Chemistry (Theory)

Time Allowed: 3 hours **Maximum Marks: 70**

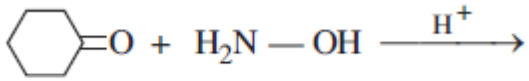
General Instructions:

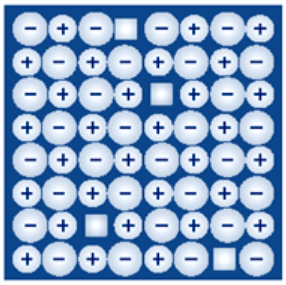
(i) **All** *questions are compulsory.*
(ii) *Questions number 1 to* **5** *are very short answer questions* **and** *carry 1 mark each.*
(iii) *Questions number 6 to 10 are short answer questions and carry 2 marks each.*
(iv) *Questions number 11 to* 22 *are also short answer questions and carry* 3 *marks each.*
(v) *Question number* 23 *is a value based question and carry* 4 *marks.*
(vi) *Questions number* 24 *to* 26 *are long answer questions and carry* **5** *marks each.*
(vii) *Use log tables, if necessary. Use of calculators is not allowed*

1.	$(CH_3)_3C—CHO$ does not undergo aldol condensation. Comment.	1
2.	In the process of wine making, ripened grapes are crushed so that sugar and enzyme should come in contact with each other and fermentation should start. What will happen if anaerobic conditions are not maintained during this process?	1
3.	A coordination compound with molecular formula $CrCl_3.4H_2O$ precipitates one mole of AgCl with $AgNO_3$ solution. Its molar conductivity is found to be equivalent to two ions. What is the structural formula and name of the compound?	1
4.	How is Brownian movement responsible for the stability of sols?	1
5.	In the Arrhenius equation, what does the factor $e^{-E_a/RT}$ corresponds to?	1
6.	(i) Allyl cholride can be distinguished from Vinyl chloride by NaOH and silver nitrate test. Comment. (ii) Alkyl halide reacts with Lithium aluminium hydride to give alkane. Name the attacking reagent which will bring out this change.	2
7.	Which of the following solutions has higher freezing point? 0.05 M $Al_2(SO_4)_3$, 0.1 M $K_3[Fe(CN)_6]$ Justify.	2
8.	Calculate the emf of the following cell at 298 K : Cr(s) / Cr^{3+} (0.1M) // Fe^{2+} (0.01M) / Fe(s) [Given : E^0_{Cell} = + 0.30 V] OR The conductivity of 10^{-3} mol /L acetic acid at 25^0C is 4.1 x 10^{-5} S cm^{-1}. Calculate its degree of dissociation, if $\wedge^0_m$ for acetic acid at 25^0C is 390.5 S cm^2 mol^{-1}.	2
9.	What happens when:	2

	(i) Orthophosphorus acid is heated? (ii) XeF_6 undergoes complete hydrolysis?	
10.	Identify the following: (i) Oxoanion of chromium which is stable in acidic medium. (ii) The lanthanoid element that exhibits +4 oxidation state. (iii)	2
11.	Give the IUPAC name of the product formed when: (i) 2-Methyl-1-bromopropane is treated with sodium in the presence of dry ether. (ii) 1- Methyl cyclohexene is treated with HI. (iii) Chloroethane is treated with silver nitrite.	3
12.	The freezing point of benzene decreases by 2.12 K when 2.5 g of benzoic acid (C_6H_5COOH) is dissolved in 25 g of benzene. If benzoic acid forms a dimer in benzene, calculate the van't Hoff factor and the percentage association of benzoic acid. (K_f for benzene = 5.12 K kg mol^{-1})	3
13.	Explain the following behaviours: (i) Alcohols are more soluble in water than the hydrocarbons of comparable molecular masses. (ii) Ortho-nitrophenol is more acidic than ortho-methoxyphenol. (iii) Cumene is a better starting material for the preparation of phenol.	3
14.	The rate constant for a first order reaction is 60 s^{-1}. How much time will it take to reduce 1g of the reactant to 0.0625 g?	3
15.	(i) Solutions of two electrolytes 'A' and 'B' are diluted. The limiting molar conductivity of 'B' increases 1.5 times while that of 'A' increases 25times. Which of the two is a strong electrolyte? Justify your answer. (ii) The products of electrolysis of aqueous NaCl at the respective electrodes are : Cathode : H_2 Anode : Cl_2 and not O_2. Explain.	3
16.	(i) Write the expression for Freundlich's equation to describe the behaviour of adsorption from solution. (ii) What causes charge on sol particles? (iii) Name the promoter used in the Haber's process for the manufacture of ammonia.	3
17.	An organic aromatic compound 'A' with the molecular formula C_6H_7N is sparingly soluble in water. 'A' on treatment with dil HCl gives a water soluble compound 'B'. 'A' also reacts with chloroform in presence of alcoholic KOH to form an obnoxious smelling compound 'C'. 'A' reacts with benzene sulphonyl chloride to form an alkali soluble compound 'D'.'A' reacts with	3

