THE INDIAN SCHOOL
HALF-YEARLY EXAMINATION (2024-25)
CHEMISTRY (043)
XI
SET-A

Time allowed: 3 hours   *Maximum Marks:70*   *No. of printed pages:07*

General Instructions:

(i) *All questions are compulsory.*

(ii) *The question paper has five sections and 33 questions.*

(iii) *Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section– E has 3 questions of 5 marks each.*

(iv) *There is no overall choice. However, internal choices have been provided in some questions. The student has to attempt only one of the alternatives in such questions.*

Section-A

Multiple Choice Questions (16 Marks)

Q No.	Question	Marks
1	How many moles of lead (II) chloride will be formed from a reaction between 6.5 g of PbO and 3.2 g HCl? [Given At. mass of Pb=207g mol⁻, O = 16 g mol⁻, Cl = 35.5 g mol⁻] (a) 0.011 mol (b) 0.044 mol (c) 0.029 mol (d) 0.333 mol	1
2	Which of the following structures of ClF_3 is the most stable? (d) All three are of equivalent stability	1
3	The **incorrect** statement among the following is (a) Bonding molecular orbitals possess less energy than combining atomic orbitals. (b) Bonding molecular orbitals are denoted by $\sigma^*\ \pi^*$, etc.	1

	(c) Every electron in bonding molecular orbitals contributes to attraction between atoms. (d) Bonding molecular orbital contributes towards the stability of the molecule.	
4	Which of the following molecules, has a shape similar to the CO_2 molecule? (a) CH_2Cl_2 (c) C_2H_2 (b) $SnCl_2$ (d) NO_2	1
5	In vinyl cyanide $CH_2=CHCN$ the hybrid states of C-1, C-2, and C-3 are respectively (a) sp^3, sp^2, sp (c) sp, sp^2, sp^3 (b) sp, sp^2, sp^2 (d) sp^2, sp^2, sp^3	1
6	Diazomethane is best represented as a resonance hybrid from the linear resonating structure shown as below $CH_2 = \overset{+}{N} = \overset{-}{N} \longleftrightarrow \overset{+}{CH_2} - N = \overset{-}{N} \longleftrightarrow \overset{-}{CH_2} - \overset{+}{N} \equiv N \longleftrightarrow \overset{-}{CH_2} - N = \overset{+}{N}$ I II III IV Which of the following statements is correct? (a) II indicates CH_2N_2 can act as electrophile. (c) IV indicates CH_2N_2 can act as 1,3-dipole. (b) III indicates CH_2N_2 can act as nucleophile. (d) all are correct.	1
7	Which of the following is not a permissible arrangement of electrons in an atom? (a) $n=5, l=3, m=0, s=+1/2$ (c) $n=3, l=2, m=-2, s=-1/2$ (b) $n=3, l=2, m=-3, s=-1/2$ (d) $n=4, l=0\ m=0, s=-1/2$	1
8	Which of the following is a true statement? (a) RCOOH is more stable than $RCOO^-$. (c) RCOOH and $RCOO^-$ do not show resonating structures. (b) $RCOO^-$ is more stable than RCOOH. (d) All the above.	1
9	Arrange the following in an increasing order of stability. $O_2, O_2^{2-}, O_2^+, O_2^-$.	1
10	The pair of elements containing only metalloids in the following is. (a) Na and K (c) Cu and Hg (b) F and Cl (d) Si and Ge	1
11	The statement that is **not** correct for the periodic classification of elements is:	1

