

Enrolment No:



Course: CHEM-1001 (Chemistry) (End Semester Examination)

Programme: B.Tech. . APE- UP, Civil, Mechanical, Mechatronics, ADE, GSE, GIE, Mining, FSE, CS-CCVT, CS-Big Data, CS-O&G, CS-IOT, CS-MFT, CS-OSS, CS-MC, CS-GG

Semester: II (2017-18)

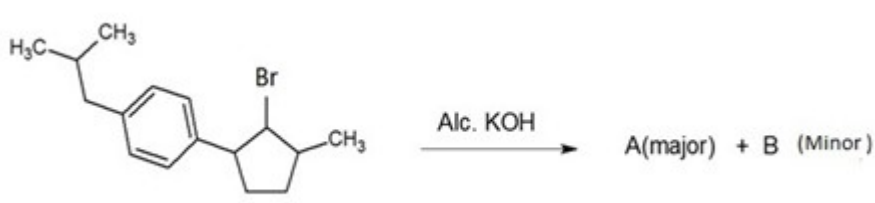
Time: 03 hrs.

Max. Marks:100

Instructions: Read all the below mentioned instructions carefully and follow them strictly:

- 1) Write your **Enrolment No.** at the top of the question paper
- 2) Do not write anything else on the question paper except your roll number
- 3) **ATTEMPT ALL THE PARTS OF A QUESTION AT ONE PLACE ONLY**
- 4) Internal choice is given for question number 12
- 5) CO1, CO2, CO3, CO4 & CO5 mentioned in the last column stand for course outcomes and are for official use only

Section - A (Attempt all FIVE Questions)

1.	At 291K, the conductivity of saturated solution of $ZnCl_2$ is $3.86 \times 10^5 Scm^{-1}$ and that of water used for solution is $0.15 \times 10^5 Scm^{-1}$. The ionic conductances of Zn^{+2} and Cl^- at infinite dilution are 51.0 and $47.0 Scm^2 eq^{-1}$, respectively. Calculate the solubility of $ZnCl_2$ in solution.	[4]	CO3
2.	Complete the following reaction with mechanism: 	[4]	CO2
3.	Solutions of two electrolytes 'C' and 'D' are diluted. The molar conductance of D increases 2.0 times while that of C increases 30 times. Which of the two is a stronger electrolyte? Justify your answer.	[4]	CO2
4.	In the following: $(CH_3)_2CHI + OH^- \xrightarrow{CH_3COCH_3} (CH_3)_2CHOH$ $(CH_3)_2CHI + OH^- \xrightarrow{H_2O} (CH_3)_2CHOH$ specify the mode of reaction in both the cases along with proper justification.	[4]	CO2
5.	Classify the polymers on the basis of chemical structure (type of monomeric unit used).	[4]	CO1

SECTION - B (Attempt all FIVE Questions)

6.	Calculate the bond energy of $C \equiv C$ in C_2H_2 from the following data:	[8]	CO3
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	(i) $C_2H_2(g) + 5/2 O_2(g) \rightarrow 2CO_2(g) + H_2O$; $\Delta H = -310 \text{ Kcal}$ (ii) $C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta H = -94 \text{ Kcal}$ (iii) $H_2(g) + 1/2 O_2(g) \rightarrow H_2O(g)$; $\Delta H = -68 \text{ Kcal}$ Bond energy of C- H bonds = 99 Kcal Heat of sublimation of C = 171 Kcal and bond energy of H-H = 52 Kcal		
7.	i. The K_p for the reaction $N_2O_4 \leftrightarrow 2NO_2$ is 640 mm at 775K. Calculate the percentage dissociation of N_2O_4 at equilibrium pressure of 160 mm. ii. For a homogeneous gaseous reaction, $A \rightarrow B + C + D$, the initial pressure was P_0 while pressure after time 't' was P. Derive an expression for rate constant K in terms of P_0 , P and t, assuming it to be a first order reaction.	[8]	CO3
8.	A solution of $CuSO_4$ was electrolyzed between copper electrodes. Before electrolysis, 10.09g of the solution contained 0.01790g of $CuSO_4$. After the experiment, 20.12g of the anodic solution contained 0.06230g of $CuSO_4$. At the same time, 0.011894g of copper was deposited in the copper coulometer placed in series. Calculate the transport numbers of Cu^{2+} and SO_4^{2-} ions. (Cu=63.5, O=16 and S=32)	[8]	CO3
9.	Identify all the missing reagents / products / reactants in the given sequence of reaction. Also give the mechanism for each step. <div style="text-align: center;"> </div>	[8]	CO2
10.	i. Calculate the number of particles of 10 nm radius formed from spherical particle having radius of 150 nm. ii. Calculate the wavelength of X-rays, which produces a diffraction angle 2θ equal to 16.80° for a crystal. Assume first order diffraction with inter particle distance in crystal of 0.2 nm.	[4+4]	CO1
SECTION - C			
(Question No. 11 is Compulsory; Attempt any one from question numbers 12A & 12B)			
11.	i. (A) Discuss the formation of various types of films prepared by chlorine with tin and silver. (B) Explain why?	[8+8+4]	CO2 CO3 CO1

