements will form basic oxides. ½+1+½

R **Q. 9. (i) State the basis of classification of elements in the modern periodic table ?**

(ii) How does the metallic character of element vary as we go down the group.

[Board Term II, Set (2025), 2012]

Ans. (i) Atomic number. ½

(ii) Down the group, the effective nuclear charge experienced by the valence electron decreases because the outer most electrons are further away from the nucleus. Therefore, they can be lost easily. Hence metallic character increases down the group. 1½

[CBSE Marking Scheme, 2012]

A **Q. 10. (i) Atomic number of Mg and Al are 12 and 13, respectively. Write down their electronic configuration.**

(ii) Mention the period of the modern periodic table to which the above two elements belong. Give reason for your answer.

[Board Term II, Set (2008) 2012]

Ans. (i) Mg : 2, 8, 2 Al : 2, 8, 3 ½+½

(ii) 3rd period because electrons in these atoms are filled in K, L, M shells. 1

[CBSE Marking Scheme, 2012]

A **Q. 11. Nitrogen (atomic number 7) and phosphorus (atomic number 15) belong to group 15 of the periodic table. Write the electronic configuration of these two elements. Which of these will be more electronegative and why ?**

[NCERT Exemplar]

[Board Term II, Set (2016), 2012]

Ans. (i) Nitrogen : K shell-2 L shell-5 ½

Phosphorus : K shell-2 L shell-8 M shell-5 ½

(ii) Phosphorus will be less electronegative because its electrons are further away from the nucleus and thus nucleus can be easily lost. 1

[CBSE Marking Scheme, 2012]

A **Q. 12. The atomic radii of three elements A, B and C of a periodic table are 186 pm, 104 pm and 143 pm respectively. Giving a reason, arrange these elements in the increasing order of atomic numbers in the period.**

[Board Term II, Set (2024), 2012]

Ans. Order of atomic number of element

A < C < B. 1

Because atomic size generally decreases along a period, so B has the highest atomic number followed by C and A. 1

[CBSE Marking Scheme, 2012]

A **Q. 13. (i) Atomic radius of hydrogen is 37 pm. Express it in metres.**

(ii) How does atomic size vary in a group and in a period ? **[Board Term II, Set (2015), 2012]**

Ans. (i) 1 pm = 10^{-12} m. 1

Atomic radius = 37×10^{-12} m.

(ii) In a group atomic size : Increases down the group. ½

In a period atomic size : decreases in moving from left to right. **[CBSE Marking Scheme, 2012]** ½

A **Q. 14. (i) Element 'Y' with atomic number 3 combines with element 'A' with atomic number 17. What would be the formula of the compound ?**

(ii) What is the electronic configuration of an element with atomic number 10 ? What will be its valency ? **[Board Term II, Set (2022), 2012]**

Ans. (i) Electronic configuration of element 'Y' with atomic number 3 = 2, 1 ½

Element 'A' with atomic number 17 = 2, 8, 7 ½

Formula of the compound : YA.

(ii) Electronic configuration of element configuration of the element with atomic number 10 = 2, 8 ½

Valency : Zero. ½

[CBSE Marking Scheme, 2012]

A **Q. 15. Three elements X, Y and Z belong to 17th group but 2nd, 3rd and 4th period respectively. Number of valence electrons in Y is 7. Find the number of valence electrons in X and Z.**

[Board Term II, Set (2015), 2012]

Ans. It will be 7 in X as well as in Z. 1

The reason being that number of electrons in the outermost shell in the elements in same group is same. **[CBSE Marking Scheme, 2012]** 1

A **Q. 16. Na, Mg, Al and P belong to 3rd period but are placed in first, second, thirteenth and fifteenth group. Number of shells occupied in Mg is three. What is the number of occupied shells in Na, Al and P. Give reasons for your answer.**

[Board Term II, Set (2017) 2012]

Ans. It is three in Na, Al and P. 1

Elements with the same number of occupied shells are placed in same period. 1

[CBSE Marking Scheme, 2012]

A **Q. 17. Arrange the following elements in the descending order of atomic size and give a reason for your answer.** **Mg, Cl, P, Ar.**

(Atomic numbers of the above elements are 12, 17, 15, 18 respectively)

[Board Term II, Set (2009), 2012]

Ans. Mg, P, Cl, Ar. **1**

Increase in atomic number means increase in nuclear charge which tends to pull the electrons closer to the nucleus and reduces the size of the atom. **[CBSE Marking Scheme, 2012] 1**

A **Q. 18. Out of the elements X and Y, which has bigger atomic radius ? Give reason to justify your answer.**

(i) X has atomic number 18 and atomic mass 40.

(ii) Y has atomic number 20 and atomic mass 40.

[Board Term II, Set (2020), 2012]

Ans. Radius of Y is bigger than that of X. **1**

In 'X' the number of shells is three while in Y it is four. **[CBSE Marking Scheme, 2012]1**

A **Q. 19. The position of three elements X, Y and Z in the periodic table are shown below :**

(i) Which type of ion, cation or anion, will be formed by element X ?

(ii) Which element, Y or Z, has the atom of comparatively larger size ?

Give reason in each case.

[Board Term II, Set (2036), 2012]

Group 1	Group 2
–	–
X	–
–	–
Y	Z

Ans. (i) The valency of X is one. It has tendency to lose one electron. Therefore, X will form cation. **1**

(ii) Y ; because atomic radius decreases across a period due to increase in the electrostatic force between electrons and nucleus. **1**

[CBSE Marking Scheme, 2012]

U **Q. 20. (i) How does the tendency to gain electrons change as we go down the group ? Give reason.**

(ii) Given below is a part of the periodic table. How does the valency vary, as we move vertically downward from Li to Fr. Give reason.

[Board Term II, Set (2021), 2012]

Li	Be
Na	
K	
Rb	
Cs	
Fr	Ra

Ans. (i) Tendency to gain electrons decreases on moving down the group because with increase in size, effective '+ve' nuclear charge decreases. ½ + ½

(ii) Valency remains constant as we move downwards. Elements of the same group have the same number of valence electrons. ½ + ½

[CBSE Marking Scheme, 2012]

U **Q. 21. Two elements X and Y have atomic numbers 12 and 16 respectively. To which period of the modern periodic table do these two elements belong ? What type of bond will be formed between them and why ?**

[Board Term II, Set (2023), 2012]

Ans. Electronic configuration of element X, atomic number 12 = 2, 8, 2 ½

Electronic configuration of element Y, atomic numbers 16 = 2, 8, 6 ½

Both have three shells, so they belong to period 3. ½

They will form ionic bond as X will form electropositive ion and Y will form electronegative ion. ½

[CBSE Marking Scheme, 2012]

A **Q. 22. The atomic number of elements A, B, C, D and E are given below [Board Term II, Set (2025), 2012]**

Element	A	B	C	D	E
Atomic no.	7	10	12	4	19

From the above table, answer the following questions :

(i) Which two elements are chemically similar ?

(ii) Which is an inert gas ?

(iii) Which element belongs to 3rd period of periodic table ?

(iv) Which element among these is a non-metal ?

Ans. (i) C and D **(ii)** B

(iii) C **(iv)** A ½ + ½ + ½ + ½

A **Q. 23. Given below are atomic radii of same elements of second period.**

Element	B	O	N	C
Atomic Radii in pm	88	66	74	77

Arrange these elements in the increasing order of their atomic number. Give reason for your answer.

