Vikas Bharati Public School
Sample Paper (Session 2025-26)
Class: XI
Subject: Chemistry

Time: 3 Hrs. **M.M -70**

General Instructions:

(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 very 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.

(Atomic mass of C= 12, H= 1, O=16, N=14, Na=23, Cl=35.5, Mg= 24)

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.

1. Choose the correct statement related to the formation of nitronium ion as an electrophile.

(a) Sulphuric acid acts as an acid and Nitric acid acts as a base.

(b) Sulphuric acid acts as a base and Nitric acid acts as an acid.

(c) Sulphuric acid and Nitric acid both act as acids.

(d) HSO_4^{1-} acts as a conjugate acid and $H_2NO_3^+$ acts as a conjugate base.

2. Ratio of empirical formula mass to molecular formula mass of benzene will be-

(a) 1:6 **(b)** 3:2

(c) 6:1 **(d)** 2:3

3. Two particles X and Y are associated with de Broglie wavelengths 1nm and 4 nm respectively. If mass of X is nine times the mass of Y, Calculate the ratio of kinetic energies of X and Y.

(a) 3:1 **(b)** 16:9

(c) 5:12 **(d)** 9:1

4. Which one of the following arrangements of molecules is correct based on their dipole moments?

(a) $BF_3 > NF_3 > NH_3$ **(b)** $NF_3 > BF_3 > NH_3$

(c) $NH_3 > BF_3 > NF_3$ **(d)** $NH_3 > NF_3 > BF_3$

5. Using VSEPR theory, predict the species which has square pyramidal shape.

(a) $SnCl_2$ **(b)** SF_6

(c) SO_3 **(d)** BrF_5

6.	Calculate the entropy change in JK^{-1} mol^{-1} associated with the fusion of one mole of a solid at its melting point of 27°C. (Given: Enthalpy of fusion is 2930 J mol^{-1})	
(a)	9.77	**(b)** 19.73
(c)	2930	**(d)** 108.5
7.	The formation of O_2^{1-} (g) from O_2 (g) is endothermic even though oxygen achieves a noble gas configuration. This is primarily due to:	
(a)	High electronegativity of oxygen.	**(b)** Small size of oxygen atom.
(c)	Strong electrostatic repulsion between O^{1-} and the incoming electron.	
(d)	High ionization enthalpy of oxygen.	
8.	The maximum value of ($\Delta H - \Delta U$) at 27°C among the following reactions is: -	
(a)	$H_2(g)+Cl_2(g) \longrightarrow 2HCl(g)$	**(b)** $PCl_5(g) \longrightarrow PCl_3(g)+Cl_2(g)$
(c)	N_2O_4 (g) $\longrightarrow 2NO_2(g)$	**(d)** $NH_4HS(s) \longrightarrow NH_3(g)+H_2S(g)$
9.	Find out the correct statement from the following-	
(a)	28 g of CO contains 12g carbon and 16g oxygen	
(b)	One mole of CO reacts completely with half mole of O_2 to form CO_2	
(c)	N_2 and CO has same molar mass	
(d)	All of the above	
10.	For the reaction, $3Br_2 + 6CO_3^{2-} + 3H_2O \longrightarrow 5Br^{1-} + BrO_3^{1-} + 6HCO_3^{1-}$, which of the following statements is true?	
(a)	Carbonate is oxidized	**(b)** Bromine is only oxidized
(c)	Bromine is both oxidized and reduced	**(d)** Bromine is only reduced
11.	Which of the following pairs can form a buffer solution?	
(a)	HCl and NaCl	
(b)	NH_3 and NH_4Cl	
(c)	NaOH and NaCl	
(d)	H_2SO_4 and $KHSO_4$	
12.	Which of the following is an example of meta directing group?	
(a)	-CHO	**(b)** $-NH_2$
(c)	$-OCH_3$	**(d)** -NHR

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) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(B) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(C) Assertion is correct statement but reason is wrong statement.

(D) Assertion is wrong statement but reason is correct statement.

