SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: ENGR 340 Department: Engineering & Sci. Transfer

Course Title: Intro. to Chemical Engineering Semester: Spring Year: 1999

Objectives/Competencies

Course Objective	Competencies
1. To understand the SI and American Engineering systems of units.	1. List the primary units of each system. 2. List the derived units of each system. 3. Convert any unit in one system to its corresponding unit in the other system.
2. To understand the mole unit.	1. Define a gram mole, pound mole, kilogram-mole, and ton-mole. 2. Convert from one type of mole unit to another type of mole unit.
3. To learn the various definitions used in analysis and measurements that deal with masses, weight, and volume: Density, specific gravity, specific volume, mole fraction, and weight fraction.	1. Define density, specific volume, specific gravity, mole fraction and weight fraction. 2. Calculate densities, specific volumes, specific gravities, mole fractions, and weight fractions. 3. Convert mole fractions to mass fractions and conversely. 4. Convert between densities, specific volumes and specific gravities.

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4. To be able to choose a "basis" in solving a problem.	1. Explain the term basis. 2. Choose the appropriate basis for a given problem.
5. To review the various types of concentrations of a solute in a solvent such as parts per millions(PPM), molarity, molality, and normality.	1. Define molarity, molality, normality and parts per million. 2. Calculate molarities, molalities, normalities, and parts per million. 3. Convert between molarity, molality, normality, and parts per million.
6. To study the concept of temperature, the four temperature scales and the conversions between these scales.	1. Express the concept of temperature. 2. Convert a temperature as one scale to the corresponding temperature on any scale. 3. Compute the temperature change on any temperature scale to the corresponding temperature change on any other scale.
7. To learn the concept of pressure and the differences between atmospheric pressure, absolute pressure, gage pressure and vacuum.	1. Define absolute pressure, atmospheric pressure, gage pressure and vacuum. 2. Compute the absolute pressure knowing the atmospheric pressure and either the gage pressure or vacuum.
8. To review balancing chemical equations.	1. Explain what balancing an equation means. 2. Balance any chemical equation.
9. To be able to pick out the limiting reactant, the excess reactant, and calculate the percent excess of the excess	1. Define limiting reactant and excess reactant. 2. Identify the limiting and excess reactants in a chemical

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reactant.	reaction problem. 3. Calculate the percent excess of the excess reactant in a chemical reaction problem.
10. To be familiar with the terms conversion, selectivity, and yield and to be able to make calculations with them.	1. Define the conversion, selectivity and yield. 2. Calculate the conversion, selectivity, and yield in a chemical reaction problem.
11. To learn the definition of flue gas or stack gas.	1. Define a flue gas or stack gas. 2. Calculate a flue gas or stack gas analysis.
12. To know what is meant by an Orsat analysis of a gas.	1. Define the Orsat analysis of a gas. 2. Calculate the Orsat analysis of a flue gas or stack gas.
13. To be able to calculate the theoretical air (or theoretical oxygen), the excess air (or excess oxygen) in a combustion problem.	1. Define theoretical air or oxygen, excess air or oxygen, and percent excess air or oxygen. 2. Calculate theoretical air or oxygen. 3. Calculate excess air or oxygen. 4. Calculate percent excess air or oxygen.
14. To be able to algebraically formulate the necessary material balance equations for any problem.	1. Write the general conservation of mass equation applicable to any problem. 2. Write the necessary conservation of mass equations for a problem without chemical reactions. 3. Write the necessary conservation of mass equations for a problem with chemical reactions. 4. Write any conservation of mass equation in terms of mass

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	or moles.
15. To know how to solve material balance problems with direct solutions.	1. Solve a material balance system of equations by solving one equation at a time.
16. To know how to solve material balance problems using algebraic techniques (solution of simultaneous of linear algebraic equations).	1. Solve a material balance system of equations using matrix techniques.
17. To be able to use the concept of a tie element in solving material balance problems.	1. Define a tie element. 2. Construct a material balance equation using a tie element.
18. To learn how to solve material balance problems containing recycle, bypass and purge streams.	1. Define recycle, bypass and purge. 2. Construct material balance equations for problems containing recycle, or bypass, or recycle with purge.
19. To be able to solve material balance problems using computer solutions.	1. Apply Polymath to solve any algebraic system of material balance equations. 2. Apply spreadsheets to solve any algebraic system of material balance equations.
20. To be able to use the Ideal Gas Law to solve problems involving the gaseous state of a pure substance.	1. List all of the various forms of the Ideal Gas Law. 2. Solve for the volume or pressure or temperature using the Ideal Gas Law.
21. To know how to calculate the density and specific gravity of a gas.	1. Define density and specific gravity. 2. Combine the definitions of density and specific gravity