[Board Term II, Set 2018, 2012]

Ans. B, C, N, O. **1**

In a period, as the atomic number increases, size of the atom decreases. This is because increase in nuclear charge tends to pull electrons closer to nucleus and reduces the size of the atom. **1**

[CBSE Marking Scheme, 2012]

A **Q. 24. (i) An element has electronic configuration 2, 8, 6. Explain its position in the periodic table.**

(ii) Size of sodium atom is bigger than that of hydrogen atom. Why ? **[Board Term II, Set (2036), 2012]**

Ans. (i) Third period and group 16. **1**

(ii) Size increases down the group as new shells are added. **1**

A Q. 25. Some of the elements and their atomic numbers are mentioned in the following table :

Element	Atomic number
P	3
Q	17
R	13
S	11

(i) How many valence electrons are there in the element 'R' ?

(ii) What is the valency of 'P' ?

(iii) Write the chemical formula of the compound formed by combining the elements 'P' and 'Q' ?

(iv) Out of the two elements 'P' and 'S', which one is larger in size ? [Board Term II, Set (67003), 2012]

Ans. (i) 3. ½

(ii) 1. ½

(iii) PQ. ½

(iv) S. ½

[CBSE Marking Scheme, 2012]

Short Answer Type Questions-II (3 marks each)

R Q. 1. **What is meant by atomic radius ? Explain why it decreases across a period ?**

[Board Term II, Set-GFUTB86, 2015]

Ans. The distance from centre of nucleus to outermost shell of an atom is atomic radius.

Atomic radius decreases across a period because electron is added in the same shell. So attraction between nucleus and valence shell increases due to which outermost shell is pulled in closer to the nucleus. **[CBSE Marking scheme, 2015] 1 + 2**

A Q. 2. **How does the atomic radius of the elements change on going**

(i) from left to right in a period, and

(ii) down a group

in the Modern Periodic Table ? Give reason in support of your answer.[Delhi Comptt. 31/1/1 2017]

Ans. (i) Atomic radius decreases ½

Reason : Nuclear charge increases which tends to pull the electrons closer to the nucleus. **1**

(ii) Atomic radius increases ½

Reason : Number of shells increases on going down the group. **1**

[CBSE Marking Scheme, 2017]

R Q. 3. **Write the names given to the vertical columns and horizontal rows in the Modern Periodic Table. How does the metallic character of elements vary on moving down a vertical column ? How does the size of atomic radius vary on moving left to right in a horizontal row ? Give reason in support of your answer in the above two cases.** **[Delhi 31/1/1 2017]**

Ans. Vertical Column — Groups ½

Horizontal Rows — Period ½

Metallic character increases

Reason : Ability to lose electrons increases on moving down the group due to increases in distance between the nucleus and the valence electrons/decrease in the attraction between the nucleus and the valence electrons. ½

Atomic radius decreases

Reason : The nuclear charge increases on moving from left to right across a period resulting in increase in the attraction between the nucleus and the valence electrons.

[CBSE Marking Scheme, 2017]

Detailed Answer :

In the modern periodic table, there are 18 vertical columns known as Groups and 7 horizontal rows known as Periods.

Metallic character increases on moving down a group in the Modern Periodic table. As we move down the group, the electrostatic attraction between the nucleus and the outermost electron decreases due to increase in the distance between them. This happens because; on moving down the group a new shell a added. So, the valence electron can be easily lost by the element, thereby metallic character increases on moving down a group.

The size of atomic radius decreases on moving left of right in a horizontal row. When, we move across a period, the number of electrons in the same shell increases. This leads to greater electrostatic attraction between the nucleus and the outermost electron. This increased attraction pulls the outermost electron closer to the nucleus, thereby decreasing the atomic size. **3**

U Q. 4. **(i) Name the element with atomic number 17.**

(ii) To which period does it belong ?

(iii) To which group does it belong ?

(iv) Write its electronic configuration.

[Board Term II, Delhi Set-UV6TFLN, 2016]

Ans. (i) Chlorine ½

(ii) 3^{rd} period **1**

(iii) 17^{th} group **1**

(iv) 2, 8, 7. **[CBSE Marking Scheme, 2016]** ½

R Q. 5. **How many groups and periods are there in the modern periodic table? How do the atomic size and metallic character of elements vary as we move ?**

(i) down a group and

(ii) from left to right in a period.

[Board Term II, Delhi Set I, 2015]

Ans. There are 18 groups and 7 periods in the modern periodic table.

(i) Atomic size generally increases down a group due to the addition of new shell and metallic character also increases down a group due to the increase in tendency to lose electrons.

(ii) Atomic size goes on decreasing along a period from left to right.

Metallic character decreases along a period due to decrease in tendency to lose electrons. **1 + 1 + 1**

[CBSE Marking Scheme, 2015]

R **Q. 6. Why is atomic number considered to be a more appropriate parameter than atomic mass for the classification of elements in a periodic table ? How does the metallic character elements vary as we move (i) from left to right in a period, and (ii) top to bottom in a group in the modern periodic table ? Give reasons to justify your answers ?** **[Foreign 31/2/1 2017]**

Ans. Atomic number is more important parameter than atomic mass as atomic number determines the number of valence electrons which decide the chemical properties of an atom of an element. **1**

Metallic character decreases from left to right in a period, because the tendency to lose electrons decreases due to increased attraction between nucleus and valence electrons. ½+½

Metallic character increases down the group, as the tendency to lose electrons increases, due to decreased attraction between nucleus and valence electrons because outermost electrons are farther away. ½+½

R **Q. 7. (a) Define the following terms :**

(i) Valency, (ii) Atomic size.

(b) How do the valency and the atomic size of the elements vary while going from left to right along a period in the modern periodic table ?

[Board Term II, Delhi Set I, II, III, 2014]

Ans. (a) (i) Valency : The combining power or the combining capacity of an atom is called its valency.

(ii) Atomic size: Atomic size or atomic radius is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

(b) On moving from left to right in the periodic table, valency increases up to 4 and then decreases.

The electrons present in the last shell determine the valency of a particular element.

If the number of valence electrons is less than or equal to 4, valency = number of valence electrons

If the number of valence electrons is more than 4, valency = 8 - number of valence electrons

Atomic size decreases along a period. This is because on moving across a period, the number of valence shells remains the same and the electrons increase by one unit. As a result, the nuclear charge increases and thus, the atomic radius decreases.

1 + 1 + ½ + ½

R **Q. 8. What is meant by 'group' in the modern periodic table ? How do the following change on moving from top to bottom in a group ?**

(i) Number of valence electrons

(ii) Number of occupied shells

(iii) Size of atoms

(iv) Metallic character of element

(v) Effective nuclear charge experienced by valence electrons. [Board Term II, Outside Delhi Set II, 2014]

Ans. Vertical columns of the periodic table are known as groups.

(i) The number of valence electrons remains constant when we move down the group.

(ii) The number of occupied shells increases down the group.

(iii) The size of atom increases down the group.

(iv) The metallic character of elements increases down the group.

