

Washtenaw Community College Comprehensive Report

CEM 105 Fundamentals of Chemistry

Effective Term: Fall 2015

Course Cover

Division: Math, Science and Health

Department: Physical Sciences

Discipline: Chemistry

Course Number: 105

Org Number: 12320

Full Course Title: Fundamentals of Chemistry

Transcript Title: Fundamentals of 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.

Pre-requisite, co-requisite, or enrollment restrictions

Outcomes/Assessment

Rationale: 3-yr review

Proposed Start Semester: Fall 2015

Course Description: Students with an interest in nursing or other health related areas, or needing a general science elective, find that this broad survey of the major topics in chemistry including states of matter, physical and chemical changes, stoichiometry, atomic and molecular structure, gases and gas laws, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions meets the requirements of their program.

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

Prerequisite

high school chemistry taken in the 2 years prior to enrolling in this course
or

Prerequisite

CEM 090 minimum grade "C"

General Education

MACRAO

MACRAO Science & Math

MACRAO Lab Science Course

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

University of Michigan

Wayne State University

Student Learning Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

Assessment 1

Assessment Tool: ACS exam

Assessment Date: Winter 2017

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer Key

Standard of success to be used for this assessment: 75% of students will score at or above the national average on the exam.

Who will score and analyze the data: Departmental faculty

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.

Assessment 1

Assessment Tool: Lab Reports

Assessment Date: Fall 2017

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

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 assessed will score 6 out of 9 or higher on the lab report.

Who will score and analyze the data: Departmental faculty

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

Assessment 1

Assessment Tool: ACS exam

Assessment Date: Winter 2017

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Answer Key

Standard of success to be used for this assessment: 75% of students will score at or above the national average on the exam.

Who will score and analyze the data: Departmental faculty

Course Objectives

1. Recognize that the principle scientific approach to problem solving is found in the Scientific Method and identify the steps involved in moving from Hypothesis to Theory .

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
2. Classify matter according to state, chemical and or physical properties/changes, or composition.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
3. Describe and calculate the energy changes that occur during chemical and physical processes.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
4. Use and interpret symbolic notation representing atoms and compounds.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
5. Describe the history of the atom , beginning with Democritus through Dalton's Atomic Theory concluding with the current nuclear model of the atom.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
6. Apply the concept of dimensional analysis to problems involving English, Metric and SI units.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
7. Apply rules for Significant figures to all calculations throughout the course and in the lab.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

8. Apply the concept of the mole in chemical calculations to determine quantities such as empirical formulas, stoichiometric amounts and solution concentrations.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

9. Represent electron configurations of atoms.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

10. Predict properties of elements based on electron configuration and position in the Periodic Table.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

11. Account for trends in periodic properties based on size of subshell, effective nuclear charge and strength of electrostatic attraction between nucleus and valence electrons.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

12. Distinguish among ionic, metallic and covalent bonds, identify which type occurs in various substances and compare their properties.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

13. Write Lewis electron dot structures for atoms, ions, and molecules and interpret Lewis structures to determine shape and polarity of molecules.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

14. Name ionic, molecular and acid compounds given a chemical formula and write the formula for these compounds given their name.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

15. Write and balance chemical equations.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

redox reactions.

16. Classify chemical reactions given reactants and products.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

17. Given the reactants in a metathesis reaction and a solubility table, write balanced molecular and ionic equations, identify spectator ions, and write net ionic equations.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

18. Apply the concept of stoichiometry to calculations involving chemical reactions, including calculations of theoretical yield, percent yield and molar volume problems for gases.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

19. Use the Kinetic Molecular Theory to account for observed macroscopic properties of a gas and to explain the experimentally determined gas laws.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

20. Describe the effects of temperature, pressure, volume and quantity on the behavior of a gas based on the Gas Laws - Boyle's, Charles, Gay-Lussac's, and Dalton's.

Matched Outcomes

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

21. Use the Ideal Gas Law to predict values of temperature, pressure, volume or quantity of a gas or to determine molar mass of a gas.

Matched Outcomes

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

22. Describe properties of solids and liquids.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

23. Sketch and interpret heating/cooling curves and phase diagrams

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

24. Describe the specific properties of water that make it a most unusual liquid.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

25. Identify specific solution terminology and explain the concept of solubility using the solubility rule "like dissolves like" .

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

26. Outline the steps in the solution process, including energy changes that occur.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

27. Recognize and calculate various types of solution concentration.

Matched Outcomes

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

28. Explain how reaction rates are related to Collision Theory indicating the specific factors that can affect reaction rates.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

29. Identify the energy changes that occur when chemical bonds are made or broken.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.

30. Use Le Chatelier's Principle to make predictions about how reactions in equilibrium will be affected by changes in temperature, pressure, concentration and presence of a catalyst.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or

- amounts of gases; analyze intermolecular forces of substances and predict properties.
31. Describe the concept of dynamic equilibrium. Write and interpret equilibrium constant expressions.

Matched Outcomes

3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.
32. Define acids and bases according to the Bronsted Lowry model

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
33. Describe a Titration using correct terminology and solve problems related to titrations.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.
34. Define a buffer solution and describe how this solution is able to resist changes in pH in the presence of additional acid or base.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.
35. Assign oxidation numbers to the atoms in a given chemical formula.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
36. For a given oxidation-reduction reaction identify the species that are oxidized; reduced; the oxidizing agent; and the reducing agent.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
37. Balance oxidation/reduction equations using half-reactions.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or

- amounts of gases; analyze intermolecular forces of substances and predict properties.
38. Describe chemical cells (electrolytic and voltaic) explaining how these reactions produce and/or use electricity.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
39. Observe laboratory safety procedures.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
40. Keep a laboratory journal.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
41. Manipulate laboratory equipment.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
42. Interpret and follow written procedures.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
43. Make observations and collect data.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
44. Interpret and summarize data and calculate results

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
45. Apply significant figures to measurements, calculations and data analysis.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.

46. Draw conclusions based on experiment results.

Matched Outcomes

2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
3. Apply the basic concepts to calculate stoichiometric quantities; determine electron configurations and predict trends in periodic properties; draw Lewis Structures and predict molecular shape and properties; calculate temperature, pressures, volumes or amounts of gases; analyze intermolecular forces of substances and predict properties.
47. Classify given acids or bases as weak or strong.

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
 2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
48. Interpret pH values or litmus paper test results to determine if a solution is acidic, basic, or neutral

Matched Outcomes

1. Recognize the concepts and principles of general chemistry relating to matter, energy, fundamental measurements, stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces, acids/bases and redox reactions.
2. Perform laboratory procedures related to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.

New Resources for Course

Course Textbooks/Resources

Textbooks

Zuhmdahl. *Introductory Chemistry - a foundation*, customized ed. Cengage Learning, 2014, ISBN: 978-1-305-039.

Manuals

griswold - wcc chem department. Fundamentakls of Chemistry - a laboratory manual CEM 105, Huron Valley publishing solutions, 09-01-2014

Periodicals

Software

Equipment/Facilities

Level III classroom

Reviewer

Faculty Preparer:

Kathleen Butcher

Department Chair/Area Director:

Kathleen Butcher

Dean:

Kristin Brandemuehl

Vice President for Instruction:

Bill Abernethy

Action

Faculty Preparer

Recommend Approval

Recommend Approval

Approve

Date

Oct 28, 2014

Oct 28, 2014

Oct 29, 2014

Dec 01, 2014