KENDRIYA VIDYALAYA SANGATHAN LUCKNOW REGION
CUMULATIVE EXAMINATION 2022 -23
SUBJECT- CHEMISTRY (043)
SET-1

MM- 70 **CLASS- XI** **TIME – 3 HOURS**

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

1. There are 35 questions in this question paper with internal choice.
2. SECTION A - Q. No. 1 to 14 are MULTIPLE CHOICE questions and 15 to 18 are assertion reason question and carrying 1 mark each.
3. SECTION B - Q. No. 19 to 25 are short answer questions carrying 2 marks each, and Q. No. 26 to 30 are short answer questions carrying 3 marks each.
4. SECTION C- Q. No.31 and 32 are case based question carrying 4 marks, and 33 to 35 are long answer questions and carrying 5 marks each.
5. All questions are compulsory.

SECTION - A

Question 1. Which of the following weighs the most?
(a) One g – atom of nitrogen
(b) One mole of water
(c) One mole of sodium
(d) One molecule of H_2SO_4

Question 2 A symbol not only represents the name of the element but also represents
(a) Atomic Mass
(b) Atomic Number
(c) Atomicity
(d) Atomic Volume

Question 3. The increasing order (lowest first) for the values of e/m (charge/mass) for
(a) e, p, n, α
(b) n, p, e, α
(c) n, p, α, e
(d) n, α, p, e

Question 4. Which of the following statements in relation to the hydrogen atom is correct?
(a) 3s orbital is lower in energy than 3p orbital
(b) 3p orbital is lower in energy than 3d orbital
(c) 3s and 3p orbitals are of lower energy than 3d orbital
(d) 3s, 3p and 3d orbitals all have the same energy

OR

The magnetic quantum number specifies
(a) Orientation of orbitals
(b) Shape of orbitals
(c) Size of orbitals
(d) Nuclear Stability

Question 5. Which of the following element has least number of electrons in its M-shell?
(a) K
(b) Mn
(c) Ni
(d) Sc

OR

The electrons of the same orbitals can be distinguished by
(a) Principal quantum number
(b) Azimuthal quantum number

(c) Spin quantum number
(d) Magnetic quantum number

Question 6. The element with atomic number 35 belongs to
(a) d – Block
(b) f – Block
(c) p – Block
(d) s – Block

Question 7. The correct order of first ionization potential among following elements, Be, B, C, N and O is
(a) B < Be < C < O < N
(b) B < Be < C < N < O
(c) Be < B < C < N < O
(d) Be < B < C < O < N

Question 8. On the Pauling's electronegativity scale the element next to F is
(a) N
(b) Cl
(c) O
(d) Ne.

OR

The group number, number of valence electrons, and valence of an element with the atomic number 15, respectively, are:
(a) 16, 5 and 2
(b) 15, 5 and 3
(c) 16, 6 and 3
(d) 15, 6 and 2

Question9. The species having pyramidal shape is
(a) SO_3
(b) BrF_3
(c) SiO_3^{2-}
(d) OSF_2

Question 10.The structure of IF_7 is
(a) Pentagonal bipyramid
(b) Square pyramid
(c) Trigonal bipyramid
(d) Octahedral

Question 11.The outer orbitals of C in ethene molecule can be considered to be hybridized to give three equivalent sp^2 orbitals. The total number of sigma (s) and pi (p) bonds in ethene molecule is
(a) 1 sigma (s) and 2 pi (p) bonds
(b) 3 sigma (s) and 2 pi (p) bonds
(c) 4 sigma (s) and 1 pi (p) bonds
(d) 5 sigma (s) and 1 pi (p) bonds

OR

Which of the following is a linear molecule?
(a) ClO_2
(b) CO_2
(c) NO_2
(d) SO_2

Question 12.In which of the following process, a maximum increase in entropy is observed?
(a) Dissolution of Salt in Water
(b) Condensation of Water
(c) Sublimation of Naphthalene
(d) Melting of Ice

Question 13. Which thermodynamic function accounts automatically for enthalpy and entropy both?
(a) Helmholtz Free Energy (A)
(b) Internal Energy (E)
(c) Work Function
(d) Gibbs Free Energy

OR

Third law of thermodynamics provides a method to evaluate which property?
(a) Absolute Energy
(b) Absolute Enthalpy
(c) Absolute Entropy
(d) Absolute Free Energy

Question14. The enthalpies of combustion of carbon and carbon monoxide are -393.5 and -283.0 $kJmol^{-1}$ respectively. The enthalpy of formation of carbon monoxide is:
(a) -676 kJ
(b) 110.5 kJ
(c) -110.5 kJ
(d) 676.5 kJ

From question 15 to 18, Assertion reason type questions and consist of two statements – **Assertion (A) and Reason (R).** You have to answer the questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q.15. Assertion: Equal moles of different substances contain same number of constituent particles.
Reason: Equal weights of different substances contain the same number of constituent particles.