	$NaNO_2$ and HCl to form a compound 'E' which on reaction with phenol forms an orange red dye 'F'. Elucidate the structures of the organic compounds from 'A' to 'F'.	
18.	(i) Which vitamin deficiency causes rickets? (ii) Name the base that is found in nucleotide of RNA only. (iii) Glucose on reaction with acetic acid gives glucose penta acetate. What does it suggest about the structure of glucose?	3
19.	Name the type of reaction involved in the formation of the following polymers from their respective monomers (i) PVC. (ii) Nylon6. (iii) PHBV.	3
20.	Describe the role of (i) NaCN in the extraction of gold from its ore. (ii) Cryolite in the extraction of aluminium from pure alumina. (iii) CO in the purification of Nickel	3
21.	A metal ion M^{n+} having d^4 valence electronic configuration combines with three bidentate ligands to form a complex compound. Assuming $\Delta_o > P$: (i) Write the electronic configuration of d^4 ion. (ii) What type of hybridisation will M^{n+} ion has? (iii) Name the type of isomerism exhibited by this complex.	3
22.	The magnetic moments of few transition metal ions are given below: **Metal ion** **Magnetic moment(BM)** Sc^{3+} 0.00 Cr^{2+} 4.90 Ni^{2+} 2.84 Ti^{3+} 1.73 (at no. Sc = 21, Ti =22, Cr = 24, Ni = 28) Which of the given metal ions : (i) has the maximum number of unpaired electrons? (ii) forms colourless aqueous solution? (iii) exhibits the most stable +3 oxidation state? **OR** Consider the standard electrode potential values (M^{2+} / M) of the elements of the first transition series. Ti V Cr Mn Fe Co Ni Cu Zn -1.63 -1.18 -0.90 -1.18 -0.44 -0.28 -0.25 +0.34 -0.76 Explain: (i) E^o value for copper is positive. (ii) E^o value of Mn is more negative as expected from the trend.	3

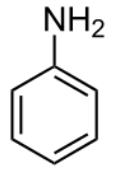
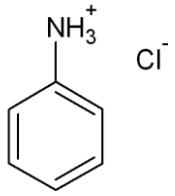
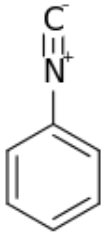
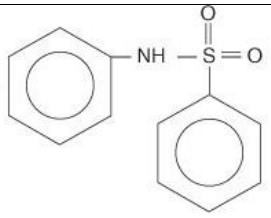
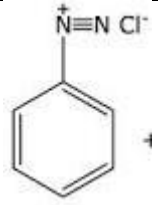
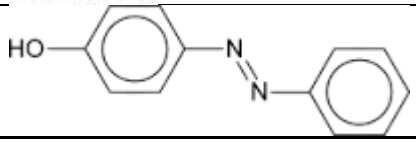
	(iii) Cr^{2+} is a stronger reducing agent than Fe^{2+}.	
23.	Ashwin observed that his friend Shubham was staying aloof, not playing with friends and becoming easily irritable for some weeks. Ashwin told his teacher about this, who, in turn, called Shubham's parents and advised them to consult a doctor. Doctor after examining Shubham prescribed antidepressant drugs for him. After reading the above passage, answer the following questions: i) Name two antidepressant drugs. ii) Mention the values shown by Ashwin. iii) How should Shubham's family help him other than providing medicine? iv) What is the scientific explanation for the feeling of depression?	4
24.	(a) Arrange the following in the order of property indicated against each set: (i) F_2, Cl_2, Br_2, I_2 (increasing bond dissociation enthalpy) (ii) H_2O, H_2S, H_2Se, H_2Te (increasing acidic character) (b) A colourless gas 'A' with a pungent odour is highly soluble in water and its aqueous solution is weakly basic. As a weak base it precipitates the hydroxides of many metals from their salt solution. Gas 'A' finds application in detection of metal ions. It gives a deep blue colouration with copper ions. Identify the gas 'A' and write the chemical equations involved in the following: (i) Gas 'A' with copper ions (ii) Solution of gas 'A' with $ZnSO_4$ solution. **OR** **Answer the following questions** (a) Write the formula of the neutral molecule which is isoelectronic with ClO^-. (b) Draw the shape of $H_2S_2O_7$. (c) Nitric acid forms an oxide of nitrogen on reaction with P_4.Write the formula of the stable molecule formed when this oxide undergoes dimerisation. (d) Bleaching action of chlorine is permanent. Justify. (e) Write the disproportionation reaction of that oxoacid of nitrogen in which nitrogen is in +3 oxidation state.	5
25.	Write the products of the following reactions: (*i*)  (*ii*) $2C_6H_5CHO + \text{conc. } NaOH \longrightarrow$ (*iii*) $CH_3COOH \xrightarrow{Cl_2/P}$ (*b*) Give simple chemical tests to distinguish between the following pairs of	5

