Book Name: Selina Concise

INTEXT - QUESTION - 1

Solution 1:

a) The modern periodic law states that "The properties of elements are the periodic functions of their atomic number." Henry Moseley put forward the modern periodic law.
b) A tabular arrangement of the elements in groups (vertical columns) and periods (horizontal rows) highlighting the regular trends in properties of elements is called a Periodic Table. Modern Periodic table has 7 periods and 18 groups.

Solution 2:

Valency is the combining capacity of the atom of an element. It is equal to the number of electrons an atom can donate or accept or share. It is just a number and does not have a positive or negative sign.
Group 1 elements have 1 electron in their outermost orbital, while Group 7 elements have 7 electrons in their outermost orbital.
Valency depends on the number of electrons in the outermost shell (i.e. valence shell).
If the number of electrons present in the outermost shell is 1, then it can donate one electron while combining with other elements to obtain a stable electronic configuration.
If the number of electrons present in the outermost shell is 7, then its valency is again 1 (8 - 7 = 1) as it can accept 1 electron from the combining atom.
In a given period, the number of electrons in the valence (outermost) shell increases from left to right. But the valency increases only up to Group 14, where it becomes 4, and then it decreases, that is, it becomes 1 in Group 17.

Solution 3:

The horizontal rows are known as periods and vertical columns in the periodic table are known as groups

Solution 4:

Periodicity is observed due to the similar **electronic configuration**.
(Number of valence electrons / atomic number / electronic configuration).

Solution 5:

(i) Though the number of shells remain the same, number of valence electrons increases by one, as we move across any given period from left to right.
(ii) While going from top to bottom in a group, the number of shells increases successively i.e. one by one but the number of valence electrons remains the same.

Solution 6:

(i) Elements in the same group have equal valency.
(ii) Valency depends upon the number of valence electrons in an atom.
(iii) Copper and zinc are transition elements.
(iv) Noble gases are placed at the extreme right of the periodic table.

Solution 7:

(i) Alkali metals	Sodium and potassium
(ii) Akaline earth metals	Calcium and magnesium
(iii) halogens	Chlorine and bromine
(iv) Inert gas	Neon and Argon
(v) Transition element	Iron and Cobalt
(vi) Lanthanides	Cerium and Europium
(vii) Actinides	Uranium and Neptunium

Solution 8:

(i) The properties that reappear at regular intervals, or in which there is a gradual variation at regular intervals, are called periodic properties and the phenomenon is known as the periodicity of elements.
(ii) The third period elements, Na, Mg, Al, Si, P and Cl summarize the properties of their respective groups and are called typical elements.
(iii) The elements of the second period show resemblance in properties with the elements of the next group of the third period leading to a diagonal relationship. Such elements are called bridge elements.

Solution 9:

Noble gases are unreactive since they have their outermost orbit complete. Due to stable electronic configuration they hardly react with other elements. So these elements are placed in a separate group i.e.18

Solution 10:

Beryllium and magnesium will show similar chemical reactions as calcium. Since these elements belong to same group 2 and also have two electrons in their outermost shell like calcium.

Solution 11:

Metals: Lithium, Beryllium, Sodium, Magnesium, Aluminium, Potassium, Calcium.

Non-metals: Hydrogen, Helium, Carbon, Nitrogen, Oxygen, Fluorine, Neon, Phosphorus, Sulphur, Chlorine, Argon.

Solution 12:

(i) Outermost shell complete – Noble gases
(ii) Outermost shell incomplete – Representative elements
(iii) two outermost shell incomplete – Transition elements
(iv)one electron short of octet – Halogens
(v) two electrons in the outermost orbit - Alkaline Earth metals

Solution 13:

(i) 30
(ii) It belongs to group 12 and fourth period.
(iii) It is a metal.
(iv) The name assigned to this group is IIB

Solution 14:

Elements	Valency	Formula of oxides
Na	1	Na_2O
Mg	2	MgO
Al	3	Al_2O_3
Si	4	SiO_2
P	5	P_2O_5
S	2	SO_2
CI	1	Cl_2O

Solution 15:

An element A with atomic number 14 belongs to period three and there are eight elements in this period.

