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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**TEST 1**

**Winter Semester:** 2021- 22

**Course Code:** PET 316

**Course Name:** Fundamentals of Process Engineering Calculations

**Program & Sem:** B. Tech (PET) & VI Sem

**Date:** 26<sup>th</sup> April 2022

**Time:** 01:30 PM to 02:30 PM

**Max Marks:** 30

**Weightage:** 15%

**Instructions:**

- (i) Read the all questions carefully and answer accordingly.
- (ii) Question paper consist of three parts, PART A, B & C.
- (iii) All questions are mandatory.

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(4Qx 2M= 8M)**

1. Describe what do you understand by the term valency? (C.O.No.1) [Knowledge]
2. List out the different methods of expressing the composition of mixtures? (C.O.No.1) [Knowledge]
3. Define Daltons Law. (C.O.No.1) [Knowledge]
4. What do you understand by Equivalent weight? (C.O.No.2) [Comprehension]

**Part B [Thought Provoking Questions]**

**Answer both the Questions. Each Question carries SIX marks.**

**(2Qx6M=12M)**

5. 625 grams of  $H_2CO_3$  is mixed with 1500ml to prepare a solution in chemistry lab for a chemical reaction. Now the Chemist want the composition of the following is to be expressed in normality. Find out the composition expressed in terms of Normality. (C.O.No.1) [Knowledge]
6. An analysis on an unknown gaseous mixture was conducted. Upon the analysis the gaseous mixture was found to contain contains 50kg  $NH_3$ , 40kg  $Cl_2$  and 30kg  $O_2$ . Calculate the average molecular weight of the gas and the volume occupied by the mixture at 3 atm and 50 °C. [A.wt Cl=35.5, A.wt N=14 ] (C.O.No.2) [Comprehension]

**Part C [Problem Solving Questions]**

**Answer the Question. Question carries TEN marks.**

**(1Qx10M=10M)**

- 7 A solution is to be prepared in the lab for conducting a chemical reaction. 320 grams of Phosphorus acid ( $H_3PO_4$ ) was dissolved in water to prepare 2500ml of solution. The Chemist wants the concentration to be expressed in different units. Express the concentration in Normality, Molarity and Molality? [A.wt P=31] (C.O.No.2) [Comprehension]



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**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**TEST 2**

**Winter Semester:** 2021- 22

**Course Code:** PET 316

**Course Name:** Fundamentals of Process Engineering Calculations

**Program & Sem:** B. Tech (PET) & VI Sem

**Date:** 1<sup>st</sup> June 2022

**Time:** 01:30 PM to 02:30 pm

**Max Marks:** 30

**Weightage:** 15%

**Instructions:**

- (i) *Read the all questions carefully and answer accordingly.*
- (ii) *Question paper consist of three parts, PART A, B & C*
- (iii) *All questions are mandatory*

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(4Qx2M=8M)**

Q.NO.1. Describe what do you understand by the term Relative humidity? (C.O.No.2) [Knowledge]

Q.NO.2. How do we separate the solute in the absorption process? (C.O.No.3) [Knowledge]

Q.NO.3. The amount of inert gas in the lean gas of an absorption process is 88 kgmole, what will be the amount of inert gas in the feed? Give your answer with a valid reason.

(C.O.No.3) [Knowledge]

Q.NO.4. Why do we use Inert gas in absorption process?

(C.O.No.3) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer both the Questions. Question carries SIX marks.**

**(2Qx6M=12M)**

Q.NO.5. Conditioned air at 760 mmHg total pressure, 70°C and at a humidity of 0.04 kg water per kg of bone dry air enters the drier. It leaves the drier at 760 mmHg total pressure and 70°C, with RH 79%. Vapour pressure of water at 50°C is 89.5 mmHg. If 65 kg of water enters into the air stream per hour, calculate the rate of bone dry air flowing through the dryer. (C.O.No.2) [Knowledge]

Q.NO.6. A gas mixture contains 32% of CO<sub>2</sub> as solute and 68% of Argon as Inert Gas is fed to an absorption tower, which it is contacted with monoethanolamine (MEA) which is used as a solvent which absorbs CO<sub>2</sub>. The molar flow rate of solvent flowing in the absorption tower is 350 kgmol/hr. The lean gas leaving the tower contains CO<sub>2</sub>=6.5%, monoethanolamine=4.5 % and rest is Argon gas. Calculate the percentage recovery of solute CO<sub>2</sub>. (C.O.No.3) [Application]

**Part C [Problem Solving Questions]**

**Answer the Question. Question carries TEN marks.**

**(1Qx10M=10M)**

Q.NO.7 A mixture contains methane, ethane and butane. A distillation column separates 21% methane, 61% ethane and 18% butane. The Top product contains 91% methane, 6% ethane. The waste product contains 4% ethane. Calculate the quantities of distillate and residue if 3200 kgmol/h of feed is fed.