13.	**Assertion (A):** Cyclooctane is cyclic and has conjugated 8π-electron system but it is not an aromatic compound. **Reason (R):** (4n + 2) π electrons rule does not hold good and ring is not planar.
14.	**Assertion (A):** The reaction of H^+ with an alkene is an example of the +E effect. **Reason (R):** In the +E effect, the π-electrons of the multiple bonds are transferred to the atom to which the reagent gets attached.
15.	**Assertion(A):** The sum of q + w is a state function. **Reason(R) :** Work and heat are state functions.
16.	**Assertion(A):** One mole of O_2 gas and one mole of O_3 gas occupy the same volume at STP. **Reason(R):** Avogadro's law states that equal volumes of all gases at the same temperature and pressure contain equal number of molecules.

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.

17.	**(i)**	If the density of a 3M solution of NaCl is 1.25 g/mL, calculate the molality of the solution.
18.	**(i)**	Write the electronic configuration of Cu^{1+} and Cr^{3+}
	(ii)	What does the negative sign in expression for the energy of an electron in a hydrogen atom indicate?
19.	**(i)**	Why does the bond order of O_2^{2-} decrease compared to O_2? What does this imply about the stability and bond length of O_2?
	(ii)	Ethyne molecule is linear. Explain this statement based on hybridization with context of VBT.
20.		2g of Magnesium is burnt with 2g of dioxygen gas in a closed vessel.
	(i)	Identify the limiting reagent and calculate the amount of MgO being formed.
	(ii)	Which reactant is left in excess and by how much?
		OR

OR

(i)	Calculate mole fraction of ethylene glycol ($C_2H_6O_2$) in solution containing 20% of $C_2H_6O_2$ by mass.
(ii)	Which contains more atoms: 1g of Au(s) or 1g of Li(s)? Give reason as well.
21.	Calculate the uncertainty in the velocity of a wagon of mass 4000 kg whose position is known accurately of ±10m.

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.

22. Balance the following redox reactions: -

(i) $H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + H_2O$ (Acidic medium)

(ii) $MnO_4^{1-} + I^{-1} \rightarrow MnO_2 + I_2$ (Basic medium)

23. A compound XY_5 is discovered. All X–Y bond lengths are not equal. What can you infer about:

(i) The shape and hybridization of compound.

(ii) Draw the shape of compound.

(iii) Bond length comparison for axial and equatorial bonds along with the reason.

24. Consider structures A to G given in the table and answer the questions given below-

A	$CH_3CH_2CH_2CH_2OH$
B	$CH_3CH_2CH(OH)CH_3$
C	$CH_3CH_2OCH_2CH_3$
D	$CH_3CH_2COCH_2CH_3$
E	$CH_3COCH_2CH_2CH_3$
F	$CH_3CH_2CH_2CH_2CH_3$
G	$(CH_3)_2CHCH_2CH_3$

(i) Identify the pairs of compounds that represents chain isomerism.

(ii) Which of the listed compounds exhibit position isomerism?

(iii) Identify the pair of compounds that are metamers

25. **(i)** For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, enthalpy change of reaction is -92.4 kJ/mol.

(a) If the temperature is increased, what happens to the spontaneity of the reaction?

(b) Calculate the temperature at which the reaction reaches equilibrium. (Given $\Delta S = -189.3$ J/K mol)

(ii) At the boiling point of a liquid, what is the value of ΔG? Explain.

26. A 0.1 M solution of Formic acid [HCOOH] has Ka=1.77×10^{-4}. Calculate the following-

(i) pH of the solution (Use log 4.12= 0.614)

(ii) Percent dissociation of HCOOH.

27. Calculate the enthalpy of combustion of ethylene.

Given that the enthalpy of hydrogenation of ethylene, combustion of hydrogen and ethane are -135.6 kJ/mol, -286.2kJ/mol and -1560.6 kJ/mol respectively at 298 K.

OR

Consider the reaction given: $OF_2 + H_2O \rightarrow O_2 + 2HF$

Calculate the enthalpy change for the reaction.

