केन्द्रीय विद्यालय संगठन, कोलकाता संभाग

KENDRIYA VIDYALAYA SANGATHAN, KOLKATA REGION

सत्रांतपरीक्षा / SESSION ENDING EXAMINATION-2025-26

अधिकतम अंक/ MAX. MARKS-70

कक्षा/CLASS- ग्यारहवीं/XI

समय/Time:3Hrs.

विषय/ Subject: **रसायनविज्ञान**/ CHEMISTRY(043)

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.

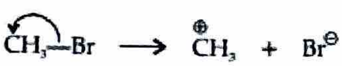
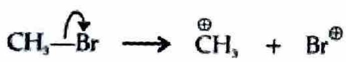
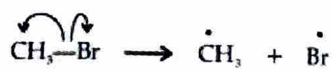
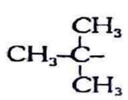
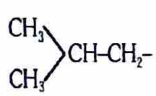
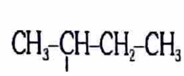
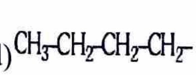
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.

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

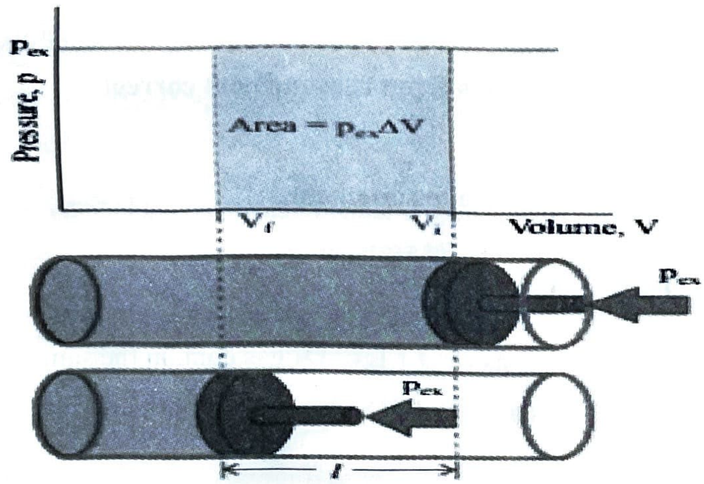
(e) SECTION D consists of 2 case - based questions carrying 4 marks each.

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

Q. No.		**Mark (s)**
	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.	What will be the molarity(M) of pure water? (a) 18M (b)50.0M (c) 55.6M (d)100M	**1**
2.	Find the molecule with the maximum dipole moment (a) CH_4 (b) NH_3 (c) CO_2 (d) NF_3	**1**
3.	In which of the following substances will hydrogen bond be strongest? (a) HCl (b) H_2O (c) HI (d) H_2S	**1**
4.	In the long form of the periodic table, the valence shell electronic configuration of $4s^2 4p^3$ corresponds to the element present in:	**1**

	(a) Group 15 and period 4 (b) Group 13 and period 5 (c) Group 14 and period 5 (d) Group 13 and period 4	
5.	In the reaction $3Br_2 + 6CO_3^{2-} + 3H_2O \rightarrow 5Br^- + BrO_3^- + 6HCO_3^-$ (a) bromine is oxidised and carbonate is reduced (b) bromine is reduced and water is oxidised (c) bromine is neither reduced nor oxidised (d) bromine is both reduced and oxidised	**1**
6.	Oxidation number of P in PO_4^{3-}, of S in SO_4^{2-} and that of Cr in $Cr_2O_7^{2-}$ are respectively:(a) +3, +6 and +5 (b) +5, +3 and +6 (c) +3, +6 and +6 (d) +5, +6 and +6	**1**
7.	The symbol and name according to the IUPAC system for the element with atomic number 120, respectively area) Ubn and unbinilium b)Ubn and unbiunium c) Ubn and unnilbium d) Ubn and unnilium	**1**
8.	Covalent bonds can undergo fission in two differentways. The correct representation involving the heterolytic fission of $CH_3 - Br$ is: (a)  (b)  (c)  (d) 	**1**
9.	What is the correct order of decreasing stability of the following cations? $CH_3-\overset{\oplus}{C}H-CH_3$ **I** $CH_3-\overset{\oplus}{C}H-OCH_3$ **II** $CH_3-\overset{\oplus}{C}H-CH_2-OCH_3$ **III** (a) II > I > III (b) II > III > I (c) III > I > II (d) I > II > III	**1**
10.	The structure of isobutyl group in an organic compound is :- (a)  (b)  (c)  (d)	**1**
11.	The IUPAC name of the products ofozonolysis of $(CH_3)_2C = CH_2$ is : (a)Methanal and Ethanal (b) Methanal and Propanal	**1**

