

Code.No: RR310802

RR

SET-1

III B.TECH – I SEM EXAMINATIONS, NOVEMBER - 2010
CHEMICAL ENGINEERING THERMODYNAMICS - II
(CHEMICAL ENGINEERING)

Time: 3hours

Max.Marks:80

Answer any FIVE questions
All questions carry equal marks

- - -

- 1.a) Derive the relationship for ΔU and ΔH for sensible heat effects for a homogenous substance with constant composition
- b) Derive Clapeyron equation to find the latent heat, when volumetric data is not available. [8+8]
- 2.a) Derive an expression for estimating the effect of pressure on enthalpy for a real gas. Prove that, from this expression, it does not have any effect on ideal gas.
- b) Calculate the standard enthalpy change of combustion at 298.15 K for liquid ethyl alcohol, if produced water is in gas state. The heat of formation of $CO_2(g)$, $H_2O(g)$ and $C_2H_5OH(l)$ are -393.978, -241.997 and -277.819 KJ respectively. [8+8]
- 3.a) Define fugacity of a pure component and of species in solution. Prove that fugacity of a component in two phases will be equal if both phases are in equilibrium.
- b) Derive generalized co-relation for fugacity from virial equation of state. [8+8]
- 4.a) What is meant by data reduction? Explain how p-x-y data is reduced.
- b) Prove that if component 1 obeys Henry law then component 2 in a binary mixture will obey Raoult's law over the same concentration range. [8+8]
- 5.a) What do you mean by bubble point and dew point. Discuss and plot boiling point diagram and distribution diagram.
- b) The excess Gibbs energy for a binary system is given by $G^E / RT = Ax_1x_2$. Obtain the corresponding expression for $\ln \gamma_1$ and $\ln \gamma_2$. [6+10]
- 6.a) Write the mixing rule commonly used for cubic equation of states. How mixing rule is different from combining rule?
- b) Prove $\ln \bar{\Phi}_1 = P / RT (B_{11} + y_2^2 \delta_{12})$ for a binary mixture. [6+10]
- 7.a) Show by stability analysis that LLE is predicted by the expression $G^E / RT = Ax_1x_2$, $A \geq 2$
- b) Draw and discuss the VLLE diagram for partially miscible liquids [8+8]
- 8.a) Derive the equation $\Delta G^0 = -RT \ln K$
- b) N-butane is isomerizes to i-butane by the action of catalyst at moderate temperature. It is found that the equilibrium is attained at the following composition:

Temp(K)	mol % of n-butane
317	31.00
391	43.00

Assuming ideal condition, calculate the standard free energies of the reaction at 317 K and 391 K and average value of heat of reaction over this temperature range. [6+10]

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(CHEMICAL ENGINEERING)

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- 1.a) Define fugacity of a pure component and of species in solution. Prove that fugacity of a component in two phases will be equal if both phases are in equilibrium.
- b) Derive generalized co-relation for fugacity from viral equation of state. [8+8]

- 2.a) What is meant by data reduction? Explain how p-x-y data is reduced.
- b) Prove that if component 1 Obeys Henry law then component 2 in a binary mixture will obey Raoult's law over the same concentration range. [8+8]

- 3.a) What do you mean by bubble point and dew point. Discuss and plot boiling point diagram and distribution diagram.
- b) The excess Gibbs energy for a binary system is given by $G^E / RT = Ax_1x_2$. Obtain the corresponding expression for $\ln\gamma_1$ and $\ln\gamma_2$. [6+10]

- 4.a) Write the mixing rule commonly used for cubic equation of states. How mixing rule is different from combining rule?
- b) Prove $\ln \bar{\Phi}_1 = P / RT(B_{11} + y_2^2\delta_{12})$ for a binary mixture. [6+10]

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- 6.a) Derive the equation $\Delta G^0 = -RT \ln K$
- b) N-butane is isomerizes to i-butane by the action of catalyst at moderate temperature. It is found that the equilibrium is attained at the following composition:

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- 7.a) Derive the relationship for ΔU and ΔH for sensible heat effects for a homogenous substance with constant composition
- b) Derive Clapeyron equation to find the latent heat, when volumetric data is not available. [8+8]

- 8.a) Derive an expression for estimating the effect of pressure on enthalpy for a real gas. Prove that, from this expression, it dose not have any effect on ideal gas.
- b) Calculate the standard enthalpy change of combustion at 298.15 K for liquid ethyl alcohol, if produced water is in gas state. The heat of formation of $CO_2(g)$, $H_2O(g)$ and $C_2H_5OH(l)$ are -393.978, -241.997 and -277.819 KJ respectively. [8+8]

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- 1.a) What do you mean by bubble point and dew point. Discuss and plot boiling point diagram and distribution diagram.
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- 2.a) Write the mixing rule commonly used for cubic equation of states. How mixing rule is different from combining rule?
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- b) Prove that if component 1 Obeys Henry law then component 2 in a binary mixture will obey Raoult's law over the same concentration range. [8+8]

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- b) Draw and discuss the VLLE diagram for partially miscible liquids [8+8]

- 2.a) Derive the equation $\Delta G^0 = -RT \ln K$
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