Washtenaw Community College Comprehensive Report

CEM 101 Introductory Chemistry
Effective Term: Fall 2023

Course Cover

College: Math, Science and Engineering Tech
Division: Math, Science and Engineering Tech
Department: Chemistry
Discipline: Chemistry
Course Number: 101
Org Number: 12320
Full Course Title: Introductory Chemistry
Transcript Title: Introductory Chemistry
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Consultation with all departments affected by this course is required.
Outcomes/Assessment
Rationale: Three-year review
Proposed Start Semester: Fall 2023
Course Description: In this course, students are introduced to the general concepts of chemistry such as the states of matter, classification of compounds, atomic structure, density, types of chemical reactions, gas laws and stoichiometry. Students will explore best practices and use chemical laboratory procedures to perform experiments, collect data and calculate results. Students with no background in high school chemistry or who have not had high school chemistry for 4 or more years may wish to take this class before taking CEM 105 or CEM 111.

Course Credit Hours

Variable hours: No
Credits: 4
Lecture Hours: Instructor: 45 **Student:** 45
Lab: Instructor: 45 **Student:** 45
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90
Repeatable for Credit: NO
Grading Methods: Letter Grades
Audit
Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

General Education

MACRAO

MACRAO Science & Math

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4
Assoc in Science - Area 4
Assoc in Arts - Area 4

Michigan Transfer Agreement - MTA

MTA Lab Science

Request Course Transfer

Proposed For:

Eastern Michigan University
Ferris State University
Grand Valley State University
Michigan State University
Oakland University
University of Michigan
Wayne State University
Western Michigan University

Student Learning Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter and changes, including fundamental measurements, density, stoichiometry, types of chemical reactions, electronic structure, acids/bases, gases, basic atomic theory, chemical bonding and intermolecular forces at an introductory level.

   Assessment 1

   Assessment Tool: Outcome-related multiple-choice departmental exam questions
   Assessment Date: Winter 2025
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: All
   How the assessment will be scored: Answer key
   Standard of success to be used for this assessment: 70% of the students will score 70% or higher
   Who will score and analyze the data: Departmental faculty

2. Perform laboratory procedures related to science processes and apply basic math concepts, chemical calculations and dimensional analysis to collecting data and calculating results.

   Assessment 1

   Assessment Tool: Sample of laboratory reports
   Assessment Date: Fall 2025
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: Random sample of 25% of students in each section
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 70% of the students will score 7 out of 10 (70%) or higher
   Who will score and analyze the data: Departmental faculty

3. Apply the basic concepts of dimensional analysis, exponential notation and significant figures to calculate stoichiometric quantities, solution concentrations and temperature, and pressures and volumes of gases.

Assessment 1
Assessment Tool: Outcome-related multiple-choice departmental exam questions
Assessment Date: Fall 2025
Assessment Cycle: Every Three Years
Course section(s)/other population: All
Number students to be assessed: All
How the assessment will be scored: Answer key
Standard of success to be used for this assessment: 70% of the students will score 70% or higher
Who will score and analyze the data: Departmental faculty

4. Classify compounds as ionic, molecular, or acids, and apply nomenclature rules to recognize correct chemical names, formulas and balanced chemical equations.

Assessment 1
Assessment Tool: Outcome-related multiple-choice departmental exam questions
Assessment Date: Fall 2025
Assessment Cycle: Every Three Years
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Standard of success to be used for this assessment: 70% of the students will score 70% or higher
Who will score and analyze the data: Departmental faculty

Course Objectives

1. Define terms basic to chemistry, relating to chemical components, and relating to changes and properties.
2. List the three states of matter and describe the characteristics of each.
3. Classify units as being basic or derived.
4. Set up and solve problems involving a "per expression" (conversion factor) by dimensional analysis.
5. Given a mass, length, or volume expressed in metric units, kilo units, centri units, or milli units, express that quantity in the three other units.
6. Add, subtract, multiply and divide measured quantities and correctly express units in the answer, reducing the units by cancellation to their lowest terms.
7. Identify the exponent and base in a given expression.
8. Identify the coefficient, exponential and unit label in a measured quantity expression in exponential form.
9. Convert any number in ordinary decimal form to exponential form, or any number in exponential form to ordinary decimal form.
10. Express any quantity in stand exponential notation (scientific notation).
11. Add, subtract, multiply and divide quantities in exponential notation and express results in scientific notation.
12. Determine the number of significant figures in a measured quantity.
13. Add, subtract, multiply and divide measured quantities and express the results in standard exponential form, rounded to the proper number of significant figures and correct units.
14. Given a quantity expressed in a metric unit, express that quantity in an appropriate English unit and vice versa.
15. Given two of the following for a sample of a pure substance, calculate the third: mass, volume, density.
16. Identify the features of Dalton's Atomic Theory, and state whether each feature is still considered to be valid.
17. Describe the nuclear model of the atom, and identify the three basic subatomic particles by charge and approximate atomic mass.
18. Define basic terms used in representing atoms: atomic number, mass number, isotope, atomic mass unit, atomic mass.