(v) The effective nuclear charge decreases down the group. **½ × 6 = 3**

R **Q. 9. Write the number of periods the modern periodic table has. State the changes in valency and metallic character of elements as we move from left to right in a period. Also state the changes, if any, in the valency and atomic size of elements as we move down a group.**

[Board Term II, Delhi Set III, 2015]

Ans. No. of periods : 7. ½

Valency across a period increases from 1 to 4, then decreases from 4 to zero. **1**

Metallic character of elements across a period decreases. ½

Valency remains the same down a group ½

Atomic size of elements increases down a group. ½

U **Q. 10. Na, Mg and Al are the elements of the 3rd period of the Modern Periodic Table having group number 1, 2 and 13 respectively. Which one of these elements has the (a) highest valency, (b) largest atomic radius, and (c) maximum chemical reactivity ? Justify your answer stating the reason for each.** **[OD 31/1/2017]**

Ans.

A **Q. 11. Calcium is an element with atomic number 20. Stating reason for each of the following questions :**

(i) Is calcium a metal or non-metal ?

(ii) Will its atomic radius be larger or smaller than that of potassium with atomic number 19 ?

(iii) Write the formula of its oxide.

[Board Term II, Delhi Set I, 2016]

Ans. (i) It is a metal. ½

Since it has two electrons in its outermost shell/ two valence electrons, which it can lose easily. ½

(ii) K (19) is placed before Ca (20) in the same period/ fourth period. ½

Since the atomic radius decreases along a period, the atomic radius of calcium is smaller than that of potassium. ½

(iii) The formula of oxide of calcium is CaO, because the valency of calcium as well as that of oxygen is 2. **[CBSE Marking Scheme, 2016]** ½+½

A **Q. 12. An element 'M' with electronic configuration (2, 8, 2) combines separately with NO_3^-, SO_4^{2-} and PO_4^{3-} radicals. Write the formula of the three compounds so formed. To which group and period of the modern periodic table does the element 'M' belong ? Will 'M' form covalent or ionic compounds? Give reason to justify your answer. [Board Term II, Delhi Set I, 2016]**

Ans. (i) The electronic configuration (2, 8, 2) of the element 'M' suggests that it belongs to group 2 and period 3 of the modern periodic table and its valency is 2. ½+½

(ii) The chemical formula of the compounds are :

$M(NO_3)_2$ / $Mg(NO_3)_2$; MSO_4 / $MgSO_4$; $M_3(PO_4)_2$ / $Mg_3(PO_4)_2$. 3×½ = 1½

(iii) 'M' will form ionic compounds by losing two electrons. **[CBSE Marking Scheme, 2016]** ½

A **Q. 13. Two elements 'A' and 'B' belong to the 3rd period of Modern periodic table and are in group 2 and 13 respectively. Compare their following characteristics in tabular form :**

(i) Number of electrons in their atoms

(ii) Size of their atoms

(iii) Their tendencies to lose electrons

(iv) The formula of their oxides

(v) Their metallic character

(vi) The formula of their chlorides.

[Board Term II, Delhi Set III, 2016]

Ans.

Sr. No.	Characteristics	A	B
(i)	Number of electrons in their atoms	4 or 12 or 20	5 or 13 or 21
(ii)	Size of their atoms	Bigger	Smaller
(iii)	Their tendencies to lose electrons	More	Less
(iv)	The formula of their oxides	AO	B_2O_3
(v)	Their metallic character	More metallic	Less metallic
(vi)	The formula of their chlorides	ACl_2	BCl_3

[CBSE Marking Scheme, 2016] 6 × ½ = 3

R **Q. 14. Name any two elements of group one and write their electronic configurations. What similarity do you observe in their electronic configurations ? Write the formula of oxide of any of the above said element. [Board Term II, Delhi Set II, 2016]**

Ans. (i) Two elements of group 1 are Na, K / Sodium, potassium. 2×½

Electronic configurations Na = 2,8,1; K = 2,8,8,1 2×½

(ii) Similarity : Both have one valence electron / One electron in outermost shell. ½

(iii) **Oxide** – Na_2O / K_2O. ½

[CBSE Marking Scheme, 2016]

A **Q. 15. An element 'X' (Atomic number = 20) burns in the presence of oxygen to form a basic oxide.**

(i) Identify the element and write its electronic configuration.

(ii) State its group number and period number in the Modern Periodic Table.

(iii) Write a balanced chemical equation for the reaction when this oxide is dissolved in water.

[Board Term II, Foreign Set I, 2016]

Ans. (i) X(20)--- 2, 8, 8, 2. It is calcium. ½ + ½
(ii) Second group, fourth period. ½ + ½
(iii) $CaO + H_2O \longrightarrow Ca(OH)_2$ 1
[CBSE Marking Scheme, 2016]

A **Q. 16. An element 'X' belongs to third period and second group of the Modern Periodic Table.**
(i) Write its electronic configuration.
(ii) Is it a metal or non-metal ? Why ?
(iii) Write the formula of the compound formed when 'X' reacts with an element
(a) Y of electronic configuration 2, 6 and (b) Z with electronic configuration 2, 8, 7.
[Board Term II, Foreign Set II, 2016]

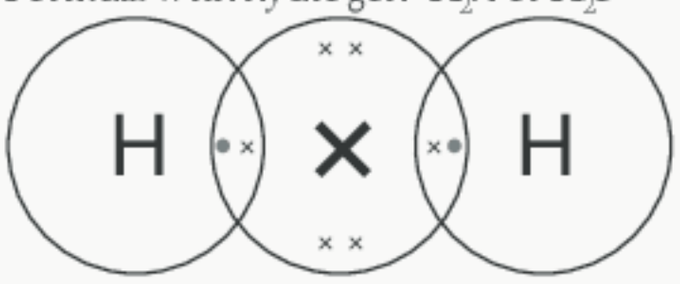
Ans. (i) Electronic Configuration – 2,8,2. ½
(ii) Metal, as it can easily lose electrons (from outer most orbit) ½ + ½
(iii) X Y X Z
2 2 2 1 ½
Compound – XY XZ_2 ½ + ½
[CBSE Marking Scheme, 2016]

A **Q. 17. The atomic number of an element 'X' is 19.**
(i) Write its electronic configuration.
(ii) To which period of the Modern Periodic Table does it belong and what is its valency ?
(iii) If 'X' burns in oxygen to form its oxide, what will be its nature – acidic, basic or neutral ?
(iv) Write balanced chemical equation for the reaction when this oxide is dissolved in water.
[Board Term II, Foreign Set III, 2016]

Ans. (i) Electronic Configuration of X(19) – 2,8, 8, 1. ½
(ii) Fourth Period, Valency 1. ½ + ½
(iii) Basic oxide (X_2O).
(iv) $X_2O + H_2O \longrightarrow 2XOH$. ½ + ½
[CBSE Marking Scheme, 2016]

A **Q. 18. An element 'X' belongs to 3rd period and group 16 of the Modern Periodic Table.**
(i) Determine the number of valence electrons and the valency of 'X'.
(ii) Molecular formula of the compound when 'X' reacts with hydrogen and write its electron dot structure.
(iii) Name the element 'X' and state whether it is metallic or non-metallic. **[Board Term II, O.D. Set I, 2016]**

Ans. (i) Electronic configuration of X = 2,8,6.
Valence electrons = 6.
Valency = 8-6= 2. ½ + ½
(ii) Formula with hydrogen- H_2X or H_2S



½ + ½
(iii) Sulphur; non-metal. ½ + ½
[CBSE Marking Scheme, 2016]

U **Q. 19. An element 'X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.**
[Board Term II, O.D. Set I, 2016]

