



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

**LAST REVIEW: 2010-2011**

*(i.e. 2003-2004)*

**NEXT REVIEW: 2015-16**

*(i.e. 2008-2009)*

**STATUS: A**

*(A, I, D)*

**COURSE TITLE: General Chemistry II**

**COMMON COURSE NUMBER: CHM 1046**

**CREDIT HOURS: 3**

**CONTACT HOUR BREAKDOWN**

*(per 16 week term)*

**CLOCK HOURS:**

*(Voc. Course ONLY)*

Lecture: **48**

Lab:

Clinic:

Other:

**PREREQUISITE(S): MAC 1105, CHM 1041 or CHM 1045, and CHM 1045L**

**COREQUISITE(S): CHM 1046L**

**PRE/COREQUISITE(S):**

**COURSE DESCRIPTION** *(750 characters, maximum)*: This is the final course of the two-semester general chemistry sequence: CHM 1045 and CHM 1046; and the final course of the three-semester general chemistry sequence: CHM 1040, CHM 1041, and CHM 1046. These sequences include two laboratories: CHM 1045L to be taken concurrently with CHM 1041 or CHM 1045, and CHM 1046L to be taken with CHM 1046. Topics covered include thermodynamics, kinetics, equilibrium, electrochemistry, coordination chemistry, descriptive chemistry of metals, nuclear chemistry and an introduction to organic chemistry.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): 4B Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): 4 Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

### UNIT TITLES

1. Reading and Writing in Chemistry
2. Thermodynamics
3. Kinetics
4. Chemical Equilibrium
5. Aqueous Equilibrium
6. Electrochemistry
7. Some Descriptive Chemistry: Metals
8. Coordination Compounds
9. Nuclear Chemistry
10. Introduction to Organic Chemistry



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

\*\*\* Complete the following only if course is seeking general education status \*\*\*

### GENERAL EDUCATION Competencies and Skills \*:

In the box to the right of the Competency/Skill, enter all specific **student learning outcome** unit numbers, as indicated in the course outline (i.e. 1.1, 2.7, 4.2, 4.0 and 5.12) that apply.

|  |  |
|--|--|
| <b>Course must include <u>all</u> of the following:</b>  |  |
| <b>1. Read with critical comprehension**</b>   | 1.1,1.2,2.1,2.3,3.3,4.2,4.6,5.2,5.3,5.9,5.11,8.1,8.3,8.4,8.5,9.3,10.2,10.3,10.4                      |
| <b>2. Write clearly and coherently**</b>   | 1.1,1.3,3.2,3.3,4.1,6.4,6.8,7.0,7.1,7.6,8.3,9.1,9.2,9.4,9.6,9.8,10.2,10.3                            |
| <b>3. Demonstrate literacy as appropriate within a given discipline**</b>  | e) 1.1,1.3,2.2,2.4,2.5,3.2,3.4,4.5,5.1,5.4,5.5,5.6,5.8,5.10,5.12,5.14,6.5,6.6,9.7<br>f) 6.1,6.3, 6.8 |
| <b>4. Apply problem solving skills or methods to make informed decisions in a variety of contexts**</b>  | 2.2,3.5,4.4,5.7,5.13,6.2,6.7,7.2,7.3,7.4,7.5,8.6,10.5  |
| <b>Course must include at least <u>one</u> of the following:</b>   |  |
| <b>5. Differentiate between ethical and unethical behavior</b>   |  |
| <b>6. Demonstrate an understanding of the physical, biological, and social environments and how individual behaviors impact this complex system.</b> | 2.5, 5.7, 6.3, 9.8, 9.9  |
| <b>7. Demonstrate an understanding of and appreciation for human diversities and commonalities.</b>  |  |
| <b>8. Speak and listen effectively.</b>  |  |

*\*General Education Competencies and Skills endorsed by 2010-2011 General Education Task Force*

### \*\*Required Competencies

#### 1) Read with critical comprehension.

The student will be introduced to the basic texts, concepts, vocabulary, and methods necessary for developing an understanding of the discipline and meeting the required benchmarks as stated in the course outline.

#### 2) Write clearly and coherently.

The student will demonstrate an understanding and mastery of subject matter in a variety of ways, including writing. Writing activities may include both graded and ungraded essays, short answer quizzes, summaries, reactions, journals, and various other reports.