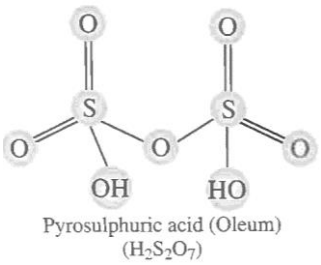
	compounds: (*i*) Benzaldehyde and Benzoic acid (*ii*) Propanal and Propanone OR (*a*) Account for the following: (*i*) CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN. (*ii*) 2-Fluorobutanoic acid is a stronger acid than 3-Fluorobutanoic acid. (*b*) Write the chemical equations to illustrate the following name reactions: (*i*) Etard reaction. (ii) Rosenmund's reaction. (c) Give the mechanism of cyanohydrin formation when carbonyl compounds react with HCN in the presence of alkali.	
26.	(i) Following is the schematic alignment of magnetic moments: Identify the type of magnetism. What happens when these substances are heated? (ii) If the radius of the octahedral void is 'r' and radius of the atoms in close packing is 'R'. What is the relation between 'r' and 'R'? (iii) Tungsten crystallizes in body centred cubic unit cell. If the edge of the unit cell is 316.5 pm. What is the radius of tungsten atom? **OR** **(i)** Identify the type of defect shown in the following figure:  What type of substances show this defect? (ii) A metal crystallizes in a body centred cubic structure. If 'a' is the edge length of its unit cell, 'r' is the radius of the sphere. What is the relationship between 'r' and 'a'? (iii) An element with molar mass 63 g / mol forms a cubic unit cell with edge length of 360.8 pm. If its density is 8.92 g/ cm^3. What is the nature of the cubic unit cell?	5

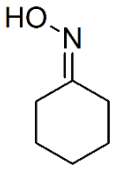
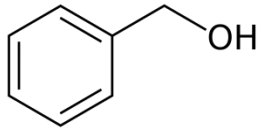
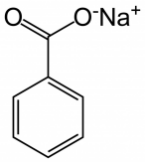
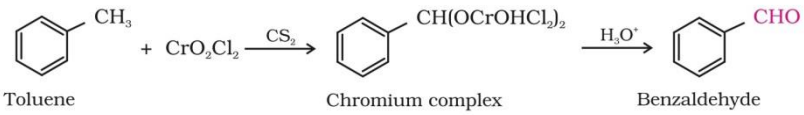
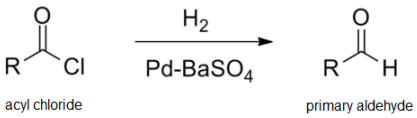
MARKING SCHEME

