

Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN

--	--	--	--	--	--	--	--	--	--

Fourth Semester B.E. Degree Examination STOICHIOMETRY(18BT41)

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			*Bloom's Taxonomy Level	Marks
Q.01	a	A chemist is interested in preparing 500ml 1 normal, 1molar and 1molal solution of H ₂ SO ₄ . Assuming the density of solution to be 1.075 g/cm ³ . Calculate the quantities of H ₂ SO ₄ to be taken to prepare the solution.	L1	10
	b	A solution of castic soda containing 20% NaOH by weight. The density of the solution is 1.196 kg/lit. find normality, molarity and molality.	L1	10
OR				
Q.02	a	Define the following: i) Normality ii) Molarity iii) Molality iv) PPM v)Daltons law	L1	10
	b	A natural gas has the following composition by volume, CH ₄ =82%, C ₂ H ₆ =12% and N ₂ =6%. Calculate i) Density of gas at 298K and 101.325 kPa, ii) Composition by weight % and iii) Average molecular weight.	L1	10
Module-2				
Q. 03	a	The dilute acid containing 25% H ₂ SO ₄ is concentrated by commercial grade sulphuric acid containing 98% H ₂ SO ₄ to obtain desired acid containing 65% H ₂ SO ₄ . Find the quantities of the acids required to make 1000kg of desired acid.	L2	10
	b	10000 kg/hr of solution containing 20% methanol is continuously fed to a distillation column, distillate is found to contain 98% methanol and waste solution from column carries 7% methanol. All percentages are by weight, calculate the i) mass flow rate of the distillate and bottom product ii) the percent loss of methanol.	L2	10
OR				
Q.04	a	Soyabean seeds are extracted with hexane in batch reactor. The flaked seeds are found to contain 18.6% oil, 69% solids and 12.4% mixture by weight. At the end of the extraction process cake is separated from hexane-oil mixture. The cake is analyzed to contain 08% Oil, 87.7% solids and 11.5% moisture by weight find the percentage recovery of oil.	L2	10
	b	Explain Ultimate and proximate analyses of fuels.	L2	06
	c	Write a short note on calorific value of fuels	L2	04
Module-3				
Q. 05	a	Define the following with block diagram: i) Recycle operation ii) Bypass iii) Purge.	L2	06
	b	Fresh juice contains 15% solids and 85% water by weight and is to be concentrated to contain 40% solids by weight. In a single stage evaporation system, it is found that volatile constituents of juice escape with water leaving the concentrated juice a flat taste. In order to overcome this problem, part of the fresh feed bypasses the evaporator. This operation is shown schematically in fig. Calculate: (a)the fraction of juice that bypasses the evaporator. (b)the concentrated juice produced (containing 40% solids) per 100kg of fresh juice fed to the process.	L2	14

OR																								
Q. 06	a	Define the following: i) Yield ii) Selectivity iii) Limiting reactant iv) Excess reactant v) % excess	L2	10																				
	b	A combustion chamber is feed with butane and excess air. Combustion of butane is complete. The composition of gases on volume basis is given below. CO ₂ =9.39%, H ₂ O=11.73%, O ₂ =4.70%, N ₂ =74.18%. Find % excess air used and mole ratio of air to butane used.	L2	10																				
Module-4																								
Q. 07	a	A stream flowing at rate of 15,000 mol/hr containing 25 mole% N ₂ and 75 mole% H ₂ is to be heated from 298K to 473K. calculate the heat that must be transferred using C _p data given below. C _p = a+bT+cT ² +dT ³ . KJ/K. mol K.	L3																					
		<table border="1"> <thead> <tr> <th>Gas</th> <th>A</th> <th>b*10⁻³</th> <th>c*10⁻⁶</th> <th>d*10⁻⁹</th> </tr> </thead> <tbody> <tr> <td>N₂</td> <td>29.5909</td> <td>-5.41</td> <td>13.1829</td> <td>-4.968</td> </tr> <tr> <td>H₂</td> <td>28.6105</td> <td>1.0194</td> <td>-0.1476</td> <td>0.769</td> </tr> </tbody> </table>	Gas	A	b*10 ⁻³	c*10 ⁻⁶	d*10 ⁻⁹	N ₂	29.5909	-5.41	13.1829	-4.968	H ₂	28.6105	1.0194	-0.1476	0.769							
Gas	A	b*10 ⁻³	c*10 ⁻⁶	d*10 ⁻⁹																				
N ₂	29.5909	-5.41	13.1829	-4.968																				
H ₂	28.6105	1.0194	-0.1476	0.769																				
	b	Define the following: i) Heat of reaction ii) Heat of formation iii) Heat of combustion iv) Hess's law of constant heat summation.	L3	08																				
OR																								
Q. 08	a	Obtain an empirical equation for calculating the heat of reaction at any temperature T(in K) for the reaction: CO(g)+2H ₂ (g) → CH ₃ OH(g) Data: ΔH _R ^o =-90.41 KJ/mol C _p = a+bT+cT ² +dT ³ . KJ/K. mol K.	L3	12																				
		<table border="1"> <thead> <tr> <th>Gas</th> <th>a</th> <th>b*10⁻³</th> <th>c*10⁻⁶</th> <th>d*10⁻⁹</th> </tr> </thead> <tbody> <tr> <td>CO(g)</td> <td>29.0227</td> <td>-2.8165</td> <td>11.6437</td> <td>-4.7063</td> </tr> <tr> <td>H₂(g)</td> <td>28.6105</td> <td>1.0194</td> <td>-0.1476</td> <td>0.769</td> </tr> <tr> <td>CH₃OH(g)</td> <td>21.137</td> <td>70.843</td> <td>25.86</td> <td>-28.497</td> </tr> </tbody> </table>	Gas	a	b*10 ⁻³	c*10 ⁻⁶	d*10 ⁻⁹	CO(g)	29.0227	-2.8165	11.6437	-4.7063	H ₂ (g)	28.6105	1.0194	-0.1476	0.769	CH ₃ OH(g)	21.137	70.843	25.86	-28.497		
Gas	a	b*10 ⁻³	c*10 ⁻⁶	d*10 ⁻⁹																				
CO(g)	29.0227	-2.8165	11.6437	-4.7063																				
H ₂ (g)	28.6105	1.0194	-0.1476	0.769																				
CH ₃ OH(g)	21.137	70.843	25.86	-28.497																				
	b	Calculate the Heat of formation of liquid ethyl acetate at 298K. Data: Standard Heat of formation of CO ₂ (g)= -393.51 KJ/mol Standard Heat of formation of HO ₂ (l)= -285.83 KJ/mol Standard Heat of combustion of liquid ethyl acetate = ΔH _c ^o =2230.91 KJ/mol	L3	08																				
Module-5																								
Q. 09	a	With generalized process flow sheet explain the manufacture of Penicillin.	L3	10																				
	b	Explain briefly about historical development of bioprocess technology	L3	10																				
OR																								
Q. 10	a	Mention the different unit operations involved in a typical bioprocess with flow sheet.	L3	10																				
	b	What is the role of bioprocess engineer in a biotechnology industry.	L3	10																				