

Chapter 3: Classification of Elements and Periodicity in Properties

NCERT Exemplar · Class 11 · Chemistry

Multiple Choice Questions (Type-I)

Question 1

Consider the isoelectronic species, Na^+ , Mg^{2+} , F^- and O^{2-} . The correct order of increasing length of their radii is _____.

- (i) $\text{F}^- < \text{O}^{2-} < \text{Mg}^{2+} < \text{Na}^+$
- (ii) $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-}$
- (iii) $\text{O}^{2-} < \text{F}^- < \text{Na}^+ < \text{Mg}^{2+}$
- (iv) $\text{O}^{2-} < \text{F}^- < \text{Mg}^{2+} < \text{Na}^+$

Solution

Ans: (ii)

All the given ions are isoelectronic species thus their radii depend upon the charge more the negative charge higher would be the atomic radii and higher the positive charge lesser would be the atomic radii.

Question 2

Which of the following is not an actinoid?

- (i) Curium ($Z = 96$)
- (ii) Californium ($Z = 98$)
- (iii) Uranium ($Z = 92$)
- (iv) Terbium ($Z = 65$)

Solution

Ans: (iv)

Actinoids possess $Z=90-103$.

Terbium is lanthanoid.

Question 3

The order of screening effect of electrons of s, p, d and f orbitals of a given shell of an atom on its outer shell electrons is:

(i) $s > p > d > f$

(ii) $f > d > p > s$

(iii) $p < d < s > f$

(iv) $f > p > s > d$

Solution

Ans: (i)

The orbitals nearer to the nucleus possess more shielding effect.

Question 4

The first ionisation enthalpies of Na, Mg, Al and Si are in the order:

(i) $\text{Na} < \text{Mg} > \text{Al} < \text{Si}$

(ii) $\text{Na} > \text{Mg} > \text{Al} > \text{Si}$

(iii) $\text{Na} < \text{Mg} < \text{Al} < \text{Si}$

(iv) $\text{Na} > \text{Mg} > \text{Al} < \text{Si}$

Solution

Ans: (i)

As Mg contains fully filled 3s orbital thus its ionisation is higher than that of Na and Al.

Question 5

The electronic configuration of gadolinium (Atomic number 64) is

- (i) (Xe) 4f35d56s2
- (ii) (Xe) 4f75d26s1
- (iii) (Xe) 4f75d16s2
- (iv) (Xe) 4f85d66s2

Solution

Ans: (iii)

Gadolinium is a lanthanoid which belongs to the f-block elements with electronic configuration $(n-2)f^{14}(n-1)d^0ns^2$

Question 6

The statement that is not correct for periodic classification of elements is:

- (i) The properties of elements are periodic function of their atomic numbers.
- (ii) Non metallic elements are less in number than metallic elements.
- (iii) For transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals.
- (iv) The first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

Solution

Ans: (iii)

As per Aufbau principle 3d orbitals are filled first than 4s as due to lower n value.

Question 7

Among halogens, the correct order of amount of energy released in electron gain (electron gain enthalpy) is:

- (i) $F > Cl > Br > I$
- (ii) $F < Cl < Br < I$
- (iii) $F < Cl > Br > I$
- (iv) $F < Cl < Br < I$

Solution

Ans: (i)

The electron gain enthalpy decreases down the group, however as the size of F atom is much smaller thus it leads to repulsion upon addition of electrons on its 2p orbital for this electron gain enthalpy of Cl is higher than that of F.

Question 8

The period number in the long form of the periodic table is equal to

- (i) magnetic quantum number of any element of the period.
- (ii) atomic number of any element of the period.
- (iii) maximum Principal quantum number of any element of the period.
- (iv) maximum Azimuthal quantum number of any element of the period.

Solution

Ans: (iii)

Period number indicates the maximum value of principal quantum number.

Question 9

The elements in which electrons are progressively filled in 4f-orbital are called

(i) actinoids

(ii) transition elements

(iii) lanthanoids

(iv) halogens

Solution

Ans: (iii)

The lanthanides which belong to the f-block elements are the elements where 4f-orbitals are filled progressively.

