KOTHARI INTERNATIONAL SCHOOL, NOIDA

ANNUAL EXAMINATION, SESSION: 2023-24

GRADE: 11 SUBJECT: CHEMISTRY (043)

SET B

DATE & DAY: 14th FEB 2024

MAXIMUM MARKS: 70 **TIME ALLOTTED: 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. The empirical formula and molecular mass of a compound are CH_2O and 180 g respectively. What will be the molecular formula of the compound? **(1)**

(a) CH_3COOH
(b) HCHO
(c) CH_3OH
(d) $C_6H_{12}O_6$

Q2. One Gram Molecule of Benzene is equal to **(1)**

(a) 72 g Benzene
(b) 18 g Benzene
(c) 76 g of Benzene
(d) 78 g Benzene

Q3. Rutherford's gold foil experiment drew the following conclusion: **(1)**

(a) mass of the atom is assumed to be uniformly distributed over the atom

(b) an atom possesses a spherical shape in which the positive charge is uniformly distributed

(c) most of the space in the atom is empty

(d) none of these

Q4. Which of the following series of transitions in the spectrum of hydrogen falls in visible region ? **(1)**

(a) Paschen series

(b) Lyman series

(c) Balmer series

(d) Brackett series

Q5. Which of the following has least electron affinity? **(1)**

(a) Oxygen

(b) Argon

(c) Nitrogen

(d) Boron

Q6. The anion O^- is isoelectronic with: **(1)**

(a) Ne

(b) N^{2-}

(c) N^{3-}

(d) F^-

Q7. The molecule Ne_2 does not exist because **(1)**

(a) Nb > Na

(b) Nb = Na

(c) Nb < Na

(d) None of these

Q8. The oxidation number of Cl in Cl_2O_7 is **(1)**

(a) + 7

(b) +5

(c) +3

(d) – 7

Q9. The work done in case of isothermal free expansion is **(1)**

(a) maximum
(b) minimum
(c) zero
(d) positive

Q10. Which of the following is not an electrophile? **(1)**

(a) $:CH_2$
(b) $+CH_3$
(c) SO_3
(d) $:SH^-$

Q11. Which of the following compounds reacts with sodium to liberate hydrogen gas? **(1)**

(a) Ethane
(b) Propene
(c) Acetylene
(d) Benzene

Q12. An element which is an essential constituent of all organic compounds belongs to: **(1)**

(a) group 1
(b) group 14
(c) group 15
(d) group 16

Q13. Given below are two statements labelled as Assertion (A) and Reason(R). **(1)**

Assertion: For any chemical reaction at a particular temperature, the equilibrium constant is fixed and is a characteristic property.
Reason: Equilibrium constant is independent of temperature.

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 but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q14. Assertion (A): Electron gain enthalpy becomes less negative as we go down a group. **(1)**
Reason (R): Size of the atom increases on going down the group and the added electron would be farther from the nucleus.

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 but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q15. Given below are two statements labelled as Assertion (A) and Reason(R). **(1)**

Assertion (A): Combustion of all organic compounds is an exothermic reaction.
Reason (R): The enthalpies of all elements in their standard state are zero.
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 but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q16. Given below are two statements labelled as Assertion (A) and Reason(R). **(1)**

Assertion (A): BF_3 molecule has zero dipole moment.
Reason (R): F is electronegative and B–F bonds are polar in nature.

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 but 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

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. Suggest a method to separate the constituents from the following mixture: **(2)**
(i) A mixture of ammonium chloride and sodium chloride
(ii) A mixture of plant pigments

Q18. How many moles of methane are required to produce 22g CO_2 (g) after combustion? **(2)**

Q19. Predict the shapes of the following molecules using VSEPR theory. **(2)**
(i) BCl_3
(ii) $SiCl_4$

Q20. The value of Kc for the reaction, $2A \rightleftharpoons B + C$ is 2×10^{-3}. At a given time, the composition of reaction mixture is[A]=[B]=[C]= 3×10^{-4} M. In which direction the reaction will proceed? **(2)**

Q21. For the reaction, $2Cl(g) \rightarrow Cl_2(g)$, what are the signs of ΔH and ΔS ? **(2)**

OR

Predict the entropy change in-
(i) A liquid crystallizes into solid
(ii) Temperature of a crystallize solid raised from OK to 115K

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. (i) Draw the cis- and trans-structures for **hex-2-ene**. **(3)**
(ii) Which isomer will have higher boiling point and why?

Q23. A compound made up of two elements A and B has A= 70 %, B = 30 %. Their relative number of moles in the compound are 1.25 and 1.88. Calculate: **(3)**
(i) Atomic masses of the elements A and B
(ii) Molecular formula of the compound, if its molecular mass is found to be 160

OR

Dinitrogen and dihydrogen react with each other to produce ammonia according to the following chemical equation: $\mathbf{N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)}$
(i) Will any of the two reactants remain unreacted?
(ii) If yes, which one and what would be its mass?

