Reg. No. :

Question Paper Code: 54902

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fourth Semester

Chemical Engineering

15UCH402 - CHEMICAL PROCESS CALCULATIONS

(Regulation 2015)

(Psychometric chat and Necessary Data book must be provided)

(Any missing data maybe assumed suitably)

Duration: 1.15 hrs   Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. 1 atmospheric pressure is equal to____ N/m^2 CO1- R

   (a) 101325   (b) 10^5 (c) 100   (d) 1

2. The number gram moles of the solute dissolved in one litre of solution   CO1- R

   (a) atomic weight   (b) molarity   (c) molality   (d) normality

3. The reactant that would disappear first if a reaction goes to completion is ___   CO2- R

   (a) initial reactant   (b) limiting reactant   (c) final reactant   (d) product

4. The basis for material balance is the law of conservation of _____   CO2- R

   (a) steady state   (b) mass   (c) momentum   (d) unsteady state

5. The temperature of the vapour- gas mixture recorded by a thermometer is   CO3- R

   (a) WBT   (b) DBT   (c) dew point   (d) humidity

6. The ratio of partial pressure of vapour in gas phase to vapour pressure   CO3- R
   of pure liquid at DBT is

   (a) humidity   (b) dew point   (c) relative humidity   (d) absolute humidity

7. When the standard heat of combustion is negative then the calorific value is   CO4- R

   (a) positive   (b) zero   (c) negative   (d) one

8. Determination of moisture and volatile matter is done by   CO4- R

(a) moisture content   (b) proximate analysis   (c) ultimate analysis   (d) combustion

9. 1 Calorie is equal to_____J   CO5- R

(a) 4.184   (b) 3.18   (c) 6.628   (d) 0

10. The heat of formation of hydrocarbons is calculated by   CO5- R

(a) Raoults law   (b) Amagats law   (c) Henry's law   (d) Hess's law

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. A saturated solution of salicylic acid in methanol contains 64 kg of   CO1- App   (8)
salicylic acid per 100 kg of methanol at 298 K. Find the composition
of solution in

(i) weight % and

(ii) mole %.

12. A single effect evaporator is fed with 10,000 kg/hr of weak liquor   CO2- App   (8)
containing 15% caustic by weight and is concentrated to get thick
liquor containing 40% by weight caustic. Calculate

(i) kg/hr of water evaporated and

(ii) kg/hr of thick liquor obtained.

13. The dry bulb temperature and dew point of ambient air were found to   CO3- Ana   (8)
be 302 K and 291 K respectively. Barometer reads   100 kPa.
Calculate:

(a) Absolute molal humidity,

(b) Absolute humidity,

(c) % RH,

(d) The % saturation,

(e) The humid heat and

(f) The humid volume.

Data: Vapor pressure of water at 291 K = 2.0624 kPa

Vapor pressure of water at 302 K = 4.004 kPa

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14. Calculate the GHV and NHV at 298 K (25^0c) of the gas having   CO4- App   (8)
    following composition by volume:

    CH_4 : 74.4%, C_2H_6 : 8.4%, C_3H_8 : 7.4%, i-C_4H_{10} : 1.7%, n-C_4H_{10} :
    2.0%, i-C_5H_{12} : 0.5%, n-C_5H_{12} : 0.4%, N_2 : 4.3%, and CO_2 : 0.9%

    Data:

Component	$-\Delta H^0_c$=(gross),kJ/mol	$-\Delta H^0_c$=(net),kJ/mol
H_2	890.65	802.62
CH_4	1560.69	1428.64
C_2H_6	2219.17	2043.11
n-C_4H_{10}	2877.40	2657.32
n-C_5H_{12}	3535.77	3271.67
i-C_5H_{12}	3528.83	3264.73
i-C_4H_{10}	3535.77	3271.67

15. From the following data compute the enthalpy change of formation for   CO5- E   (8)

    NH_3 at 480 ^{0}C

    DATA:

    ΔH_f at 25 ºC for = -10.96kcal/kmol

    C_P for N_2 = 6.76 +(6.06 $\times 10^{-4}$T) +(13 $\times 10^{-8}$T^2)

    C_P O_2 = 6.85 +(2.8 $\times 10^{-4}$T) +(22 $\times 10^{-8}$T^2)

    C_P NH_3 = 6.703 +(0.0063 T) where T is in K.