Ans. Atomic number of X = Mass number of X – No of neutrons ½
= 35 – 18 = 17 ½
Therefore, Electronic configuration of
X = 2, 8, 7 ½
Group number = 17 ½
Period = 3
Valency = 8 – 7 = 1 ½ + ½
[CBSE Marking Scheme, 2016]

OR

[Topper Answer, 2016]

U **Q. 20. Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.**
(i) State their positions (Group number and period number both) in the Modern Periodic Table.
(ii) Arrange these elements in the decreasing order of their atomic radii.
(iii) Write the formula of the compound formed when 'X' combines with 'Z'.
[Board Term II, O.D. Set I 2016]

Ans. (i) X (7) = 2,5 Group 15; Period 2 ½
Y(8) = 2,6 Group 16; Period 2 ½
Z(9) = 2,7 Group 17; Period 2 ½
(ii) X > Y > Z ½
(iii) XZ_3 1
[CBSE Marking Scheme, 2016]

U **Q. 21. The position of eight elements in the modern periodic table is given below where atomic numbers of elements are given in the parenthesis.**

Period No.		
2	Li(3)	Be(4)
3	Na(11)	Mg(12)
4	K(19)	Ca(20)
5	Rb(37)	Sr(38)

(i) Write the electronic configuration of Ca.
(ii) Predict the number of valence electrons in Rb.
(iii) What is the number of shells in Sr ?

(iv) Predict whether K is a metal or a non-metal.

(v) Which one of these elements has the largest atom in size ?

(vi) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.

[Board Term II, O.D. Set III 2016]

Ans. (i) Ca = 2, 8, 8, 2 ½

(ii) Valence electrons in Rb = 1 ½

(iii) Five ½

(iv) Metal ½

(v) Rb is biggest in size ½

(vi) Be < Mg < Ca < Rb. ½

[CBSE Marking Scheme, 2016]

OR

[Topper Answer, 2016]

A **Q. 22. Na, Mg and Al are the elements of the same period of modern periodic table having one, two and three valence electrons respectively. Which of these elements (i) has the largest atomic radius, (ii) is least reactive ? Justify your answer stating reason for each case.**

[Board Term II, Delhi II, 2015]

Ans. (i) Na/Sodium.

Reason : The atomic size decreases from left to right due to the increase in the nuclear charge.

(ii) Al/Aluminium.

Reason : The tendency to lose electrons decreases from left to right.

[CBSE Marking Scheme, 2015] 1½ + 1½

Detailed Answer :

(i) Na will have the largest atomic radius as atomic size goes on decreasing along a period from left to right. It is due to increase in nuclear charge (number of protons in nucleus) which pulls the electrons towards it, *i.e.,* force of attraction between nucleus and valence electrons increases, therefore atomic size decreases.

(ii) Al is least reactive because reactivity of an element depends upon the ability of its atoms to donate or accept electrons. Tendency to lose electrons along a period generally decreases with decrease in atomic size, *i.e.,* the force of attraction between the valence electrons and the nucleus increases, therefore electrons cannot be removed easily. 1 + 2

U **Q. 23. Four elements A, B, C and D have atomic numbers 12, 13, 14 and 15 respectively.**

Answer the following questions giving reasons :

(i) What is the number of valence electrons and valency of D ?

(ii) Which of them will have largest atomic radii ?

(iii) Which of these elements will form the most basic oxide ? **[Board Term II, SQP, 2016]**

Ans. (i) Valence electrons in 'D' = 5 and Valency of 'D' = 3. **1**

(ii) 'A' will have largest atomic radii because atomic radius decreases across a period from left to right. **1**

(iii) 'A' will form the most basic oxide as it is most metallic. **[CBSE Marking Scheme, 2016]** **1**

A **Q. 24. "Electronegativity is the case of gaining electrons".**

(a) Which type of elements will have high electronegativity ?

(b) How does electronegativity change as we move

(i) across a period

(ii) down a group ?

[Board Term II, Set-FF7NBE6, 2015]

Ans. (a) Non-metals

(b) (i) Increases

(ii) Decreases

[CBSE Marking Scheme, 2015] 1 + 1 + 1

U **Q. 25. Two elements 'P' and 'Q' belong to the same period of the modern periodic table and are in Group –1 and Group –2 respectively. Compare their following characteristics in tabular form :**

(i) The number of electrons in their atoms

(ii) The sizes of their atoms

(iii) Their metallic characters

(iv) Their tendencies to lose electrons

(v) The formula of their oxides

(vi) The formula of their chlorides

[Board Term II, O.D. Set I, 2015]

Ans.

Sr. No.	Property	P	Q	
(i)	No. of electrons in the atom	3 11 19	4 12 20 (any one pair)	½
(ii)	Size of the atom	Bigger	Smaller	½
(iii)	Metallic character	More metallic	Less metallic	½
(iv)	Tendency to lose electrons	More	Less	
(v)	Formula of oxides	P_2O	QO	½
(vi)	Formula of chlorides	PCl	QCl_2	½

Note : For parts (v) and (vi) examples using symbols of elements may also be accepted. ½

[CBSE Marking Scheme, 2015]

Detailed Answer :

(i) P has 1 valence electron, Q has 2 valence electrons.

(ii) 'P' is bigger than 'Q'.

(iii) 'P' is more metallic than 'Q'.

(iv) 'P' has more tendency to lose electrons than 'Q'.
(v) P_2O and QO are formula of their oxides.
(vi) P Cl and Q Cl_2 are formula of their chlorides.
½ + ½ + ½ + ½ + ½ + ½

U **Q. 26. From the following elements :**
$_4Be$, $_9F$, $_{19}K$, $_{20}Ca$
(i) Select the element having one electron in the outermost shell.
(ii) Two elements of the same group.
Write the formula and mention the nature of the compound formed by the union of $_{19}K$ and element X (2,8,7). **[Board Term II, Delhi Set I, 2015]**

Ans. (i) The elements which have one electron in the outermost shell are
$_{19}K = 2, 8, 8, 1$
(ii) Two elements of the same group are Beryllium (Be) and Calcium (Ca).
$_4Be = 2, 2$
$_{20}Ca = 2, 8, 8, 2$
Formula of element K and element X :
Both elements K and X have valency one
So, K (1) × X (1)
$K_1X_1 = KX/KCl$
It is an electrovalent compound. **1+1+1**
[CBSE Marking Scheme, 2015]

A **Q. 27. The atomic number of an element 'X' is 20.**
(i) Determine the position of the element 'X' in the periodic table.
(ii) Write the formula of the compound formed when 'X' reacts/combines with another element 'Y' (atomic number 8).
(iii) What would be the nature (acidic or basic) of the compound formed ? Justify your answer.
[Board Term II, Delhi Set I, 2015]

Ans. Electronic configuration = 2, 8, 8, 2. ½
(i) 'X' is present in the 2nd group and 4th period of the periodic table. ½ + ½
(ii) XY. ½
(iii) Basic because X is a metal and the oxides of metals are basic in nature (Y, Atomic number = 8, Oxygen). ½ + ½

A **Q. 28. An element 'X' is placed in the 3rd group and 3rd period of the Modern Periodic Table. Answer the following questions stating reason for your answer in each case :**
(i) Write the electronic configuration of the element 'X'.
(ii) Write the formula of the compound formed when the element 'X' reacts with another element 'Y' of atomic number 17.
(iii) Will the oxide of this element be acidic or basic ?
[Board Term II, Foreign II, 2015]