19. Given the name or the symbol of an element from a selected list, write the other.
20. Describe "periodic" as applied to the Periodic Table of Chemical Elements and use the Periodic Table to classify elements.
21. Identify those elements that exist as diatomic molecules.
22. Given the formula for a chemical compound, classify it as ionic or molecular.
23. Given the name or formula of a binary molecular compound, write the other.
24. Given the formula of a compound, determine if it will act as an acid.
25. Given the name or formula for a binary acid, write the other.
26. Given the name of a polyatomic ion, name the corresponding oxoacid.
27. Given the name or formula of an ionic compound, write the other.
28. Given the formula of a compound, determine the number of atoms of each element in the formula.
29. Calculate the formula mass of any compound whose formula is known or given.
30. Define the mole and, given the number of moles (or units) in any sample, calculate the number of units (or moles) in the sample.
31. Calculate the molar mass of any substance whose chemical formula is known.
32. Given a chemical equation, develop "per expressions" from mole ratios among reactants and products as indicated by coefficients.
33. Given a chemical equation and the number of moles or grams of one species in the reaction, calculate the number of moles or grams of any other species.
34. Given the actual yield and information from which the theoretical yield can be calculated, determine the percent yield.
35. Identify characteristic properties of gases and the main features of the Ideal Gas Model.
36. Define the term "pressure" and describe the devices and units used to measure it.
37. Given a temperature value in either kelvins or in degrees Celsius, calculate the other.
38. Describe the relationships between volume, temperature and pressure of a gas.
39. For a fixed quantity of a confined gas, given the initial temperature, pressure, and volume and the final values of any two conditions, calculate the final value of the third condition.
40. Identify characteristic properties of a solution and define terms relating to solutions.
41. Define solution concentration using a "per expression".
42. Given either the % concentration of a solution or the grams of solute and grams of solvent in a solution, calculate the other.
43. Given two of the following, calculate the third: moles of solute, volume of solution, molarity.
44. Given the quantity of any species participating in a chemical reaction for which the equation can be written, find the quantity of any other species, either quantity being measured in: a) grams or, b) volume of solution of specified molarity.
45. Define the terms relating to titration.
46. Identify the properties of acids and bases and the ion that is present in solution for each.
47. Write equations for simple acid-base reactions.
48. Given an equation for a Bronsted-Lowry acid-base reaction, identify the acid, the base, and conjugate pairs.
49. Distinguish between the terms "strong" and "weak" as applied to acids and bases.
50. Given the pH of a solution, classify it as acidic, basic or neutral.
51. Given the volumes of two solutions that react with each other in a titration, the molarity of one solution and the equation for the reaction, calculate the molarity of the second solution.
52. Describe the extranuclear structure of the atom.
53. Give the qualitative relationships between wavelength, frequency and energy.
54. Identify the principal energy levels and sublevels in an atom and describe their relative energies.
55. Describe the shapes of s and p type orbitals.
56. Recognize that chemical properties of an element depend on its electron configuration.
57. Write ground state electron configurations for the first 36 elements.
58. Write the valence electron configuration and Lewis electron dot symbol for any representative element.
59. Given the symbol for a representative element, identify other elements having similar chemical properties and elements having different chemical properties.