	<p>a) Bolts and nuts are preferred to be of same metal.</p> <p>b) Corners of metal furniture are more prone to corrosion.</p> <p>ii. Discuss the following: (a) Addition of chlorine to cis-2-butene produces racemic mixture as product. (b) Partial racemisation is achieved in SN₁ reaction.</p> <p>iii. How can we get the nanoparticles of ZnO by micro-emulsion method?</p>		
12A.	<p>i. 2.56g coal sample was weighed in a silica crucible. The weight of the silica crucible is 20g. After heating for an hour at 105°C, the residue weighed 2.18g. The crucible was covered with a lid and heated to 7 min at 950°C. The residue weighed 1.628g. The crucible was then heated without lid at 725°C and weight of silica crucible was found to be 20.265g. Calculate the percentage of moisture, volatile content, ash and fixed carbon content in the sample.</p> <p>ii. In Arrhenius's equation for a certain reaction, the value of A and E (activation energy) are $4 \times 10^{13} \text{ s}^{-1}$ and 98.6 kJ/mol respectively. If the reaction is of first order, at what temperature will its half-life period be 10 minutes?</p> <p>iii. Give two examples each of addition polymerization and condensation polymerization.</p>	[8+8+4]	CO4 CO2 CO1
12B.	<p>i. (a) The enthalpies of combustion of two fuels, ethane and butane are -484.8 kJ/mole and -797.4 kJ/mole, respectively. Which of the two is better fuel? (b) 0.151 g of the organic compound and barium chloride gave 0.466 g of barium sulphate. Calculate the percentage of Sulphur.</p> <p>ii. $\text{NOCl} + \text{O}_3 \rightarrow \text{NO}_2\text{Cl} + \text{O}_2$ Mechanism for this reaction is given as,</p> $\text{N}_2\text{O}_5 \xrightarrow{K_1} \text{NO}_2 + \text{NO}_3$ $\text{NO}_2 + \text{NO}_3 \xrightarrow{K_2} \text{N}_2\text{O}_5$ $\text{NO}_2 + \text{O}_3 \xrightarrow{K_3} \text{NO}_3 + \text{O}_2$ $\text{NOCl} + \text{NO}_3 \xrightarrow{K_4} \text{NO}_2\text{Cl} + \text{NO}_2$ <p>Answer the following with respect to above: a) Write the rate law in terms of NOCl. b) Identify actual intermediates. c) Write rate laws in terms of intermediates. d) Prove that:</p> $-d[\text{NOCl}]/dt = (K_1 K_3 K_4 / K_2)^{1/2} [\text{NOCl}]^{1/2} [\text{O}_3]^{1/2} [\text{N}_2\text{O}_5]^{1/2}$ <p>iii. Discuss the role of vulcanization in improving the quality of natural rubber.</p>	[8+8+4]	CO4 CO2 CO1

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