	(a) The properties of elements are the periodic function of their atomic numbers. (b) Non-metallic elements are less in number than metallic elements. (c) For transition elements, the 3d-orbitals are filled with electrons after 3p-orbitals and before 4s-orbitals. (d) The first ionization enthalpies of elements generally increase with the increase in atomic number as we go along a period.	
12	The order of the screening effect of electrons of s, p, d and f orbitals of a given shell of an atom in its outer shell electrons is: (a) $s > p > d > f$ (c) $p < d < s > f$ (b $f > d > p > s$ (d) $f > p > s > d$	1
	In the following questions a statement of assertion is followed by a statement of reason. Choose the correct answer from the following choices. (a) Assertion and reason both are correct and the reason is the correct explanation of the assertion. (b) Assertion and reason both are correct statements but the reason is not the correct explanation of the assertion. (c) The assertion is correct but the reason is wrong. (d) The assertion is wrong but the reason is correct.	
13	Assertion (A): Electron gain enthalpy becomes less negative as we go down a group. Reason (R): The size of the atom increases on going down the group and the added electron would be farther from the nucleus.	1
14	Assertion: Orbitals with the same value of l and m_l have the same angular wave function. Reason: The angular wave function doesn't depend upon the value of n.	1
15	Assertion: PH_3 is a stronger nucleophile than NH_3. Reason: PH_3 is a stronger base than NH_3.	1
16	Assertion: 28 g of N_2 has equal volume as 44 g of another gas at the same conditions of temperature and pressure. Reason: The molecular mass of the other gas is 44 g mol^{-1}.	1
	SECTION-B **Very Short Answer Question (10 Marks)**	

17	Write the bond-line formula for the following	
	(a) 3-methylheptane	1
	(b) 2,3-Dimethylhexane	1
	OR	
	Write the structural formula for the following:	
	(a) 2, 3-dibromo-1-phenylpentane	1
	(b) 3-nitrocyclohexene	1
18	Calculate the de-Broglie wavelength of an electron travelling at1% speed of light. [Mass of electron=9.1×10^{-31} kg; velocity of light= 3×10^8 ms^{-1}; h= 6.626×10^{-34} J s]	2
19	(a) H_2O is liquid at room temperature but H_2S is gas, why?	2
	(b) O_2 is paramagnetic but O_2^{2-} (peroxide ion) is diamagnetic. Why?	
20	Elemental analysis of an organic compound containing C, H, N and O and weighing 7.3g was found to contain 3.6g of carbon, 0.7g of H and 1.4g of nitrogen. Calculate the empirical formula of an organic compound. [Given; Atomic Mass (g mol$^-$) C=12; H=1; N=14]	2
21	Draw the Lewis Dot structure of (a) Mg_3N_2 (b) NCl_3.	2

SECTION-C
Short Answer Question (21 Marks)

22	State three characteristics each of 's' and 'p' block elements.	3
	OR	
	Elements A, B, C and D have atomic numbers 12, 19, 29 and 36 respectively. On the basis of electronic configuration, predict the period and group of the periodic table to which each element belongs.	
23	What is the modern periodic law? Give important characteristics of the long form of the modern periodic table.	3
24	(a) How many electrons are present in NO_3^- ?	3
	(b) An atom of an element contains 24 electrons and 28 neutrons. Deduce	
	(i) the number of protons	
	(ii) the electronic configuration of the element.	
25	20g of a sample of $Ba(OH)_2$ is dissolved in 10ml of 0.5 M HCl solution. The excess of HCl solution was titrated with 0.2 M NaOH solution. The volume of NaOH	3

	solution used was 10ml. Calculate the percentage of Ba(OH)$_2$ in the sample. [Given molar mass of Ba (OH)$_2$=171g mol$^-$]	
26	(a) B$_2$ has ten electrons but is paramagnetic. Why?	1
	(b) o-Nitrophenol has less a lower boiling point than p-nitrophenol. Why?	1
	(c) Draw the resonating structures and resonance hybrid of CO$_3$ $^{2-}$.	1
27	Explain the following:	
	(a) Ammonia has a higher boiling point than phosphine.	1
	(b) Helium does not form any chemical compound.	1
	(c) All bonds in PCl$_5$ are not equivalent. Give reason.	1
28	(a) Explain the term hyperconjugation.	1
	(b) Arrange the following species in the increasing order of their stability. CH$_3$-CH$_2$$^+$, (CH$_3$)$_2$ - CH$^+$, (CH$_3$)$_3$-C$^+$, CH$_3$$^+$.	1
	(c) Draw the resonance structure of Buta-1,3-diene	1

SECTION-D

Case Study Questions (8 Marks)

The following questions are case based. Each question carries 4 marks.