#### 3) Demonstrate and apply literacy across all the disciplines (indicate which ones apply).

- a) **Information literacy** means understanding how to locate needed information, using the appropriate technology for the task, managing and evaluating the extracted information and using it effectively and ethically.
- b) **Technology literacy** is the ability to responsibly and effectively use appropriate technology to access, manage, integrate, or create information, and/or use technology to accomplish a given task.
- c) **Workplace literacy** is having the appropriate knowledge and skills to communicate and work with others effectively and perform job duties, whether it is through the use of computers and/or other technology.
- d) **Cultural literacy** is recognizing, understanding, and appreciating the similarities and differences between one's own culture and the cultures of others through a study of the arts, customs, beliefs, values, and history that define a culture.
- e) **Quantitative literacy** is having the ability to formulate, solve and interpret mathematical/statistical operations and graphical/tabular representations to make informed decisions.
- f) **Scientific literacy** means understanding the methodology and application of the scientific process, the physical and biological worlds, and recognizing that scientific knowledge is continuously updated or revised as new information is discovered.



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## COURSE OUTLINE

**4. Apply problem-solving skills or methods to make informed decisions in a variety of contexts.**

The student will use acquired skills or methods to recognize, analyze, adapt, and apply critical thinking to solve problems and make informed decisions.



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

### EVALUATION:

In the box to the right of the Methods of Assessment, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 4.0, 4.2 and 5.12) that apply.

|  |  |
|--|--|
| 1. Portfolio                           |  |
| 2. Short essays                        | 1.0, 3.5, 4.1, 4.4, 6.3, 7.2, 7.3, 9.8, 9.9                                    |
| 3. Research Papers                     | 1.0, 3.1, 6.3, 9.8, 9.9  |
| 4. Group projects                      | 1.0, 3.1, 6.3, 7.4, 9.2, 9.8, 9.9  |
| 5. Discussions (In class and online)   | 1.3, 1.4, 3.1, 3.5, 4.4, 5.7, 6.3, 6.8, 7.2, 9.8                               |
| 6. Multiple Choice tests               | 2.2-2.5, 3.3, 5.3, 5.4, 8.1, 8.5, 9.4, 10.2, 10.6                              |
| 7. Presentations                       | 1.0, 3.1, 4.4, 6.3, 7.6  |
| 8. Service Learning Projects           |  |
| 9. Quizzes (pop, announced, etc.)      | 2.1-2.5, 3.3, 5.1, 5.8, 6.7, 8.1, 8.4, 9.4, 10.2, 10.4                         |
| 10. Take-home tests                    | 1.0, 2.4, 5.12, 5.14, 6.6  |
| 11. Summaries, critiques, and analyses |  |
| 12. Reaction papers                    |  |
| 13. Surveys                            |  |
| 14. Performance                        |  |
| 15. Short answer tests                 | 1.0, 2.2-2.5, 3.2-3.4, 4.2-4.6, 5.2,5.10, 5.13, 6.5, 8.5, 9.4, 9.9, 10.1, 10.5 |
| 16. Classroom debates and colloquia    | 1.4  |
| 17. Blogs, wikis, web pages            |  |
| 18. Other (Please explain)             |  |



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: CHM 1046

## UNITS

### Unit 1: Reading and Writing in Chemistry

#### General Outcome:

**1.0 The student shall be able to clearly communicate in writing information derived from course related readings about the major concepts and themes in the chemical sciences.**

#### Specific Measurable Learning Outcomes:

**Upon successful completion of this unit, the student shall be able to:**

- 1.1 Demonstrate in writing the ability to analyze, evaluate, compare, and/or extract data relevant to chemistry from course related readings.**
- 1.2 Evaluate the validity of information from a variety of sources, including but not limited to such sources as electronic, print sources, and data bases.**
- 1.3 Demonstrate with the use of diagrams, drawings, outlines, concept maps, and/or other methods the connections among chemical concepts.**
- 1.4 Demonstrate the ability to use the appropriate technology to carry out course requirements.**



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 2 Thermodynamics

#### General Outcome:

- 2.0 The student shall be able to demonstrate familiarity with the fundamental principles of chemical thermodynamics.

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Define and use the common thermodynamic symbols and terms.
- 2.2 Perform calculations based on heat transfer.
- 2.3 Discuss the concept of a state function. Analyze the major thermodynamic state functions (such as  $\Delta H^\circ$ ,  $\Delta S^\circ$ , and  $\Delta G^\circ$ ) and recognize and interpret the meaning of the signs of these functions.
- 2.4 Calculate  $\Delta H^\circ$ ,  $\Delta S^\circ$ , and  $\Delta G^\circ$  utilizing data from thermodynamic tables.
- 2.5 Use  $\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$  to perform calculations and conclude whether a reaction is spontaneous or non-spontaneous from the results.



