INDIAN SCHOOL SOHAR
TERM-1 (2022 – 2023)
CHEMISTRY (043)

CLASS : XI **MAX. MARKS : 70**
DATE : 02.10.2022 **TIME Allowed : 3 hours**

General Instructions:

(a) There are 33 questions in this question paper. All questions are compulsory.
(b) Section A: Q. No. 1 to 16 are objective type questions, Q. No. 1 and 2 are passage-based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
(c) Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
(d) Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
(e) Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
(f) There is no overall choice. However, internal choices have been provided.
(g) Use of calculators and log tables is not permitted.

SECTION – A [OBJECTIVE TYPE]

1. Read the passage given below and answer the following questions. (1×4=4)

Many chemical reactions take place in solutions. Quantitative study of a solution requires knowing its concentration i. e, the amount of solute present in a given amount of solution. The simplest way is to express concentration by mass percentage or volume percentage or in terms of molarity, which gives the concentration of solute present in 1 dm^3 of solution. Concentration can also be expressed in terms of molality, which gives amount in moles of solute present in 1 kg of solvent or mole fraction which gives the mole fraction of solute or solvent present in the solution.

The following are multiple choice questions. Choose the most appropriate answer:

(i) Commercially available concentrated hydrochloric acid contains 38% HCl by mass. The molarity of the solution (density of solution is 1.20 g cm^{-3}) is

(a) 10.4 (b) 6.34
(c) 12.48 (d) 16.42

(ii) The mass of sodium carbonate (Na_2CO_3) present in 500 ml of 1.5 M solution is

(a) 79.5 g (b) 15.9 g
(c) 159 g (d) 7.95 g

(iii) A chemist needs to add 3.20 g of glucose to a reaction mixture. What volume in mL of 2.5 M glucose solution he should use for the addition?

(a) 6.82 mL (b) 12.06 mL
(c) 8.44 mL (d) 7.12 mL

(iv) The mole fraction of ethylene glycol ($C_2H_6O_2$) in 20% of $C_2H_6O_2$ by mass is

(a) 0.162 (b) 0.068
(c) 0.096 (d) 0.227

OR

What is the mole fraction of sucrose in 2.5 m aqueous solution of sucrose?

(a) 0.092 (b) 0.086
(c) 0.043 (d) 0.956

2. Read the passage given below and answer the following questions. (1×4=4)

The electrons are distributed around the nucleus in various energy levels called shells, subshells and orbitals. A set of quantum numbers completely describe the position and total energy of electron in an atom. The various permitted values of quantum numbers are:

Principal quantum number, n=1, 2, 3, ……

Azimuthal quantum number, l= 0,1, 2, ……. (n-1)

Magnetic quantum number, m_l = - l …… 0….. +l

Spin quantum number, m_s= +1/2 and -1/2

In these questions (Q. No.(i) to (iv)), a statement of assertion followed by a 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 correct explanation for assertion.

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

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

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

(i) **Assertion :** The number of orbitals for *d*- subshell is 5.
Reason : Magnetic quantum number gives the number of orbitals in a given subshell.

(ii) **Assertion :** Set of quantum numbers n= 3, *l*=2, m_l=0 and s= +1/2 is not possible.
Reason : For each value of l,m_l can have -l……. 0…… + l values.

(iii) **Assertion :** Angular momentum of the electron in 4p-orbital is larger than that in the 3p-orbital.
Reason : Energy of 4p-orbital is higher than that of the 3p-orbital.

OR

Assertion : For the outer most electron in K atom, the orbital angular momentum is zero.
Reason : For 4s-electron, l=0 and orbital angular momentum is zero.

(iv) **Assertion** : Maximum number of electrons that a f-subshell can have is 14.
Reason : f-subshell has l= 3 value.

Following questions (q. No. 3-11) are Multiple Choice Questions carrying 1 mark each:

3. Identify the wrong statement in the following;

(a) Amongst the isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius

(b) Amongst the isoelectronic species greater than negative charge on the anion larger is the ionic radius It loses water due to reverse osmosis

(c) Atomic radius of the element increases as one moves down the first group of the periodic table.