Q.16. Assertion: It is impossible to determine the exact position and exact momentum of an electron simultaneously.
Reason: The path of an electron in an atom is clearly defined.

Q.17. Assertion: Second period consists of 8 elements.
Reason: Number of elements in each period is four times the number of atomic orbitals available in the energy level that is being filled.

OR

Assertion: Hydrogen can be placed in group 1.
Reason: Hydrogen can gain an electron to achieve a noble gas arrangement.

Q.18. Assertion: H_2^+ is more stable than H_2^- .
Reason: H_2^+ has no antibonding electron while H_2^- has one antibonding electron.

SECTION – B

Q.19.(i) What is the mass of one molecule of sodium chloride? 1

(ii)What is the percentage composition of Ca in $CaCO_3$? 1

Q.20 .Calculate the weight of iron which will be converted into its oxide (Fe_3O_4) by the action of 18 g of steam on it as following reaction equation

$$Fe_{(s)} + H_2O_{(g)} \longrightarrow Fe_3O_4(s) + H_2$$ 2

Q.21 (i) Arrange the following orbitals in the order in which electrons may be normally expected to fill them. 3s, 2p, 3p, 2s, 3d, 4s. 1

(ii)An atom has 2 K, 8 L, and 5 M electrons. Write the electronic configuration of the atom. How many unpaired electrons are there in the atom? 1

OR

(i) Give the values of all four quantum numbers for the electron with the highest energy in the sodium atom. 1

(ii)Why Bohr's orbits are called stationary orbits? 1

Q 22. (i)Arrange the following in increasing order of size. 1

N3-, Na+, F–, O2-, Mg2+

(ii)What would be the IUPAC name and symbol for the element with atomic number 120? 1

Q23.(i) Write the Lewis structure of the polyatomic ions CN^-, SO_4^{2-}. 1

(ii)Arrange the following in order of decreasing bond angle?

H_2O, CO_2, NH_3 CH_4. 1

Q24.(i) Why ethyl alcohol is completely miscible with water? 1

(ii) Benzene ring contains alternate single and double bonds, yet all the C-C bonds are of equal length. Why? 1

OR

(i)Write the Lewis structure of the nitrate ion NO_2 1

(ii) Why HCl is polar whereas the Cl_2 molecule is non-polar? 1

Q 25.(i) Name two intensive and extensive properties of a system. 1

(ii) Neither q nor w is a state function but q + w is a state function. Why? 1

OR

(i)What is the relationship between the standard enthalpy of formation and the enthalpy of a compound? 1

(ii)What is the sign of ΔH for endothermic reactions and why? 1

Q 26.An organic compound containing C, H, and O gave the following percentage composition: C = 40.687%, H = 5.085%, O = 54.228%. The molecular mass of the compound is 118. Calculate the molecular formula of the compound. (C-12, H-1, O- 16) 3

OR

Calculate the number of moles of $KMnO_4$ required to oxidize completely 2.70 g of oxalic acid ($H_2C_2O_4$) in acidic solution. Reaction follows as following equation, (K- 39, Mn – 55,)

$2KMnO_4 + 3\ H_2SO_4 + 5H_2C_2O_4 \rightarrow K_2SO_4 + 2\ MnSO_4 + 8\ H_2O + 10\ CO_2$

Question 27.(i) Give four examples of species that are isoelectronic with Ca^{2+}. (1+1+1)

(ii)What do you mean by Vander Waals' radius?

(iii)The electronic configuration of an element is $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$. Name the period and the group to which it belongs?

Question 28.(i)Why covalent bonds are called directional bonds whereas ionic bonds are called non-directional? (1+1+1)

(ii) Which out of CH_3F and CH_3Cl has a higher dipole moment and why?

(iii) Using the VSEPR theory identifies the type of hybridization of OF_2.

Question 29.(i)What will happen to internal energy if work is done by the system? (1+1+1)

(ii) Name the two most common modes by which system and surroundings exchange their energy?