Solution 16:

(i) Electronic configuration of P: 2, 8, 5
(ii) 15^{th} Group and 3^{rd} Period.
(iii) Valency of P = 8 - 5 = 3
(iv) Phosphorus is a non-metal.
(v) It is an oxidizing agent.
(vi) Formula with chlorine = PCl_3

INTEXT - QUESTION - 2

Solution 1:

(i) Electron affinity
(ii) Atomic size
(iii)Metallic character
(iv)Non-metallic character
(v) Ionization energy

Solution 2:

Atomic size is the distance between the centre of the nucleus of an atom and its outermost shell.
It's measured in Angstrom and Picometre

Solution 3:

(i) The atomic size of an atom increases when we go down a group from top to bottom
(ii) It increases as we move from right to left in a period

Solution 4:

(i) Second Period: Fluorine <Neon< Oxygen< Nitrogen < Carbon < Boron< Beryllium < Lithium.
(ii) Third Period: Chlorine < Argon < Sulphur < Phosphorus < Silicon < Aluminum < Magnesium < Sodium.

Solution 5:

(i) The size of Neon is bigger compared to fluorine because the outer shell of neon is complete(octet).As a result, the effect of nuclear pull over the valence shell electrons cannot be seen. Hence the size of Neon is greater than fluorine.
(ii) Since atomic number of magnesium is more than sodium but the numbers of shells are same, the nuclear pull is more in case of Mg atom. Hence its size is smaller than sodium.

Solution 6:

(i) An atom is always bigger than cation since cation is formed by the loss of electrons; hence protons are more than electrons in a cation. So the electrons are strongly attracted by the nucleus and are pulled inward.

(ii) An anion is bigger than an atom since it is formed by gain of electrons and so the number of electrons are more than protons. The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence the size expands.

(iii) An anion is bigger than an atom since it is formed by gain of electrons and so the number of electrons are more than protons. The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence the size expands.

Solution 7:

The periodic variation in electronic configuration as one move sequentially in increasing order of atomic number produces a periodic variation in properties.

As the elements are arranged in increasing order of atomic number, the metals with tendency to lose electrons are placed on the left and the metallic character decreases from left to right and increases down a group and non-metals with tendency to gain electrons are placed automatically on the right and the non-metallic character increase across a period and decreases down a group.

Solution 8:

(i) The metallic character decreases as we go from left to right in a period.

(ii) It increases as we go down a group

Solution 9:

(i) Across a period, the chemical reactivity of elements first decreases and then increases.

(ii) Down the group, chemical reactivity increases as the tendency to lose electrons increases down the group.

Solution 10:

The melting and boiling points of metals decrease on going down the group.
Example: Observe the trend in group 1 elements given in the following table:

Metals	m.p	b.p
Li	180.5°C	1347°C
Na	94.5°C	883°C
K	63.5°C	774°C

From the above table, it is clear that m.p. and b.p. decrease from Li to K.
The melting and boiling points of non-metals increase on going down the group.
Example: Observe the trend in Group 17 elements given in the following table:

Non-metals	m.p.	b.p.	Physical state
Fluorine	-219.6°C	-187°C	Gas
Chlorine	-101°C	-34.6°C	Gas
Bromine	-7.2°C	+58.8°C	Liquid
Iodine	+113.6°C	+183°C	Solid

From the above table, it is clear that m.p. and b.p. increase from F to I.

Solution 11:

(i) The element from the 17^{th} group has 7 electrons in its outermost shell.
(ii) The name of the element is bromine.
(iii) Bromine belongs to the halogen family.
(iv) The element $^{27}_{13}Y$ has three electrons in its outermost shell which it can donate; hence, its valency is three. While the valency of bromine is

1. Thus, $^{27}_{13}Y$ can donate three electrons, and bromine can accept 1 electron to get the stable electronic configuration.

