Washtenaw Community College Comprehensive Report

CEM 111 General Chemistry I
Effective Term: Fall 2019

Course Cover

Division: Math, Science and Engineering Tech
Department: Physical Sciences
Discipline: Chemistry
Course Number: 111
Org Number: 12320
Full Course Title: General Chemistry I
Transcript Title: General Chemistry I
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 syllabus review based on assessment report submission.
Proposed Start Semester: Spring/Summer 2019
Course Description: In this course, students will learn the major topics in chemistry including states of matter, physical and chemical changes, stoichiometry, atomic and molecular structure, chemical bonding, thermochemistry and intermolecular forces. It is intended for students in a professional or pre-professional curriculum. Students need intermediate algebra skills to be successful in this course.

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

No Level Required

Requisites

Prerequisite
MTH 169 minimum grade "C"
or higher (excludes MTH 178 and 181)
Prerequisite
high school chemistry (taken within last 5 years)

or
Prerequisite
CEM 101 minimum grade "C"
(taken within last 5 years),

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:

Student Learning Outcomes

1. Recognize the concepts and principles of general chemistry relating to stoichiometry, electronic structure, periodic properties, chemical bonding, energy and heat, intermolecular forces and physical properties of substances.
   Assessment 1
   Assessment Tool: Departmental final assessment exam
   Assessment Date: Fall 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: All
   How the assessment will be scored: The final assessment exam (specifically part A) is a multiple choice exam and will be scored using an answer key
   Standard of success to be used for this assessment: 75% of students will score 70% or higher on the test questions from Part A of the final assessment exam
   Who will score and analyze the data: Faculty teaching the course will score the test. The data will be analyzed by the full-time chemistry faculty

2. Apply the appropriate concepts or principles of chemistry to solve chemical problems.
   Assessment 1
   Assessment Tool: Departmental final assessment exam
   Assessment Date: Fall 2019
   Assessment Cycle: Every Three Years
   Course section(s)/other population: All
   Number students to be assessed: All
   How the assessment will be scored: The problems with multiple choice answers (Part B of the departmental final exam) will be blind-scored against an answer key. The limiting reactant problem in which students have to show their work will be blind-scored using a departmentally-developed rubric.
   Standard of success to be used for this assessment: 75% of students will score 70% or higher on the multiple choice questions. 75% of students will score 70% or higher on the limiting reactant problem requiring that they show their work.
   Who will score and analyze the data: The test questions will be scored by the faculty teaching the course. The data will be analyzed by the full-time chemistry faculty.

3. Follow the science process in the laboratory by properly collecting and recording data, calculating and analyzing results, and drawing conclusions based on the analyses.

Assessment 1

Assessment Tool: Lab report
Assessment Date: Fall 2019
Assessment Cycle: Every Three Years
Course section(s)/other population: All
Number students to be assessed: Random sample of 25%
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 70% or higher on the lab report (7 out of 10 points)
Who will score and analyze the data: The chemistry faculty will score the lab reports and analyze the data

Course Objectives

1. Recognize how the scientific method develops microscopic models from macroscopic observations.
2. Identify steps of the scientific method present in a scientific article.
3. Differentiate between observations and inferences.
4. Measure and record data.
5. Perform calculations on data to obtain results.
6. Draw conclusions from experimental observations or results.
7. Recognize accuracy and precision in data sets.
8. Classify matter based on macroscopic properties.
9. Represent matter symbolically.
10. Use and interpret symbolic notation representing atoms.
11. Apply the concept of the mole in chemical calculations to determine quantities such as empirical formulas, stoichiometric amounts and solution concentrations.
12. Identify the general and quantative relationships among the characteristics of waves: wavelength, frequency, speed and energy.
13. Represent electron configurations of atoms.
14. Predict properties of elements based on electron configuration and position in the Periodic Table.
15. Account for trends in periodic properties based on size of subshell, effective nuclear charge and strength of electrostatic attraction between nucleus and valence electrons.
16. Describe metathesis reactions and list the indicators of reaction and types of products that allow these reactions to occur.
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.
18. Write Lewis electron dot structures for atoms, ions and molecules.
19. Interpret Lewis structures to determine shape, polarity and orbital hybridization of molecules.
20. Distinguish among ionic, metallic and covalent bonds, identify which type occurs in various substances, and compare their properties.
21. Assign oxidation numbers to the atoms in a given chemical formula.
22. For a given oxidation-reduction reaction identify the species that are: oxidized; reduced; the oxidizing agent; and the reducing agent.
23. Describe the properties of elements and compounds that exist as gases at room temperature.
24. Describe the effects of temperature, pressure, volume and quantity on the behavior of a gas.
25. Use the Ideal Gas Law to: predict values of temperature, pressure, volume or quantity of a gas; determine molar mass of a gas; determine density of a gas at a given temperature and pressure.
26. Use the Kinetic Molecular Theory to account for observed macroscopic properties of a gas and to explain the experimentally determined gas laws.
27. Recognize the conditions in which real gases deviate from ideal gas behavior and account for the deviations in terms of assumptions of the Kinetic Molecular Theory.
28. Define energy and differentiate between kinetic and potential energy.
29. Identify the energy changes that occur when chemical bonds are made or broken.
30. Describe and calculate the energy changes that occur during chemical and physical processes.

