KOTHARI INTERNATIONAL SCHOOL, NOIDA

ANNUAL EXAMINATION, SESSION: 2025-26

GRADE: 11 SUBJECT: CHEMISTRY (043)

SET A

DAY & DATE: FRIDAY- FEBRUARY 06, 2026

MAXIMUM MARKS: 70 **TIME ALLOWED: 3 HOURS**

NAME: _____ **ROLL NO:_____**

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

(a) There are 33 questions in this question paper with internal choice.

(b) SECTION A consists of 16 multiple-choice questions carrying 1 mark each.

(c) SECTION B consists of 5 short answer questions carrying 2 marks each.

(d) SECTION C consists of 7 short answer questions carrying 3 marks each.

(e) SECTION D consists of 2 case-based questions carrying 4 marks each.

(f) SECTION E consists of 3 long answer questions carrying 5 marks each.

(g) All questions are compulsory.

(h) Use of log tables and calculators is not allowed.

SECTION – A

The following questions are multiple -choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

Q1. Photoelectric effect established that light **(1)**

(A) behaves like particles

(B) behaves like magnetic fields

(C) behaves like waves

(D) behaves like rays

Q2. The number of moles of solute present in 1 kg of a solvent is called. **(1)**

(A) Molarity (M)

(B) ppm

(C) Normality(N)

(D) Molality (m)

Q3. Lines in the hydrogen spectrum which appear in the infrared region of the electromagnetic Spectrum, are called as: **(1)**

(A) Balmer series
(B) Hydrogen line series
(C) Hydrogen series
(D) Paschen series

Q4. 30 % aqueous solution of glucose (Molar mass 180 g/mL) by mass. The mole fraction of glucose is equal to **(1)**

(A) 0.06
(B) 0.041
(C) 0.02
(D) 0.08

Q5. The element with atomic number 26 will be found in group : **(1)**

(A) 2
(B) 8
(C) 6
(D) 10

Q6. The Ionic radius of cation is always——— **(1)**

(A) Less than the atomic radius
(B) more than the atomic radius
(C) Equal to atomic radius
(D) Cannot be predicted

Q7. Which of the following correctly represents the increasing order of effective nuclear charge in Na, Al, Mg and Si atoms? **(1)**

(A) Na < Mg < Si <Al
(B) Na < Mg <Al < Si
(C) Mg < Na <Al< Si
(D) Na = Mg =Al = Si

Q8. Amongst H_2O, H_2S, H_2Se and H_2Te the one with the highest boiling point is **(1)**

(A) H_2O because of hydrogen bonding
(B) H_2Te because of higher molecular weight
(C) H_2S because of hydrogen bonding
(D) H_2Se because of lower molecular weight.

Q9. Maximum bond angle is present in case of **(1)**

(A) BBr_3

(B) BCl_3

(C) BF_3

(D) Same in all

Q10. If the bond energies of H—H, Br—Br and H—Br are 433, 192 and 364 kJ mol^{-1}, respectively, then $\Delta H°$ for the reaction. **(1)**

$H_2(g) + Br(g) \rightarrow 2HBr\ (g)$ is

(A) –261 kJ

(B) –103 kJ

(C) +261 kJ

(D) –1031 kJ

Q11. The correct thermodynamic conditions for the spontaneous reaction at all temperature is: **(1)**

(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 $\Delta S < 0$

Q12. What is the conjugate base of OH^-? **(1)**

(A) O^{2-}

(b) O^-

(c) H_2O

(d) O_2

For Questions number 13 to 16, two statements are given---- one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

Q13. **Assertion(A)**: Lithium is a strong reducing agent. **(1)**

Reason(R): Lithium has lowest value of the standard reduction potential.

Q14. **Assertion(A)**: The vapour pressure of pure liquid has a fixed value at a particular temperature. **(1)**

Reason(R): When equilibrium is reached, no more vapour are formed.

Q15. **Assertion(A)** : Benzene on heating with conc. H_2SO_4 and Conc HNO_3 gives nitro benzene. **(1)**

Reason(R): Mixture of Conc H_2SO_4 and Conc HNO_3 produces electrophile SO_3.

Q16. **Assertion(A)**: Chain isomerism is observed in compounds containing four or more than four carbon atoms. **(1)**

Reason(R): Only alkanes show chain isomerism.

SECTION – B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

Q17. A molecule of PCl_5 exists while that of NCl_5 does not. Explain. **(2)**

Q18. Calculate the molarity of NaOH in the solution prepared by dissolving its 4 g in enough water to form 250 mL of the solution. **(2)**

Q19. Calculate the bond enthalpy of Cl—Cl bond from the following data: **(2)**

$$\mathbf{CH_4(g) + Cl_2(g) \rightarrow CH_3Cl(l) + HCl(l)} \qquad [\Delta H = -100.3 \text{ kJ mol}^{-1}]$$

Given: bond enthalpies of C—H, C—Cl and H—Cl bonds are 413, 326 and 431 kJ mol^{-1} respectively.