Question 10

Which of the following is the correct order of size of the given species:

(i) $I > I^- > I^+$

(ii) $I^+ > I^- > I$

(iii) $I > I^+ > I^-$

(iv) $I^- > I > I^+$

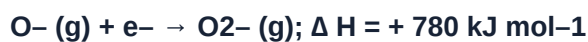
Solution

Ans: (iv)

I^+ possess the highest effective nuclear charge whereas I^- possess the least among the given species.

Question 11

The formation of the oxide ion, O^{2-} (g), from oxygen atom requires first an exothermic and then an endothermic step as shown below:



Thus process of formation of O_2^- in gas phase is unfavourable even though O_2^- is isoelectronic with neon. It is due to the fact that,

- (i) oxygen is more electronegative.
- (ii) addition of electron in oxygen results in larger size of the ion.
- (iii) electron repulsion outweighs the stability gained by achieving noble gas configuration.
- (iv) O^- ion has comparatively smaller size than oxygen atom.

Solution

Ans: (iii)

High amount of energy has to be supplied in order to overcome the e--e- repulsion that arises when O^- gets converted to O_2^- by accepting an electron.

Question 12

Comprehension given below is followed by some multiple choice questions. Each question has one correct option. Choose the correct option. In the modern periodic table, elements are arranged in order of increasing atomic numbers which is related to the electronic configuration. Depending upon the type of orbitals receiving the last electron, the elements in the periodic table have been divided into four blocks, viz, s, p, d and f. The modern periodic table consists of 7 periods and 18 groups. Each period begins with the filling of a new energy shell. In accordance with the Aufbau principle, the seven periods (1 to 7) have 2, 8, 8, 18, 18, 32 and 32 elements respectively. The seventh period is still incomplete. To avoid the periodic table being too long, the two series of f-block elements, called lanthanoids and actinoids are placed at the bottom of the main body of the periodic table.

(a) The element with atomic number 57 belongs to

- (i) s-block
- (ii) p-block
- (iii) d-block
- (iv) f-block
- (iv) $4f^{14}5d^{10}6s^2 6p^4$
- (iv) 102
- (iv) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^7 4s^2$

(iv) light metals**Solution**

Ans: (iii) d-block

Lanthanum is the element with the atomic number 57 and it belongs to the d-block.

(b) The last element of the p-block in 6th period is represented by the outermost electronic configuration.

(i) $7s^2 7p^6$

(ii) $5f^{14} 6d^{10} 7s^2 7p^0$

(iii) $4f^{14} 5d^{10} 6s^2 6p^6$

Ans: (iii) $4f^{14} 5d^{10} 6s^2 6p^6$

The last element of the p-block in 6th period is Radon

(c) Which of the elements whose atomic numbers are given below, cannot be accommodated in the present set up of the long form of the periodic table?

(i) 107

(ii) 118

(iii) 126

Ans: (iii) 126

Presently there are 7 periods and 18 groups in the long form of periodic table and it can acquire only 118 elements.

(d) The electronic configuration of the element which is just above the element with atomic number 43 in the same group is _____.

(i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

(ii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^3 4p^6$

(iii) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$

Ans: (i) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 4s^2$

Manganese is the element which is just above the element with atomic number 43

(e) The elements with atomic numbers 35, 53 and 85 are all _____.

(i) noble gases

(ii) halogens

(iii) heavy metals

Ans: (ii) halogens

Atomic number	Element
35	Bromine
53	Iodine
85	Astatine

Question 13

Electronic configurations of four elements A, B, C and D are given below : (A) $1s^2 2s^2 2p^6$ (B) $1s^2 2s^2 2p^4$ (C) $1s^2 2s^2 2p^6 3s^1$ (D) $1s^2 2s^2 2p^5$

Which of the following is the correct order of increasing tendency to gain electron :

(i) $A < C < B < D$

(ii) $A < B < C < D$

(iii) $D < B < C < A$

(iv) $D < A < B < C$

Solution

Ans: (i)

The electron gain enthalpy of 2p orbital is higher than that of the 3s orbital.

Multiple Choice Questions (Type-II)

Question 14

Which of the following elements can show covalency greater than 4?

