BUDHA DAL PUBLIC SCHOOL, PATIALA
First Term Examination (23 September 2025)
Class XI (Science)
Subject - Chemistry
(Set-A)

Time: 3hrs.   M.M.70

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. 1 mole of CH_4 contains

    a) 6.02×10^{23} atoms of H   b) 4 gram-atoms of hydrogen

    c) 1.81×10^{23} molecules of CH_4 d) 3 g of carbon

Q2. 10 mol of Zn reacts with 10 mol of HCl. The number of moles of H_2 produced is

    a) 5 mol   b) 10 mol   c) 20 mol   d) 2.5 mol

Q3. Which of the following is dependent on temperature?

    a) Molarity   b) Molality   c) Mole fraction   d) Mass percentage

Q4. For the electrons of oxygen atom, which of the following statements is correct?

    a) Z_{eff} for an electron in a 2s orbital is the same as Z_{eff} for an electron in a 2p orbital.

    b) An electron in the 2s orbital has the same energy as an electron in the 2p orbital.

    c) Z_{eff} for an electron in 1s orbital is the same as z_{eff} for an electron in a 2s orbital.

    d) The two electrons present in the 2s orbital have spin quantum numbers 'm', but of opposite sign.

Q5. A p-orbital can accommodate upto

    a) four electrons   b) six electrons

    c) two electrons with parallel spin   d) two electrons with opposite spin

Q6. The period number in the long form of the periodic table is equal to

    a) magnetic quantum number of any element of the period

    b) atomic number of any element of the period

    c) maximum Principal quantum number of any element of the period.

    d) maximum Azimuthal quantum number of any element of the period

Q7. The ion having highest radius is

    a) Al^{3+} b) N^{3-} c) Na^+ d) F^-

Q8. In the structure of ClF_3, the number of lone pairs of electrons on central atom 'Cl' is?

    a) one   b) two   c) four   d) three

A-1

Q9. Match the entries of Column I with entries of Column II

Column I (Molecule)	Column II (Shape)
A. CO_2	i) Pentagonal bipyramidal
B. BF_3	ii) Linear
C. IF_7	iii) Planar triangular
D. H_2O	iv) Tetrahedral
E. SiF_4	v) Bent

Which of the following is the best matched options?

a) A – (ii), B – (iii), C – (i), D – (v), E – (iv)   b) A – (iii), B – (v), C – (ii), D – (i), E – (iv)

c) A – (iv), B – (ii), C – (v), D – (i), E – (iii)   d) A – (iii), B – (iv), C – (i), D – (v), E – (ii)

Q10. A well stoppered thermoflask contains some ice cubes. This is an example of a/an

a) closed system   b) open system   c) isolated system   d) non-thermodynamic system

Q11. For which reaction, S will be maximum?

a) $Ca(s) + \frac{1}{2}O_2(g) \rightarrow CaO(s)$ b) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

c) $C(s) + O_2(g) \rightarrow CO_2(g)$ d) $N_2(g) + O_2(g) \rightarrow 2NO(g)$

Q12. The correct thermodynamic conditions for the spontaneous reaction at all temperature is

a) $\Delta H > 0$ and $\Delta S < 0$ b) $\Delta H < 0$ and $\Delta S > 0$

c) $\Delta H < 0$ and $\Delta S < 0$ d) $\Delta H < 0$ and $\Delta S = 0$

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.

Q13. Assertion (A) : While filling different subshells in an atom, electrons enter into 3d subshell before filling 4p subshell.

Reason (R) :Electrons prefer to remain unpaired as far as possible.

Q14. Assertion (A) : Helium and Beryllium both are chemically inert.

Reason (R) : They have similar outer electronic configuration of the type ns^2.

Q15. Assertion (A) : Sodium chloride formed by the action of chlorine gas on sodium metal is a stable compound.

Reason (R) :This is because sodium and chloride ions acquire octet in sodium chloride formation.

Q16. Assertion (A) : Absolute values of internal energy cannot be determined.

Reason (R) : It is impossible to determine the exact values of constituent energies of the substance.

Section - B

Q17. In three moles of ethane (C_2H_6), calculate the following:

a) Number of moles of hydrogen atoms

b) Number of molecules of ethane

Q18. Calculate the total number of electrons present in one mole of methane.

OR

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

a) Z = 17, A = 35   b) Z = 92, A = 233

19.
a) State Modern Periodic Law

b) Define Electron gain Enthalpy

Q20. Explain the shape of (a) $BeCl_2$ (b) XeF_4 molecule on the basis of VSEPR theory

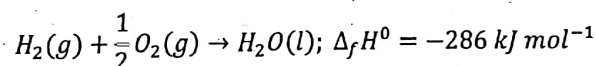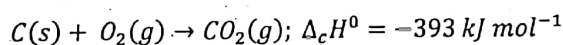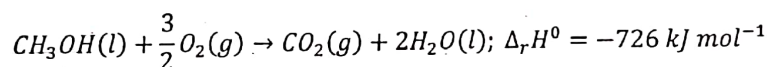Q21. Differentiate between Extensive and Intensive properties giving examples.

Section – C

Q22. A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96g. What are its empirical and molecular formulas?

Q23. If the velocity of the electron in Bohr's first orbit is 2.19×10^6 ms^{-1}, calculate the de Broglie wavelength associated with it.

Q24. Calculate energy of 1 mole of photons of radiation whose frequency is 5×10^{14} Hz.

