QB365

Important Questions - Classification of Elements and Periodicity in Properties

11th Standard CBSE

Chemistry Reg.No. : | | | | | | |

Time : 01:00:00 Hrs

Total Marks : 50

Section-A

1) Why were the names eka-aluminium and eka-silicon given to gallium and germanium by Mendeleev? **1**

2) Which element do you think would have been named by **1**

(i) Lawrence Berkeley laboratory

(ii) Seaborg's group

3) Which properties of the elements depend on the electronic configuration of the atoms and which do not? **1**

4) Write the atomic number of the element present in the third period and seventeenth group of the periodic table. **1**

5) Elements have been classified as s, p, d and f-block element on the basis of the type of orbital which receives the last electron. Are there any exceptions to this generalisation?comment. **1**

6) Noble gases have positive electrons gain enthapy. Why? **1**

7) What are horizontal rows and vertical columns of the periodic table called? **1**

8) What is the basic difference in approach between the Mendeleev's periodic law and the modern periodic law? **1**

9) Which important property did Mendeleev use to classify the elements in his periodic table and did he stick to that? **1**

10) How many elements can be accommodated in the present set up of the long form of the periodic table? Explain. **1**

Section-B

11) Explain why cations are smaller and anions are large in radii than their parent atoms ? **2**

12) Give reason for the following statements Halogens act as good oxidising agents. **2**

13) Would you expect the second electron gain enthalpy of O as positive, more negative or less negative than the first? Justify your answer. **2**

14) For each of the following pairs, predict which one has lower first ionisation enthalpy? **2**

Be^{+} or Mg^{2+}

15) For each of the following pairs, predict which one has lower first ionisation enthalpy? **2**

I or I^{-}

16) Among the elements B,Al,C and Si, **2**

Which elements has the highest first inonisation enthalpy?

17) Among the elements B,Al,C and Si, **2**

Which element has the most metallic character?

18) The first ionisation enthalpy $\Delta_i H$es of the third period elements, Na, Mag and Si are respectively 496,737 and 786 kj mol^{-1}. Predict whether the first $\Delta_i H$e for Ai will be more close to 575 or 760 kJ mol^{-1}? Justify your answer. **2**

19) Using the periodic table, predict the formulae of compounds which might be formed by the following pairs of elements; silicon and bromine **2**

20) Give the name and atomic number of the inert gas atom in which the total number of numbers of d-electrons is equal to the difference in numbers of total p and s electrons. **2**

Section-C

21) In the modern periodic table, the elements in group IB(11) and IIB(12) are shown in d-block. This block is the place where the transition elements are found. Why do you think some chemists argue that the group IB(11) and IIB(12) elements should not be considered as d-block elements? **5**

22) Use the periodic table to answer the following questions. **5**
Identify an element that would tend to gain two electrons.

23) Predict the formulae of the stable binary compounds that would be formed by the combination of the following pairs of elements. **5**
(v) Phosphorus and fluorine

24) Write short note on the following. **5**
(i) de-Chancourtois classification
(ii) Dobereiner's triads
(iii) Periodicity
(iv) Periodic table
(v) Position of hydrogen

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Section-A

1) **1**
These names were given to gallium and germanium by Mendeleev because he thought that these elements will have similar properties as that of aluminium and silicon, respectively.

2) (i) Lawrencium (Z=103) and Berkelium (Z=97) (ii) Seaborgium (Z=106) **1**

3) **1**
Chemical and many physical properties of the elements depend on the electronic configuration of the atoms, whereas the nuclear properties do not.

4) **1**
General configuration for 17th group elements is $ns^2\ np^5$. In the third period, the principal quantum number for valence shell is three, so the electronic configuration of valence shell for the given element is $3s^2$, $3p^5$. Third period starts from atomic number, Z=11 and end at Z=18. Hence, the atomic number of the given element is 10+7=17.

5) **1**

Some exceptions are (i) The last electron in Zn, Cd and Hg enters the 4s, 5s and 6s orbital respectively. therefore, on the basis of type of orbital being filled, these elements should be regarded as s-block elements but they placed under **d-block elements**. (ii) Th (thorium) receives the last electron in the d-orbital but is placed under f-block elements.

6) **1**

7) **1**

8) **1**

Mendeleev's periodic law It states that the properties of the elements are a periodic function of their atomic weights

Modern periodic law It states that the properties of the elements are a periodic function of their atomic numbers. Thus, change in the base of classification of elements from atomic weight to atomic number is the basic difference between Mendeleev's periodic law and the modern periodic law.

9) **1**

Mendeleev used atomic weight as the basis of classification of elements in the periodic table. He arranged 63 elements known at that time in the periodic table on the basis of the order of their increasing atomic weight. At some places he ignored the increasing order of atomic weights where the elements having similar properties are placed together.

10) **1**

In the present set up of the long form of the periodic table, we have eighteen groups, seven periods (i.e. principal quantum number, n=7) and four blocks (s, p, d and f-block elements).