(i) Be

(ii) P

(iii) S

(iv) B

Solution

Ans: (ii) & (iii)

Both P and S have vacant d-orbital for which they execute extended covalency.

Question 15

Those elements impart colour to the flame on heating in it, the atoms of which require low energy for the ionisation (i.e., absorb energy in the visible region of spectrum). The elements of which of the following groups will impart colour to the flame?

(i) 2

(ii) 13

(iii) 1

(iv) 17

Solution

Ans: (i)&(iii)

Alkali metals and alkaline earth metals have low ionization enthalpy.

Question 16

Which of the following sequences contain atomic numbers of only representative elements?

(i) 3, 33, 53, 87

(ii) 2, 10, 22, 36

(iii) 7, 17, 25, 37, 48

(iv) 9, 35, 51, 88

Solution

Ans: (i)&(iv)

The s-block elements and p-block elements together are called representative elements.

Question 17

Which of the following elements will gain one electron more readily in comparison to other elements of their group?

(i) S (g)

(ii) Na (g)

(iii) O (g)

(iv) Cl (g)

Solution

Ans: (i)&(iv)

Both S and Cl have the higher tendency to gain electrons in order to attain stable nearest noble gas configuration i.e. of Argon.

Question 18

Which of the following statements are correct?

- (i) Helium has the highest first ionisation enthalpy in the periodic table.
- (ii) Chlorine has less negative electron gain enthalpy than fluorine.
- (iii) Mercury and bromine are liquids at room temperature.
- (iv) In any period, atomic radius of alkali metal is the highest.

Solution

Ans: (i),(iii)&(iv)

He with $1s^2$ electronic configuration has the highest electron gain enthalpy in the periodic table.

In any period the alkali metals have lowest effective nuclear charge in that particular period for which its atomic radius is highest in that period.

Question 19

Which of the following sets contain only isoelectronic ions?

- (i) Zn^{2+} , Ca^{2+} , Ga^{3+} , Al^{3+}
- (ii) K^+ , Ca^{2+} , Sc^{3+} , Cl^-
- (iii) P^{3-} , S^{2-} , Cl^- , K^+
- (iv) Ti^{4+} , Ar , Cr^{3+} , V^{5+}

Solution

Ans: (ii)&(iii)

Isoelectronic species/ions are those species that possess the same number of electrons.

Question 20

In which of the following options order of arrangement does not agree with the variation of property indicated against it?

- (i) $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$ (increasing ionic size)
- (ii) $\text{B} < \text{C} < \text{N} < \text{O}$ (increasing first ionisation enthalpy)
- (iii) $\text{I} < \text{Br} < \text{Cl} < \text{F}$ (increasing electron gain enthalpy)
- (iv) $\text{Li} < \text{Na} < \text{K} < \text{Rb}$ (increasing metallic radius)

Solution

Ans: (ii)&(iii)

The ionization enthalpy of N is higher than that of F because it possess half filled orbital which provide it extra stability due to symmetry

As the atomic size of F is much smaller thus its electron gain enthalpy is lower than that of the Cl

Question 21

Which of the following have no unit?

- (i) Electronegativity
- (ii) Electron gain enthalpy
- (iii) Ionisation enthalpy
- (iv) Metallic character

Solution

Ans: (i)&(iv)

Both electronegativity and metallic character do not possess units as they both are qualitative properties not a quantitative property.

Question 22

Ionic radii vary in

- (i) inverse proportion to the effective nuclear charge.
- (ii) inverse proportion to the square of effective nuclear charge.
- (iii) direct proportion to the screening effect.
- (iv) direct proportion to the square of screening effect.

Solution

Ans: (i)&(iii)

Ionic radii decreases with the increase of the effective nuclear charge and increases with the increase of shielding effect or e⁻-e⁻ repulsion as it outweighs the effective nuclear charge effect.

Question 23

An element belongs to 3rd period and group-13 of the periodic table. Which of the following properties will be shown by the element?

- (i) Good conductor of electricity
- (ii) Liquid, metallic
- (iii) Solid, metallic
- (iv) Solid, non metallic

Solution

Ans:(i)&(iii)

Aluminium is the element which is a metal and good conductor of electricity.

