



C&PE 221

Chemical Engineering Thermodynamics I

This is a short version of my syllabus that focuses on the standards-based grading policies.

Instructor Contact Information

Professor Elizabeth Corson

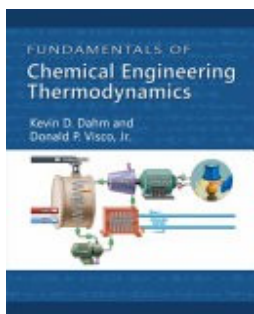
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Course Description

Fundamentals and applications of the First and Second Laws of Thermodynamics with strong emphasis on material, energy and entropy balances to solve engineering problems involving pure components. Topics include: Cycles (Rankine, Brayton, refrigeration, etc.), the calculus of thermodynamics, equations of state for realistic thermodynamic properties, departure functions, equilibrium and stability criteria, fugacity, and single component phase equilibrium (vaporization, melting, sublimation).

Prerequisite: MATH 126 or MATH 146; and C&PE 211. Corequisite: EPHX 210 or PHSX 211 or PHSX 213; or consent of department.

Course Materials



Fundamentals of Chemical Engineering Thermodynamics

ISBN: 9781111580704

Authors: Kevin D. Dahm, Donald P. Visco

Publisher: Cengage Learning

Publication Date: 2014-01-01

[Student Companion Site](#)

Students may purchase or rent a hard copy or purchase the ebook.

Learning Outcomes

By the end of this course, students will be able to:

- LO1 - Define system boundaries and classify systems by mass exchange, energy exchange, and process constraints (open, adiabatic, isothermal, etc).
- LO2 - Determine phase behavior by identifying process stream phases and interpreting phase diagrams and phase transition data.
- LO3 - Apply material balance equations to analyze chemical engineering systems.
- LO4 - Apply energy balance equations to analyze chemical engineering systems.
- LO5 - Compute changes in internal energy and enthalpy using heat capacities or thermodynamic tables.
- LO6 - Apply the ideal-gas law and determine when ideal-gas behavior is appropriate.
- LO7 - Assess process feasibility using the Second Law by evaluating entropy changes and applying entropy balance equations.
- LO8 - Identify reversible and irreversible processes and recognize irreversible features that lead to entropy generation.
- LO9 - Analyze thermodynamic cycles by evaluating efficiencies and COPs, assessing unit operations, and proposing designs that meet specifications.
- LO10 - Evaluate work in thermodynamic processes by computing actual and ideal work.
- LO11 - Manipulate thermodynamic equations to derive and prove fundamental relationships.
- LO12 - Evaluate real behavior by computing and applying residual properties obtained from equations of state.
- LO13 - Estimate vapor pressure using Clausius–Clapeyron, shortcut, and Antoine equations and select the appropriate equation based on the assumptions.
- LO14 - Apply cubic equations of state by computing their parameters, solving them, and interpreting the physical meaning of each root.
- LO15 - Determine the equilibrium state of a system by applying the equilibrium criterion and calculating fugacity from an equation of state.
- LO16 - Learn new concepts through preparation, participation, and by engaging in a cycle of practice, feedback, and revision.
- LO17 - Solve problems collaboratively by engaging in effective teamwork within a small group.

Grading

This course will use standards-based grading.

Learning objectives LO1–LO15 will be assessed through Assessments 1–7. Each problem will address one or more learning objectives. Each problem will be graded as "Achieved", "Not Yet", or "No Attempt" for the relevant learning objectives. The minimum number of times a student must demonstrate "Achieved" for each learning objective is listed in this table:

# of Achieved	Learning Objective
2	LO1
2	LO2
2	LO3
2	LO4
2	LO5
2	LO6
2	LO7
2	LO8
2	LO9
2	LO10
2	LO11
1	LO12
1	LO13
1	LO14
1	LO15
85%	LO16
85%	LO17

For each N required demonstrations of achievement, there will be at least 2N problems assessing that learning objective.

Learning objective LO16 will be assessed through Homework 1–8, attending lectures, and goal setting assignments. At least 85% of the points must be received to achieve LO16.

Learning objective LO17 will be assessed through Discussion assignments 1–7, attending Discussion, and peer feedback assignments. At least 85% of the points must be received to achieve LO17. If your discussion group members unanimously

agree that you did not contribute during Discussion, you will not achieve LO17.

To view your achievement of each learning outcome LO1–LO15 throughout the course, go to Canvas > Grades > Learning Mastery. To view your achievement of learning outcomes LO16 and LO17 throughout the course, go to Canvas > Grades > Traditional Gradebook.

The final grade will be determined by the following:

Letter Grade	GPA	LO1–LO15	LO16 and LO17
A	4.0	14	✓ ✓
A-	3.7	14	—
B+	3.3	12	✓ ✓
B	3.0	12	—
C+	2.3	11	✓ ✓
C	2.0	11	—
D	1.0	10	—
F	0	< 10	—

Depending on overall student performance in the course, I reserve the right to lower (but not raise) the above grade cutoffs. However, this is not something you should count on.

Homework Reassessment

Homework Reassessment

Homework assignments that were submitted on time and met the initial submission requirements (all problems fully completed) are eligible for reassessment. For any problem that did not receive full points, you may rework the problem and submit for reassessment.

In your new submission, the reworked problem must include an analysis at the beginning with the following structure: "In my first attempt I made a mistake on _____. I did not understand _____. Now I know _____. To show my improved learning, I _____."

Submit a new "late submission" through Gradescope by the late submission deadline (typically one week after the original due date), including only the specific problems to be reassessed.

Assessment Schedule

Assessment 1	Week 3	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15			
Assessment 2	Week 5	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assessment 3	Week 7	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assessment 4	Week 9	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Quiz 1	Week 10	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assessment 5	Week 12	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Quiz 2	Week 14	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assessment 6	Week 14	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assessment 7	Week 16 (Final)	<table><tr><td>L01</td><td>L02</td><td>L03</td><td>L04</td><td>L05</td><td>L06</td><td>L07</td><td>L08</td><td>L09</td><td>L10</td><td>L11</td><td>L12</td><td>L13</td><td>L14</td><td>L15</td></tr></table>	L01	L02	L03	L04	L05	L06	L07	L08	L09	L10	L11	L12	L13	L14	L15
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Assignment Schedule

Week #	Date	Assignments
1	1/22/26	Team Contract
1	1/22/26	Discussion 0
1	1/23/26	Goal Setting 1
2	1/29/26	Peer Evaluation 1
2	1/29/26	Discussion 1
2	1/30/26	Homework 1
3	2/6/26	Homework 2
4	2/12/26	Discussion 2
4	2/13/26	Homework 3
5	2/20/26	Homework 4
6	2/26/26	Discussion 3
7	3/6/26	Homework 5
8	3/12/26	Discussion 4
8	3/13/26	Goal Setting 2
9	3/27/26	Homework 6 Peer Evaluation 2
10	4/2/26	Discussion 5
11	4/9/26	Discussion 6
11	4/10/26	Homework 7
13	4/23/26	Discussion 7
13	4/24/26	Homework 8
15	5/7/26	Discussion 8
15	5/8/26	Peer Evaluation 3