



Solution 42

(a)

$$\begin{aligned}\text{Average atomic mass} &= \frac{\text{Mass of X} + \text{Mass of Z}}{2} \\ &= \frac{7 + 39}{2} = 23\end{aligned}$$

(b) The average atomic mass of elements X and Z is equal to the atomic mass of element Y.

(c) Dobereiner's law of triads.

(d) X is lithium, Y is sodium and Z is potassium.

(e) Chlorine, Bromine, Iodine.

Solution 43

Sodium does not belong to the set. This is because all other elements belong to group 2 but sodium belongs to group 1.

Solution 44

Chlorine does not belong to the set. This is because all other elements belong to 2nd period whereas chlorine belongs to 3rd period.

Solution 45

(a) No. This is because the elements Na, Si and Cl do not have similar properties even though the atomic mass of middle element Si is almost equal to the average atomic mass of first element Na and third element Cl.

(b) Yes. This is because the elements Be, Mg and Ca have similar properties and the atomic mass of middle element Mg is almost equal to the average atomic mass of first element Be and third element Ca.

Solution 46

(a) Same period (Third period): Na, Mg, Al.

(b) Same group (First group): Li, Na, K.

Solution 47

(a) Neon (2, 8).

(b) Magnesium.

(c) Silicon (2, 8, 4).

(d) Boron (2, 3).

(e) Carbon (2, 4).

Solution 48

Li, Na, K : All these elements are metals having a valency of 1.

Ca, Sr, Ba: All these elements are metals having a valency of 2.

Cl, Br, I : All these elements are halogens.

Solution 49

(a) (i) Gallium (ii) Germanium.

(b) 4th period.

(c) Gallium: 13th group; Germanium: 14th group.

(d) Gallium: Metal; Germanium: Metalloid.

(e) Gallium: 3; Germanium: 4.

Solution 50

(a) Newlands' law of octaves.

(b) Newlands.

(c) This classification of elements is compared with a characteristic of musical scale because in this classification, the repetition in the

properties of elements is just like the repetition of eighth note in an octave of music .

(d) This classification of elements could be applied only up to the element calcium and not beyond that .

Solution 1

(i) Metallic character decreases.

(ii) Atomic size decreases .

Solution 2

On moving from left to right in a period, the tendency of atoms to gain electrons increases.

Solution 3

On moving from left to right in a period, the tendency of atoms to lose electrons decreases

Solution 4

(a) In group 1 of alkali metals, the chemical reactivity increases from lithium to francium.

(b) In group 17 of halogen elements, the chemical reactivity decreases from fluorine to iodine.

Solution 5

All elements in the same column of the periodic table as boron have 3 valence electrons.

Solution 6

The element fluorine is in group 17 of the periodic table and has a valency of 1. So, all the elements in the same group of periodic table as fluorine will have a valency of 1.

Solution 7

(a) 1

(b) 8

Solution 8

False

Solution 9

The first elements in the periods of the periodic table have 1 valence electron. Such elements are called alkali metals.

Solution 10

On moving from left to right in a period, the atomic size decreases.

Solution 11

On going down in a group of the periodic table, the metallic character of elements increases.

Solution 12

(i) The number of valence electrons increases from 1 to 2 in the 1st period of the periodic table.

(ii) The valence electrons increase from 1 to 8 in the 2nd period of the periodic table.

Solution 13

The valency of elements increases from 1 to 4 and then decreases to zero in the 3rd period.

Solution 14

All the elements in a group have the same valency while going down the group.

Solution 15

(a) Sodium.

(b) Fluorine .

Solution 16

2, 1 ; 2, 2 ; 2, 3 ; 2, 4 ; 2, 5 ; 2, 6 ; 2, 7 ; 2, 8 .

Solution 17

$F < N < Be < Li$.

Solution 18

$Ga < Mg < Ca < K$.

Solution 19

(i) Elements in the same group have equal valency.

(ii) The metallic character of elements in a period decreases gradually on moving from left to right

Solution 20

- (a) Periods
- (b) Increases
- (c) Decreases
- (d) Increases
- (e) Decreases

Solution 21

N (2, 5) ; P (2, 8, 5) ; Nitrogen will be more electronegative because its atom has small size due to which the attraction of its nucleus for the incoming electron is more

Solution 22

(a) 2.