Therefore, the formula of the compound is $AlBr_3$

Solution 12:

(i) Yes, these elements belong to the same group but are not from the same period.
(ii) We know that m.p. decreases on going down the group. Hence, from the above table, the elements can be ordered according to their period as follows:

Elements	B	C	A
m.p.	180.0	97.0	63.0

The metallic character increases as one moves down the group.
Hence, the order of the given elements with increasing metallic character is as follows: B

INTEXT - QUESTION - 3

Solution 1:

(a) The energy required to remove an electron from a neutral isolated gaseous atom and convert it into a positively charged gaseous ion is called Ionization energy or ionization potential.
(b) $M(g) + I.E \longrightarrow M^{+}(g) + e^{-}$
M can be any element
It is measured in electron volts per atom. Its S.I unit $kJmol^{-1}$.

Solution 2:

The energy required to remove the residual electrons one by one is called successive ionization energy.

Solution 3:

(a) Ionization energy increases as we move from left to right across a period as the atomic size decreases.
(b) Ionization energy decreases down a group as the atomic size increases.

Solution 4:

Helium has the highest ionization energy of all the elements while cesium has the lowest ionization energy

Solution 5:

Second period: Neon > Fluorine > Oxygen > Nitrogen > Carbon > Boron > Beryllium > Lithium

Third Period: Argon> Chlorine > Sulphur > Phosphorus > Silicon > Aluminum >Magnesium > Sodium

Solution 6:

(a) Electron affinity is the energy released when a neutral gaseous atom acquires an electron to form an anion.

(b) Second period: Lithium<Boron<Carbon<Oxygen<Fluorine

Neon, Nitrogen and Beryllium do not follow the trend.

Solution 7:

Electron affinity depends on:

(a) Atomic size

(b) Nuclear charge

Solution 8:

Electron affinity values generally increases across the periods left to right and decreases down the group top to bottom.

Solution 9:

(a) As we move from left to right the increase in atomic number and decrease in size results in a greater nuclear pull. As a result, the ability to attract the electrons increases, and so does the electron affinity.

But noble gases have complete stable octet configuration, hence their electron affinity is lower than halogens.

Hence halogens on extreme right have highest electron affinity in a period.

(b) Chlorine is smaller than sulphur with a bigger atomic number. Since its nuclear pull is more, hence its electron affinity is higher than sulphur.

Solution 10:

Since size of chlorine is bigger than fluorine hence the electrons being farther away from the nucleus experience a lesser force of attraction, hence electron negativity of chlorine is less than fluorine

Solution 11:

Electronegativity measures an atom's tendency to attract shared pair of electrons towards itself. Its S.I unit is Pauling unit.

Solution 12:

(a) The element fluorine has the highest electronegativity and Caesium has the lowest electronegativity.

(b) The nature of oxides changes from basic to acidic as we move from left to right in third period. Hence sodium forms most basic oxide while oxide of Aluminum is amphoteric and oxides of phosphorus, sulphur and chlorine are progressively acidic.

Solution 13:

(a) Ionization energy

(b) Metallic character

(c) Electronegativity

Solution 14:

(a) On moving across a period, nuclear pull increases because of the increase in atomic number, and thus, the atomic size decreases. Hence, elements cannot lose electrons easily. Hence, Group 17 elements are strong non-metals, while Group 1 elements are strong metals.

(b) On moving across a period, nuclear pull increases because of the increase in atomic number, and thus, the atomic size decreases. Hence, elements cannot lose electrons easily. Hence, Group 17 elements are strong non-metals, while Group 1 elements are strong metals. 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, i.e. they can lose electrons easily.

(c) The atomic size of halogens is very small. The smaller the atomic size, the greater the electron affinity, because the effective attractive force between the nucleus and the valence electrons is greater in smaller atoms, and so the electrons are held firmly.

(d) The reducing property depends on the ionisation potential and electron affinity of the elements. In a period, from left to right in a horizontal row of the periodic table, the atomic size decreases and the nuclear charge increases, so the electron affinity and ionisation energy both increase. Hence, the tendency to lose electrons decreases across the period from left to right and thus the reducing property also decreases across the period from left to right.

The electron affinity and ionisation potential decreases along the group from top to bottom. Hence, the tendency to lose electrons increases, and thus, the reducing property also increases along the group from top to bottom.