(iii) Predict the following reaction spontaneous or non-spontaneous at 350K, ΔS for the reaction is 1.1jK$^-$

$CH_{4(g)} + 2O_{2(g)} \quad CO_{2(g)} + 2H_2O_{(g)}$, $\Delta H = -891$ KJmol$^-$

Q 30.Define Hess's Law of constant heat summation with a suitable example. Write its applications.3

Q 31. CASE STUDY BASED

Read the passage and answer the following questions:
A large number of orbitals are possible in an atom. Qualitatively these orbitals can be distinguished by their size, shape and orientation. An orbital of smaller size means there is more chance of finding the electron near the nucleus. Similarly, shape and orientation mean that there is more probability of finding the electron along with certain directions than along others. The principal quantum number determines the size and to large extent the energy of the orbital. Azimuthal quantum number, 'l' is also known as orbital angular momentum or subsidiary quantum number. It defines the three-dimensional shape of the orbital. Each shell consists of one or more subshells or sub-levels. The number of sub-shells in a principal shell is equal to the value of n. Magnetic orbital quantum number. 'ml ' gives information about the spatial orientation of the orbital with respect to a standard set of co-ordinate axis. The fourth quantum number is known as the electron spin quantum number (ms). An electron spins around its own axis, much in a similar way as the earth spins around its own axis while revolving around the sun.
In these questions, a statement of assertion followed by the statement of reason is given. Choose the correct answer out of the following choices:
(A) Assertion and reason both are correct statements and reason is the correct explanation for assertion.
(B) Assertion and reason both are correct statements and reason is not the correct explanation for assertion.
(C) Assertion is the correct statement but reason is wrong statement.
(D)Assertion is the wrong statement but reason is correct statement.
(i) Assertion: Each orbital is designated by three quantum numbers labeled as n, l and ml.
Reason: 'n' is a positive integer with value of n = 1,2,3.
(ii) Assertion: The principal quantum number identifies the shell.
Reason: Size of an orbital decrease with the increase of principal quantum number 'n'.
(iii) Assertion: For n = 2, the possible value of l can be 0 and 1.
Reason: For a given value of n, l can have n values ranging from 0 to n – 1.
(iv)Assertion: Each orbital in an atom, is defined by a set of values for n, l and ml.
Reason: ml designates the orientation of the orbital.

OR

Assertion: Spin quantum numbers ms can take the values of +½ or –½.
Reason: Two spin states of the electron and are normally represented by two arrows, ↑ (spin down) and ↓ (spin up).

Q 32. CASE STUDY BASED

Electronegativity is defined as the tendency/power/urge of an atom in a molecule to attract the shared pair of electrons towards itself. Variation across a period: Electronegativity generally increases from left to right across a period. Variation within a group: It generally decreases in going from top to bottom within a group. L. Pauling gave the highest value of 4.0 to F due to its highest electronegative character. Electronegativity decreases from top to bottom in a group and therefore Cl is less electronegative than F. Electron gain enthalpy of second period elements in group 16 and group 17 is less negative than elements of period third because of the compact size of its atom (2 orbits) in period 2 as compared to elements of period 3 (3 orbits) the mutual electronic repulsion in elements of period 2 is more than that of elements of period 3.

(i) Explain why chlorine has a higher electron affinity than Fluorine?
(ii)Though chlorine has nearly the same electronegativity as nitrogen, yet there is no hydrogen bonding in HCl. Why?
(iii) Why ionization enthalpy of Nitrogen is greater than that of oxygen?
(iv) Arrange the following in order of increasing of intermolecular force of attraction:
HCl, CO_2, H_2O, H_2

Q 33.(i) The uncertainty in the momentum Δp of a football thrown by Tom Brady during the super bowl traveling at 40m/s is 1×10^{-6} of its momentum. What is its uncertainty in position (Δx)? Mass=0.40kg ($h = 6.626 \times 10^{-34}$ Js)
(ii) A certain photon has a momentum of 1.50×10−27 kg m/s. What will be the photon's de Broglie wavelength?

Question 34 (i) What is meant by the term bond order?
(ii) Calculate the bond order of N_2, O_2, O_2^+ and O_2^- ?

OR

(i) Draw the resonating structure of carbonate ion.
(ii) Mention the hybridization and shape of the following molecules

(a)PCl_3 (b) CH_4 (c) BCl_3

Question 35. Define the following and give one suitable example of each
(i) Standard enthalpy of formation.
(ii) Standard enthalpy of combustion
(iii) Enthalpy of atomization
(iv) Enthalpy of solution
(v) Enthalpy of sublimation

OR

(i) State first law of thermodynamics and give its mathematical expression.

(ii) Calculate the enthalpy of formation of methane, given that the enthalpies of combustion of methane, graphite, and hydrogen are 890.2 kJ, 393.4 kJ, and 285.7 kJ mol^{-1} respectively.

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