	(c) Propanone and Ethanal (d) Propanone and Methanal	
12.	The correct values ofStandard Free energy change (ΔG°) and Equilibrium Constant (K) values at Equilibrium condition respectively are- a) 0 and 1b) 1 and 0c) 0 and <1d) 0 and >1	1
	In the following questions (Q. No. 13 - 16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choice **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**: Under identical conditions, 1 L of O_2 gas and 1 L of O_3 gas contain the same number of oxygen atom.**Reason**: 1 L of O_2 gas and 1 L of O_3 gas contain the same number of moles under identical conditions.	1
14.	**Assertion** :The ionic radii of O^{2-} and $Mg^{2+}$are same. **Reason** :Both O^{2-} and Mg^{2+} arcisoelectronic species.	1
15.	**Assertion:**It is impossible to determine the exact position and exact momentum of an electron simultaneously. **Reason:**The path or trajectory of an electron in an atom is clearly defined, as proposed by Bohr's model.	1
16.	**Assertion** : U is a state function. **Reason** :T is an intensive property.	1
	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.	Permanganate ion (MnO_4^-) reacts with sulphur dioxide gas in an acidic medium to produce Mn^{2+} and hydrogen sulphate ion. (Balance by ion electron method)	**2**
18.	a) Predict the change in internal energy for an isolated system at constant volume. b) Carefully observe the following picture and answer the following question.  What does the shaded area (in the graph drawn above) represent in the figure?	**1+1**
18 **OR**	Find out the internal energy change for the reaction $A(l) \longrightarrow A(g)$ at 373K. Heat of vaporisation is 40.66 kJ/mol and R= 8.3 J $mol^{-1}K^{-1}$.	**2**
19.	(a)What is mass percent silicon in 100 g of sodium silicate, Na_2SiO_3? [Given: Atomic masses of Na = 23u, Si = 28u, O = 16u]. (b) How many molecules of Sulphur (Atomic. Mass- 32) are present in 32g of Sulphur(S_8).	**1+1**
20.	Applying Molecular Orbital theory to compare the stability of the following pairs a)O_2 ,$O_2^+$and b) N_2 , N_2^+	**1+1**

21.	Which of the following shows geometrical isomerism? i)CHCl=CHCl, ii) $CH_2=CCl_2$, iii) $CCl_2=CHCl$ give the structures of its cis- and trans- forms.	1+1
	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.	A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formula?	3
23.	a) Write the electronic configuration and count the number of unpaired electron present in Cr^+ion in its lowest energy state. [Cr is placed in between V and Mn in modern periodic table.] b) State Pauli's exclusion principle.	1+1 1
24.	a)Why the electron gain enthalpy of the elemental fluorine is less negative than the elemental chlorine? b)Among the given elements B, Al, C and Siwhichelement has the highest first ionisation enthalpy(ΔiH_1)? c)Explain why Be has higher ΔiH_1than B ?	1x3
24 OR	a)Explain why : O has lower ΔiH1 than N and F? b) Nitrogen possesses the positive electron gain enthalpy, whereas the oxygen possesses the negative. But oxygen has lower first ionisation enthalpy than nitrogen. Explain.	1+2
25.	a)Explain following- All the bonds in a molecule of PCl_5 are not equivalent. b) Give one example of molecule having five electron pairs on central atom in which 3 are bp and 2 are lp. c) State the hybridization & shape of SF_4molecule.	1 1 1
26.	a)What is the effect of increasing pressure and addition of catalyst for the reaction given below: $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ b) For the equilibrium reaction $NO(g) + O_3(g) \rightleftharpoons NO_2(g) + O_2(g)$, $K_p = 6.3\times 10^{14}$ at 1000 K. what is the Kp for reverse reaction?	1 1 1

	c) If reaction quotient (Q_c) is less than K_c , the equilibrium tends to shift in which direction.	
27.	a) Write I.U.P.A.C. Name of - $(CH3)_3$ C – OH b) classify the following as electrophile or nucleophile: $AlCl_3$, NH_3 c)Write the resonance structures of aniline and identify the most stable one.	**1** **1** **1**
28.	a) Suggest a route for the preparation of nitrobenzene starting from acetylene? b) Name an ortho and para directing deactivating group. c) Why does benzene undergo electrophilic substitution reactions easily and nucleophilic substitution reactions with difficulty?	**1** **1** **1**
	SECTION D **The following questions are case-based questions and carries 4 marks each. Read the passage carefully answer the questions that follow:**	
29.	Bronsted acids are proton donors whereas Bronsted bases are proton acceptors. Acids on donating proton form conjugate bases whereas bases form conjugate acids after accepting proton. Buffer solution is a solution whose pH does not change. By adding small amount of H^+ or OH^- .The decrease in concentration of the ion by adding another ion as common ion is called common ion effect. Ksp (solubility product) is product of molar concentrations of ions raised to power no. of ions per formula of ions per formula of the compound in sparingly soluble salt. Precipitation occurs only if ionic product exceeds solubility product. Solubility of salt decreases in presence of common ion. Kw the ionic product of water is $1x10^{-14}$ at 298 k. Kw increases with increase in temperature. a) What will be the conjugate base of $\mathbf{HCO_3^-}$ and what will be the conjugate acid ofNH_3? b) The conc. of H_3O^+ is 4x 10^{-4} . Find its pH. [log2= 0.301] c) Give an example of basic buffer solution. d) A monobasic weak acid solution has a molarity of 0.005 M and pH of 5. What is its percentage ionization in this solution? (a) 2.0 (b) 0.2 (c) 0.5 (d) 0.25	**1** **1** **1** **1**
30.	In organic molecules, the covalent bond may acquire polar character due to	**4**