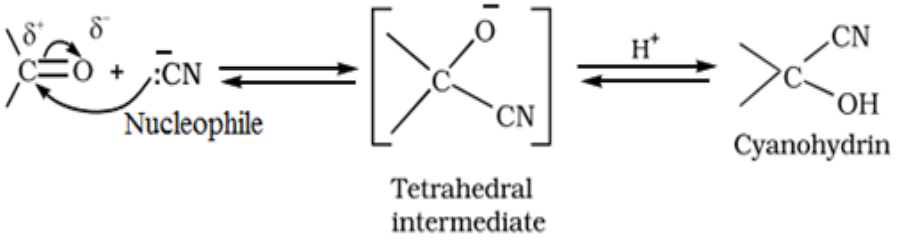
1	No α H is present	1
2	Ethanol will be converted into ethanoic acid.	1
3	$[Cr(H_2O)_4Cl_2]Cl$ Tetraaquadichloridochromium(III) chloride	½ + ½
4	The Brownian movement has a stirring effect, which does not allow the particles to settle.	1
5	$e^{-E_a/RT}$ Corresponds to the fraction of molecules that have kinetic energy greater than E_a.	1
6	(i) Vinyl chloride does not respond to NaOH and silver nitrate test because of partial double bond character due to resonance. (ii) Hydride ion / H^-	1 1
7	0.05 M $Al_2(SO_4)_3$ has higher freezing point. 0.05 M $Al_2(SO_4)_3$: i = 5, $\Delta T_f \propto$ No of particles ; ΔT_f = i x concentration = 5 x 0.05 = 0.25 moles of ions 0.1 M $K_3[Fe(CN)_6]$: i = 4, = 4 x 0.1 = 0.4 moles of ions	1 ½ ½
8	$2Cr(s) + 3Fe^{2+}(aq.) \rightarrow 3Fe(s) + 2Cr^{3+}(aq.)$ n = 6 $E_{Cell} = E^0_{Cell} - \frac{2.303RT}{nF}\log\frac{[Cr^{3+}]^2}{[Fe^{2+}]^3}$ $E_{Cell} = 0.30 - \frac{0.059}{6}\log\frac{[10^{-1}]^2}{[10^{-2}]^3}$ E_{Cell} = 0.26 V OR $\wedge_m = \frac{1000\kappa}{C}$ $\wedge_m = \frac{1000 x 4.1 x 10^{-5}}{10^{-3}}$ = 41 S cm^2 mol^{-1} $\alpha = \frac{\wedge_m^c}{\wedge_m^0}$ $\alpha = \frac{41}{390.5}$ = 0.105	½ ½ ½ ½ ½ ½ ½ ½
9	(i) Orthophosphorus acid on heating disproportionates to give orthophosphoric acid and phosphine gas.	1

	$4H_3PO_3 \xrightarrow{heat} PH_3 + 3H_3PO_4$ (ii) When XeF_6 undrgoes complete hydrolysis,it forms XeO_3. $XeF_6 + 3H_2O \rightarrow 6HF + XeO_3$	1
10	(i) $Cr_2O_7^{2-}$ (ii) Cerium	1 1
11	(i) 2,5-Dimethylhexane. (ii)1-Methyl-1-iodocyclohexane. (iii) Nitroethane.	1+1+1
12	$\Delta T_f = i K_f m$ $2.12 = i \frac{5.12x\,2.5\,x1000}{122\ x25}$ i= 0.505 for association $i = 1 - \frac{\alpha}{2}$ α = 0.99 Percentage association of benzoic acid is 99.0%	½ 1 ½ ½ ½
13	(i) Because of H-bond formation between alcohol and water molecule. (ii) Nitro being the electron withdrawing group stabilises the phenoxide ion. (iii) side product formed in this reaction is acetone which is another important organic compound.	1+1+1
14	$t = \frac{2.303}{k} \log \frac{[R]_0}{[R]}$ $t = \frac{2.303}{60} \log \frac{1}{0.0625}$ t = 0.0462 s	1 1 1
15	(i) 'B' is a strong electrolyte. A strong electrolyte is already dissociated into ions, but on dilution interionic forces are overcome, ions are free to move. So there is slight increase in molar conductivity on dilution. (ii) On anode water should get oxidised in preference to Cl^-, but due to overvoltage/ overpotential Cl^- is oxidised in preference to water.	1 1 1
16	(i) $\frac{x}{m} = kC^{1/n}$ (ii) The charge on the sol particles is due to • Electron capture by sol particles during electrodispersion. • Preferential adsorption of ions from solution. • Formulation of electrical double layer. (any one reason) (iii) Molybdenum acts as a promoter for iron.	1 1 1

17	<table><tr><td>A</td><td>  </td></tr><tr><td>B</td><td>  </td></tr><tr><td>C</td><td>  </td></tr><tr><td>D</td><td>  </td></tr><tr><td>E</td><td>  </td></tr><tr><td>F</td><td>  </td></tr></table>	½ each
18	(i) Vitamin D. (ii) Uracil. (iii) 5 OH groups are present.	1 1 1
19	(i) Addition (ii) Condensation/Hydrolysis (iii) Condensation	1 1 1
20	(i) Gold is leached with a dilute solution of NaCN in the presence of air (ii) Cryolite lowers the high melting point of alumina and makes it a good conductor of electricity. (iii) CO forms a volatile complex with metal Nickel which is further decomposed to give pure Ni metal.	1 1 1