Short Answer Questions

Question 24

Explain why the electron gain enthalpy of fluorine is less negative than that of chlorine.

Solution

Ans: As the atomic size of F is much smaller which leads to high e--e- repulsion upon addition of electrons thus its electron gain enthalpy is less than that of Cl.

Question 25

All transition elements are d-block elements, but all d-block elements are not transition elements. Explain.

Solution

Ans: Transition elements are named so because they form a bridge between s-block elements and p-block elements. Zn, Cd and Hg are among those elements that are d-block elements but they do not exhibit most of the properties of transition elements.

Question 26

Identify the group and valency of the element having atomic number 119. Also predict the outermost electronic configuration and write the general formula of its oxide.

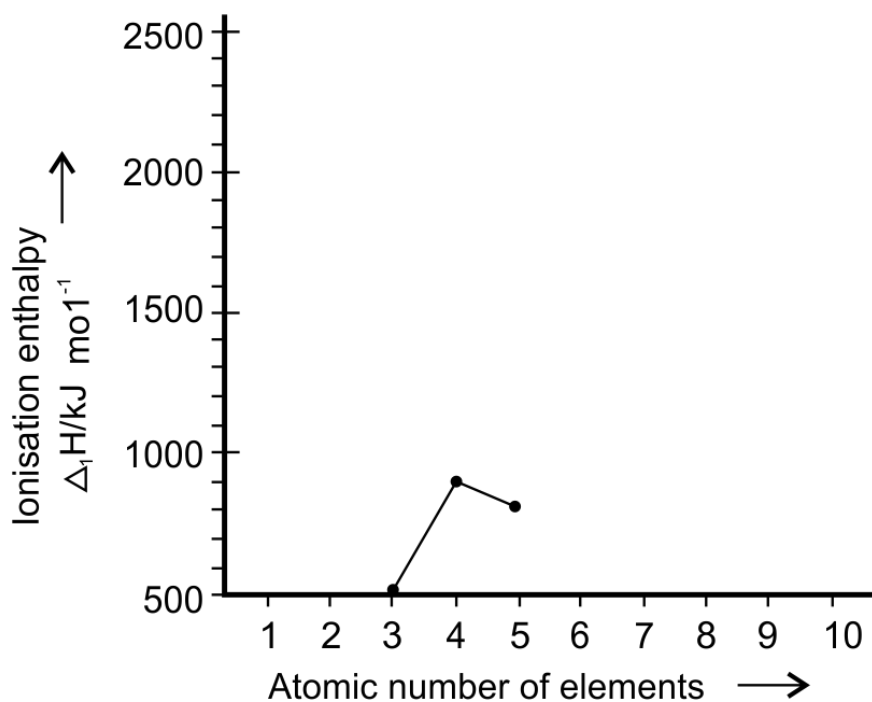
Solution

Ans:

Group	1
Valency	1
Outermost electronic configuration	8s1
Formula of Oxide	M ₂ O

Question 27

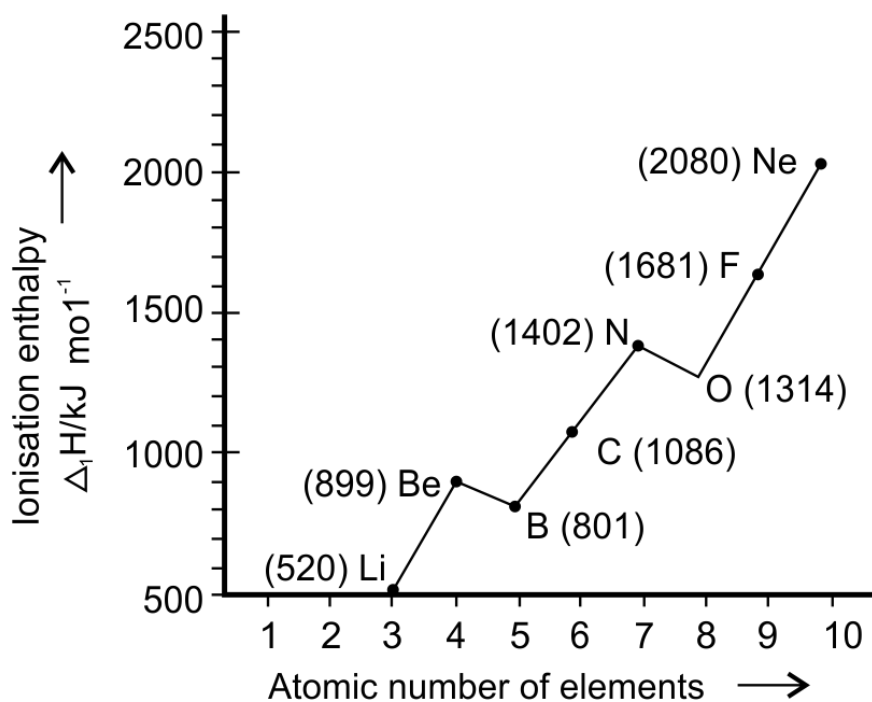
Ionisation enthalpies of elements of second period are given below : Ionisation enthalpy/ k cal mol⁻¹ : 520, 899, 801, 1086, 1402, 1314, 1681, 2080.