For groups 1 and 2, the number of valence electrons is equal to the group number.

(b) 2.

Valency is determined by the number of valence electrons present in the atom of the element.

(c) 5.

For groups 13 to 18, the number of valence electrons is equal to (group no. - 10).

(d) 3.

The number of electrons lost or gained by one atom of an element to achieve the nearest inert gas configuration, gives us the valency.

Solution 23

(a) The horizontal rows of elements in a periodic table are called periods. As we move from left to right in a period, the atomic number of elements increases which means that the no. of protons and electrons in the atom increases. Due to large positive charge on the nucleus, the electrons are pulled in more close to the nucleus and the size of the atom decreases.

(b) (i) On moving from left to right in a period, the chemical reactivity of elements first decreases and then increases.

Example: In the 3rd period of elements, sodium is a very reactive element, magnesium is less reactive whereas aluminium is still less reactive. Silicon is the least reactive in the third period. Now, phosphorus is quite reactive, sulphur is still more reactive whereas chlorine is very reactive.

(ii) On moving from left to right in a period, the basic nature of oxides decreases and the acidic nature of oxides increases.

Example: In the 3rd period of the periodic table, sodium oxide is highly basic in nature and magnesium oxide is comparatively less basic. The aluminium and silicon oxides are amphoteric in nature. Phosphorus oxides are acidic, sulphur oxides are more acidic whereas chlorine oxides are highly acidic in nature.

Solution 24

(a) On moving from left to right in a period of the periodic table, the atomic size decreases. As we move from left to right in a period, the atomic number of elements increases which means that the no. of protons and electrons in the atoms increases. Due to large positive charge on the nucleus, the electrons are pulled in more close to the nucleus and the size of atom decreases.

(b) On moving from left to right in a period, the metallic character of elements decreases.

Solution 25

(a) (i) All the elements of a group have similar chemical properties because they have same no. of valence electrons in their outermost shell.

(ii) All the elements of a period have different chemical properties because they have different no. of valence electrons in their atoms.

(b) Order of atomic numbers of elements: $X < Z < Y$. Because as the atomic number increases in a period from left to right, the size of atoms goes on decreasing

Solution 26

(a) On going down in a group of the periodic table, the electropositive character of elements increases.

(b) (i) In a group, all the elements have the same valency.

(ii) In a period, on moving from left to right, the valency of elements first increases from 1 to 4 and then decreases to zero.

Solution 27

(a) The fundamental difference between the electronic configuration of group 1 and group 2 elements is that group 1 elements have 1 valence electron in their atoms whereas group 2 elements have 2 valence electrons in their atoms.

(b) (i) All the chemically similar elements will have same valence electrons.

(ii) The 1st element in a period is determined by the no. of valence electrons in its atoms. The 1st element of every period has 1 valence electron.

Solution 28

(a) Usual number of valence electrons is 8; Valency is 0 (zero).

(b) The number of valence electrons remains the same.

Solution 29

(a) The main characteristic of last elements in a period is that they all have 8 valence electrons in their atoms except helium. Such elements are called noble elements.

(b) (i) 2

(ii) 8.

Solution 30

(a) On going down in a group of the periodic table, the atomic size increases. When we move from top to bottom in a group, a new shell of electrons is added to the atoms at every step due to which the size of atom increases.

(b) The similarity in the atoms of lithium, sodium and potassium is that all of them have 1 valence electron each.

Solution 31

(a) The tendency of an atom to lose electrons increases on moving down in a group of the periodic table. As we go down in group 1, one more electron shell is added at every stage and the size of the atom increases. The valence electrons become more and more away from the nucleus and hold of the nucleus on valence electrons decreases. Due to this, the atoms can lose valence electrons more easily to form positive ions and hence electropositive character increases.

(b) The tendency of an atom to gain electrons decreases on going down in a group of the periodic table. When we move from top to bottom in group 17, a new shell of electrons is added to the atoms at every step, due to which the size of atom increases. The nucleus goes more deep inside the atom due to which the attraction of nucleus for the incoming electron decreases due to which the atom cannot form negative ions easily and hence the electronegative character decreases.

Solution 32

(a) As we move from Na to Cl in the 3rd period, the size of the atoms of the elements decreases. Na atom is the biggest whereas Cl atom is the smallest in size. As we move from left to right in a period, the atomic no. of elements increases i.e. the number of protons and electrons in the atoms increases. Due to large positive charge on nucleus, the electrons are pulled in more close to the nucleus and thus the size of the atom decreases from Na to Cl.