(e) In a period, the size of an atom decreases from left to right. This is because the nuclear charge, i.e. the atomic number increases from left to right in the same period, thereby bringing the outermost shell closer to the nucleus. Therefore, considering the third period given above, it has been found that sodium is the largest in size, while chlorine is the smallest.

EXCERSISE: 1

Solution 1:

(a) The total number of electron shells in an atom determines the period to which the element belongs, and the valence electrons determine the group to which it will belong. So with the help of electronic configuration we can figure out the period and group number of an element.

Elements with one and two valence electrons belong to group 1 and 2 respectively, while to determine the group number of elements with 3 to 8 valence electrons, we add 10 to their valence electrons.

For example an element X has atomic number 15

Its configuration will be:

K shell has 2 electrons, L will have 8, and the remaining 5 will be placed in M shell

Since it has three shells it belongs to period 3 and with 5 valence electrons the element will be placed in five plus ten that is the 15^{th} group

So with the help of electronic configuration we can figure out the period and group number of an element.

(b) Atomic number = Number of protons

Hence, number of protons in K atom = 19

Number of neutrons = Mass number − Atomic number

Hence, number of neutrons in K atom = 39−19 = 20

Number of electrons = Number of protons

Hence, number of electrons = 19

And electronic configuration of K atom = 2, 8, 8, 1

Since K atom has 4 shells, hence it belongs to fourth period.

With one valence electron, it belongs to group 1

Number of protons in P atom = 15

Number of neutrons in P atom = 31−15 = 16

Number of electrons in P atom = 15

And electronic configuration of P atom = 2, 8, 5

Since it has three shells, it belongs to period 3 and with 5 valence electrons Phosphorus is found in five plus ten that is 15^{th} group.

Solution 2:

(a) Fluorine, chlorine and bromine are non-metals with seven valence electrons. They are highly electronegative elements with valency of one. They exist as diatomic molecules. They form ionic compounds with alkali metals

(b) They are known as halogens. The term means salt forming and therefore compounds containing these elements are called salts.

Solution 3:

The last element in each period of the periodic table is a gaseous element with its valence shell completely filled. Except for helium with complete duplet configuration, rest all the 5 gases have complete octet configuration.

These group 18 elements are commonly referred to as noble gases.

Solution 4:

The electronic configuration of an element determines its position in Modern Periodic table. The element with one valence electron is the first while the element with 8 valence electrons is placed in the 18th group of a period.

Solution 5:

(i) The number of valence electrons increases by one as we move from left to right in a period. The group number 1 and 2 have 1 and 2 valence electrons respectively while group 13 to 18 have group number minus 10 = valence electrons. So, group 13 to 18 have 3, 4, 5, 6, 7 and 8 valence electrons respectively.

(ii) Valency is determined by the number of valence electrons. For elements belonging to group 1, 2 and 13, the valency is equal to the number of valence electrons, so their valency is 1, 2 and 3 respectively.

Since the elements in group 14 to 17 needs to gain electrons to complete their octet configuration. Their valency is 8 minus the number of valence electrons. So their valencies are 4, 3, 2 and 1 respectively.

Solution 6:

(a) The horizontal rows in the periodic table are called **Periods**.

(b) On moving across a period from right to left in periodic table, the atomic size of the atom **increases**.

(c) on moving from right to left in the second period, the number of valence electrons **decreases**

Solution 7:

(a) Since it belongs to group II, it has 2 valence electrons and hence it is a metal.

(b) Barium is placed below calcium in the group. Since, it has more number of shells; it is easier for it to lose its valence electrons to complete its octet configuration. Hence it is more reactive than calcium.

(c) It needs to lose its 2 valence electrons to complete its octet configuration; therefore its valency is also 2.

(d) The formula of its phosphate will be $(Ba)_3 (PO_4)_2$

(e) As we move from left to right in a period, the size decreases, therefore, it will be smaller than Cesium

Solution 8:

(a) The number of valence electrons increases by one as we move across any given period. Therefore as we move from Lithium to Neon in period 2, the valence electrons will increase from 1 to 7.

(b) The metallic character decreases as we move from left to right while the non metallic character increases.

