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 producd by $N_2 + 3H_2$ -----→$2NH_3$. Calculate molal flow rate of H_2 corresponding to the nitrogen feed rate of 25 kmoles/hr.

5. For the reaction $C_2H_4 + 2Cl_2$ ---→$C_2HCl_3 + H_2 + HCl$. Calculate the amount of HCl produced from 50 Kg C_2H_4.

6. 100 Kgmoles of ethanol are charged to dehydrogenation reactor to produce acetaldehyde. The product stream is found to contain 45 kgmoles 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

$CH_4 + O_2$--→$HCHO + H_2O$; $CH_4 + 2O_2$--→$CO_2 + 2H_2O$.

100 kgmoles of methane are charged, if product stream is found to contain 10 kgmoles CO_2

and 40 kgmoles HCHO, calculate(i)% conversion of methane(ii)% yield of HCHO.

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

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

$C_2H_4 + ½ O_2 \rightarrow C_2H_4O$. 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 n60 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 25^0C to 200^0C using mean molal heat capacity data

   Cp_m (between 200 and 25^0C) = 7.021 Kcal/kmol K
7. Calculate the heat required to increase the temperature of 40 Kg/hr of kerosene to heat it from 30^0C to 80^0C. Cp for kerosene is 0.83 Kcal/kg ^{0}C

8 marks question

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

Standard heat of formation of CO_2 = -393.51 KJ/mol

Standard heat of formation of H_2O = -285.83 KJ/mol

Standard heat of formation of C_4H_6= -2520.11 KJ/mol

9. Calculate the enthalpy change between reactants and products if both are at 25^0C and if 60 gmoles of CO_2 are produced by the reaction

$2\ C_4H_{10} + 13\ O_2 \text{ ----}\rightarrow 8\ CO_2 + 10\ H_2O$

Compound	Standard heat of formation
C_4H_{10}	- 30.14 Kcal/gmol
CO_2	- 94.051 "
H_2O	- 68.315 "

10. Calculate standard heat of reaction of

$C_2H_5OH \text{ -------}\rightarrow CH_3CHO + H_2$

Compound	Standard heat of combustion
C_2H_5 OH	- 336.82 Kcal/gmol
CH_3CHO	- 284.98 "
H_2	- 68.317 "

11. At what rate in Kcal/hr heat must be transferred to water at 50^0C to generate steam at 100^0C? Latent heat of vaporization (λ) =540 Kcal/kg

H_2O - 68.315 "