(d) Atomic radius of the elements increases as one moves across left to right in the second period of the period table

4. Which one of the following orbitals does not make sense?

(a) 6s (b) 3p

(c) 2d (d) 4f

OR

A subshell with n = 6, l = 2 can accommodate a maximum of:

(a) 10 electrons (b) 12 electrons

(c) 36 electrons d) 72 electrons

5. The molarity of a solution obtained by mixing 800 ml of 0.5 M HCl with 200 ml of 1 M HCl will be

(a) 0.8 M (b) 0.6 M

(c) 0.4M (d) 0.2M

6. The spectral line in hydrogen spectrum obtained when the electron jumps from n = 5 to n = 2 energy level belongs to;

(a) Lyman series (b) Balmer series

(c) Paschen series (d) Pfund series

OR

In Bohr's theory the radius, r of orbit is proportional to

(a) n (b) n^2

(c) n^{-1} (d) n^{-2}

7. Which pair of atomic number represents s – block elements?

(a) 7, 15 (b) 6, 12

(c) 9, 17 (d) 3, 12

8. If uncertainty in the position of the electron is zero, the uncertainty in its momentum would be

(a) Zero (b) $\geq h/4\pi$ (c) $<h/ h/4\pi$ (d) infinite

OR

How many spectral lines are produced in the spectrum of hydrogen atom from 5^{th} energy level?

(a) 5 (b) 10

(c) 15 (d) 4

9. The number of significant figures in 0.0101 is;

(a) 3 (b) 2

(c) 4 (d) 5

10. Which of the following pairs of d– orbitals have electron density along the axis?

(a) d_{Z^2}, d_{xz} (b) d_{xz}, d_{yz}

(c) d_{z^2}, $d_{x^2-y^2}$ (d) d_{zy}, $d_{x^2-y^2}$

11. if the density of a solution is 3.12 g mL^{-1}, the mass of 1.5 mL solution in significant figure is ____

(a) 4.7 g (b) 4680 X 10^{-3} g

(c) 4.680 g (d) 46.80 g

In the following questions (Q. No. 12 to 16) a statement of assertion followed by a 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 correct explanation for assertion.

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

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

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

12. **Assertion** **:** One atomic mass unit is defined as one – twelfth of the mass of one C-12 atom.

Reason **:** Carbon – 12 isotope is the most abundant isotope of the carbon and has been chosen as standard.

13. **Assertion** **:** All isotopes of a given element show the same type of chemical behaviour.

Reason **:** The chemical properties of an atom are controlled by the number of electrons in the atom.

14. **Assertion** **:** All microscopic bodies in motion have wave character.

Reason **:** Microscopic bodies have very large mass.

OR

Assertion : Hydrogen has one electron in its orbital but it produces several spectral lines.

Reason : There are many excited energy levels available.

15. **Assertion** : Boron has smaller first ionization enthalpy than beryllium.

Reason : The penetration of a 2s electron to the nucleus is more than 2p electron hence 2p electron is more shielded by the inner core of electrons than 2s electron.

16. **Assertion** : Steam is a mixture.

Reason : In a compound, the composition of the elements must be fixed.

SECTION – B

The following questions, Q. No. 17 to 25 are Short Answer Type I and carry 2 mark each

17. Calculate to proper significant figures;

(a) 12.6 X 11.2 (b) 108 / 7.2

OR

How much copper can be obtained from 100 g of copper sulphate ($CuSO_4$)?

(Atomic mass of Cu = 63.5 u, S = 32 u, O = 16 u)

18. (i) Name the element with (a) largest atomic radius and (b) smallest atomic radius in the third Period.

(ii) Name the element having general electronic configuration $ns^2\ np^4$ in fourth period.

19. Wavelength of different radiations are given below:

λ(A) = 300 nm, λ(B) = 300 µm, λ(C) = 3 nm, λ(D) = 30 A^0. Arrange these radiations in the increasing order of their energies.

OR

What do you mean by (i) Stark effect (ii) Zeeman effect?

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

OR

The first ($I.E_1$) and second ($I.E_2$) ionization energies (kJ / mol) of a new element designated by roman numerals are shown below

	$I.E_1$	$I.E_2$
I	2372	5251
II	520	7300
III	900	1761
IV	1680	3380

Which of these elements is likely to be (i) a reactive metal (ii) a reactive non – metal (iii) noble gas (iv) a metal that forms a binary halide of the formula AX_2?

21. (i) What is wave number?

(ii) Calculate the wave number of the radiation having a frequency of $4x10^{11}$ kHz?

22. (i) The outer electronic configuration of some element is:

(a) $3s^2 3p^4$ (b) $3d^{10}\ 4s^2$ (c) $3s^2\ 3p^6\ 4s^2$ (d) $6s^2 4f^3$; to which groups do these elements belong to?

(ii) State the modern periodic law.

23. Calculate the number of moles in the following:

(a) 7.85 g of ion (b) 4.68 mg of silicon. (Atomic mass of Fe = 58.8 u and Si = 28.1 u)

24. (i) What is electron gain enthalpy?