Q20. (a) Which distillation method is used to separate a mixture of o-nitrophenol and p-nitrophenol? **(2)**

(b) Name the type of isomerism exhibited by acetone and propanal.

Q21. ***Attempt either option a or b.*** **(2)**

a. For the equilibrium,

$$\mathbf{2NOCl(g) \rightarrow 2NO(g) + Cl_2(g)}$$

the value of the equilibrium constant, *Kc* is 3.75×10^{-6} at 1069 K. Calculate the *Kp* for the reaction at this temperature?(Given: R = 0.0831Lbar/K/mol)

OR

b. How can you predict the following stages of a reaction by comparing the value of Kc and Qc ?

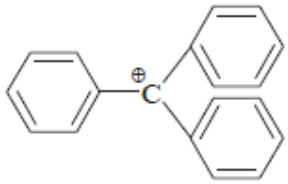
(i) Net reaction proceeds in the forward direction.

(ii) No net reaction occurs.

SECTION – C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

Q22. (a) The structure of triphenylmethyl cation is given below. This is very stable and some of its salts can be stored for months. Explain the cause of high stability of this cation. **(3)**



(b) Why tertiary carbanions are not stable? Explain.

Q23. ***Attempt either option a or b.*** **(3)**

a. A compound on analysis was found to contain C = 34.6%, H = 3.85% and O = 61.55%.Calculate the empirical formula.

OR

b. (i) What is the limiting reagent?

(ii) Oxygen is prepared by catalytic decomposition of potassium chlorate ($KClO_3$). Decomposition of potassium chlorate gives potassium chloride (KCl) and oxygen (O_2).If 2.4 mol of oxygen is needed for an experiment, how many grams of potassium chlorate must be decomposed?
(At. mass of K = 39, Cl=35.5, O = 16)

Q24. The first (IE_1) and second (IE_2) ionisation energies (kJ/mol) of a new element designated by Roman numerals are shown below: **(3)**

	IE_1	IE_2
I	2372	5251
II	520	7300
III	900	1760
IV	1680	3380

Which of these elements is likely to be

(i) a reactive metal

(ii) a reactive non-metal

(iii) a noble gas, and

Q25. Balance the given redox reaction in **<u>acidic medium</u>*.(Steps of balancing to be shown*)**. **(3)**

$$Cr_2O_7^{2-} + H^+ + I^- \longrightarrow Cr^{3+} + I_2 + H_2O$$

Q26. (i) Write de Broglie equation. **(3)**

(ii) The uncertainty in the position of a moving bullet of mass 10 g is 10^{-5} m. Calculate The uncertainty in its velocity.

(Given : h = 6.626×10^{-34} Js).

Q27. Which is most stable out of O^{2+}, O^{2-} & O_2^{2-}.? Explain. Arrange them in increasing order of bond length & bond dissociation energy. **(3)**

Q28. Describe the effect of : **(3)**

(a) addition of H_2

(b) addition of CH_3OH

(c) removal of CO

on the equilibrium of the reaction:

$$\mathbf{2H_2(g) + CO\ (g) \rightarrow CH_3OH\ (g)}$$

SECTION – D

The following questions are case -based questions. Each question has an internal choice and carries 4 marks each. Read the passage carefully and answer the questions that follow.

Q29. **Read the passage given below and answer the following questions:** **(1×4=4)**

The capacities of shells with a given principal quantum number are fixed by

(1) the rules governing the permitted values of the quantum numbers and

(2) the Pauli Exclusion Principle.

The permitted values of the quantum numbers are:

Principal quantum number	n	1 to ∞
Azimuthal quantum number	l	0 to n–1 (n values)
Magnetic quantum number	m_l	$-l$ to $+l$, ($2l$ +1 values)
Spin quantum number	m_s	– ½ or + ½ (2 values)

The Pauli Exclusion Principle states that no two electrons in the same atom may have the same values of all four quantum numbers. It follows that, for a given value of n, there are $2n^2$ different sets of values for the quantum numbers, because l may have the values 0, 1, . . ., n–1, and for each value

of *l* there are 2*l* +1 values of m_l and for each set of values of *l* and m there are just two choices for ms.
(Reference : Thomas H. Hazlehurst, J. Chem. Educ. 1941, 18, 12, 580 Publication Date: December 1, 1941, Journal of American Chemical Society).

Answer the following questions on the basis of above data:

(i) Azimuthal quantum number defines:
(A) e/m ratio of electron
(B) spin of electron
(C) angular momentum of electron
(D) magnetic momentum of electron

(ii) What is the maximum number of electrons having n = 3 and l = 2?