(b) Helium and neon atoms have completely filled outermost electron shells (containing the maximum number of electrons which can be accommodated in them).

Solution 33

(a) Modern periodic table arranges the elements according to increasing atomic numbers. So, the atomic number of cobalt (27) comes first whereas the atomic number of nickel (28) comes later.

(b) In Mendeleev's periodic table, hydrogen has been placed in group I since like alkali metals, hydrogen also combines with halogens, oxygen and sulphur to form compounds having similar formulae. This means that hydrogen resembles alkali metals in some of the properties.

Hydrogen also resembles halogens in some of the properties. So, hydrogen could also be placed in group VII of halogen elements. Thus, Mendeleev's periodic law could not assign a correct position to hydrogen in the periodic table.

Solution 34

(a) The horizontal rows of elements in a periodic table are called periods.

Characteristics:

(i) The elements in a period have consecutive atomic numbers.

(ii) The no. of elements in period is fixed by the maximum no. of electrons which can be accommodated in various shells.

The vertical columns in a periodic table are called groups.

Characteristics:

(i) The elements in a group do not have consecutive atomic numbers.

(ii) All the elements in a group have similar electronic configurations and show similar properties.

(b) The size of atom decreases on moving from left to right in a period. As we move from left to right in a period, the atomic number of elements increases which means that the no. of protons and electrons in the atom increases. The electronic configuration of the atoms increases in the same shell. Due to large positive charge on the nucleus, the electrons are pulled in more close to the nucleus and the size of the atom decreases.

On going down in a group of the periodic table, the atomic size increases. The no. of electron shells in the atoms gradually increases and the electronic configuration also increases due to which the atomic size increases.

(c) (i) The atomic size increases gradually from lithium to francium.

(ii) The metallic character increases from lithium to francium.

(d) On going down in a group of the periodic table, the atomic size and metallic character increases. When we move down from top to bottom in group 1 of alkali metals, the size of atoms increases gradually from lithium to francium.

In group 1 of alkali metals, lithium is the least metallic element whereas francium is the most metallic element.

(e) Periods have elements with consecutive atomic numbers .

Solution 35

(a) The 1st period has two elements because the 1st electron shell of an atom can take a maximum of two electrons only. The 2nd period of the periodic table has 8 elements because the maximum no. of electrons which can be put in the 2nd shell of an atom is 8.

(b) The elements in the same group show similar properties because they have similar electronic configuration (having the same number of valence electrons) whereas the elements of different groups have different electronic configurations (different number of valence electrons) due to which they show different properties.

(c) (i) F; Br

(ii) Li; Li

(d) Fluorine and chlorine have been placed in the same group because both of them have 7 valence electrons.

(e) Merits of modern periodic table:

(i) The modern periodic table is based on the atomic numbers of elements which is the most fundamental property of elements.

(ii) It helps us to understand why elements in a group show similar properties but elements in different groups show different properties.

(iii) It explains the reasons for the periodicity in properties of elements.

(iv) It tells us why the properties of elements are repeated after 2, 8, 18 and 32 elements.

Solution 36

(a) The vertical columns in a periodic table are called groups.

(i) The greatest metallic character is found in the elements in the

lowest part of the group.

(ii) The largest atomic size is found in the lowest part of the group.

(b) Group 1 elements have 1 valence electron and are ionic in chemical reactions. Their chemical reactivity increases down the group. They are electropositive in nature and it increases down the group.

Whereas, the elements of group 17 have 7 valence electrons. They all are non-metals. Their chemical reactivity decreases down the group. They are electronegative in nature and it decreases down the group.

(c) The no. of valence electrons in the atoms of elements decides which element will be the 1st element in a period and which will be the last in a period.

(d) The properties of elements are repeated after 2, 8, 18 and 32 elements in the periodic table because the electronic configurations of the elements are repeated in this manner.

(e) Advantages of the periodic table:

(i) It has made the study of chemistry systematic and easy.

(ii) It is easier to remember the properties of an element if its position in the periodic table is known.

(iii) The type of compounds formed by an element can be predicted by knowing its position in the periodic table.

(iv) It is used as a teaching aid in chemistry in schools and colleges.

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