21	(i) $t_{2g}^4 e_g^0$ (ii) sp^3d^2 (iii) optical isomerism	1 1 1
22	(i) Cr^{2+} (ii) Sc^{3+} (iii) Sc^{3+} **OR** (i) The high energy to transform Cu(s) to Cu^{2+}(aq) is not balanced by its hydration enthalpy. (ii) Mn^{2+} has d^5 configuration(stable half-filled configuration) (iii) d^4 to d^3 occurs in case of Cr^{2+} to Cr^{3+}. (More stable t_{2g}^3) while it changes from d^6 to d^5 in case of Fe^{2+} to Fe^{3+}.	1 1 1
23	(i) Equanil, Iproniazid, phenelzine(any two) (ii) empathetic, caring, sensitive or any two values can be given. (iii)They should talk to him, be a patient listener, can discuss the matter with the psychologist. (iv)If the level of noradrenaline is low, then the signal sending activity becomes low and the person suffers from depression.	½+½ ½ +½ 1 1
24	(a) (i) $I_2 < F_2 < Br_2 < Cl_2$ (ii) $H_2O < H_2S < H_2Se < H_2Te$ (b) Gas A is Ammonia / NH_3 (i) $Cu^{2+}(aq) + 4\ NH_3\ (aq) \rightleftharpoons [Cu(NH_3)_4]^{2+}\ (aq)$ (ii) $ZnSO_4(aq) + 2NH_4OH(aq) \rightarrow Zn(OH)_2(s) + (NH_4)_2SO_4(aq)$ **OR** (a) **ClF** (b)  Pyrosulphuric acid (Oleum) ($H_2S_2O_7$) (c) N_2O_4 (d) Bleaching action of chlorine is due to oxidation. $Cl_2 + H_2O \rightarrow 2HCl + [O]$ (e) $3HNO_2 \rightarrow HNO_3 + H_2O + 2NO$	1 1 1 1 1 1 1 1 1 ½ ½ 1

25	(i) 	1
	(ii)  + 	½ +½
	(iii) Cl-CH_2-COOH	1
	B(I) $NaHCO_3$ test.	1
	(ii) Iodoform test./Fehling's Test/ Tollen's Tesst	1
	OR	
	A (i) steric and electronic factor. (ii) Inductive effect decreases with distance and hence the conjugate base of 2-Fluorobutanoic acid is more stable.	½+½1
	b) i) 	1
	(ii) 	1
	(c)	1

	$HCN + OH^- \rightleftharpoons :\bar{C}N + H_2O$  Tetrahedral intermediate	
26	(i) Ferrimagnetism. These substances lose ferrimagnetism on heating and become paramagnetic. (ii) r = 0.414 R (iii) $r = \frac{\sqrt{3}}{4}a$ $r = \frac{\sqrt{3}}{4}\ x\ 316.5$ r = 136.88 pm OR (i) Schottky defect It is shown by ionic substances in which the cation and anion are of almost similar sizes. (ii) $r = \frac{\sqrt{3}}{4}a$ (iii) $\rho = \frac{zM}{a^3 N_A}$ $8.92 = \frac{z\ x\ 63}{(3.608\,x\,10^{-8})^3\ 6.022\,x10^{23}}$ z = 4 So it is face centred cubic lattice	1 1 1 1 ½ ½ 1 1 1 ½ 1 ½

CBSE SAMPLE PAPER CHEMISTRY-2017-18

MM: 70 **BLUE PRINT** **TIME 3 HRS**

No	CHAPTER	VSA	SA-1	SA-11	VBQ	LA	TOTAL
1	SOLID STATE					1(5) (U)	9(23)
2	SOLUTIONS		1(2) (U)	1(3) (A)			
3	ELECTROCHEMISTRY		1(2) (A)	1(3) (U)			
4	CHEMICAL KINETICS	1(1) (R)		1(3) (A)			
5	SURFACE CHEMISTRY	1(1) (R)		1(3) (R)			
6	EXTRACTION OF METALS			1(3) (U)			7(19)
7	p-BLOCK		1(2) (U)			1(5) (A)	
8	d AND f BLOCK ELEMENTS		1(2) (R)	1(3) (E&MD)			
9	COORDINATION CHEMISTRY	1(1) Hots		1(3) Hots			
10	HALOALKANES AND HALOARENES		1(2) (A)	1(3) (A)			10(28)
11	ALCOHOLS, PHENOLS AND ETHERS	1(1) (E&MD)		1(3) (U)			
12	ALDEHYDES, KETONES AND CARBOXYLIC ACID	1(1)Hots				1(5) (E&MD)	
13	ORGANIC COMPOUNDS COTAINING NITROGEN			1(3) (A)			
14	BIOMOLECULES			1(3) (U)			
15	POLYMERS			1(3) (E&MD)			
16	CHEMISTRY IN EVERY DAY LIFE				1(4) (E&MD)		
	Total						26(70)

R-Recall; U-Understanding; A-Application, Hots- Higher Order Thinking Skills-;
E&MD-Evaluation and multidisciplinary