



Indian School Al Wadi Al Kabir

Assessment – I (2025-2026)

Class: XI
Date: 16/09/2025

Subject: Chemistry (043)
Set- I

Max. marks: 70
Time: 3 Hours

General Instructions:

Read the following instructions carefully.

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

Questions 1 to 16 are multiple-choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1. The mass percent of C in CO_2 is _____.

- A. 42.85 %
- B. 27.27 %
- C. 2.727 %
- D. 4.285 %

2. According to Bohr's theory for the hydrogen atom, the angular momentum of an electron is:

- A. $mvr = nh/2\pi$
- B. $mvr = nh/4\pi$
- C. $mvr = nh/\pi$
- D. $mvr = nh/4$

3. The element with atomic number 23 belongs to

- A. 3rd period and 13th group
- B. 4th period and 13th group
- C. 4th period and 5th group
- D. 3rd period and 5th group

4. The formal charges on Carbon and Oxygen in CO are:

- A. Carbon = -1, Oxygen = +1
- B. Carbon = +1, Oxygen = -1
- C. Carbon = -2, Oxygen = +2
- D. Carbon = 0, Oxygen = 0

5. If 100 ml of a 1 M solution is diluted to 200 ml, what will be the molarity of the solution obtained?

- A. 2 M
- B. 1 M
- C. 100 M
- D. 0.5 M

6. Identify the expression that is commonly known as Bohr's frequency rule.

- A. $\Delta E = h\nu$
- B. $\nu = h / \Delta E$
- C. $\nu = h/2\pi$
- D. $\nu = h/4\pi$

7. Considering the elements B, C, N, F, and Si, the correct order of their non-metallic character is:

- A. $B > C > Si > N > F$
- B. $Si > C > B > N > F$
- C. $F > N > C > B > Si$
- D. $F > N > C > Si > B$

8. The bond order in N_2 is the same as in

- A. O_2
- B. O_2^{2-}
- C. NO^+
- D. F_2

9. Calculate the number of atoms present in 4.4 g of CO_2 . (Atomic mass of C = 12u, O = 16u)

- A. 1.8066×10^{23} atoms.
- B. 6.022×10^{22} atoms
- C. 0.1 atom
- D. 3 atoms

10. Which quantum number differentiates between orbitals of the same shape but different orientations?

- A. Principal quantum number
- B. Azimuthal quantum number
- C. Magnetic quantum number
- D. Spin quantum number

11. The IUPAC name of the element with atomic number 114 is

- A. Nilnilquadium
- B. Ununtetraium
- C. Nilnilbium
- D. Ununquadium

12. The number of radial nodes in the 3s orbital is:

- A. 0
- B. 1
- C. 2
- D. 3

13. **Assertion (A):** No two electrons in an atom can have the same set of all four quantum numbers.

Reason (R): Hund's rule of maximum multiplicity governs the arrangement of electrons in degenerate orbitals.

Select the most appropriate answer from the options 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 but R is true

14. **Assertion (A):** Fluorine is less electronegative than Chlorine.

Reason (R): The electron gain enthalpy of Fluorine is less negative than Chlorine.

Select the most appropriate answer from the options 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 but R is true.

15. **Assertion (A):** NH_3 is more polar than NF_3 .

Reason (R): The bond dipoles and the orbital dipole in NH_3 are in the same direction.

Select the most appropriate answer from the options 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 but R is true

16. **Assertion (A):** Electrons are added in 4f orbital after 6s orbital is filled.

Reason (R): 4f orbitals have a more complex shape.

Select the most appropriate answer from the options 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 but R is true

Section-B

Questions 17 to 21 are very short-answer questions carrying 2 marks each.

17. **Attempt either option A or B**

A. Answer the following:

- I. Define the term 1 amu.
- II. Prove that the sum of all mole fractions is unity.

OR

B. Answer the following:

- I. Define the term 1 mole.
- II. A change in temperature affects molarity. Comment on the statement.

18. Draw the boundary surface diagrams of:

- I. p_x
- II. d_{xy}

19. I. The second ionization enthalpy of Na is higher than that of Mg.

II. The first element of each of the groups 1 and 2 and groups 13-17 differs in many respects from the other members of their respective group. Give two reasons.

20. Write any two limitations of the octet rule with examples.

21. Calculate the wavelength of a ball of mass 200 g moving with a velocity of 15 m s^{-1} . ($h = 6.626 \times 10^{-34} \text{ Js}$)

Section-C

Question No. 22 to 28 are short-answer questions, carrying 3 marks each.

22. I. If 10 volumes of dihydrogen react with 5 volumes of dioxygen, how many volumes of water vapour would be produced?
II. 23 g of ethanol (molar mass 46 g mol^{-1}) is dissolved in 54 g of water (molar mass 18 g mol^{-1}). Calculate the mole fraction of ethanol and water in the solution.
23. Calculate the energy associated with the first orbit of Li^{2+} . What is the radius of this orbit?
24. Give reasons for the following statements.
I. The C-O bond length in CO_3^{2-} is the same.
II. LiI is more covalent in nature than LiF.
III. The van der Waals radius of the chlorine molecule is longer than its covalent radius.
25. (a) Define the terms.
I. Ionization enthalpy
II. Isoelectronic species

(b) State the Modern Periodic law.
26. Calculate the frequency of the photon emitted when an electron in a Hydrogen atom moves from $n = 4$ level to $n = 2$ level. ($h = 6.626 \times 10^{-34} \text{ Js}$)
27. Arrange the following in increasing order as mentioned.
I. Mg^{2+} , O^{2-} , F^- (size)
II. Si, P, S (Ionization energy)
III. F, Br, Cl (Electronegativity)
28. Calculate: (Attempt any three)
I. Find the mass of KOH required to prepare 1 L of 1 molar solution. (Atomic mass of K=39u, O=16 u)
II. What is the mass of CO_2 present in 2 moles of it? (Atomic mass of C = 12 u)
III. What is the mass of 1 molecule of NH_3 ? (Atomic mass of N = 14 u)
IV. What mass of a substance is added to water to make a solution of 30 g, and mass% = 5%?