31. Interpret thermochemical reactions.
32. Calculate heats of reaction using tabulated enthalpy of formation values, Hess' Law, or experimental calorimetry data.
33. Identify types of intermolecular forces acting in a given substance.
34. Predict and account for trends in properties of liquids such as vapor pressure, melting point, boiling point, viscosity and surface tension based on intermolecular forces.
35. Describe the concept of dynamic equilibrium.
36. Define equilibrium vapor pressure and interpret vapor pressures curves.
37. Sketch and interpret heating/cooling curves and phase diagrams.
38. Outline the steps in the solution process, including energy changes that occur.
39. Explain the solubility rule "like dissolves like" and apply the rule to predict solubilities.
40. Differentiate amount various solution characteristics.
41. Describe how the dynamic equilibrium process applies to a saturated solution.
42. Recognize how various factors affect solution conductivity.
43. Distinguish between ionization and dissociation and write reactions representing each.
44. Define: electrolyte, nonelectrolyte, strong electrolyte and weak electrolyte in terms of conductivity and number of ions present in solution.
45. Define acids and bases according to the Bronsted Lowry model.
46. Summarize differences between weak and strong acids (or bases) in terms of: conductivity, degree of ionization and relative number of hydronium ions (or hydroxide ions) produced.
47. Classify given acids or bases as weak or strong.
48. Define pH and describe its relationship to degree of acidity in a solution.
49. Interpret pH values or litmus paper test results to determine if a solution is acidic, basic or neutral.
50. Predict whether a given salt solution will be acidic, basic or neutral.
51. Define a buffer solution and describe the two substances it must contain.
52. Write net ionic equations that show how a buffer neutralizes added acid or base.
53. Observe laboratory safety procedures.
54. Keep a laboratory journal.
55. Interpret and follow written procedures.
56. Manipulate laboratory equipment to make measurements.
57. Make observations and collect data.
58. Interpret and summarize data and calculate results.
59. Apply significant figures to measurements, calculations and data analysis.
60. Draw conclusions based on experimental results.

New Resources for Course

Course Textbooks/Resources

Textbooks

OpenStax (free OER). *Chemistry* , 1st ed. OpenStax (free electronic book--OER), 2016

Manuals

Periodicals

Software

Equipment/Facilities

Level III classroom

Testing Center

Data projector/computer

Other: Laboratory with data projector and computer. MIcroLab computer interface, software and laptops.

Reviewer	Action	Date

Faculty Preparer:

Tracy Schwab	*Faculty Preparer*	*Jan 09, 2019*
Department Chair/Area Director:		
Suzanne Albach	*Recommend Approval*	*Jan 17, 2019*
Dean:		
Kristin Good	*Recommend Approval*	*Jan 18, 2019*
Curriculum Committee Chair:		
Lisa Veasey	*Recommend Approval*	*Feb 18, 2019*
Assessment Committee Chair:		
Shawn Deron	*Recommend Approval*	*Feb 19, 2019*
Vice President for Instruction:		
Kimberly Hurns	*Approve*	*Feb 20, 2019*