Ans. Since the information given in the question is inaccurate, full marks are to be awarded to every candidate. **3**

A **Q. 29. In the following table, the positions of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table :**

Group→ Period↓	1	2	3–12	13	14	15	16	17	18
2	A			B		C			D
3					E				F

On the basis of the above table, answer the following questions :
(i) Name the element which forms only covalent compounds.
(ii) Name the element which is a metal with valency three.
(iii) Name the element which is a non-metal with valency three.
(iv) Out of B and C, whose atomic radius is bigger and why ?
(v) Write the common name for the family to which the elements D and F belong.
[Board Term II, Delhi Set III, 2015]

Ans. (i) E ½
(ii) B ½
(iii) C ½
(iv) B, because atomic radius decreases from left to right due to increase in the nuclear charge. **1**
(v) Noble gases. ½

U **Q. 30. The elements $_4Be$, $_{12}Mg$ and $_{20}Ca$ each having two valence electrons in their valence shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case,**
(i) In which group should they be?
(ii) Which one of them is least reactive ?
(iii) Which one of them has the largest atomic size ?
[Board Term II, O.D. Set-I, 2015]

Ans. (i) They all belong to group 2 because all three have 2 electrons in their outermost shell.
(ii) Be is least reactive because it has 2 shells and due to more nuclear change it is not easy to take electrons from it.
(iii) Ca is the element having largest atomic radius because it has 4 shells. **1+1+1**
[CBSE Marking Scheme, 2015]

A **Q. 31. Four elements P, Q, R and S belong to the third period of the Modern Periodic Table and have respectively 1, 3, 5 and 7 electrons in their outermost shells. Write the electronic configurations of Q and R and determine their valencies. Write the molecular formula of the compound formed when P and S combine.**
[Board Term II, Foreign Set II, 2015]

Ans. Electronic configuration of Q = 2, 8, 3
Valency of Q = 3 **1**
Electronic Configuration of R = 2, 8, 5
Valency of R = 8 – 5 = 3 **1**
Electronic configuration of P = 2, 8, 1
Electronic configuration of S = 2, 8, 7 **1**
Formula : PS/NaCl

A **Q. 32. Based on the group valency of elements state the formula for the following giving justification for each :**

(i) Oxides of 1st group elements,

(ii) Halides of the elements of group 13, and

(iii) Compounds formed when an element of group 2 combines with, an element of group 16.

[Board Term II, Delhi Set I, 2014]

Ans. (i) Valency of group 1 elements = 1

Valency of oxygen = 2

Oxides of group 1 elements :

Formula of the oxides of group 1 is M_2O, where M is the group 1 element and O is oxygen.

(ii) Valency of group 13 elements = 3

Valency of halogens = 1

Halides of group 13 elements :

Formula of the halides of group 13 is MX_3, where M is the group 13 element and X is halogen.

(iii) Valency of group 2 elements = 2

Valency of group 16 elements = 2

Compounds of group 2 and group 16 elements :

Formula of the compounds of group 2 and 16 is MN, where M is the group 2 element and

N is the group 16 element. **1+1+1**

A **Q. 33. Consider two elements 'A' (Atomic number 17) and 'B' (Atomic number 19) :**

(i) Write the positions of these elements in the modern periodic table giving justification.

(ii) Write the formula of the compound formed when 'A' combines with 'B.'

(iii) Draw the electron dot structure of the compound and state the nature of the bond formed between the two elements.

[Board Term II, Delhi Set II, III, 2014]

Ans. (i) Position of the elements in the periodic table :

Element	Period	Group
A	3	17
B	4	1

(ii) Atomic number of A = 17

Electronic configuration A = 2, 8, 7

Number of valence electrons of A = 7

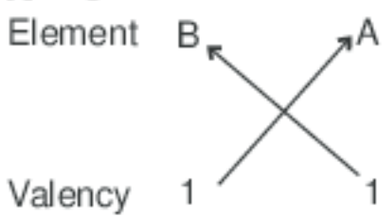
Valency of A = 8 – 7 = 1

Atomic number of B = 19

Electronic configuration B = 2, 8, 8, 1

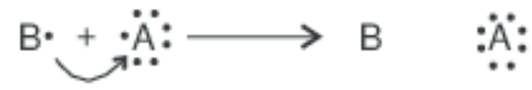
Number of valence electrons of B = 1

Valency of A = 1



So, the formula of the compound formed when elements A and B combine is BA.

(iii)



Lewis Structure : $[B]^+[:A:]^-$ **1+1+1**

A **Q. 34. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons in the outermost shell respectively. State the period in which these elements can be placed in the modern periodic table. Write the electronic configuration of the atoms of A and D and the molecular formula of the compound formed when A and D combine.**

[Board Term II, Outside Delhi Set I, 2014]

Ans.

Elements	Valence electrons	Period
A	1	3
B	3	3
C	5	3
D	7	3

Electronic configuration of A : $1s^2\ 2s^2\ 2p^6\ 3s^1$

Electronic configuration of D : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

Molecular formula of the compound formed with A and D

Atomic number of A = 11

Electronic configuration A = 2, 8, 1

Number of valence electrons of A = 1

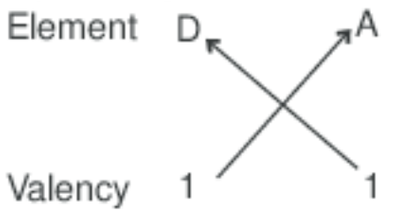
Valency of A = 1

Atomic number of D = 17

Electronic configuration D = 2, 8, 7

Number of valence electrons of D = 7

Valency of D = 8 – 7 = 1



So, the formula of the compound formed when elements A and D combine is AD. **1+1+1**

A **Q. 35. Study the following table in which positions of six elements A, B, C, D, E and F are shown as they are in the modern periodic table :**

Group → / Period ↓	1	2	3-12	13	14	15	15	17	18
1.	A					B			C
2.				D	E				F

On the basis of the above table, answer the following questions :

(i) Name the element which forms only covalent compounds.

(ii) Name the element which is a metal with valency three.

(iii) Name the element which is a non-metal with valency three.

(iv) Out of D and E, which is bigger is size and why ?

(v) Write the common name for the family to which the elements C and F belong.

[Board Term II, Outside Delhi Set I, II, III, 2014]

Ans. (i) Element E will form covalent compounds by sharing its four valence electrons.

(ii) Element D is a metal with valency three.

(iii) Element B is a non-metal with valency three.

(iv) We know that the size of elements decreases on moving left to right in a period. Therefore, element D is greater than element E.

(v) The name of the family to which elements C and F belong is the noble gas family (group 18).

½ + ½ + ½ + 1 + ½

A **Q. 36. The elements Li, Na and K, each having one valence electron, are in period 2, 3 and 4 respectively of modern periodic table.**

(i) In which group of the periodic table should they be?

(ii) Which one of them is least reactive ?

(iii) Which one of them has the largest atomic radius ?

Give reason to justify your answer in each case.

[Board Term II, Delhi Set III, 2013]

Ans. (i) They are in group 1 because all the elements in group have 1 valence electron. They form positively charged ions by losing one electron.

(ii) Lithium is least reactive because reactivity of an element depends upon the ability of its atoms to donate or accept electrons.