[10M] (C.O.No.3) [Application]



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**SCHOOL OF ENGINEERING**

**END TERM EXAMINATION**

**Winter Semester:** 2021- 22

**Course Code:** PET 316

**Course Name:** Fundamentals of Process Engineering Calculations

**Program & Sem:** B. Tech (PET) & VI Sem

**Date:** 30<sup>th</sup> June 2022

**Time:** 09:30 AM to 12:30 PM

**Max Marks:** 100

**Weightage:** 50%

**Instructions:**

(i) *Read the all questions carefully and answer accordingly.*

(ii) *All questions are mandatory*

**Part A [Memory Recall Questions]**

**Answer all the Questions. Each question carries TWO marks.**

**(9Qx 2M= 18M)**

- Q.NO.1. What do you understand by Mole fraction? (C.O.No.1) [Knowledge]
- Q.NO.2. Define Valency? (C.O.No.2) [Knowledge]
- Q.NO.3. Define Daltons Law. (C.O.No.2) [Knowledge]
- Q.NO.4. What do you understand by Raoults Law? (C.O.No.3) [Knowledge]
- Q.NO.5. What do you understand by the term humidity? (C.O.No.2) [Knowledge]
- Q.NO.6. In a simple distillation process, what are the two outlets of the distillation column called? (C.O.No.3) [Knowledge]
- Q.NO.7. Which component in absorption process does not take part in the reaction? (C.O.No.2) [Knowledge]
- Q.NO.8. What is the difference between extraction and absorption? (C.O.No.4) [Knowledge]
- Q.NO.9. What do you understand by Low calorific value (LCV)? (C.O.No.4) [Knowledge]

**Part B [Thought Provoking Questions]**

**Answer the Questions. Question carries EIGHT marks.**

**(5Qx8M= 40M)**

- Q.NO.10. A chemical reaction is carried out in a lab. The scientist needs to prepare 2 litre of 3N H<sub>2</sub>SO<sub>3</sub> solution for the chemical reaction. Find out how much amount in gram of H<sub>2</sub>SO<sub>3</sub> is needed. [A.wt S=32] (C.O.No.1) [Application]

Q.NO.11.  $\text{Na}_2\text{CO}_3$  is decomposed in a chemical reaction. The products obtained are  $\text{Na}_2\text{O}$  and  $\text{CO}_2$ . The strength of the aqueous solution of  $\text{Na}_2\text{O}$  is 25% by weight. Express  $\text{Na}_2\text{O}$  in terms of weight per cent. [A.wt Na=23,C=12]



Q.NO.12. An astronaut lands in an unknown planet to study the gaseous composition of the atmosphere of that planet. After conducting the various experiment it was found that the atmosphere contains  $\text{CO}_2=24\%$ ,  $\text{NO}_2=16\%$ ,  $\text{C}_2\text{H}_6=26\%$ ,  $\text{C}_4\text{H}_{10}=34\%$  (composition by weight). [A.wt N=14] Evaluate the following

i) Composition of gas by volume

ii) Average Molecular Weight

iii) Density of gas at 523K and 5 atm. (C.O.No.2) [Application]

Q.NO.13. A diluted acid was prepared for a chemical reaction. The strength of Sulphurous acid ( $\text{H}_2\text{SO}_3$ ) sample is found to be 30%  $\text{SO}_2$  by weight. Find out the actual concentration of  $\text{H}_2\text{SO}_3$  (Weight %) in the acid. The chemical reaction is given below. [A.wt S=32]



Q.NO.14. Conditioned air at 760 mmHg total pressure,  $80^\circ\text{C}$  and at a humidity of 0.06 kg water per kg of bone dry air enters the drier. It leaves the drier at 760 mmHg total pressure and  $80^\circ\text{C}$ , with RH 81%. Vapour pressure of water at  $50^\circ\text{C}$  is 91.5 mmHg. If 75 kg of water enters into the air stream per hour, calculate the rate of bone dry air flowing through the dryer. (C.O.No.4) [Application]

### Part C [Problem Solving Questions]

**Answer the Questions. Question carries FOURTEEN marks.**

**(3Qx14M=42M)**

Q.NO.15 A solution is to be prepared in the lab for conducting a chemical reaction. 240 grams of Phosphorus acid ( $\text{H}_2\text{SO}_4$ ) was dissolved in water to prepare 3600ml of solution. The Chemist wants the concentration to be expressed in different units. Express the concentration in Normality, Molarity and Molality? [A.wt P=31] (C.O.No.1) [Application]

Q.NO.16. 8,000 kg/h of solution containing 30% methanol is continuously fed to a distillation column. Distillate is found to contain 94% methanol and waste solution from the column carries 3% methanol. All percentage are by weight. Estimate the flowing

(i) The mass flow rates of distillate and bottom product

(ii) The percentage loss of methyl alcohol? (C.O.No.3) [Application]

Q.NO.17. A gas mixture contains 32% of  $\text{CO}_2$  as solute and 68% of Argon as Inert Gas is fed to an absorption tower, which it is contacted with monoethanolamine (MEA) which is used as a solvent which absorbs  $\text{CO}_2$ . The molar flow rate of solvent flowing in the absorption tower is 350 kgmol/hr. The lean gas leaving the tower contains  $\text{CO}_2=6.5\%$ , monoethanolamine=4.5 % and rest is Argon gas. Estimate the percentage recovery of solute  $\text{CO}_2$ . (C.O.No.4) [Application]