(ii) What is d-Block elements? Why are the called transition metal?

25. State (i) Heisenberg's uncertainty principle.

(ii) Pauli's Exclusion principle.

SECTION – C

Q. No. 26 to 30 are Short Answer Type II and carry 3 marks each

26. Account for the following;

(i) Ionization enthalpy of nitrogen is more than that of oxygen.

(ii) A cation is always smaller than its parent atom.

(iii) Noble gases have large positive electron gain enthalpies.

OR

(i) Assign the position of the elements having outer electronic configuration (a) ns^2np^4 for n = 3 (b) $(n-1)\ d^2\ ns^2$ for n = 4

(ii) Among the elements: B, Al, C and Si (a) Which has the largest atomic radius? Why?

(b) Which has most metallic character? Why?

27. (i) How many nodes are present in 3p orbital?

(ii) Draw the shape of three p orbital.

(iii) Which shell would be the first to have a g– subshell?

OR

(i) The electron energy in hydrogen atom is given by $E_n = (-2.18X10^{-18})/n^2$ joules. Calculate the energy required to remove and electron completely from the n = 2 orbit. What is the longest wavelength (in A˚) of light that can be used to cause the transition?

28. (i)Calculate the amount of Carbon dioxide that could be produce when

(a)1 mole of C in burned air.

(b) 1 mole of C is burned in 16 g of dioxygen.

(ii) How many moles of iron can be made from Fe_2O_3 by the use of 16 mol of carbon monoxide in the following reactions: $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

29. (i) Define (a) metallic radius (b) van der Waal's radius.

(ii) Which important property did Mendeleev used to classified the elements in his period table?

30. Calculate the mass percent of the different elements present in sodium sulphate (Na_2SO_4)

SECTION - D

Q. No. 31 to 33 are Long Answer Type and carrying 5 marks each

31. (i) Balance the following equations by hit and trial method **(2+3)**

(a) $KMnO_4 + HCl \longrightarrow KCl + MnCl_2 + H_2O + Cl_2$

(b) $C_3H_8 (g) + O_{2\,(g)} \longrightarrow CO_2(g) + H_2O (l)$

(ii) Calculate the empirical and molecular formula of the compound having the following percentage composition: Na = 36.5%, H = 0.8%, P = 24.6%, O = 38.1%. the molecular mass of the compound is 128 amu. Also name the compound.

OR

(i) What is a limiting reagent? **(1+2+2)**

(ii) 50.0 kg of N_2 (g) and 10.0 kg of H_2(g) are mixed to produce NH_3 (g). Calculate the NH_3(g) formed. Identify the limiting reagent in the production of NH_3.

(iii)(a) What is molality of a solution?

(b) Will the molality of the solution be affected by temperature? Give reason.

32. (i) Calculate the wavelength and frequency of limiting line of Lyman series. **(3+1+1)**

(Rydberg constant = 109677 cm^{-1})

(ii) Give Quantum numbers for electrons with highest energy in sodium atom (Z = 11).

(iii) Which of the following sets of quantum numbers are not possible? Give reason:

(a) n = 1; l = 0; m_l = 0; m_s = -1/2

(b) n = 0; l = 0; m_l = 0; m_s = -1/2

OR

Answer the following question: **(1+1+1+1+1)**

(i) (n + l) value for 14^{th} electron in an atom.

(ii) Increasing order of filling electron in 4f, 5p and 6d subshells.

(iii) 'm' and 'l' value for last electron of Mg atom [atomic number = 12]

(iv) Subshell in which last electron is present in Ga [Z = 31]

(v) Sum of spin of all electron in element having atomic number 14.

33. (i) What is photo-electric effect? **(1+1+3)**

(ii) The kinetic energy of the ejected electron is independent of intensity of the incident radiation. Give reason.

(iii) A photon of wavelength $4x10^{-7}$ m strikes on metal surface, the work function of the metal being 2.13 eV. Calculate (a) energy of the photon (eV) (b) the kinetic energy of the emission and (c) the velocity of the photoelectron. (1 eV= 1.602 X 10^{-19} J)

OR

(i) Give three postulates of Bohr's model of hydrogen atom. **(3+2)**

(ii) Chlorine is prepared in laboratory by treating manganese dioxide (MnO_2) with aqueous HCl according to the reaction: $4HCl(aq) + MnO_2(s) \longrightarrow 2H_2O(l) + MnCl_2(aq) + Cl_2(g)$

How many grams of HCl react with 5.0 g of manganese dioxide? (Atomic mass of Mn = 55 u, O = 16 u, H = 1 u, Cl=35.5 u).