(iii)
(a) Write the correct set of quantum numbers(value of n and l) for the unpaired electron of chlorine atom.
(b) The total number of orbitals in a shell having principal quantum number n is
(1) 2n
(2) n^2
(3) $2n^2$
(4) n+1

OR

(iii) (b)Match the following:

	List-I		List-II		List-III
a.	2s	p.	Dough not shape	i.	along z-axis
b.	$2p_x$	q.	Spherical	ii.	In between x & y-axis
c.	$3d_{xy}$	r.	Dumb bell	iii.	non-directional
d.	$3d_{z2}$	s.	Double dumb bell	iv.	along x-axis

Q30. Read the passage given below and answer the following questions: (1+1+2=4)

Hydrocarbons are compounds of carbon and hydrogen only, obtained from coal and petroleum mainly which are major sources of energy. Hydrocarbons are classified as open chain, saturated (alkanes),unsaturated (alkenes and alkynes), cyclic (alicyclic) and aromatic based on structure. Alkanes show conformational isomerism due to free rotation along C-C bond leading to staggered and eclipsed conformations of ethane. The angle of rotation about C-C bond is called the dihedral angle or torsional angle and is maximum, i.e. 180 0 in staggered conformation and minimum in eclipsed conformation. Thus, torsional strain is minimum in staggered conformation and maximum in eclipsed

form. The two forms differ in energy by 12.5kJ mol-1. This energy barrier is so small that small thermal or kinetic energy is sufficient to overcome it by intermolecular collisions. Alkenes show geometrical (Cis-trans) isomerism due to restricted rotation around carbon-carbon double bond.

Answer the following questions on the basis of above data:

(a) Which conformation of ethane is relatively more stable?

(b) Alkanes show conformational isomerism but alkenes do not .Why?

(c) Draw Sawhorse's projections of ethane ?

OR

(c) Why is trans but-2-ene has higher melting point than cis but-2-ene?

SECTION E

The following questions are long answer type and carry 5 marks each. All questions have an internal choice.

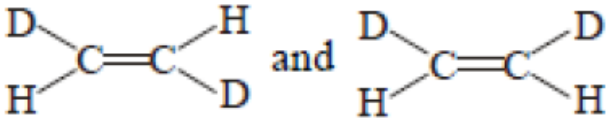
Q31. ***Attempt either option A or B.*** **(1×5=5)**

A. Attempt ***any five*** of the following:

(a) Arrange the following: [***Increasing order of stability***]

(*i*) $(CH_3)_3\overset{\oplus}{C}$, $CH_3CH_2\overset{\oplus}{C}H(CH_3)$, $CH_3CH_2CH_2\overset{\oplus}{C}H_2$

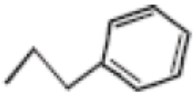
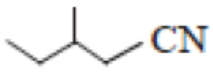
(b)What is the relation between the following pairs?



(c) Identify(underline the atom) electrophilic centers in the following CH_3CHO and CH_3CN.

(d) Name a suitable technique of separation of the components from a mixture of Calcium sulphate and camphor.

(e) Give the IUPAC name of the following compounds:

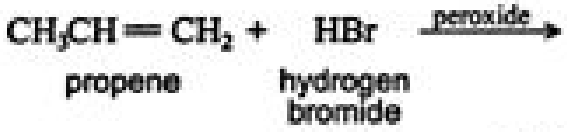
(*i*)  (*ii*) 

(f) Draw possible isomers of the compound CH_2ClCH_2CHO

OR

B. (i) Complete the following reaction:

(1+1+3=5)



(ii) Name the intermediate that gets formed in the reaction.

(iii) Outline the detailed mechanism for the above reaction indicating the major and minor product.

Q32. ***Attempt either option A or B.*** **(1×5=5)**

A. What is meant by entropy? Predict the sign of entropy change in each of the following:

(*i*) H_2 (at 298 K, 1 atm) $\longrightarrow$ H_2 (at 298 K, 10 atm)

(*ii*) H_2O (at 298 K, 1 atm) $\longrightarrow$ H_2O (at 330 K, 1 atm)

(*iii*) $2NH_4NO_3(s) \longrightarrow 2N_2(g) + 4H_2O(g) + O_2(g)$

(iv) Crystallization of copper sulphate from its saturated solution

(*v*) $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$.

OR

B. (i) State Hess's law.

(ii) For the reaction: **(2+3=5)**

$2A(g) + B(g) \longrightarrow 2D(g)$

$\Delta U° = -10.5$ kJ and

$\Delta S° = -44.1$ J K^{-1} mol^{-1}

Calculate $\Delta G°$ for the reaction and predict whether the reaction may occur spontaneously.

Q33. ***Attempt either option A or B.*** **(1×5=5)**

A. (i) Give reason for following

(a) Ethyne is more acidic than ethane.

(b) Nitration of Toluene give ortho and para nitro toluene but not m-Nitro toluene.

(ii) Complete the following equations:

a) $CH_3CH(Cl)\text{-}CH_2\text{-}CH_3 \xrightarrow{Alc\ KOH}$

b) $CaC_2 + 2H_2O \longrightarrow$

(iii) Give a chemical test to distinguish the following pairs: Ethene and Ethyne

OR

B. (i) Write chemical equation for lab preparation of ethene. **(1×5=5)**

(ii) What happens:

(a) when ethene is passed through Br_2 water.(***Give chemical equation***)

(b) Ethene is oxidized in presence of Alk $KMnO_4$.(***Give chemical equation***)

(iii) Convert the following:

(a) Ethyne to Propyne

(b) Benzene to Acetophenone