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GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester – Regular) Examinations, December – 2020

BPCPR 3040 – MATERIAL & ENERGY BALANCE

(Petrochem and Petroleum Refinery Engineering)

Time: 2 hrs

Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)

(1 x 10 = 10 Marks)

Q.1. Answer **ALL** questions

[CO#] [PO#]

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|---|-----|---|
| <p>a. Which one is an incorrect conversion</p> <p>(i) 1 inch = 2.54 cm (ii) 1 mile = 5280 ft.</p> <p>(iii) 1 ft. = 12 inch (iv) None of the mentioned</p> | CO1 | 1 |
| <p>b. A car is travelling with a speed of 550 ft/sec. How fast it is going in miles per hour?</p> <p>(i) 375 (ii) 750</p> <p>(iii) 900 (iv) 1800</p> | CO1 | 1 |
| <p>c. The ratio of partial pressure of the vapour in the gas mixture and the vapour pressure of the vapour component is called</p> <p>(i) Relative Humidity (ii) Humidity</p> <p>(iii) Dry air pressure (iv) None of the mentioned</p> | CO4 | 2 |
| <p>d. Psychrometric chart is plotted between the parameters</p> <p>(i) Humidity and temperature (ii) Humidity and pressure</p> <p>(iii) Humidity and volume of the dry air (iv) None of the mentioned</p> | CO4 | 2 |
| <p>e. Any arbitrary portion of or whole process that is considered for analysis is called</p> <p>(i) System (ii) Boundary</p> <p>(iii) Surrounding (iv) None of the mentioned</p> | CO3 | 3 |
| <p>f. For the given reaction $C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$. If the reactants C_5H_{12} & O_2 are having 2 moles and 8 moles of initial feed respectively. Which is the excess reactant in the reaction?</p> <p>(i) C_5H_{12} (ii) O_2</p> <p>(iii) CO_2 (iv) H_2O</p> | CO2 | 4 |
| <p>g. Volume of a system is</p> <p>(i) Intensive property (ii) Extensive property</p> <p>(iii) Neither intensive nor Extensive (iv) None of the mentioned</p> | CO3 | 3 |
| <p>h. $Q = UA(T_2 - T_1)$; When $Q < 0$</p> <p>(i) Heat is transferred from system (ii) Heat is transferred from surrounding</p> <p>(iii) Heat is gained by system (iv) None of the mentioned</p> | CO3 | 3 |
| <p>i. Purge stream comes from?</p> <p>(i) Feed stream (ii) Product stream</p> <p>(iii) Recycle stream (iv) None of the mentioned</p> | CO2 | 4 |
| <p>j. How many gm moles oxygen are there in 88 gms carbon di oxide?</p> <p>(i) 1 (ii) 2</p> <p>(iii) 3 (iv) 4</p> | CO1 | 1 |

PART – B: (Short Answer Questions)**(2 x 5 = 10 Marks)**Q.2. Answer ALL questions

	[CO#]	[PO#]
a. Convert volumetric flow rate of $5\text{m}^3/\text{s}$ into l/s	CO1	1
b. If 'H' is the absolute humidity and 'T' is the dry bulb temperature of humid air, explain how to calculate the wet bulb temperature ' T_w ' and the dew point temperature ' T_D ' using humidity chart?	CO4	2
c. List out few advantaged of recycling operations.	CO2	4
d. State Kopp's rule	CO3	3
e. Differentiate Proximate and Ultimate analysis	CO3	3

PART – C: (Long Answer Questions)**(6 x 5 = 30 Marks)**Answer ANY FIVE questions

	Marks	[CO#]	[PO#]
3. Cracked gas from a petroleum refinery has the following composition by volume: methane 45%, ethane 10%, ethylene 25%, propane 7%, propylene 8%, n-butane 5%. Find (a) the average molecular weight of the gas mixture, (b) the composition by weight and (c) specific gravity of the gas mixture.	(6)	CO1	1
4. Air is flowing through a duct under a draft of 4.0cm of H_2O . The barometer indicates that the atmospheric pressure is 730 mm Hg. What is the absolute pressure of the gas in inches of mercury?	(6)	CO1	1
5. Air at a temperature of 20°C and pressure 750 mm Hg has a relative humidity of 80%. (a) Calculate the molal humidity of air. (b) Calculate the humidity of this air if its temperature is reduced to 10°C and its pressure increased to 35 psi, condensing out some of the water. (c) Calculate the weight of water condensed from 1000ft^3 of gas. Data: Vapour pressure of H_2O at 20°C = 17.5 mm Hg and at 10°C = 9.2 mm Hg.	(6)	CO4	2
6. Partial pressure of water vapour in a mixture of air-water vapour at a total pressure of 800 mmHg and a temperature of 60°C is 100 mmHg. Calculate the following (i) Humidity (ii) mole fraction (iii) volume fraction (iv) relative humidity (v) g of water / m^3 mixture. Assume vapour pressure is 150 mmHg at 60°C .	(6)	CO4	2
7. It is required to prepare 1250 kg of a solution composed of 12 wt.% ethanol and 88 wt.% water. Two solutions are available, the first contains 5 wt.% ethanol, and the second contains 25 wt.% ethanol. How much of each solution are mixed to prepare the desired solution?	(6)	CO3	3
8. The exhaust gas from a hydrocarbon fuel oil fired furnace shows 10.2% - CO_2 , 7.9% O_2 and 81.9% N_2 by Orsat analysis. Calculate (i) % Excess of Air used , (ii) Kg of dry air supplied per kg of Oil burnt.	(6)	CO3	3
9. Calculate the standard heat of formation of acetylene (C_2H_2) given that the standard heat of combustion of acetylene is -1299.61 KJ, the standard heat of combustion of carbon is -393.51 KJ and the standard heat of formation of liquid water is -285.84 KJ	(6)	CO3	3
10. Calculate the theoretical flame temperature of a gas having 20% CO and 80% N_2 when burnt with 150% excess air. Both air and gas being at 25°C . Data: Heat of formation of CO_2 = -94052 cal/gmol CO = -26412 cal/gmol at 25°C Cpm values are, CO_2 =12.1, O_2 =7.9, N_2 =7.55 Cal/gmol K	(6)	CO3	3

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