

## Question Bank (G scheme)

Name of Subject: Stoichiometry

Subject code: 17315

Semester : Third

Course: Chemical

### Unit Test II

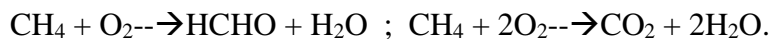
#### Chapter 3 Material balance with chemical reaction(32marks)

##### 3 marks question

1. Define i) % conversion ii) % yield iii) % excess
2. Define limiting component and excess component.
3. Define stoichiometric equation with an example.
4. Ammonia is produced by  $N_2 + 3H_2 \rightarrow 2NH_3$ . Calculate molal flow rate of  $H_2$  corresponding to the nitrogen feed rate of 25 kmol/hr.
5. For the reaction  $C_2H_4 + 2Cl_2 \rightarrow C_2HCl_3 + H_2 + HCl$ . Calculate the amount of HCl produced from 50 Kg  $C_2H_4$ .
6. 100 Kgmol of ethanol are charged to dehydrogenation reactor to produce acetaldehyde. The product stream is found to contain 45 kmol acetaldehyde. Find % conversion of ethanol.
7. Formaldehyde is produced from methanol in catalytic reactor. The production rate of formaldehyde is 1000 kg/hr. If conversion of methanol is 65%, calculate the required feed rate of methanol.

##### 8 marks question

8. Methane oxidation reactions are



100 kmol of methane are charged, if product stream is found to contain 10 kmol  $CO_2$  and 40 kmol HCHO, calculate (i) % conversion of methane (ii) % yield of HCHO.

9. A combustion reactor is fed with 50 kmol of butane and 2100 kmol air per hour. Calculate % excess air.

10. Oxidation of ethylene to produce ethylene oxide is given by

$C_2H_4 + \frac{1}{2} O_2 \rightarrow C_2H_4O$ . If air is used 20 % in excess of that theoretically required, calculate

the quantity of air supplied based on 100 kgmoles of  $C_2H_4$  fed to reactor.

11. The feed containing 60 mol% A, 30 mol% B and 10 mol% inerts enters a reactor. The product stream leaving the reactor is found to contain 2 mol% A. The reaction taking place is  $2A + B \rightarrow C$ . Find the percentage of original A getting converted to C

12. CO and steam are fed to a reactor for production of hydrogen and  $CO_2$ . The product gas is found to contain 38.46%  $H_2$ , 38.46%  $CO_2$  and 23.08%  $H_2O$  by mol. Find the mol ratio of steam to CO fed to reactor.

13. The gaseous reaction  $A \rightarrow 2B + C$  takes place isothermally in a constant pressure reactor.

Starting with a mixture of 75% A and 25% inerts (by volume), in a specified time the volume

doubles. Calculate the conversion achieved.

#### Chapter 4

#### Energy balance(18marks)

#### 3 marks question

1. Define

i) Standard heat of formation

ii) Standard heat of combustion

iii) Standard heat of reaction

2. Define i) calorie ii) kilocalorie iii) BTU

3. Define i) specific heat ii) latent heat

4. Define i) adiabatic reaction ii) adiabatic reaction temperature

5. The standard heat of combustion of phenol is -714.71 kcal/gmol. Calculate the heat evolved by combustion of 470 gms of phenol

6. Calculate the heat that must be added to 3 kgmoles of air to heat it from  $25^{\circ}C$  to  $200^{\circ}C$  using mean molal heat capacity data

$C_{p,m}$  (between 200 and  $25^{\circ}C$ ) = 7.021 Kcal/kmol K

7. Calculate the heat required to increase the temperature of 40 Kg/hr of kerosene to heat it from  $30^{\circ}C$  to  $80^{\circ}C$ .  $C_p$  for kerosene is 0.83 Kcal/kg  $^{\circ}C$

#### 8 marks question

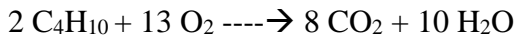
8. Calculate the heat of formation of liquid 1-3 butadiene using the following data

Standard heat of formation of  $\text{CO}_2 = -393.51 \text{ KJ/mol}$

Standard heat of formation of  $\text{H}_2\text{O} = -285.83 \text{ KJ/mol}$

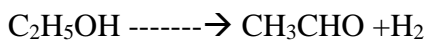
Standard heat of formation of  $\text{C}_4\text{H}_6 = -2520.11 \text{ KJ/mol}$

9. Calculate the enthalpy change between reactants and products if both are at  $25^\circ\text{C}$  and if 60 gmoles of  $\text{CO}_2$  are produced by the reaction



Compound	Standard heat of formation
$\text{C}_4\text{H}_{10}$	- 30.14 Kcal/gmol
$\text{CO}_2$	- 94.051 “
$\text{H}_2\text{O}$	- 68.315 “

10. Calculate standard heat of reaction of



Compound	Standard heat of combustion
$\text{C}_2\text{H}_5 \text{OH}$	- 336.82 Kcal/gmol
$\text{CH}_3\text{CHO}$	- 284.98 “
$\text{H}_2$	- 68.317 “

11. At what rate in Kcal/hr heat must be transferred to water at  $50^\circ\text{C}$  to generate steam at  $100^\circ\text{C}$ ? Latent heat of vaporization ( $\lambda$ ) = 540 Kcal/kg

$\text{H}_2\text{O}$	- 68.315 “
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