

BUDHA DAL PUBLIC SCHOOL, PATIALA
First Term Examination (23 September 2025)

Class XI (Science)
Subject - Chemistry
(Set-B)

M.M.70

Time: 3hrs.

General Instructions:

1. There are 33 questions in this question paper with internal choice.
2. Section A consists of 16 multiple-choice questions carrying 1 mark each.
3. Section B consists of 5 short answer questions carrying 2 marks each.
4. Section C consists of 7 short answer questions carrying 3 marks each.
5. Section D consists of 2 case-based questions carrying 4 marks each.
6. Section E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

Section - A

- Q1. Number of atoms of He is 100 u of He (Atomic mass of He is 4 u) is
a) 25 b) 50 c) 100 d) 400
- Q2. The number of atoms present in 0.1 moles of a triatomic gas is
a) 1.806×10^{23} b) 1.806×10^{22} c) 3.600×10^{23} d) 6.026×10^{22}
- Q3. Complete the following analogy:
Number of moles of solute in 1L of the solution : A :: Number of moles of solute in 1 Kg of solvent : B
a) A : Formality, B : Molality b) A : Normality, B : Formality
c) A : Molarity, B : Molality d) A : Molarity, B : Normality
- Q4. The number of radial nodes for 3p orbital is
a) 3 b) 4 c) 2 d) 1
- Q5. 4d, 5d, 5f and 6p orbitals are arranged in the order of decreasing energy. The correct option is
a) $6p > 5f > 4d > 5p$ b) $5f > 6p > 4d > 5p$ c) $5f > 6p > 5p > 4d$ d) $6p > 5f > 5p > 4d$
- Q6. Which of the following is the correct order of size of the given species :
a) $1 > 1^- > 1^+$ b) $1^+ > 1^- > 1$ c) $1 > 1^+ > 1^-$ d) $1^- > 1 > 1^+$
- Q7. The first ionization energy of lithium is
a) greater than Be b) less than Be c) equal to Na d) equal to F
- Q8. Which of the following compounds has zero dipole moment
a) CCl_4 b) CHCl_3 c) HF d) NH_3
- Q9. In NO_3^- ion, the number of bond pairs and lone pairs of electron on nitrogen atom are
a) 2, 2 b) 3, 1 c) 1, 3 d) 4, 0
- Q10. The total entropy change for a system is its surrounding increases, if the process is
a) reversible b) irreversible c) exothermic d) endothermic
- Q11. Enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound
a) should always be negative b) should always be positive
c) will be equal to twice the energy of combustion d) may be positive or negative

1. In which case change in entropy is negative

- a) Sublimation of solid to gas b) $2H(g) \rightarrow H_2(g)$
c) Evaporation of water d) Expansion of a gas at temperature

In these questions (Q.No. 13 to 16), two statements are given - one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to the questions from the codes (a), (b), (c) and (d) as given below:

- a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true and R is not the correct explanation of A.
c) A is true but R is false.
d) A is false and R is true.

13. Assertion (A) : Hydrogen has one electron in its orbit but it produces several spectral lines.

Reason (R) : There are many excited energy levels available.

14. Assertion (A) : Atomic size of N is bigger than that of O.

Reason (R) : O has higher nuclear charge than N.

15. Assertion (A) : Covalent bonds are called non-directional bonds.

Reason (R) : A covalent bond is formed by the overlap of half-filled atomic orbitals which have definite direction

16. Assertion (A) : For the reaction, $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$, $\Delta H > \Delta U$

Reason (R) : Enthalpy change is always greater than internal energy change.

Section - B

17. Calculate the amount of carbon dioxide that could be produced when

- a) 1 mole of carbon is burnt in air
b) 2 moles of carbon are burnt in 16 g of dioxygen

18. a) Calculate the number of electrons which will together weigh one gram.

- b) Calculate the mass and charge of one mole of electrons.

OR

Write the complete symbol for the atom with the given atomic number (Z) and atomic mass (A).

- a) $Z = 4, A = 9$ b) $Z = 17, A = 35$

19. a) State Mendeleev's Periodic law

- b) Define Ionization enthalpy

20. Explain the shape of (a) BCl_3 (b) H_2S molecule on the basis of VSEPR theory

21. Define the following :

- a) Adiabatic process b) Isobaric process

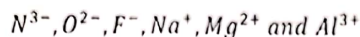
Section - C

22. Determine the empirical formula and molecular formula of an oxide of iron, which has 69.9% iron and 30.1% dioxygen by mass. Its molecular mass is 159.7g. (Atomic mass of Fe = 56 and O = 16)

23. Calculate the wavelength of an electron moving with a velocity of $2.05 \times 10^7 \text{ ms}^{-1}$.

24. Yellow light emitted from a sodium lamp has a wavelength (λ) of 580 nm. Calculate the frequency (ν) and wavelength ($\bar{\nu}$) of the yellow light.

225. Consider the following species :



- a) What is common in them?
- b) Arrange them in the order of increasing ionic radii.