	displacement of electrons. The displacement of electrons may take place due to difference in electronegativity of the two atoms involved in the covalent bond (Inductive effect), or due to presence of attacking agent in the vicinity of a multiple bond (Electromeric effect), or due to delocalisation of electrons through resonance (Resonance effect), or a special kind of resonance in which delocalisation of electrons takes place through overlap between sigma bond orbital and pi bond orbital. a) Electronegativity of carbon atoms depends upon their state of hybridisation. In which of the following compounds, the carbon marked with asterisk is most electronegative? (i) $CH_3 - CH_2 - {}^*CH_2 - CH_3$(ii) $CH_3 - {}^*CH = CH - CH_3$ (iii) $CH_3 - CH_2 - C \equiv {}^*CH$ (iv) $CH_3 - CH_2 - CH = {}^*CH_2$ b)Calculate the total no. of Sigma (σ) andPi (π) bond present in Pent-1-en-4-yne. c)Which of the following compound(s) contain all the carbon atoms in the same hybridisation state? $H—C \equiv C—C \equiv C—H, CH_3—C \equiv C—CH_3,\ CH_2 = C = CH_2, CH_2 = CH—CH = CH_2$ d)Why Organic compound is fused with Na metal in detection of N, S, halogens? OR, how is chloroform (Boiling point 334 K) and aniline (b.pt. 457 K) are separated?	
	SECTION E **The following questions are long answer type and carry 5 marks each.**	
31.	a) Draw the shapes of d-orbitals. b)Which of the following sets of quantum number are not possible (give reason) i) n = 0 ,l = 0, m =0,ms =+ 1/2 . ii) n=1, l =0,m =0,ms =-1/ 2 . ? c) Calculate the de-Broglie wave lengths of an electron travelling with a speed of 10% of light. **OR** a) Calculate the total number of angular nodes and radial nodes present in 3p orbital. b) An atomic orbital has n=2. What are the possible values of l and m? c) What is the lowest value of n that allow f orbitals to exist? d) Calculate the wavelength of an electron moving with a velocity of 2.05 x 10^5 m/s	2 1 2 1 1 1 2

32.	a) Calculate the standard enthalpy of formation of $CH_3OH(l)$ from the following data: $CH_3OH\ (l) + 3/2\ O_2\ (g) \rightarrow CO_2\ (g) + 2H_2O\ (l);\ \Delta_c H^{\theta} = -726\ kJ\ mol^{-1}$ $C\ (g) + O_2\ (g) \rightarrow CO_2\ (g);\ \Delta_f H^{\theta} = -393\ kJ\ mol^{-1}$ $H_2(g) + 1/2\ O_2\ (g) \rightarrow H_2O\ (l);\ \Delta_f H^{O} - 286\ kJ\ mol^{-1}$	3
	b) Justify the following statements: (i) An endothermic reaction is always thermodynamically spontaneous. (ii) The entropy always increases on going from liquid to vapour state at any temperature T.	2
	OR	
	a) For the reaction at 298 K, $2A + B \rightarrow C$, $\Delta H = 400\ kJ\ mol^{-1}$ and $\Delta S = 0.2\ kJ\ K^{-1}\ mol^{-1}$ At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range.	2
	b) For the reaction $2A(g) + B(g) \rightarrow 2D(g)$ $\Delta U^{0} = -10.5$ kJ and $\Delta S^{0} = -44.1\ JK^{-1}$. Calculate ΔG^{0} for the reaction, and predict whether the reaction may occur spontaneously.	2
	c) The value of $\Delta_f H^{0}$ for NH_3 is – 91.8 $kJ\ mol^{-1}$. Calculate enthalpy change for the following reaction : $2NH_3\ (g) \rightarrow N_2\ (g) + 3H_2\ (g)$	1
33.	a) Write the reaction of the following: i) Decarboxylation reaction ii) Friedel Craft's acylation	2
	b) Complete the following reactions by writing the major product(s): i) $CH_3 - CH = CH_2 + HBr(peroxide) \rightarrow$ ii) $CH_3CH_2CH(Br)CH_3 + KOH\ (alc.) \rightarrow$	2
	c)Convert Benzene to p-Nitro chlorobenzene.	1
	OR	
	a) An alkane C_8H_{18} is obtained as the only product on subjecting a primary alkyl halide to Wurtz reaction. On monobromination this alkane yields a single isomer of a tertiary bromide. Write the structure of alkane and the tertiary bromide.	2
	b) Complete the following reactions by writing the major product(s): i)$CH_3 - CH = CH_2 + HBr \rightarrow$ ii) $CH_3CH_2CH(OH)CH_3$ + Conce. H_2SO_4 + heat(443K) $\rightarrow$	2
	c) ConvertPhenol to Chlorobenzene.	1