Therefore, the maximum number of elements which can be accommodated in the present set up of the long form of the periodic table in accordance with Aufbau principle is

$1s^2$, $2s^2$, $3s^2$, $3p^6$, $4s^2$, $3d^{10}$, $4p^6$, $5s^2$, $4d^{10}$, $5p^6$, $6s^2$,$4f^{14}$, $5d^{10}$, $6p^6$, $7s^2$, $5f^{14}$, $6d^{10}$, $7p^6$=118.

Section-B

11) **2**

Cations are always smaller in radii than their parent atoms because by the loss of one or two electrons, effective nuclear charge increases . Due to this, forces of attraction of nucleus for electrons increases and hence, ionic radii decreases. On the other hand, anions are always larger in radii than their parent atoms because by the addition of one or two electrons effective nuclear charge decreases.

Due to this, forces of attraction between nucleus and valence shell electrons decreases and hence, ionic radii of anion increases.

12) **2**

Due to highly negative electron gain enthalpy they act as good oxidising agents as they can gain electrons easily.

13) **2**

$O(g) + e^- \rightarrow O^-(g); \Delta_{eg}H = -141 \quad kJ \quad mol^{-1}$ When an electron is added to oxygen atom to form $O(g) + e^- \rightarrow O^{2-}(g); \Delta_{eg}H = +780 \quad kJ \quad mol^{-1}$ ion energy is released. hence, first electron gain enthalpy of oxygen is negative. But when another electron is added to O^- ion to form O^{2-} ion, it feels stronger electrostatic repulsion. Hence, addition of second electron gain enthalpy of oxygen is positive.

14) **2**

Be^+ has lower H_1 than Mg^{2+} because in case of Be^+, the removel of one electron gives a stable inert gas configuration but in case of Mg^{2+}, the electron has to be removed from the stable inert gas configuration>

15) **2**

I has lower H_1 than I^- because in case of $I^-(5s^25p^5)$, an electron has to be removed from a stable inert gas configuration.

16) **2**

Period	Group13	Group 14
2nd period	Boron	Carbon
3rd period	Aluminum	Silicon

Innisation enthalpy increase along a period with decrease in atomic size and decreases down the group with increase in atomc size. Hence, carbon has the highest first ionisation enthalpy.

17) **2**

Period	Group13	Group 14
2nd period	Boron	Carbon
3rd period	Aluminum	Silicon

Metalic character decreases across a period but increases on moving down the group. Hence, aluminum has the metallic character.

18) **2**

We know that the first innisation enthalpy generally increases from left to right along a period but the innisation enthalpy of elements of group 2 is higher than that of the corresponding element of group 13 due to the more penetrating power and less shielding of ns-electron. Thus, the correct order of ionisation enthyalpy is

Na<A1<Mg<Si

We know 496<?<737<786

Therefore, the ionisation enthalpy of A1 must be lower than that of the Mg, so its value will be close to 575

19) **2**

Silicon (Si) being a member of group 14 have four valence electrons, i.e its valency is 4. Bromine is a member of halogen family and hence, its valency is 1. When these combine, the formula of the compound formed would be

or $SiBr_4$.

20) **2**

The first inert gas which contains d electrons is krypton. Its atomic number is 36 and its electronic configuration is $1s^2$, $2s^2$, $2p^6$, $3s^2$, $3p^6$, $3d^{10}$, $4s^2$, $4p^6$

Total number of d-electrons=10

Total number of p-electrons=6+6+6=18

Total number of s-electrons=2+2+2+2=8

$\therefore$ Difference in total number of p and s electrons=18-8=10

Thus, the inert gas is krypton.

Section-C

21) **5**

In d-block, the 3d, 4d or 5d-orbitals are being filled. The properties of the transition elements are a result of their having unfilled d-orbitals. However, IB and IIB elements have full d-orbitals.

IB(11)-$(n-1)d^{10}ns^1$ e.g. Cu_{29} $[Ar]3d^{10}4s^1$

IIB(12)-$(n-1)d^{10}ns^2$.

Indeed, these elements have filled s-orbital. This is one of the reasons why some chemists think them misplaced on the end of the transition elements. But the properties of these elements resembles more the d-block elements rather than s-block elements as listed below.

(i) Cu^{2+} is colored, forms complex compounds.

(ii) Zn, Cd, and Hg like other d-block elements form complexes but s-block elements usually do not.

(iii) Like other d-block elements they also form many covalent compounds whereas s-block elements form only ionic compounds.

(iv) Like other d-block elements the first ionization energies, atomic radii are much lower than those of s-block. Electrode potential is much less negative than those of s-block elements of the same period.

Therefore, from above points, it is clear that the properties of IB and IIB resemble more d-block elements rather than the s-block elements.

22) **5**

16th group elements such as O, S, Se etc., have a tendency to accept two electrons because by the gain of two electrons they attain noble gas configuration. Their general electronic cofiuguration for valence shell is ns^2np^4.

23) **5**

S.No	Element	Group number	Electrons in valence shell	Valency	Formulae of binary compound
(v)	Group 15	5		3 or 5	$PG_3 or PF_5$
	Group 17	7		8-7=1	

24) **5**