

**Chemical Engineering Department
College of Engineering
King Saud University**

Chemical Engineering Principles – II (ChE202)

Time: 90 minutes

2nd Test

Date: 9/6/1430 H

Instructions:

- 1- Answer **ALL** questions
- 2- **Assume** any missing data **after** consulting the tables
- 3- **Take** $C_p = a + bT$ (i.e, neglect higher order terms)

Question 1 (6 points)

- i- Find the enthalpy of steam at 230 °C and 20 bars
- ii- Calculate the standard heat of reaction for: $CH_{4(g)} + O_{(g)} \rightarrow C_2H_{4(g)} + H_2O_{(l)}$
- iii- For (ii) above, what will be the amount of heat if 20 moles of methane is reacted

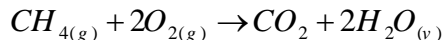
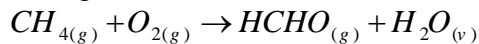
Question 2 (7 points)

An equimolar liquid mixture of methyl alcohol (CH₃OH) and water at 25 °C is fed continuously to a vessel in which the mixture is heated to 70 °C. The liquid product contains 95% (by mol) water and the vapor product contains 90% (by mol) methyl alcohol. **Neglect** the pressure effects. Take the **reference** for both methyl alcohol and water to be (liquid, 25 °C, 1 atm).

- i- Draw and label the flowchart for the unit.
- ii- Calculate the amount of heat added per 100 mol of feed.

Question 3 (7 points)

The following two reactions occur simultaneously in a continuous reactor



The feed to the reactor contains 200 mol/s of methane (CH₄) 2000 mol/s of air (21% oxygen and 79% nitrogen) at 25 °C. The products of the reactor exit at 600 °C and contain 80 mol/s of formaldehyde (HCHO) and 120 mol/s of CO₂. Assume P=1 atm.

- i- Draw and label the flowchart for the reactor.
- ii- Calculate the amount of heat added or removed from the reactor.