

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) - EXAMINATION – SUMMER 2018****Subject Code:2130504****Date:23/05/2018****Subject Name:Process Calculation****Time:10:30 AM to 01:30 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Atomic weights: C:12, H:1, O:16, S:32, Cl:35.5, Na:23, N:14, Mg:24, B:11, Si:28, Al:27, Fe:56, Zn:65

		MARKS
Q.1	(a) 1. What is molality? 2. 1 atmospheric pressure = ---- Psi. 3. What is the equivalent weight of $Al_2(SO_4)_3$.	03
	(b) In double effect evaporator plant the second effect is maintain under vacuum of 475torr (mmHg).find the absolute pressure in kgf/cm^2 , kpa, atm, bar.	04
	(c) A solution of caustic soda in water contains 20%NaOH (by weight) at333K (60°C).The density of the solution is 1.196kg/l.Find the molarity, normality and molality of the solution.	07
Q.2	(a) Calculate the weight of 1 m^3 of chlorine gas at a temperature of25°C and a pressure of 745mmHg.	03
	(b) How are you calculate the density of gas mixture?	04
	(c) The analysis of a sample of glass yields 7.8%Na ₂ O, 7%MgO, 9.7%ZnO, 2.0%Al ₂ O ₃ , 8.5%B ₂ O ₃ and 65%SiO ₂ (by wt.).convert this composition into mole%.	07
OR		
	(c) Cracked gas from a petroleum refinery has the following composition by volumeMethane45%, Ethane10%, Ethylene25%, propane7%, propylene8%, n-Butane5%Find (a) the average Mol.wt. Of gas Mixture. (b) The composition by wt. and (c) Specific gravity of the gas mixture.	07
Q.3	(a) Define the following terms: (1) excess reactant (2) percentage conversion (3) yield	03
	(b) Discuss about recycling operations.	04
	(c) It is required to make 1000kg mixed acid containing 60% H ₂ SO ₄ , 32%HNO ₃ and 8% water by blending (i) the spent acid containing 11.3% HNO ₃ , 44.4% H ₂ SO ₄ and 44.3% H ₂ O. (ii) Aqueous 90% HNO ₃ and (iii) aqueous 98% H ₂ SO ₄ . All percentages are by weight. Calculate the quantities of each of the three acids required for blending.	07

OR

Q.3	(a)	03
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Explain the following terms with reference to chemical process

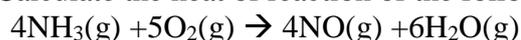
- (1) Process flow sheet
- (2) P & I diagram
- (3) Degree of freedom

(b) Using Antoine equation, Calculate vapour pressure of Acetaldehyde (C₂H₄O) at 250K **04**

Antoine constants for acetaldehyde are A = 7.134, B = 1600, C = 18.65.

(c) Soybean seeds are extracted with hexane in batch extractors. The flaked seeds contains 18.6% oil, 69.0% solids & 12.4% moisture cake. At the end of the extraction process the cake is separated from the hexane oil mixture. The cake analysis yields, 0.8% oil, 87.8% solids and 11.5% moisture. Find the % recovery of oil. All percentage are on wt. basis. **07**

Q.4 (a) Calculate the heat of reaction of the following reaction. **03**



Data : Component ΔH_f° cal/ gmol

NH₃(g) -11020

NO(g) 21570

H₂O(g) -57796

(b) In a textile mill, a double effect evaporator system concentrates weak liquor containing 4% (by weight) caustic soda to produce a lye containing 25% solids (by weight). Calculate the evaporation of water per 100 kg feed in the evaporator. **04**

(c) What will be the yield of Glauber salt (Na₂SO₄.10H₂O) if a pure 32% solution is cooled to 293K (20°C) without any loss due to evaporation? Data: Solubility of Na₂SO₄ in water at 293K (20°C) is 19.4kg per 100 kg water. **07**

OR

Q.4 (a) Calculate the heat of formation of glycerol liquid (C₃H₈O₃) at 298 K from its elements using Hess's law. Data: Heat of formation of CO₂ (g) = (-393.51 kJ/mol), Heat of formation of H₂O (l) = (-285.83 kJ/mol), Heat of combustion of glycerol liquid at 298 K = (-1659.10 kJ/mol). **03**

(b) Define: (1) Heat of reaction (2) Heat of combustion (3) Std. heat of formation (4) Heat capacity. **04**

(c) Temperature of pure Oxygen is raised from 350 to 1500K. calculate the amount of heat to be supplied for raising the temperature of 1 kmol oxygen using the following Cp^o data Cp^o = a + bT + cT² + dT³ KJ/Kmol K

a	b x 10 ³	c x 10 ⁶	d X 10 ⁹
26.0257	11.7551	- 2.3426	-0.5623

Q.5 (a) Define: Crystallization, Extraction and adsorption. **03**

(b) Define : (1) Absolute humidity (2) Humid Heat (3) Humid volume (4) Percentage humidity. **04**

(c) The dry bulb temperature and dew point of a ambient air were found to be 302K (29 C) and 291K (18°C) respectively. The barometer records 100 kpa a(750torr) **07**

Compute (a) the absolute molal humidity (b) the absolute humidity (c) the % RH (d) the % saturation € the humid heat and (f) the humid volume.

OR

- Q.5** (a) Discuss ultimate analysis of coal. **03**
(b) Describe the classification of fuels. **04**
(c) The Or sat analysis of the flue gases from a boiler house chimney gives CO₂ 11.2%, O₂:4.2% and N₂ 84.4 % (mole %). Assuming that complete combustion has taken place, (a) calculate the % excess air and (b) find the C: H ratio in the fuel. **07**