Match the correct enthalpy with the elements and complete the graph given in Fig. 3.1. Also write symbols of elements with their atomic number.

Solution

Ans:



Question 28

Among the elements B, Al, C and Si,

- (i) which element has the highest first ionisation enthalpy?
- (ii) which element has the most metallic character? Justify your answer in each case.

Solution

Ans: C has the highest ionization energy among the given elements as along the period ionization enthalpy increases whereas it decreases down the group.

Ans: Al is the most metallic element among the given elements because down the group metallic character increases.

Question 29

Write four characteristic properties of p-block elements

Solution

Ans: The characteristics properties of p-block elements are as follows:-

- (i) It contain metals, nonmetals and metalloids
- (ii) Mostly involved in covalent bonding
- (iii) Some elements show variable oxidation states
- (iv) It possesses relatively higher ionization enthalpy compared to the s-block elements.

Question 30

Choose the correct order of atomic radii of fluorine and neon (in pm) out of the options given below and justify your answer.

- (i) 72, 160
- (ii) 160, 160
- (iii) 72, 72
- (iv) 160, 72

Solution

Ans: (i)

As across the period the atomic radius decreases due to the increase of effective nuclear charge

Question 31

Illustrate by taking examples of transition elements and non-transition elements that oxidation states of elements are largely based on electronic configuration

Solution

Ans: The electronic configuration of Cr= $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

The electronic configuration of Cr after losing one electron= $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$

The electronic configuration of F= $1s^2 2s^2 2p^6 3s^2 3p^5$

The electronic configuration of F after gaining one electron= $1s^2 2s^2 2p^6 3s^2 3p^6$

From the above electronic configuration we can see that chromium will achieve stable electronic configuration after losing one 4s electron and fluorine will achieve stable electronic configuration after gaining one electron. So, the oxidation of chromium will be +1 and that of fluorine will be -1.

Question 32

Nitrogen has positive electron gain enthalpy whereas oxygen has negative. However, oxygen has lower ionisation enthalpy than nitrogen. Explain.

Solution

Ans: The N possesses a half filled p-orbital which provides it extra stability due to symmetry due to which its electron gain enthalpy is positive and its ionization enthalpy is larger than that of O.

Question 33

First member of each group of representative elements (i.e., s and p-block elements) shows anomalous behaviour. Illustrate with two examples.

Solution

Ans: The anomalous behaviour of the first member of each group of representative elements i.e. of second period can be attributed to their small size, high charge/radius ratio, high electronegativity and absence of vacant d-orbitals to expand their oxidation state. The first member of each group of p-Block elements displays their greater ability to form multiple bond with itself, e.g. $C=C, O=O, N=N$ and to other second periodic elements, e.g. $C=O, C=N, N=N$.

Question 34

p-Block elements form acidic, basic and amphoteric oxides. Explain each property by giving two examples and also write the reactions of these oxides with water.

Solution

Ans: In the p block, some elements are metallic some elements are non-metallic while some elements are metalloids in nature.

The oxides of metals are basic in nature and that of oxides of nonmetals are acidic in nature.