Ongoing from left to right in a period, the chemical reactivity of elements first decreases and then increases.

For example in period 3, Sodium is the most reactive metal and Chlorine is the most reactive non-metal and Silicon is least reactive

(c) The oxides of metals are basic and that of non-metals are acidic in general. Therefore since metallic strength decreases and non-metallic strength increases on moving from left to right across a period, the strength of basic oxides decreases, while the strength of acidic oxides increases.

For example, sodium forms a basic oxide, while sulphur and phosphorus form acidic oxides.

Solution 9:

(a) Noble gases- H and P
(b) Halogens- G and O
(c) Alkali metals - A and I
(d) D and L have valency of 4
(e) I with atomic number 11.
(f) Cl has the least atomic size in period 3 with atomic number 17.

Solution 10:

As we move down a group, the numbers of shells increases and hence the atomic size increases.
Therefore, Z will have the smallest atomic number followed by Y, while X will have the largest atomic number.
So the elements in order of increasing atomic number will be Z<Y<X.

Solution 11:

(a) Since, the distance of the valence electrons from the nucleus keeps on increasing down the group, therefore, the ionization energy keeps on decreasing. Hence the reactivity of alkali metals increases from lithium to francium.
(b) As we move down a group, the size keeps on increasing, so it becomes more difficult for atoms to attract electrons. Thus reactivity of halogens decreases from Fluorine to Astatine.

Solution 12:

(a) Since it belongs to period 3 it has 3 shells, K, L and M. The outermost M shell will have 2 valence electrons as it is placed in group II
(b) With 2 valence electrons, its valency will be 2.
(c) Since it has electronic configuration of 2, 8, 2, its atomic number is 12 and hence X is Magnesium
(d) It is a metal.

Solution 13:

(a) Group 1since the valence electrons is 1
(b) With 4 shells T belong to period 4.
(c) Number of electrons = 2+8+8+1=19
(d) T needs to lose one electron to complete its octet hence its valency is 1
(e) Since it has one valence electron, it is a metal.

Solution 14:

(a) **Group 1:** Lithium< Sodium< Potassium< Rubidium < Caesium< Francium
Group 17: Fluorine < Chlorine < Bromine< Iodine < Astatine

(b) **Group 1:** Francium
Group 17: Astatine< Iodine< Bromine< Chlorine< Fluorine

(c) **Group 1:** Francium< Cesium< Rubidium< Potassium< Sodium< Lithium
Group 17: Astatine< Iodine< Bromine< Chlorine< Fluorine

(d) **Group 1:** Francium
Group 17: Astatine

(e) **Group 1:** Lithium>Sodium> Potassium> Rubidium> Cesium> Francium
Group 17: Fluorine > Chlorine> Bromine > Iodine > Astatine

Solution 15:

Complete the following sentences choosing the correct word or words from those given in brackets at the end of each sentence:

(a) The properties of the elements are a periodic function of their **atomic number** (atomic number, mass number, reative atomic mass).
(b) Moving across a **periods** of the periodic table the elements show increasing **non-metallic** character (group, period, metallic, non-metallic).
(c) The elements at the bottom of a group would be expected to show **more** metallic character than the element at the top. (less, more).
(d) The similarities in the properties of a group of elements are because they have the same **number of outer electrons** (electronic configuration, number of outer electrons, atomic numbers).

Solution 16:

(a) Anion is formed by the gain of electrons. Thus the numbers of electrons are more than protons. The effective positive charge in the nucleus is less, so less inward pull is experienced. Hence the size expands. So the size of an atom is greater than the size of parent atom.
(b) Since Argon has stable octet configuration, so due to the inter- electronic repulsions the effect of nuclear pull over the valence shell electrons cannot be seen which results in the bigger size.
(c) Since size of Bromine is bigger than chlorine, so it becomes more difficult for Br atoms to attract electrons. Thus, Cl is more reactive than Br.

