

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. (CHEMICAL ENGINEERING) MAKE-UP EXAMINATIONS, 2018

SUBJECT: INTRODUCTION to CHEMICAL ENGINEERING [CHE3281]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

✤ Missing data may be suitably assumed.

1A.	Potassium superoxide, KO ₂ , is used in rebreathing gas masks to generate oxygen. $KO_2(s) + H_2O(I) \rightarrow KOH(s) + O_2(g)$ (Atomic Mass K-39.1, O-16, H-1) a. How many moles of O ₂ can be produced from 0.15 mol KO ₂ and 0.10 mol H ₂ O? b. Determine the limiting reactant.	3
	c. Suppose the theoretical yield for an experiment was calculated to be 19.5 grams, and the experiment was performed, but only 12.3 grams of product were recovered. Determine the % yield.	
1B.	Define mass transfer and explain about Fick's law of diffusion.	3
1C.	Given that basalt seems to well up when ocean crust pulls apart at Mid- Ocean ridges, you might decide that maybe the entire Earth is made of basalt. On your bathroom scale, a 64 in ³ (4in x 4in x 4in) block of basalt weighs 116 ounces. Use this information to calculate whether the average density of the Earth in g/cm ³ .	4
2A.	Define Chemical Engineering. Describe about any one contribution that a chemical engineer does for the society with an example.	3
2B.	At 29.6 °C, pure water has a vapor pressure of 31.1 torr. A solution is prepared by adding 86.8 g of "Y", a nonvolatile non-electrolyte to 350 g of water. The vapor pressure of the resulting solution is 28.6 torr. Calculate the molar mass of Y.	4
2C.	What is laminar flow and turbulent flow? Write the formula for Reynold's number.	3

3A.	Define mass transfer and explain about Fick's law of diffusion. What are various modes of heat transfer? Write about Fourier's law of heat conduction.			
3B.	Calculate the equivalent weight of NH ₄ OH in and H ₂ SO ₄ (mw(a) = 35g/mol) (mw (b) = 98.07g/mol). Give the justification for the calculation. NH ₄ OH + H ⁺ = H ₂ O + NH ₄ ⁺ (b) H ₂ SO ₄ + 2OH ⁻ = 2H ₂ O + SO ₄ ²⁻			
3C.	Using Dalton's law, Derive The mole fraction of component A is $X_{A} = -\frac{n_{A}}{n_{tot}} = \frac{P_{A}}{P_{tot}} = \frac{V_{A}}{V_{tot}}$		3	
4A.	Calculate the equivalent weights of H ₂ the following reactions: a)H ₂ SO ₃ + 2 LiO b) H ₂ SO ₃ + LiO	culate the equivalent weights of H_2SO_3 (MW=82) and LiOH(MW=24) in following reactions: a) $H_2SO_3 + 2 \text{ LiOH} \rightarrow 2 H_2O + \text{Li}_2SO_3$ b) $H_2SO_3 + \text{LiOH} \rightarrow H_2O + \text{LiHSO}_3$		
4B.	If a 70% (by weight) solution of glycerol has a specific gravity of 1.184 at 15°C, what is the density of the solution in (a) g/cm ³ (b) lbm/ft ³ and (c) kg/m ³ ?			
4C.	What mass of carbon dioxide is produced when 96.1 g of propane react with sufficient oxygen? $C_3H_8+O_2 \rightarrow CO_2+H_2O$			
5.	A particular coal has the following ultimate analysis on a dry basis, percent by mass:			
	Common and Demonst has more			
	Sulfur	0.6		
	Hydrogen	5.7		
	Carbon	79.2		
	Oxygen	10.0	10	
	Nitrogen	1.5		
	Ash	3.0		
	This coal is to be burned with 30% excess air. Calculate the air-fuel ratio on a mass basis.			