Q25. Among the second period elements the actual ionization enthalpies are in the order

Li < B < Be < C < O < N < F < Ne

Explain why

a) Be has higher $\Delta_i H$ than B

b) O has lower $\Delta_i H$ than N and F

Q26. Which out of NH_3 and NF_3 has higher dipole moment and why?

Q27. Draw Lewis dot structure of carbonate (CO_3^{2-})ion . Draw its resonance structures.

——OR——

Use molecular orbital theory to explain why the He$_2$ molecule does not exist.

Q28. Calculate the standard enthalpy of formation of $CH_3OH(l)$ from the following data:

$$CH_3OH(l) + \frac{3}{2}O_2(g) \rightarrow CO_2(g) + 2H_2O(l); \Delta_r H^0 = -726 \; kJ \; mol^{-1}$$

$$C(s) + O_2(g) \rightarrow CO_2(g); \Delta_c H^0 = -393 \; kJ \; mol^{-1}$$

$$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l); \Delta_f H^0 = -286 \; kJ \; mol^{-1}$$

Section – D

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

Solution is a homogeneous mixture. It is composed of solute and solvent. In a binary solution, the component present in smaller quantity is called solute while the component present in excess is known a solvent. Composition or strength of a solution can be expressed in several units, such as mass-percentage volume-percentage, gram per litre, molarity, molality, normality, formality and mole-fraction. The solution containing 1 mole of the solute in 1 L of solution is known as one molar solution while the solution containing 1 mole of the solute in 1 kg of the solvent is called 1 molal solution. The ratio of t number of moles of a particular component to the total number of moles in the solution is known mole fraction.

a) What is the unit of molarity?

b) What would be the molality of pure water?

c) A solution contains 36 g of water and 46 g of glycerine [$C_3H_5(OH)_3$]. Calculate the mole fraction of glycerine. (At Mass C = 12g, H = 12g, H = 1g , O = 16g)

OR

How can we say mole fraction is a unitless term?

A·3

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

We can never determine the atomic radius of an atom because there is never a zero probability of finding an electron, and thus never a distinct boundary to the atom. All that we can measure is the distance between two nuclei (internuclear distance). A covalent radius is one-half the distance between the nuclei of two identical atoms. An ionic radius is one-half the distance between the nuclei of two ions in an ionic bond. The distance must be apportioned for the smaller cation and larger anion. A metallic radius is one-half the distance between the nuclei of two adjacent atoms in a crystalline structure. The noble gases are left out of the trends in atomic radii because there is great debate over the experimental values of their atomic radii. The SI units for measuring atomic radii are the nanometer (nm) and the picometer (pm). 1 nm = 1 × 10⁻⁹ m and 1 pm = 1 × 10⁻¹² m

This is the covalent radius. It is ½ the distance between two nuclei of similar atoms that are bonded toe ether bv a stmzle covalent bond.
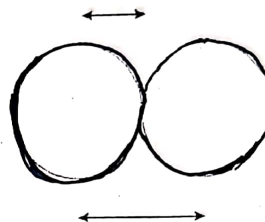
This is the ionic radius. It is ½ of the distance between the nuclei of two atoms that are bonded by an ionic bonds.

This is the metallic radius. It is ½ ᵗʰᵉ distance between the nuclei of twᵒ atoms in a crvstalline structure.
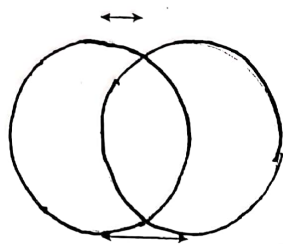
The distance between two nuclei.
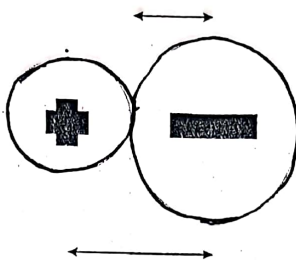
This is the distance between the two nucleuses of the atoms. The positive sign represents the cations and the negative sign represents the anion.

This is the distance between the nuclei of two metallic atoms

a) Out of van der Waals radius and covalent radius, which one is larger?
b) Why is the size of a cation smaller than that of a neutral atom?
c) How do atomic radii vary along a period and down a group of the periodic table?

OR

Which of the following pairs of atoms/ ions is smaller in size?

(a) Na or Mg   (b) Mg^{2+} and Al^{3+}

Q31. a) Calculate the wavenumber for the longest wavelength transition in the Balmer series of atomic hydrogen.

b) State (i) Pauli's Exclusion Principle   (ii) Hund's Rule of Maximum Multiplicity

OR

a) Write the electronic configurations of the following ions. (i) Na+ (ii) O^{2-} (iii) F⁻

b) How many electrons in an atom may have the following quantum numbers?

(i) $n = 4, m_s = -\frac{1}{2}$ (ii) $n = 3, l = 0$

Q32. a) Write molecular electronic configuration of O_2^+ and O_2^{2-} ions. Also calculate bond order and predict magnetic character. Which one is more stable?

b) Differentiate between sigma and pi bond.

OR

a) Explain the type of hgybridisation in C_2H_4 molecule. Draw diagram showing single and double bonds in C_2H_4 molecule.

b) Explain Hydrogen Bonding. What are its types? Explain with examples.

Q33. a) In a process, 701 J of heat is absorbed by a system and 394 J of work is done by the system. What is the change in internal energy of the process?

b) Derive relationship between Cp and Cv.

c) State First Law of Thermodynamics. Give its mathematical expression.

A4