60. Distinguish between ionic and covalent bonds, and differentiate between properties of ionic and covalent (molecular) compounds.
61. Distinguish between polar and nonpolar covalent bonds.
62. Given a table of electronegativity values, rank bonds in order of increasing or decreasing polarity.
63. Given the electronegativities of two elements, classify the bond between them as nonpolar covalent, polar covalent or ionic. If the bond is polar, state which end is positive and which end is negative.
64. Identify and describe dipole forces, dispersion forces and hydrogen bonds.
65. Given the structure of a molecule, identify the significant intermolecular forces present.
66. Given the structure of a molecule, compare or predict relative values of physical properties.
67. Observe laboratory safety procedures.
68. Keep a laboratory journal.
69. Manipulate laboratory equipment.
70. Interpret and follow written procedures.
71. Collect data.
72. Calculate results.
73. Draw conclusions based on results.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Level III classroom
Testing Center
Other: Laboratory

Reviewer	Action	Date
Faculty Preparer:		
Breege Concannon	*Faculty Preparer*	*Mar 29, 2023*
Department Chair/Area Director:		
Breege Concannon	*Recommend Approval*	*Mar 29, 2023*
Dean:		
Tracy Schwab	*Recommend Approval*	*Mar 29, 2023*
Curriculum Committee Chair:		
Randy Van Wagnen	*Recommend Approval*	*May 09, 2023*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*May 11, 2023*
Vice President for Instruction:		
Victor Vega	*Approve*	*May 12, 2023*

Washtenaw Community College Comprehensive Report

CEM 101 Introductory Chemistry
Effective Term: Fall 2020

Course Cover

Division: Math, Science and Engineering Tech
Department: Physical Sciences
Discipline: Chemistry
Course Number: 101
Org Number: 12300
Full Course Title: Introductory Chemistry
Transcript Title: Introductory Chemistry
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Consultation with all departments affected by this course is required.
Rationale: Three-year review; no major changes.
Proposed Start Semester: Winter 2019
Course Description: In this course, students are introduced to the general concepts of chemistry such as the states of matter, classification of compounds, atomic structure, density, types of chemical reactions, gas laws and stoichiometry. Students will explore best practices and use chemical laboratory procedures to perform experiments, collect data and calculate results. Students with no background in high school chemistry or who have not had high school chemistry for 4 or more years may wish to take this class before taking CEM 105 or CEM 111.

Course Credit Hours

Variable hours: No
Credits: 4
Lecture Hours: Instructor: 45 **Student:** 45
Lab: Instructor: 45 **Student:** 45
Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 90 **Student:** 90
Repeatable for Credit: NO
Grading Methods: Letter Grades
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Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

Level 3

Requisites

General Education

MACRAO

MACRAO Science & Math

General Education Area 4 - Natural Science

Assoc in Applied Sci - Area 4
Assoc in Science - Area 4
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Request Course Transfer

Proposed For:

Central Michigan University
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Oakland University
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Student Learning Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter and changes, including fundamental measurements, density, stoichiometry, types of chemical reactions, electronic structure, acids/bases, gases, basic atomic theory, chemical bonding and intermolecular forces at an introductory level.
   Assessment 1
   Assessment Tool: Multiple-choice departmental exam
   Assessment Date: Winter 2020
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: All
   How the assessment will be scored: Answer key
   Standard of success to be used for this assessment: 70% of the students will score 75% or higher
   Who will score and analyze the data: Departmental faculty

2. Perform laboratory procedures related to science processes and apply basic math concepts, chemical calculations and dimensional analysis to collecting data and calculating results.
   Assessment 1
   Assessment Tool: Sample of laboratory reports
   Assessment Date: Winter 2020
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: Random sample of 25% of students in each section
   How the assessment will be scored: Departmentally-developed rubric
   Standard of success to be used for this assessment: 75% of the students will score 7 out of 9 (77%) or higher
   Who will score and analyze the data: Departmental faculty

3. Apply the basic concepts of dimensional analysis, exponential notation and significant figures to calculate stoichiometric quantities, solution concentrations and temperature, and pressures and volumes of gases.
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70. Interpret and follow written procedures.
71. Collect data.
72. Calculate results.
73. Draw conclusions based on results.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Level III classroom

Reviewer	Action	Date
Faculty Preparer:		
Kathleen Butcher	*Faculty Preparer*	*Jun 29, 2019*
Department Chair/Area Director:		
Suzanne Albach	*Recommend Approval*	*Jan 15, 2020*
Dean:		
Victor Vega	*Recommend Approval*	*Jan 23, 2020*
Curriculum Committee Chair:		
Lisa Veasey	*Recommend Approval*	*Mar 04, 2020*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*Mar 06, 2020*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Mar 06, 2020*