(iii) Potassium will have largest atomic radius due to the addition of a new shell. Atomic size generally increases from top to bottom in a group. **1+1+1**

U **Q. 37. Four elements P, Q, R and S have atomic numbers 12, 13, 14 and 15 respectively.**

Answer the following questions giving reasons :

(i) What is the valency of Q ?

(ii) Classify these elements as metals and non-metals.

(ii) Which of these elements will form the most basic oxide ? [Board Term II, O.D. Set I, 2013]

Ans. (i) The valency of Q is 3 as its valence shell has three electrons in it.

(ii) Elements P and Q are metals as they have 2 electrons in their valence shell and they are positively charged ions whereas elements R and S are non-metals as they gain electrons to complete their octet.

(iii) P and Q will form basic oxides as they are metals.

1+1+1

A **Q. 38. Four elements A, B, C and D along with their electronic configuration are given below :**

Elements	A	B	C	D
Electronic configuration	2, 1	2, 8	2, 8, 1	2, 8, 8

Now answer the following questions :

(i) Which two elements belong to the same period ?

(ii) Which two elements belong to the same group ?

(iii) Which element out of A and C is more reactive and why ? [Board Term II, SQP, 2013]

Ans. (i) A and B, C and D have same period.

(ii) A and C have one valence electron, so they same group.

(iii) C is more reactive because C is placed below A in the periodic table and reactivity increases down the group. **1+1+1**

U **Q. 39. Two elements X and Y belong to group 1 and 2 respectively in the same period of the periodic table. Compare these elements with respect to :**

(i) number of electrons in their outermost orbit

(ii) their valencies

(iii) metallic character

(iv) their atomic size

(v) formula of their chlorides

(vii) formula of their sulphates.

[Board Term II, Set 2025, 2012]

Ans. (i) Number of electrons in the outermost orbit of X = 1 and Y = 2. ½

(ii) Valency of X = 1 and Y =2. ½

(iii) Metal X is more metallic than Y. ½

(iv) Atomic size of X is bigger than that of Y. ½

(v) Chloride XCl ; YCl_2 ½

(vi) Sulphate X_2SO_4 ; YSO_4 ½

[CBSE Marking Scheme, 2012]

A **Q. 40. From the following part of the periodic table, answer the following questions :**

1 Lithium	2	13	14 Carbon	15	16 Oxygen	17 Fluorine
X			P			Q
Y						R
Z						T

(i) Which is the most reactive metal ?

(ii) Name the family of fluorine Q, R, T.

(iii) Name one element each of group 2 and 15.

(iv) Give the name of the element P placed below carbon.

(v) Compare X and P with respect to the size of atoms.

Ans. (i) Z. ½

(ii) Halogens. ½

(iii) Magnesium and nitrogen. ½+½

(iv) Silicon. ½

(v) X has bigger size than P because X has less effective nuclear charge. ½

U **Q. 41. An atom has electronic configuration 2, 8, 2.**

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

(ii) What is its valency ?

(iii) To which of the following elements would it be chemically similar and why ? (Be-4, O-8. Justify your answer.) [Board Term II, Set (2024), 2012]

Ans. (i) 12. ½

(ii) 2. ½

(iii) Be. ½

Because Be has two electrons in its valence shell. Given element also has two electrons in its valence shell.

Since valence electrons determine the chemical property, hence the given element has same chemical properties as that of Be. 1½

[CBSE Marking Scheme, 2012]

A **Q. 42. An element X (atomic number 17) reacts with an element Y (atomic number 20) to form a compound.**

(i) Write the position of these elements in the modern periodic table.

(ii) Write the formula of the compound formed. Justify your answer in each case. [NCERT Exemplar]

[Board Term II, Delhi Set II, 2013]

Ans. (i) The position of elements X in the modern periodic table is group number 17 and period number 3. The position of element Y in the modern periodic table is group number 2 and period number 4. Electronic configuration of element X = 2, 8, 7.

It has 3 shells so period number 3.

Halogens are kept in group 17.

Electronic configuration of element Y = 2, 8, 8, 2

It has 4 shells so period number is 4.

The valence shell has 2 electrons so the group number is 2. 1½

(ii) Formula of the compound :

Valency of element Y	Valency of element X
2	1

$\therefore$ YX_2 1½

U **Q. 43. Given below are some elements of the modern periodic table :**

$_4Be$, $_9F$, $_{14}Si$, $_{19}K$, $_{20}Ca$.

(i) Select the element that has one electron in the outermost shell and write its electronic configuration.

(ii) Select two elements that belong to the same group. give reason for your answer.

(iii) Select two elements that belong to the same period. Which one of the two has bigger atomic size ?

[Board Term II, Delhi Set I, 2013]

Ans. (i) $_{19}K$ (Potassium) is the element that has one electron in the outermost shell.

Electronic configuration = 2, 8, 8, 1

(ii) $_4Be$ (Beryllium) and $_{20}Ca$ (Calcium) belong to the same group, because they have same number of valence electrons.

Be = 2, 2 and Ca = 2, 8, 8, 2

(iii) Beryllium (Be) and Fluorine (F) have same period *i.e.*, second period which has 2 shells (K and L) whereas Potassium (K) and Calcium (Ca) also belong to same period *i.e.*, fourth period which have 4 shells (K, L, M and N). 1+1+1

U **Q. 44. The position of three elements A, B and C in the periodic table are shown below :**

Groups → / Periods ↓	1	2	3
I			A
II			B
III		C	
IV			
V			
VI			
VII			
VIII			

Give reasons to explain the following :

(i) Element 'A' is a metal.

(ii) Element 'B' has larger size than 'C'.

(iii) Element 'C' has a valency - 3.

[Board Term II, Set 8XSVHLC, 2014]

Ans. (i) Element 'A' is a metal because it is present in group I (1 valence electron) and can lose electron easily. 1

(ii) Element B has larger size than 'C' because it has more number of shells than 'C'.

Also, B lies in the third period and has three shells whereas B lies in second period and has two shells. 1

(iii) 'C' being an element of 3rd group has three valence electrons, therefore its valency is 3. 1

[CBSE Marking Scheme, 2014]

R **Q. 45. Write the number of period the modern periodic table has. How do the valency and metallic character of elements vary on moving from left to right in a period ? How do the valency and atomic size of elements vary down a group ?**

[Board Term II, Delhi Set I, 2013]

Ans. There are 7 horizontal rows known as periods, that the modern periodic table has.

In periods, the number of valence electrons increases from left to right and due to decrease in atomic size, the force of attraction between the valence electrons and the nucleus increases. Metallic character decreases along the period due to decrease in tendency to lose electrons.

Atomic size generally increases from top to bottom in a group due to the addition of a new shell *i.e.*, number of shells goes on increasing down the group. 3

A **Q. 46.**

Group → / Period ↓	1	2	13	14	15	16	17	18
3	X		B	C	D	E		
4	Y							
5	Z							

Using the given part of the periodic table, answer the following questions with reason :

(i) Name the element having smallest atomic size.

(ii) Write electronic configuration of element E.

(iii) Identify the elements which have similar physical and chemical properties as the element Y.

[Board Term II, Set 2045, 2012]

Ans. (i) Element — E **1**

(ii)

K	L	M
2	8	6

1

(iii) X and Z. **1**

[CBSE Marking Scheme, 2012]

A **Q. 47. Three elements X, Y and Z have atomic numbers 7, 10 and 14 respectively.**

(i) Identify the group number of these elements in the periodic table.

(ii) Mention one unique feature each of elements Y and Z.