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	with the Ideal Gas Law to obtain equations for the density and specific gravity of an ideal gas. 3. Calculate the density and specific gravity of an ideal gas at any pressure and temperature.
22. To learn how to apply Dalton's Law of Partial Pressures and Amagats' Law of Partial Volumes to ideal gaseous mixtures.	1. Define partial pressure and partial volume. 2. Describe Dalton's Law of Partial Pressure and Amagats' Law of Partial Volumes. 3. Calculate the partial pressure and partial volume of any component gas in a gas mixture.
23. To be able to handle real gas calculations for a pure substance by various equations of state, compressibility charts, estimated properties, and actual experimental data.	1. Calculate the pressure, volume, or temperature of a real gas using any of the following methods: a. Van der Waals' equation b. Redlich Kwong equation c. Compressibility factor equation d. Virial Co-efficient equation. e. Tables of experimental data.
24. To develop an engineering judgment as to which method of calculation is best for a real gas at a prescribed set of conditions.	1. Compare the results of calculating the pressure, volume, or temperature of a real gas using the following methods: a. Van der Waals' equation b. Redlich Kwong equation c. Virial Co-efficient equation d. Compressibility factor equation e. Tables of experimental data

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25. To learn how to apply the equations of state to real gas mixtures.	1. Compute the pressure, volume or temperature of a real gas mixture using the following methods: a. Van der Waals' equation b. Redlich Kwong equation
26. To calculate the mean compressibility factor and use it with the compressibility factor charts to deal with real gas mixture.	1. Compute the mean compressibility factor using Dalton's Law and Amagats' Law.
27. To learn how to apply Kays' method of to real gas mixtures.	1. Compute the pseudocritical pressure and temperature. 2. Compute the mean compressibility factor using the pseudocritical pressure and temperature.
28. To know what vapor pressure is and be able to interpret a vapor pressure curve.	1. Define vapor pressure. 2. Read a vapor pressure curve.
29. To be able to calculate vapor pressure as a function of temperature via various equations.	1. Compute the vapor pressure as a function of temperature using the following equations: a. Clausius Clapeyron Equation b. Antoine Equation
30. To know the definition of saturation, partial saturation, relative saturation, molal saturation, and absolute saturation.	1. Define saturation, partial saturation, relative saturation, molal saturation, and absolute saturation. 2. Calculate saturation, partial saturation, relative saturation, molal saturation, and absolute saturation.

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31. To be able to solve material balance problems involving condensation and vaporization.	1. Apply the Conservation of Mass Principle to write the necessary conservation of mass equations for condensation and vaporization problems.
32. To become acquainted with Gibb's Phase Rule and its ramifications relative to phase equilibria.	1. Explain Gibb's Phase Rule. 2. Apply Gibb's Phase Rule to any non-reacting single or multi-phase system.
33. To be able to define various Thermodynamic terms such as: System, intensive property, extensive property, state.	1. Define an open system and a closed system. 2. Identify a system as being an open or closed system. 3. Explain the difference between intensive and extensive properties. 4. State the mathematical relationship between mass based intensive and extensive properties. 5. Define the concept of an equilibrium state.
34. To understand and define various forms of energy such as: Heat, work, kinetic energy, potential energy, and internal energy.	1. Define heat, work, kinetic energy, potential energy, and internal energy. 2. Define the total energy of a system.
35. To know how the Thermodynamic properties enthalpy, constant pressure specific heat, and constant specific heat are defined.	1. Define enthalpy, constant pressure specific heat, and constant volume specific heat. 2. Describe the relationship between enthalpy and the constant specific heat for an ideal gas. 3. Describe the relationship between internal energy and the constant volume specific heat.

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36. To be able to use various forms of heat capacity equations to estimate the enthalpy change of a substance that does not undergo a change in phase.	1. Calculate the enthalpy change of an ideal gas, a solid, or a liquid using heat capacity equations.
37. To be able to calculate and use mean constant pressure heat capacity of gases.	1. Define mean constant pressure heat capacity of a pure substance. 2. Apply mean constant pressure heat capacity to calculate the enthalpy change of an ideal gas.
38. To be capable of calculating the heat of fusion of a pure substance.	1. Define the heat of fusion. 2. Estimate the heat of fusion of a pure substance form the melting point.
39. To know how to calculate the heat of vaporization of a pure substance.	1. Define the heat of vaporization. 2. Calculate the heat of vaporization using Kistyakowsky's Equation. 3. Calculate the heat of vaporization using the Clausius Clapeyron Equation.

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