Q26. Explain why BeH_2 molecule has a zero dipole moment although the Be-H bonds are polar.

Q27. Draw Lewis dot structure of SO_3 . Draw its resonance structure

OR

Explain the formation of H_2 molecule on the basis of valence bond theory.

Q28. The combustion of 1 mol of Benzene takes place at 298 K and 1 atm. After combustion $CO_2(g) + H_2O(l)$ are produced and 3267 kJ of heat is liberated. Calculate the enthalpy of formation of benzene from the following data:

- a) $C_6H_6 + \frac{15}{2} O_2 \rightarrow 6CO_2 + 3H_2O \Delta H = -3267 \text{ kJ/mol}$
- b) $C + O_2 \rightarrow CO_2 \Delta H = -393.5 \text{ kJ/mol}$
- c) $H_2 + \frac{1}{2} O_2 \rightarrow H_2O \Delta H = -285.83 \text{ kJ/mol}$

Section - D

Q29. Read the passage given below and answer the following questions:

An atom is such a small particle that it is impossible to determine the actual mass of a single atom by weighting it. Initially, scientists compare the atomic masses of all the elements with hydrogen. But then the atomic masses of most of the elements came out to be fractional. So, carbon - 12 is taken as the reference for the determination of atomic masses. One atomic mass unit is defined as a mass exactly equal to one-twelfth the mass of one C-12 atom. Today, amu has been replaced by 'u' known as unified mass. Many naturally occurring elements exist as more than one isotope so average atomic mass is computed.

Molecular mass is the sum of atomic masses of the elements present in a molecule. The substance which does not contain discrete molecules as their constituent units, formula mass is calculated.

- a) Which element is used as a reference for the determination of atomic masses of elements?

OR

Why are atomic masses the average values?

- b) Calculate the molecular mass of H_2S . (Atomic mass of H = 1u, S = 32u)
- c) Why are the atomic masses of most of the elements fractional?

Q30. Read the following passage and answer the questions that follow:

By the beginning of XIX century, scientists from various countries found various chemical elements and studied their atomic weights (masses), valence, chemical and physical properties. In this regard, there was an urgent need for classification of the studied elements.

The German chemist Johann Wolfgang Döbereiner in 1817 observed that some elements would be grouped into triads based on their chemical properties. For example, calcium, strontium and barium form a triad of alkaline-earth metals. Later this researcher extended a "triads law" to other elements and found several more triads such as lithium, sodium and potassium; sulphur, selenium, tellurium, chlorine, bromine and iodine, etc. Döbereiner also discovered that the atomic weight of the second element of a triad should be approximately equal to the arithmetic average of the atomic weights of the first and third members of this triad.

The English chemist John Alexander Newlands in 1864 proposed to subdivide the elements with increasing atomic weights into octaves. However, such systemization was unsuccessful because elements with completely different chemical properties fell into the same octave. Many other attempts were made to systematize the chemical elements, but only Russian chemist Dmitri Mendeleev succeeded in this field and formulated the periodic law of elements.

1. What is Doebereiner law of triads?
2. Name the elements given by Mendeleev for which he left the gap under aluminium and silicon.
3. Why was Newland's law of octaves unsuccessful?

OR

What is drawback of Mendeleev's periodic law?

- Q31. a) (i) The energy associated with the first orbit in the hydrogen atom is $-2.18 \times 10^{-18} \text{ J atom}^{-1}$. What is the energy associated with fifth orbit?
 (ii) Calculate the radius of Bohr's fifth orbit of hydrogen atom.
- b) State (i) Heisenberg's Uncertainty Principle (ii) Aufbau Principle

OR

- a) Write the electronic configuration of the following ions (Atomic No. Cu = 29, Mn = 25, N = 7)

i) Cu^+ ii) N^{3-} iii) Mn

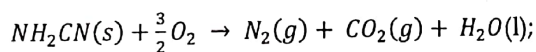
- b) (i) How many subshells are associated with $n = 4$?
 (ii) How many electrons will be present in the subshells having m_s , value of $-1/2$ for $n = 4$?

- Q32. a) Write molecular electronic configuration of N_2^- and N_2 . Also calculate bond order and predict magnetic character. Which one is more stable.
- b) Explain Hydrogen Bonding. What are its types? Explain with example.

OR

- a) Explain the type of hybridization in C_2H_2 molecule. Draw diagram showing single and double bonds in C_2H_2 molecule.
- b) What is the total number of sigma and pi bonds in the following molecule
 (i) C_2H_4 (ii) CH_4

- Q33. a) The reaction of cyanamide, $\text{NH}_2\text{CN}(s)$, with dioxygen was carried out a bomb calorimeter and ΔU was found to be $-742.7 \text{ kJ mol}^{-1}$ at 298 K. Calculate enthalpy change for the reaction at 298 K.



- b) For the reaction $2\text{Cl}(g) \rightarrow \text{Cl}_2(g)$, what are the signs of ΔH and ΔS ?
- c) Differentiate between Extensive and intensive properties giving example.

84

