Question Bank (I scheme)

Name of Course: Industrial Stoichiometry Subject code: 22315

Semester: Third Programme: Chemical

Unit test II

Unit 4 - Material balance with Chemical reaction (18 marks)

2 marks question

1. Define stoichiometric equation and stoichiometric ratio.
2. Define limiting component and excess component.
3. Give the expression for % conversion and % yield..
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.

4marks question

6. A combustion reactor is fed with 50 kgmoles of butane and 2100 kgmoles air per hour. Calculate % excess air
7. Oxidation of ethylene to produce ethylene oxide is given by $C_2H_4 + ½ O_2$ ---→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.
8. 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 ---→ C. Estimate the percentage of original A getting converted to C
9. 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.

Unit 5 - Fuel and combustion (08 marks)

2 marks question

1. Define gross and net calorific value.
2. Give classification of fuel with two examples each.
3. Write the expression for average molecular weight and density of gas mixtures.
4. Define calorific value.

4 marks question

5. Crude oil is found to contain 87% Carbon, 12.5% hydrogen and 0.5% sulphur by weight. Calculate the net calorific value of the crude oil at 25°C. GCV of crude oil at 25°C is 10750 kcal/kg oil. Latent heat of water = 538.2 kcal/kg.
6. The gross calorific value of gaseous propane at 298 K is 2219.71 kJ/mol. Calculate net calorific value of propane.
7. Coke is found to contain 90% carbon and 10% non combustible ash by weight. How many moles of oxygen are theoretically required to burn 100 kg of coke completely?

Unit 6 - Energy balance (10 marks)

2 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
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

4marks 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 combustion 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
   $2\ C_4H_{10} + 13\ O_2 \dashrightarrow 8\ CO_2 + 10\ H_2O$

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 -------→ $CH_3CHO + H_2$

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

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