(iii) Which of the above two elements belong to the same period ? **[Board Term II, Set (2036) 212]**

Ans. (i) X - 2, 5 : Group 15 ½

Y - 2, 8 : Group 18 ½

Z - 2, 8, 4 : Group 14 ½

(ii) Y is a noble gas which is unreactive and has complete outermost shell. ½

Z is metalloid and possesses semi-metal, properties of both metals and non-metals. ½

(iii) X and Y belong to the same period *i.e.*, 2nd period. ½

[CBSE Marking scheme, 2012]

Long Answer Type Questions

(5 marks each)

U **Q. 1. Examine the elements of the third period and classify them as metals or non-metals. Comment on the metallic and non-metallic character of the third period. Name the most metallic element and non-metallic element of this period.**

Ans. Na (Sodium), Mg (Magnesium) and Al(Aluminium) are metals. Si (Silicon) is a metalloid. P (Phosphorus), S (Sulphur) and Cl (Chlorine) are non-metals. 2

As we go from left to right across the third period, metallic character decreases and non-metallic character increases. 2

The most metallic element in the third period is Na and the most non-metallic element is Cl. **1**

R **Q. 2. Which element has :**

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

(ii) the electronic configuration, 2, 8, 2.

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

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

(v) Twice as many electrons in its second shell as in its first shell ? **[NCERT 2017]**

Ans. (i) Neon has two shells, both of which are completely filled with electrons (2 electrons in K shell and 8 electrons in L shell). **1**

(ii) Magnesium has the electronic configuration, 2, 8, 2. **1**

(iii) Silicon has a total of three shells, with four electrons in its valence shell (2 electrons in K shell, 8 electrons in L shell and 4 electrons in M shell). **1**

(iv) Boron has a total of two shells, with three electrons in its valence shell (2 electrons in K shell and 3 electrons in L shell). **1**

(v) Carbon has twice as many electrons in its second shell as in its first shell (2 electrons in K shell and 4 electrons in L shell). **1**

A **Q. 3. An element is placed in 2nd group and 3rd period of the periodic table, burn in presence of oxygen to form a basic oxide :**

(i) Identify the element

(ii) Write the electronic configuration

(iii) Write the balanced equation when it burns in the presence of air.

(iv) Write a balanced equation when this oxide is dissolved in water.

(v) Draw the electron dot structure for the formation of this oxide. **[NCERT Exemplar]**

Ans. (i) Magnesium.

(ii) Electronic configuration is 2, 8, 2

(iii) $2Mg + O_2 \rightarrow 2MgO$

(iv) $MgO + H_2O \rightarrow Mg(OH)_2$

(v) $Mg \rightarrow Mg^{2+} + 2e^-$

2, 8, 2 2, 8

$O + 2e^- \rightarrow O^{2-}$

2,6 2,8

(Mg^{2+}) $(:\ddot{O}:)^{2-}$ is electron dot structure.

1+1+1+1+1

A **Q. 4. An element X (2, 8, 2) combines separately with SO_4^{2-}, PO_4^{3-} radicals.**

(i) Write the formulae of the two compounds so formed.

(ii) To which group of the modern periodic table does the element X belong ?

(iii) Will it form covalent or ionic compound ? Give reasons.

Ans. (i) Formulae of these compounds are XSO_4, $X_3(PO_4)_2$. 2

(ii) It belongs to group 2nd and 3rd period. 2

(iii) It will form ionic compounds as it can lose two electrons to acquire stable electronic configuration. **1**

A **Q. 5. Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but are different in their outermost shells. It was found that elements A and G combine to form an ionic compound which can also be extracted from sea water.**

Oxides of the elements A and B are basic in nature while those of E and F are acidic. The oxide of elements D is almost neutral.

Answer the following questions based on the information given here in :

(i) To which group or period of the periodic table do the listed elements belong ?

(ii) Which one of the eight elements is likely to be a noble gas ?

(iii) Which one of the eight elements would have the largest atomic radius ?

(iv) Which two elements amongst these are likely to be the non–metals ?

(v) Which one of these eight elements is likely to be a semi–metal or metalloid ?

[Board Term II, Delhi 2010]

Ans. (i) A and B belong to group 1 and 2 because they form basic oxides. C belongs to group 13 as it has 3 valence electrons. D belongs to group 14 as it forms almost netural oxide. E and F belong to group 15 and 16 as they form acidic oxides, G belongs to group 17 as it has 7 valence electrons, and H to group 18. They belong to 3rd period of the periodic table.

(ii) H belongs to noble gas

(iii) A has largest atomic radius

(iv) E and F are likely to be non–metals

(v) D is likely to be metalloid or semi–metal.

1+1+1+1+1

High Order Thinking Skills (HOTS) Questions

Q. 1. How do the early attempts to classify the chemical elements differ from the modern attempt ? Which of the two is better and why ? Give examples. 3

Ans. The early attempts to classify elements were made on the basis of atomic masses of the elements. Modern basis is the atomic number. This is better because now it is established that atomic number of an element is the fundamental property. Further there are certain anomalies in Mendeleev's periodic table such as the position of isotopes and misplacements of certain elements, *e.g.* Argon is placed (Atomic mass - 40, atomic number = 18) before potassium in Mendeleev's periodic table (Atomic mass = 39, At. no = 19). **3**

Q. 2. What are metalloids ? How many electrons can be present in the valency shell of their atoms ? In what part of the periodic table these are located ? What type of oxide are formed by these elements ? 3

Ans. Metalloids are elements which resemble both metals and non-metals. The valency shell of metalloids contain 3, 4, 5, 6 elements starting from periods 2 to 5 respectively. They are found on the right side of the table in the zig-zag column, *e.g.*, boron, silicon, germanium, arsenic etc. They form amphoteric oxides. **3**

Q. 3. What is electronegativity ? How it is different from electron affinity ? 3

Ans. Though both electronegativity and electron affinity refer to the attraction of electron but are used in different context. Electronegativity refers to the attraction of bonding electron or shared pair of electron whereas electron affinity refers to the attraction of electron by an isolated gaseous atoms. **3**

Q. 4. What is the basic difference between a group and a period in terms of electronic configuration ? 3

Ans. In a group, though the number of shells increases as we move downward, but the number of electrons in the outermost shell remains the same.

In a period, as we move from left to right, the outermost shell or valence shell gets progressively filled from group 1 to group 18 and the shell does not change. **1½ + 1½**

Q. 5. An element 'X' is liquid, non-metallic. Can you predict its position in the periodic table ? 3

Ans. As the element 'X' is non-metallic, it may be belonging to group 17. In group 17, first two elements are gases. Metallic character of elements (non-metals) increases on moving down the group. Therefore, the element 'X' may be located in group 17 and 3rd or 4th period of the periodic table. **3**

Q. 6. Given below are the melting points and atomic radii of three elements X, Y and Z of the periodic table having '*n*' electrons in the outermost shells of their atoms —

	X	Y	Z
Melting point (°C)	**100·5**	**97·5**	**63·5**
Atomic radii (A°)	**1·33**	**1·54**	**1·96**

State four inference that can be drawn about the elements on the basis of the above data. 5

Ans. (i) Since each element contains the same number of valence electrons, *n* in the outermost shells of their atoms, therefore X, Y and Z, belong to the same group. **2**

(ii) The atomic radii increase from X to Z so metallic character increases from X towards Z. **1**

(iii) X, Y and Z have melting points above 25°C (room temperature). Therefore X, Y and Z are solid at room temperature. **1**

(iv) The ionization potential decreases from X to Z because they belong to the same group in the descending order. **1**

Q. 7. Table given below show a part of the Periodic Table

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

Using this table explain why :

(i) Li and Na are considered as active metals.