Solution 17:

(a) Neon
(b) Aluminum
(c) Phosphorus
(d) Calcium
(e) Carbon

Solution 18:

(a) SOL: Na and F
(b) SOL: Argon
(c) SOL: C, N, O and F are non-metals present in period 2 while Na, Mg and Al are metals in period 3.
(d) SOL: Silicon
(e) SOL: Argon
(f) SOL: Mg
(g) SOL: Fluorine
(h) SOL: K

Solution 19:

(a) Element with atomic number 9 and 35
(b) Element with atomic number 9.

Solution 20:

(a) Period 1 has 2 elements while period 2 and period 3 have 8 elements each.
(b) Hydrogen and helium
(c) The elements at the end of period 2 and Period 3 have 8 electrons in its outermost shell.
(d) if an element is in group 17, it is likely to be **Non metallic** (Metallic / non-metallic) in character while with one electron in its outermost energy level (shell), then it is likely to be **metallic** (Metallic / Non-metallic)

Solution 21:

Position in a group: X and Y
Position in a period: Y and X

Solution 22:

Period no. = no. of shells, so n = 3
From the formula M_2O_3 its valency is 3.
Since it is a metal, its valence shell has 3 electrons.
So its electronic configuration is 2, 8, 3
Atomic number =13
Hence the metal is Aluminum with valency 3.

Solution 23:

(a) Since the elements in a group have same number of valence electrons, they can either contain metals or non-metals like alkali and alkaline metals have only metals whereas halogens are non-metals.
(b) No two elements have the same number of electrons instead atoms of the same elements in the same group have the same number of valence electrons.
(c) Non-metals have the tendency to gain electrons to attain stable configuration and therefore are said to be electronegative. As we move from left to right the increase in atomic number and decrease in size results in a greater nuclear pull. As a result the non-metallic character increases across a period.
(d) On moving from left to right in a period, the reactivity first decreases and then increases since the tendency to lose electrons first decreases on going from left to right and then from P to Cl, tendency to gain electrons increases, so reactivity increases then. In case of a group, reactivity increases on going down since the tendency to lose electrons increases but

for non-metals, reactivity decreases on going down the group as the tendency to gain electrons decreases down the group.

Solution 24:

(a) $Cl < Cl^-$
(b) $Mg^{2+} < Mg^+ < Mg$
(c) O < N < P

Solution 25:

(a) Cl
Metals have low ionisation energy and non-metals have high ionisation energy. Also, across the period, ionisation energy tends to increase. The elements P, Na and Cl belong to the third period. Na - Group 1, P - Group 15 and Cl - Group 17.
(b) Ne
Inert gases have zero electron affinity because of their stable electronic configuration.
(c) He
Ionisation energy decreases with an increase in the atomic size, i.e. it decreases as one moves down a group. Ne, He and Ar are inert gases. He - Period 1, Ne - Period 2 and Ar - Period 3.

Solution 26:

(a) (iv) Argon
(b) (iii) Calcium
(c) (iii) Helium

Solution 2003:

(a) $(Al)_2(SO_4)_3$
(b) Covalent bonding
(c) Same number of valence electrons
(d) Helium
(e) 8
(f) Electron affinity
(g) The atomic size **Decreases** as we move from left to right across the periods, because the **atomic number** increases but the **number of shells** remains the same

Solution 2004:

(a) Na, Mg, Al, Si, P, S, Cl

(b) (i) The element below sodium in the same group would be expected to have a **Lower** (lower/higher) electro-negativity than sodium and the element above chlorine would be expected to have a **higher** (lower/ higher) ionization potential than chlorine.

(ii) remains the same

(iii) remains the same

Solution 2005:

(a) Increases

(b) Increases

(c) Increases

(d) Decreases

(e) Increases

Solution 2006:

(a) Period 2

(b) Nitrogen (N), between carbon and oxygen

(c) Carbon

(d) Be< N< F

(e) Fluorine

Solution 2007:

(a) Thallium has the most metallic character since metallic character increases down the group

(b) Boron has the highest electronegativity since it has the smallest size in the group.

(c) 3. Since all the elements in a group have same number of valence electrons.

(d) BCl_3

(e) The elements in the group to the right of boron group would be less metallic as with the decrease in size and increase in atomic number, it will be more difficult for them to lose electrons

Solution 2008:

B. Ionization potential increases from left to right across a period.