Acidic oxide



Basic oxide



Amphoteric oxide



Reaction with water



Question 35

How would you explain the fact that the first ionisation enthalpy of sodium is lower than that of magnesium but its second ionisation enthalpy is higher than that of magnesium?

Solution

Ans: The electronic configuration of Na is $(\text{Ne})3s^1$ while that of Mg is $(\text{Ne})3s^2$ as Mg possesses a fully filled 3s orbital thus its first ionisation enthalpy is higher than that of Na.

After losing one electron Na obtained the electronic configuration of Ne while Mg acquired the electronic configuration of Na thus the second ionisation energy of Na is higher than that of Mg.

Question 36

What do you understand about exothermic reactions and endothermic reactions? Give one example of each type.

Solution

Ans: Exothermic reaction- The reaction reaction in which heat is released.

For example- $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{Heat}$

Endothermic reaction- The reaction in which heat is absorbed.

For example- $2\text{NH}_3 + \text{heat} \rightarrow \text{N}_2 + 3\text{H}_2$

Question 37

Arrange the elements N, P, O and S in the order of-

(i) increasing first ionisation enthalpy.

(ii) increasing non metallic character.

Give reason for the arrangement assigned.

Solution

Ans: (i) $\text{S} < \text{P} < \text{O} < \text{N}$

The ionization enthalpy increases across the period and decreases down the group.

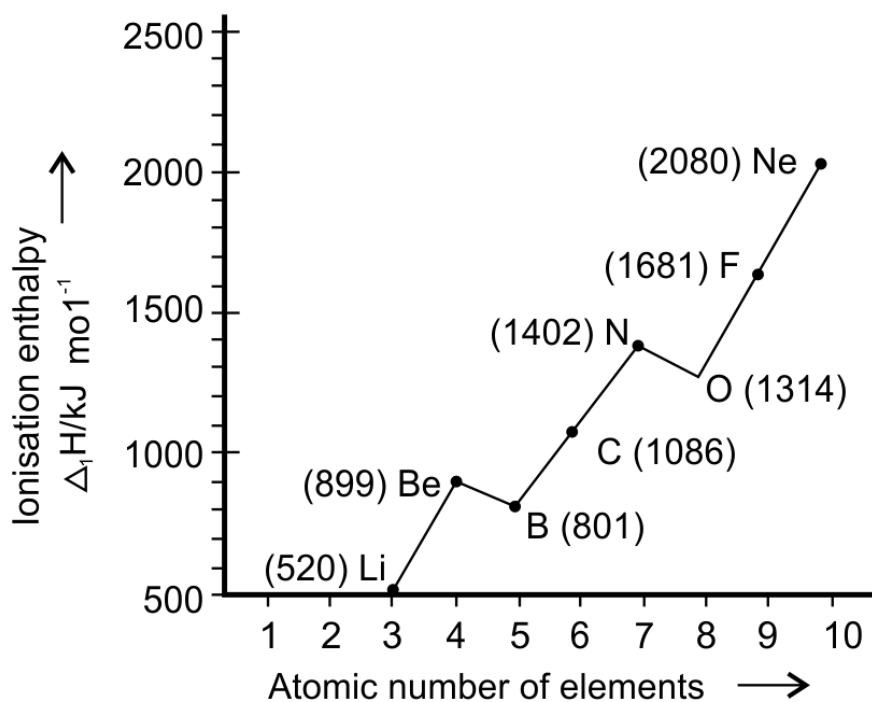
N possesses a half filled 2p orbital which provides it extra stability due to symmetry.

(ii) $\text{P} < \text{S} < \text{N} < \text{O}$

The non-metallic character increases across the period .

Question 38

Explain the deviation in ionisation enthalpy of some elements from the general trend by using Fig. 3.2



Solution

Ans: The deviation in the ionization enthalpy of some elements from the general trend can be explained by the points as given below:-

- (i) The fully filled and half filled orbital provide extra stability due to the symmetry
- (ii) The effective nuclear charge
- (iii) The e--e- repulsion which lead to instability

Question 39

Explain the following:

- (a) Electronegativity of elements increase on moving from left to right in the periodic table.
- (b) Ionisation enthalpy decrease in a group from top to bottom?