Read the passage carefully and answer the questions that follow.

29	Stoichiometry is a section of chemistry that involves calculation based on chemical equations. Chemical equations are governed by laws of chemical combination. Mass of reactants is equal to mass of products. Compound obtained from different methods contain the same elements in the fixed ratio by mass. Mole is a counting unit, equal to 6.022 x 10^{23} particles. One mole is also equal to molar mass expressed in grams. One mole of every gas at STP has volume equal to 22.4 L. The reacting species which are consumed in the reaction completely is called limiting reagent which decides amount of products formed. Concentration of solution is expressed in terms of molarity, molality and mole fraction.	
	(a) Calculate the number of moles of NH$_3$ formed by the reaction of 2 moles of N$_2$ and 2 moles of H$_2$.	1
	N$_2$(g)+3H$_2$(g)$\rightarrow$2NH$_3$(g)	1
	(b) Calculate number of electrons in 18 g of H$_2$O. [At. No. H=1; O=8].	1
	(c) Calculate the molality of 1M NaCl solution having density 1.1g/cm^3. (Molar mass of NaCl = 58.5 g/mol)	1
	(d) Define mole fraction.	

30	The atomic and ionic radii decrease with an increase in atomic number along a period from left to right. Atomic size and ionic size increases down the group. Ionization enthalpy decreases down the group and increases along a period from left to right. It also depends upon the shielding effect and the stability of electronic configuration. Electronegativity decreases down the group but increases along the period.	
	(a) Arrange the elements of the second period in the increasing order of first ionization enthalpy.	1
	(b) Arrange the elements of group 13 in increasing order of atomic size.	1
	(c) Select the amphoteric oxides among the following: NO, BeO, CO_2, Al_2O_3	2
	(d) For an element IE_1 = 738 kJ mol^{-1}, IE_2 = 1450 kJ mol^{-1}, IE_3 =7700 kJ mol^{-1}, IE_4 = 11000 kJ mol^{-1}. Name the main group to which the element belongs. Give reason.	

SECTION-E
Long Answer Question (15 Marks)

31	Attempt any five of the following:	5
	(a) Explain the photoelectric effect and the threshold frequency.	
	(b) What are cathode ray particles?	
	(c) Do the characteristics of cathode rays depend upon the nature of gas present in the cathode ray tube?	
	(d) Explain the emission and absorption spectra of an element.	
	(e) What is black body radiation?	
	(f) How are frequency and wave number related to each other?	
	(g) State the de Broglie principle.	
32	(a) What is the inductive effect? How does it differ from the electromeric effect. Briefly discuss the significance of the inductive effect.	3
	(b) What are functional isomers? Draw the functional isomer of $CH_3CH(OH)-CH_3$.	2
	OR	
	(a) What is metamerism? Give two metamers of the compound C_4H_9OH.	2
	(b) Arrange the following according to the given property.	
	(i) Decreasing order of stability	1

	$CH_3-CH_2^+$, $C_6H_5-CH_2^+$, $(CH_3)_3-C^+$, $CH_2=CH-CH_2^+$	1
	(ii) Increasing order of stability $CH_3-CH_2^-$, CH_3^-, $(CH_3)_3-C^-$, $CH_3-CH^--CH_3$	1
	(iii) Increasing order of stability $C_6H_5-CH^--CH_3$, $C_6H_5-CH_2-CH_2^-$, $C_6H_5-C^--(CH_3)_2$	
33	(a) Give reasons for the following:	
	(i) Covalent bonds are directional bonds while ionic bonds are nondirectional.	1
	(ii) The water molecule has a bent structure whereas the carbon dioxide is a linear molecule.	1
		1
	(iii) Ethyne is a linear molecule.	2
	(b) Draw the shapes of the following molecules on the basis of hybridisation.	
	BCl_3, CO_2.	
	OR	2
	(a) What do you understand by the dipole moment? Discuss two applications of the dipole moment.	3
	(b) Represent diagrammatically the bond moments and the resultant dipole moment in CO_2, NF_3 and $CHCl_3$.	