

Chemical Engineering Department
College of Engineering
King Saud University

ChE 202 – ChE Principles II

Time= 2 hours

Final Examination

6/5/1426

Answer **ALL** questions, Assume any **MISSING** data. Take **Cp=a+b.T**

Question 1

3684 m³/min of superheated steam at 400 °C and 1 bar is mixed with another stream of saturated steam at 10 bar. The stream exiting the mixer is superheated steam at 350 °C and 5 bar. The mixing unit operates adiabatically. Calculate the required molar flow rate of the 350 °C superheated steam.

Question 2

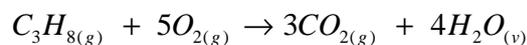
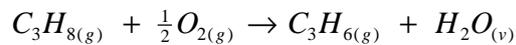
200 mol/h of a gas mixture of 20% oxygen and 80% nitrogen at 200 °C is mixed adiabatically with another gaseous stream flowing at 100 mol/h at 400 °C and containing 50% of oxygen and 50% hydrogen. Find the temperature of the exit stream. Neglect the kinetic and potential energies and the shaft work required for mixing.

Question 3

- (i) Calculate the amount of heat that must be added or removed to cool 100 mol/s of ethanol (C₂H₅OH) from 200 °C to 40°C.
- (ii) How much heat should be lost from saturated steam at 77 °C to become saturated liquid at the same temperature

Question 4

The following two reactions take place in a continuous reactor.



60 mol/s of propane (C₃H₈) at 25 °C and 200 mol/s of oxygen at 100 °C enter the reactor while the products leaves the reactor at 400 °C. The output of the reactor contains C₃H₆=40 mol/s, CO₂=60 mol/s

- (a) Calculate the molar flow rate of C₃H₈, O₂ and H₂O in the exit (output) stream.
- (b) Write the reference state you want to use for energy balance.
- (c) Construct the Enthalpy-Concentration table (n_i , \hat{H}_i).
- (d) Calculate the amount of heat that must added/removed from the unit.