Solution

Ans: As the effective nuclear charge increases and shielding effect decreases across the periods thus the electronegativity increases on moving from left to right in the periodic table.

Ans: As the number of shells increases down the group thus its ionisation enthalpy decreases down the group.

Question 40

How does the metallic and non metallic character vary on moving from left to right in a period?

Solution

Ans: Metallic character- Tendency to lose electrons.

Non-Metallic character- Tendency to accept electrons.

Across the period the metallic character decreases whereas non-metallic character increases across the period.

Question 41

The radius of Na^+ cation is less than that of Na atom. Give reason.

Solution

Ans: The radius of Na^+ ion is smaller than that of Na is due to the following reasons:-

- (i) The effective nuclear charge of Na^+ increases
- (ii) The disappearance of 3s orbital from its outermost shell electronic configuration

Question 42

Among alkali metals which element do you expect to be least electronegative and why?

Solution

Ans: The electronegativity of the alkali metals decreases down the group due to the increase of the shells thus Cs (Caesium) is the least electronegative metal in the alkali metals.

Matching Type

Question 43

Match the correct atomic radius with the element.

Element	Atomic Radius (pm)
Be	74
C	88
O	111
B	77
N	66

Solution

Ans:

Be	111
C	77
O	66
B	88
N	74

Question 44

Match the correct ionisation enthalpies and electron gain enthalpies of the following elements.

Elements		ΔH_1	ΔH_2	$\Delta_{eg} H$
(i) Most reactive non metal	A	419	3051	– 48
(ii) Most reactive metal	B	1681	3374	– 328
(iii) Least reactive element	C	738	1451	– 40
(iv) Metal forming binary halide	D	2372	5251	+ 48

Solution

Ans:

i	b
ii	a
iii	d
iv	c

Question 45

Electronic configuration of some elements is given in Column I and their electron gain enthalpies are given in Column II. Match the electronic configuration with electron gain enthalpy.

Column (I)	Column (II)
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(i) $1s^2 2s^2 sp^6$	(a) -53
(ii) $1s^2 2s^2 sp^6$	(b) -328
(iii) $1s^2 2s^2 2p^5$	(c) -141
(iv) $1s^2 2s^2 2p^4$	(d) +48

Solution

Ans:

i	d
ii	a
iii	b
iv	c

Assertion and Reason Type

Question 46

Assertion (A) : Generally, ionisation enthalpy increases from left to right in a period.

Reason (R) : When successive electrons are added to the orbitals in the same principal quantum level, the shielding effect of inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus.

- (i) Assertion is correct statement and reason is wrong statement.
- (ii) Assertion and reason both are correct statements and reason is correct explanation of assertion.
- (iii) Assertion and reason both are wrong statements.
- (iv) Assertion is wrong statement and reason is correct statement.

Solution

Ans: (ii)

The ionization energy depends upon two factors

- (a) The effective nuclear charge
- (b) The e⁻-e⁻ repulsions

Question 47

Assertion (A) : Boron has a smaller first ionisation enthalpy than beryllium. **Reason (R) :** The penetration of a 2s electron to the nucleus is more than the 2p electron hence 2p electron is more shielded by the inner core of electrons than the 2s electrons.

- (i) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
- (ii) Assertion is correct statement but reason is wrong statement.
- (iii) Assertion and reason both are correct statements and reason is correct explanation for assertion.
- (iv) Assertion and reason both are wrong statements.

Solution

Ans: (iii)

The Be has the electronic configuration of (He)2s² while B has the electronic configuration of (He)2s²2p¹. As in Be the outermost orbital i.e. 2s is fully filled thus it provides extra stability to the Be compared to B. Apart from this 2s electron is more penetrated compared to the 2p electron for which 2p electron faces more shielding effect than that of 2s electron.

Question 48

Assertion (A) : Electron gain enthalpy becomes less negative as we go down a group.

Reason (R) : Size of the atom increases on going down the group and the added electron would be farther from the nucleus.

(i) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(ii) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(iii) Assertion and reason both are wrong statements.

(iv) Assertion is wrong statement but reason is correct statement.

Solution

Ans: (ii)

The electron gain enthalpy decreases down the group due to the increase in the atomic size which leads to decrease in the effective nuclear charge.