(Given bond energies of O−F, O−H, H−F and O=O as 44, 111, 135, and 119 kcal mol^{-1} respectively)

28. 13.8 g of N_2O_4 was placed in a 1L reaction vessel at 400K and allowed to attain equilibrium

$$N_2O_4\ (g) \rightleftharpoons 2NO_2\ (g)$$

The total pressure at equilibrium was found to be 9.15 bar. Calculate Kc, Kp and partial pressure at equilibrium. (Use R= 0.083L bar/Kmol)

SECTION D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

29. An alkyl halide $C_5H_{11}Br$ 'A' reacts with ethanolic KOH to give an alkene 'B', which reacts with Br_2 to give a compound 'C', which on dehydrobromination gives an alkyne 'D'. On treatment with sodium metal in liquid ammonia one mole of 'D' gives one mole of the sodium salt of 'D' and half a mole of hydrogen gas. Complete hydrogenation of 'D' yields a straight chain alkane.

(i) Identify A, B, C and D. Write their respective IUPAC names.

(ii) Draw bond line structures of A, B, C and D.

(iii) Give all the reactions involved from A to D.

30. The following table shows the values of four quantum numbers for the outermost electron of three different elements, A, B, and C:

Element	n	l	m	s
A	3	0	0	+1/2
B	2	1	-1	-1/2
C	3	1	0	+1/2

	(i)	Calculate the maximum number of electrons which can be accommodated in the shell to which element C belongs and determine the block to which element C belong.
	(ii)	Calculate total number of orbitals for the principal quantum number associated with element B and arrange them in an increasing energy order.
	(iii)	Compare Element A and Element C. Which one is likely to be a more reactive metal? Justify your answer using their electron configurations.
		OR
		For Element C if another electron were added to the same orbital, what would be the possible quantum numbers (m and s) for that next electron according to Pauli's exclusion principle? Write the statement of Pauli's exclusion principle.

SECTION E

The following questions are long answer type and carry 5 marks each. Each question has an internal choice and carries 5 (2+2+1) marks each.

31.	**(i)**	Phenol is ortho-para directing. Justify the statement with the help of resonating structures.
	(ii)	Write structural formulae for compounds with following IUPAC names: - (a) 2-chloro 2-phenyl butane. (b) 2-Bromo-1-chloro-4-nitrobenzene
	(iii)	NH_4^+ is not considered as an electrophile. Give reason.
		OR
	(i)	Nitrobenzene is meta directing. Justify the statement with the help of resonating structures.
	(ii)	Write the IUPAC name for the following compounds: - (a) $CH_3CH(OH)CH_2\,COCH_2COOH$ (b) $(HOOC)CH_2CH(COOH)CH_2(COOH)$
	(iii)	Why does SO_3 acts as an electrophile even though it has no positive charge?
32.	**(i)**	How would you explain the fact that first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?
	(ii)	For an element 'Z', the successive ionization enthalpies (IE_1, IE_2, IE_3, IE_4) are 738, 1451, 7733, and 10540 kJ/mol respectively. To which group does this element belong? Justify your answer.
	(iii)	Why is the atomic radius of Neon significantly larger than that of Fluorine, despite Neon having a higher nuclear charge?
		OR

		OR
	(i)	Arrange the following isoelectronic species in increasing order of their ionic radii and justify your answer: Mg^{2+}, O^{2-}, Na^{1+}, F^{1-}
	(ii)	An element 'A' has IE_1 = 496 kJ/mol and IE_2 = 4562 kJ/mol. Is this element more likely to form ACl or ACl_2? Justify.
	(iii)	Why does Fluorine have a less negative electron gain enthalpy than Chlorine, even though Fluorine is more electronegative?
33.	**(i)**	An alkene 'A' contains three C – C, eight C – H σ bonds and one C – C π bond. 'A' on ozonolysis gives two moles of an aldehyde of molar mass 44 u. Identify "A" and write the IUPAC name of 'A'.
	(ii)	Convert the following: - (a) Ethane to butane (b) Benzene to m-nitro chlorobenzene
	(iii)	In the molecule CH_3-CH_2-CH_2-Br, which carbon atom experiences the least inductive effect? Why?
		OR
	(i)	Draw the structures and write IUPAC names of the products obtained by the ozonolysis of 1-Phenylbut-1-ene.
	(ii)	Convert the following: - (a) 1-bromopropane to 2-bromopropane. (b) Benzene to p- nitrotoluene
	(iii)	Identify the hybridized state of each carbon atom in the following compound $CH_2 = CH – CN$. Which carbon atom will be most acidic?