Q24. Among the elements of the second period Li to Ne, pick out the element: **(3)**
(i) with the highest first ionisation energy
(ii) with the highest electronegativity
(iii) with the largest atomic radius

Q25. An atom of an element contains 29 electrons and 35 neutrons. Deduce: **(3)**
(i) number of protons.
(ii) electronic configuration of the element.
(iii) number of unpaired electrons.

Q26. Compare the relative stability of the following species and indicate their magnetic properties: O_2, O_2^+, O_2^- (Superoxide) **(3)**

Q27. Balance the given redox reaction in **acidic medium**.***(Steps of balancing to be shown)*** **(3)**

$$\mathbf{Fe^{2+}_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Cr^{3+}_{(aq)}}$$

Q28. On the basis of Le-Chatelier principle explain how temperature and pressure can be adjusted to increase the yield of ammonia in the following reaction. **(3)**

$$\mathbf{N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)\ \Delta H = -92.38\ kJmol{-}1}$$

What will be the effect of addition of argon to the above reaction mixture at constant volume?

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)**

August Kekule in 1865 proposed the planar structure for benzene having cyclic arrangement of six carbon atoms with alternate single and double bonds and one hydrogen atom attached to each carbon atom. Thus, benzene has a cyclic planar hexagonal structure. Benzene is found to be a resonance hybrid of two Kekule structures. The hybrid structure is represented by inserting a circle in the hexagon. Besides satisfying Huckel's rule benzene is planar and involves delocalization of π-electrons. Hence, benzene is aromatic in nature.

Answer the following questions on the basis of above data:

(i) Name the phenomenon that imparts stability to benzene.
(ii) Name the product formed when ozone is added to benzene in presence of inert solvent.
(iii) Benzene is considered as the resonance hybrid of how many Kekule structures?
(iv) Benzene contains:
(a) 6π electrons
(b) 12π electrons
(c) 16π electrons
(d) 18π electrons

OR

(iv) The Kekule's structure of benzene failed to explain

(a) its unusual stability

(b) preference to substitution over addition reactions

(c) preference to addition over substitution reactions

(d) both (a) and (b)

Q30. **Read the passage given below and answer the following questions:** **(1×4)**

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 $2l$ +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 = 1?

(iii)

(a) Write the name of quantum number which determines the orientation of orbitals.

(b) Pauli exclusion principle helps to calculate the maximum number of electrons that can be accommodated in any…..

(1) orbital

(2) subshell
(3) shell
(4) All of these

OR

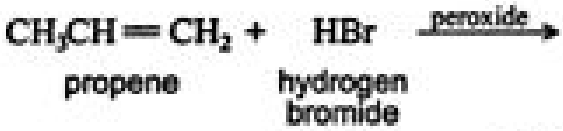
(iii) (b)Match the following:

	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.	$3d_{z^2}$	s.	Double dumb bell	iv.	along x-axis

SECTION E

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

Q31. (i) Complete the following reaction: **(1+1+3)**



(ii) Name the **intermediate(free radical, carbocation or carboanion)** that gets formed in the reaction.

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

OR

(i) What happens when benzene is treated with **(2+1+1+1)**

(a) Br_2 in presence of anhydrous $AlCl_3$

(b) Conc. H_2SO_4 at 330 K.

(ii) How would you convert Acetylene to Benzene**.(Write chemical equation)**

(iii) Name the alkane that cannot be prepared by Wurtz reaction.

(iv) Arrange the following in the increasing order of acidic character.

$HC{\equiv}CH$, CH_3CH_3, $H_2C{=}CH_2$

Q32. (i) What are extensive and intensive properties? Explain with 2 examples. **(2+3=5)**

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

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

$C(graphite) + O_2(g) \rightarrow CO_2(g)$; $\Delta cH^0 = -393$ kJ mol^{-1}

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

OR

(i) Predict the change in internal energy for an isolated system at constant volume.

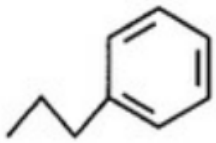
(ii) For the reaction $2A(g) + B(g) \rightarrow 2D(g)$ at 298 K $\Delta U^0 = -10.5$ kJ and $\Delta S^0 = -44.1$ JK^{-1}.Calculate ΔG^0 for the reaction, and predict whether the reaction may occur spontaneously.(Given: R= 8.314×10^{-3} kJ K^{-1} mol^{-1}) **(1+4=5)**

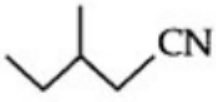
Q33. (i) Write IUPAC names of the products obtained by the ozonolysis of the following compound Pent-2-ene. **(2+3)**

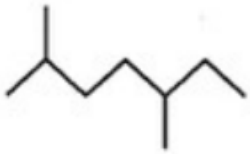
(ii) Draw Newman and Sawhorse projections for the eclipsed and staggered conformations of ethane. Which of these conformation is more stable?

OR

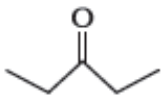
(i) Give the IUPAC names of the following compounds: **(1×5)**

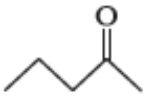
(a) 

(b) 

(c) 

(ii) What type of isomerism is present in the following pairs?





(iii) Deduce the structure of **Cyclohex-2-en-1-ol**.