Long Answer Questions**Question 49**

Discuss the factors affecting electron gain enthalpy and the trend in its variation in the periodic table.

Solution

Ans: The factors that affects electron gain enthalpy are as follows:

(a) Effective nuclear charge with its increase the electron gain enthalpy also increases

(b) Atomic size with its increase the electron gain enthalpy decreases

(c) The e⁻-e⁻ repulsion with its increase the electron gain enthalpy decreases

(d) Whenever there exists half filled or completely filled orbital than it lead to decrease the electron gain enthalpy because it leads to give extra stability to the atom due to symmetry.

The electron gain enthalpy decreases down the group and increases across the period.

Question 50

Define ionisation enthalpy. Discuss the factors affecting ionisation enthalpy of the elements and its trends in the periodic table.

Solution

Ans: The amount of energy required to remove an electron from the outermost shell of an isolated gaseous atom in its ground state is said to be ionisation enthalpy.

The factors that affect ionization enthalpy of the elements are as follows:

- Effective nuclear charge with its increase the ionization enthalpy also increases
- Atomic size with its increase the ionization enthalpy decreases
- The e⁻-e⁻ repulsion with its increase the ionization enthalpy decreases
- Whenever there exists half filled or completely filled orbital than it lead to increase the ionization enthalpy because it leads to give extra stability to the atom due to symmetry

The ionization enthalpy decreases down the group and increases across the period.

Question 51

Justify the given statement with suitable examples— “the Properties of the elements are a periodic function of their atomic numbers”.

Solution

Ans: The chemical properties and physical properties of the elements depends upon its outer electron configuration which ultimately is the periodic function of the atomic number. The elements which possess the same outer electron configuration belong to the same group or family showing similar properties.

Question 52

Write down the outermost electronic configuration of alkali metals. How will you justify their placement in group 1 of the periodic table?

Solution

Ans: The group 1 elements are called alkali metals which possess outermost electronic configuration as ns^1 . All the elements that have same outermost electron configuration possess similar properties and are placed in the same group.

Atomic Number	Symbol	Electronic Configuration
3	Li	$1s^2 2s^1$ (or) $[\text{He}] 2s^1$
11	Na	$1s^2 2s^2 2p^6 3s^1$ (or) $[\text{Ne}] 3s^1$
19	K	$1s^2 2s^2 2p^6 3s^2 4s^1$ (or) $[\text{Ar}] 4s^1$
37	Rb	$1s^2 2s^2 2p^6 3s^2 3d^{10} 4s^2 4p^6 5s^1$ (or) $[\text{Kr}] 5s^1$
55 87	Cs Fr	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 5d^{10} 5s^2 5p^6 6s^1$ (or) $[\text{Xe}] 6s^1$ $[\text{Rn}] 7s^1$

Question 53

Write the drawbacks in Mendeleev's periodic table that led to its modification.

Solution

Ans: Mendeleev arranged the elements as the periodicity of their atomic weights.

The drawbacks of Mendeleev's periodic table are as follows:-

- The position of hydrogen in the periodic table is not specified

- b. Isotopes are not included in the periodic table
- c. Elements with higher atomic mass are placed before the elements with lower atomic mass. For e.g- Co & Ni
- d. Gaps are left in his table considering the fact that more elements are yet to be discovered
- e. Inappropriate position of group VII

Question 54

In what manner is the long form of periodic table better than Mendeleev's periodic table? Explain with examples

Solution

Ans: The following points make long form of periodic table better than Mendeleev's periodic table :-

- a. It is a periodic function of atomic number
- b. Elements are grouped as per their outermost electronic configuration
- c. Proper segregation of metals and non-metals
- d. More appropriate position of group VII

Question 55

Discuss and compare the trend in ionisation enthalpy of the elements of group 1 with those of group 17 elements

Solution

Ans: As we move across the periodic table the ionization energy increases because of the increase in the effective nuclear charge and decrease of the shielding effect as more and more electrons get added in the same orbital. Thus group 1 has lower ionization enthalpy compared to that of group 17 and also group 1 by losing one electron it will acquire the nearest noble gas electronic configuration which also contributes towards its lower ionization enthalpy.