Washtenaw Community College Comprehensive Report

CEM 101 Introductory Chemistry
Effective Term: Winter 2019

Course Cover

Division: Math, Science and Engineering Tech
Department: Physical Sciences
Discipline: Chemistry
Course Number: 101
Org Number: 12300
Full Course Title: Introductory Chemistry
Transcript Title: Introductory Chemistry
Is Consultation with other department(s) required: No
Publish in the Following: College Catalog , Time Schedule , Web Page
Reason for Submission: Three Year Review / Assessment Report
Change Information:
Consultation with all departments affected by this course is required.
Rationale: new textbook OER
Proposed Start Semester: Winter 2019
Course Description: In this course, students are introduced to the general concepts of chemistry such as state of matter, classification of compounds, atomic structure, density, types of chemical reactions, gas laws and stoichiometry. Students will explore best practices and use chemical laboratory procedures to perform experiments, collect data and calculate results. Students with no backgrounds in high school chemistry or who have not had high school chemistry for 4 or more years may wish to take this class before taking CEM 105 or CEM 111.

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Level 3

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General Education Area 4 - Natural Science
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21. Identify those elements that exist as diatomic molecules.
22. Given the formula for a chemical compound, classify it as ionic or molecular.
23. Given the name or formula of a binary molecular compound, write the other.
24. Given the formula of a compound, determine if it will act as an acid.
25. Given the name or formula for a binary acid, write the other.

26. Given the name of a polyatomic ion, name the corresponding oxoacid.
27. Given the name or formula of an ionic compound, write the other.
28. Given the formula of a compound, determine the number of atoms of each element in the formula.
29. Calculate the formula mass of any compound whose formula is known or given.
30. Define the mole and, given the number of moles (or units) in any sample, calculate the number of units (or moles) in the sample.
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42. Given either the % concentration of a solution or the grams of solute and grams of solvent in a solution, calculate the other.
43. Given two of the following, calculate the third: moles of solute, volume of solution, molarity.
44. Given the quantity of any species participating in a chemical reaction for which the equation can be written, find the quantity of any other species, either quantity being measured in: a) grams or, b) volume of solution of specified molarity.
45. Define the terms relating to titration.
46. Identify the properties of acids and bases and the ion that is present in solution for each.
47. Write equations for simple acid-base reactions.
48. Given an equation for a Bronsted-Lowry acid-base reaction, identify the acid, the base, and conjugate pairs.
49. Distinguish between the terms "strong" and "weak" as applied to acids and bases.
50. Given the pH of a solution, classify it as acidic, basic or neutral.
51. Given the volumes of two solutions that react with each other in a titration, the molarity of one solution and the equation for the reaction, calculate the molarity of the second solution.
52. Describe the extranuclear structure of the atom.
53. Give the qualitative relationships between wavelength, frequency and energy.
54. Identify the principal energy levels and sublevels in an atom and describe their relative energies.
55. Describe the shapes of s and p type orbitals.
56. Recognize that chemical properties of an element depend on its electron configuration.
57. Write ground state electron configurations for the first 36 elements.
58. Write the valence electron configuration and Lewis electron dot symbol for any representative element.
59. Given the symbol for a representative element, identify other elements having similar chemical properties and elements having different chemical properties.
60. Distinguish between ionic and covalent bonds and differentiate between properties of ionic and covalent (molecular) compounds.
61. Distinguish between polar and nonpolar covalent bonds.
62. Given a table of electronegativity values, rank bonds in order of increasing or decreasing polarity.
63. Given the electronegativities of two elements, classify the bond between them as nonpolar covalent, polar covalent or ionic. If the bond is polar, state which end is positive and which end is negative.
64. Identify and describe dipole forces, dispersion forces and hydrogen bonds.
65. Given the structure of a molecule, identify the significant intermolecular forces present.
66. Given the structure of a molecule, compare or predict relative values of physical properties.
67. Observe laboratory safety procedures.

68. Keep a laboratory journal.
69. Manipulate laboratory equipment.
70. Interpret and follow written procedures.
71. Collect data.
72. Calculate results.
73. Draw conclusions based on results.

New Resources for Course

Course Textbooks/Resources

Textbooks
Manuals
Periodicals
Software

Equipment/Facilities

Level III classroom

Reviewer	Action	Date
Faculty Preparer:		
Kathleen Butcher	*Faculty Preparer*	*Sep 24, 2018*
Department Chair/Area Director:		
Kathleen Butcher	*Recommend Approval*	*Sep 24, 2018*
Dean:		
Kristin Good	*Recommend Approval*	*Sep 25, 2018*
Curriculum Committee Chair:		
Lisa Veasey	*Recommend Approval*	*Oct 29, 2018*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*Oct 30, 2018*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Nov 02, 2018*