(ii) Atomic size of Mg is less than that of Na

(iii) Fluorine is more reactive than chlorine. 5

Ans. (i) They can lose electrons easier due to bigger size, energy required to remove electron is less. 2

(ii) It is because of greater effective nuclear charge in Mg. 2

(iii) Fluorine has very small size and just needs one electron to get itself into a stable configuration to that of noble gases. Hence, they reacts pontaneously with elements to achieve that stable state, contributing to its high reactivity. 1

Q. 8. An element belongs to 4^{th} period and group 17 of the periodic table. Find out :

(i) The number of valence electrons.

(ii) Is it a metal or non–metal.

(iii) The name of the element.

(iv) Formula of its compound with hydrogen.

(v) Electron dot structure of this element with calcium. 5

Ans. (i) 7. 1

(ii) It is a non–metal. 1

(iii) Bromine. 1

(iv) HBr (Hydrogen bromide). 1

(v) $CaBr_2$ (Ca^{2+}) $(:\ddot{\underset{\cdot\cdot}{Br}}:)^-_2$. 1

Q. 9. An element has electronic configuration 2, 8, 7.

(i) To which group and period of the periodic table does it belong ?

(ii) What is atomic number of this element ?

(iii) Is it metallic or non–metallic and why ?

(iv) Identify the element.

(v) Name an element chemically similar to this element. 5

Ans. (i) Group 17, Period 3. 1

(ii) 17. 1

(iii) It is non–metallic because it has 7 valence electrons. It can gain 1 electron easily forming negative ion. 1

(iv) Chlorine. 1

(v) Bromine or Iodine or Fluorine are chemically similar to chlorine. 1

Q. 10. An element X which is a yellow solid at room temperature shows catenation and allotropy. X forms two oxides which are also formed during the thermal decomposition of ferrous sulphate crystals and are the major air pollutants.

(i) Identify the element X.

(ii) Write the electronic configuration of X.

(iii) Write the balanced chemical equation for the thermal decomposition of ferrous sulphate crystals.

(iv) What would be the nature (acidic / basic) of oxides formed ?

(v) Locate the position of the element in the Modern Periodic table. [NCERT Exemplar] 5

Ans. (i) 'X' is Sulphur. 1

(ii) Electronic configuration of 'X' is 2, 8, 6. 1

(iii) $2FeSO_4(s) \xrightarrow{heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$. 1

(iv) SO_2 and SO_3 are acidic oxides. 1

(v) It belongs to group 16 and 3^{rd} period. 1

Q. 11. An element is placed in 2nd Group and 3rd Period of the Periodic Table, burns in presence or oxygen to form a basic oxide.

(a) Identify the element

(b) Write the electronic configuration

(c) Write the balanced equation when it burns in the presence of air

(d) Write a balanced equation when this oxide is dissolved in water

(e) Draw the electron dot structure for the formation of this oxide.

Ans. (a) Magnesium

(b) 2, 8, 2

(c) $2Mg + O_2 \longrightarrow 2MgO$

(d) $MgO(s) + H_2O(e) \longrightarrow Mg(OH)_2(aq)$.

(e)

$$Mg^{\cdot\cdot} + \ddot{O}: \longrightarrow \left[Mg^{+2}\right]\left[:\ddot{O}:^{-2}\right]$$

Q. 12. Atomic number of a few elements are given below

10, 20, 7, 14

(a) Identify the elements

(b) Identify the Group number of these elements in the Periodic Table

(c) Identify the Periods of these elements in the Periodic Table

(d) What would be the electronic configuration for each of these elements ?

(e) Determine the valency of these elements.

[NCERT Exemplar 2017]

Ans. (a) (i) At. no. 10 ⟶ Neon

(ii) At no. 20 ⟶ Calcium

(iii) At no. 7 ⟶ Nitrogen

(iv) At no. 14 ⟶ Silicon

(b) (i) Group of Neon ⟶ 18th Group

(ii) Calcium ⟶ 2nd Group

(iii) Nitrogen ⟶ 15th Group

(iv) Silicon ⟶ 14th Group 2

(c) Period number

(i) Neon — 2nd Period

(ii) Calcium — 4th Period

(iii) Nitrogen — 2nd Period

(iv) Silicon — 3rd Period 2

(d) Neon — 2, 8

Calcium — 2, 8, 8, 2

Nitrogen — 2, 5

Silicon — 2, 8, 4 2

(e) Valency

Neon — Zero

Calcium — 2

Nitrogen — 3

Silicon — 4. 2

Value Based Questions

Q.1. Ria and Reena are the students of Class X. Ria is very much organized and maintained whereas Reena is an unorganised student and always faces a lot of problems in handling life situations.

(a) How organization helps in daily life ?

(b) How can you relate the above fact with the chapter 'Classification of Elements'. How classification of elements help us studying them properly ?

[DDE 2017]

Ans. (a) Organization is all about keeping things in proper order. It plays a significant role in helping us in achieving our goals. It gives us a sense of control and allows for increased productivity. 2

(b) Classification of elements is based on Organisation of the element in proper manner that helps to make the study of all the elements easier.

To make the study of all the elements in the periodic table easy, these elements have been divided into few groups in such a way that elements in the same group have similar properties. 3

Q.2. Atomic size means radius of an atom. Hema, when read this statement understood that it is the distance between centre of nucleus and the outermost shell (valence shell) of an isolated atom.

She also came to know that atomic size generally increases from top to bottom in a group, due to addition of a new shell and decrease along a period from left to right, due to increase in nuclear charge which pulls the electrons towards it.

(i) Hema has to arrange the following elements in an increasing order in a group in accordance of their atomic size Li, Rb, K, Cs, Na. 1

(ii) Atomic number is considered to be a more appropriate parameter than atomic mass for classification of elements in a periodic table. Give any two reasons to justify the statement. 2

Ans. (i) Elements arranged in an increasing order in a group are :

Li, Na, K, Rb, Cs. 1

(ii) (a) Although most of the elements were placed in the order of increasing atomic masses, increasing order could not be maintained in all cases. 1

(b) There was no place for isotopes in Mendeleev's periodic table, although they differ in atomic mass. 1

Q.3. Some metals react with water and produce metal oxides or hydroxides and liberate hydrogen gas. Metals like sodium and potassium react violently with cold water. However, calcium reacts less violently with cold water because it is less reactive as compared to Na and K. Magnesium does not react with cold water. It reacts with hot water to form magnesium hydroxide and hydrogen gas. Metals like aluminium, iron and zinc do not react with cold as well as hot water but they react with steam to form metal oxide and hydrogen gas.

(i) Which gas is produced when reactive metal reacts with water ?

(ii) How can we extinguish fire ?

(iii) Why is sodium kept in Kerosene oil ?

(iv) Which metal did not react with water even in the form of steam ?

(v) How can we prevent iron from rust ? 3

Ans.

(i) Hydrogen gas.

(ii) By carbon dioxide gas.

(iii) Because sodium reacts violently with water and air.

(iv) Lead, copper or gold.

(v) By painting iron articles. **(Any three)** 3

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