Section-D

Question No. 29 & 30 are case-based/data-based questions carrying 4 marks each.

29. Quicklime is formed by heating limestone (Calcium carbonate, CaCO_3) in a kiln to temperatures around $900\text{-}1,100^\circ\text{C}$. a process called calcination. This high heat causes the calcium carbonate to undergo thermal decomposition, releasing carbon dioxide (CO_2) gas and leaving behind calcium oxide (CaO), which is quicklime. The chemical equation for this reaction $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$

Based on the information provided above, answer the following questions: (1,1,2)

- I. What mass of CaCO_3 is required to produce 10 g of CaO ? (At mass of Ca=40 u, O = 16 u)

II. What is the volume of CO_2 produced when 10g of CaCO_3 is heated? (1 mol = 22.4 L)
(a) 22.4 L (b) 0.224 L (c) 2.24 L (d) 224 L

OR

- II. State law of definite proportions.

III. Which is greater, the no of atoms in 200 u of Ca or the no of atoms in 200 g of Ca? Explain using calculation.

30. The modern periodic table consists of 18 groups and 7 periods. Within a period, atomic numbers increase consequently, while in a group, they increase in a specific pattern.
- Elements in the periodic table are classified as s-block, p-block, d-block and f-block. About 78% of the elements are metals, while around 20% are non-metals. A few elements, such as boron (B), Silicon (Si), germanium (Ge), and arsenic (As), are classified as metalloids. The metallic character of elements increases down a group and decreases across a period from left to right.
- s-block elements: Soft, highly reactive, and do not exhibit variable oxidation states.
- p-block elements: Include metals, non-metals, and metalloids. They show variable oxidation states and occur in solid, liquid, and gaseous states.
- d-block elements (transition metals): All are metals, form coloured ions, exhibit variable oxidation states, and have high melting and boiling points.
- f-block elements (lanthanoids and actinoids): Form coloured ions. All actinoids are radioactive.

Based on the information provided above, answer the following questions. (1,1,2)

I. Write the outer electronic configuration of the d-block elements.

OR

I. Is Zn a transition element? Explain.

II. The chemical reactivity is highest at the two extremes of the periodic table and lowest in the centre. Comment.

III. Which of the following pairs of elements would have a more negative electron gain enthalpy?

(i) O or F

(ii) O or S

Give a reason for your answer.

Section-E

Question No. 31 to 33 are long-answer type questions carrying 5 marks each.

31. Attempt either A or B

A. Account for the following statements:

I. The IE_1 of B is less than that of Be.

II. The maximum covalency of B is 4.

III. Electron gain enthalpy of Ne is positive.

IV. Na^+ is smaller in size than Na.

V. The electronegativity of any given element is not constant.

OR

B. Answer the following questions:

Elements P, Q, R, S, T belong to the same period.

Element	First ionization enthalpy (IE_1) kJmol^{-1}	Electron Gain Enthalpy ($\Delta_{eg}H$) kJmol^{-1}
P	738	-40
Q	1310	-141
R	1312	-73
S	1000	-200
T	2370	+45

- I. Which of the following elements is most likely to be a noble gas?
- II. Arrange the elements in the increasing order of ability to lose the first outermost electron.
- III. Which of the following elements is most likely to be a non-metal?
- IV. What type of oxide will be formed by element S?
- V. Which of these elements is assigned a van der Waals radius instead of a covalent or metallic radius?

32. Attempt either A or B

A. Answer the following questions:

- I. Fe^{3+} is more stable than Fe^{2+} . Justify the statement.
- II. State Aufbau principle.
- III. Write all four quantum numbers of $3d^6$.
- IV. Is the following set of quantum numbers possible? Explain.
 $n = 1, l = 1, m_l = 0, m_s = +\frac{1}{2}$
- V. What is the lowest value of n that allows g orbitals to exist?

OR

B. Answer the following questions:

- I. Write the electronic configuration of Cr.
- II. How many subshells are associated with $n = 4$? Name them.
- III. Prove that the circumference of the Bohr orbit for the hydrogen atom is an integral multiple of the de Broglie wavelength associated with the electron revolving around the orbit.
- IV. State Heisenberg's Uncertainty principle.
- V. How many electrons in an atom will have the following set of quantum numbers?
 $n = 3, m_s = -\frac{1}{2}$

33. Attempt either A or B

A.

- I. Hydrogen reacts with oxygen to produce H_2O (g) according to the equation given.
 $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$
 - (i) Calculate the mass of H_2O (g) formed if 200g of hydrogen reacts with 100 g of oxygen.
 - (ii) Find the amount (no of moles) of the unreacted reactant.
- II. The density of 10% (mass %) solution of HCl is 3.65 gml^{-1} . Calculate the molarity of the solution.
(Atomic mass of Cl = 35.5 u)

OR

B.

- I. 4g of NaOH is dissolved in 36 g of water to form a 100 ml solution. Calculate the molality and molarity of the solution. (Atomic mass of Na= 23 u, O=16 u, H=1u)
- II. An organic compound contains 86% C and 14% H. Its molar mass is 28u. Find the empirical and molecular formula.