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 3 Kinetics

#### General Outcome:

- 3.0 The student shall be able to demonstrate a knowledge of the terms and concepts of chemical kinetics and be able to solve related problems.**

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Examine the factors that affect reaction rates and interpret them in terms of collision theory.**
- 3.2 Use experimental data to formulate the rate law expression. Apply the rate law and data to calculate rate constants, half-life, and reaction order.**
- 3.3 Define and use the terms: reaction intermediate, activation energy, effective collision, reaction order, homogeneous and heterogeneous catalysts, rate-determining step and reaction mechanism.**
- 3.4 Analyze and interpret energy diagrams related to kinetics.**
- 3.5 Express and evaluate the relationships among reaction mechanism, rate determining step and rate law expression.**



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 4 Chemical Equilibrium

#### General Outcome:

- 4.0 The student shall be able to demonstrate a knowledge of the fundamental principles of chemical equilibrium.

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Define chemical equilibrium and describe the properties of a system at equilibrium.
- 4.2 Write the expression for  $K$  from a balanced equation.
- 4.3 Compare the magnitude of  $K$  in general to the relative amounts of products and reactants present at equilibrium.
- 4.4 Apply Le Chatelier's Principle to describe the qualitative changes caused by various stresses on a system at equilibrium.
- 4.5 Calculate equilibrium constants ( $K$ ) from given concentration values, and calculate concentration values from given equilibrium constants.
- 4.6 Differentiate between homogeneous and heterogeneous equilibria.



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## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 5 Aqueous Equilibrium

#### General Outcome:

- 5.0 The student shall be able to demonstrate a knowledge of the principles of chemical equilibrium as applied specifically to aqueous solutions.

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Use  $K_w$  to calculate  $[H^+]$  and  $[OH^-]$  in various aqueous solutions.
- 5.2 Interpret the relationships among  $[H^+]$ ,  $[OH^-]$ , pH, and pOH and perform calculations involving these terms.
- 5.3 Distinguish between strong and weak acids and bases.
- 5.4 Calculate ionization constants for weak acids ( $K_a$ ) and bases ( $K_b$ ).
- 5.5 Apply  $K_a$  or  $K_b$  to calculate equilibrium concentrations of species present in solutions of weak acids and bases.
- 5.6 Calculate  $pK_a$  or  $pK_b$  from ionization constants.
- 5.7 Demonstrate and evaluate how a buffer system controls pH.
- 5.8 Perform calculations relevant to a buffer system.
- 5.9 Define ionic dissociation and apply this concept to aqueous solutions of salts.
- 5.10 Interpret acid-base titration curves and differentiate between equivalence point and endpoint.
- 5.11 Write the expression for  $K_{sp}$  for slightly soluble solids.
- 5.12 Calculate  $K_{sp}$  for a substance given solubility data and calculate molar solubility given  $K_{sp}$ .
- 5.13 Define the common ion effect and interpret its effect on solution concentration.
- 5.14 Evaluate the solubility of salts in a solution based on molar solubility and  $K_{sp}$ .



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## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 6 Electrochemistry

#### General Outcome:

- 6.0 The student shall be able to demonstrate a knowledge of the terms and concepts related to electrochemical systems.

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Describe the components and processes occurring in electrolytic cells.
- 6.2 Apply Faraday's Law of Electrolysis to specific electrolytic systems.
- 6.3 Discuss some commercial applications of electrolysis.
- 6.4 Describe the components and processes present in voltaic cells.
- 6.5 Apply the information contained in a standard electrode potential tables for evaluating  $E^\circ$  for a voltaic cell and for predicting reaction spontaneity.
- 6.6 Define and apply the Nernst equation to electrochemical systems.
- 6.7 Relate the terms  $E^\circ$  cell to Gibbs free energy change, and  $\Delta G^\circ$  to the thermodynamic equilibrium constant  $K$ .
- 6.8 Evaluate the components and relate them to the reactions in commercial voltaic cells.



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: CHM 1046

## Unit 7 Some Descriptive Chemistry: Metals

### General Outcome:

- 7.0 The student shall be able to demonstrate a knowledge of some of the common metallic elements, their properties and chemistry.

### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Categorize the general properties of metals.
- 7.2 Interpret metal bonding and its effect on the properties of metals.
- 7.3 Appraise the periodicity of metallic properties within the periodic table.
- 7.4 Describe reactivity, abundance, and importance of metal compounds in nature.
- 7.5 Evaluate periodic trends of the transition metals.
- 7.6 Compare the properties of some important transition metals and their compounds.



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 8 Coordination Compounds

#### General Outcome:

- 8.0 The student shall be able to demonstrate a knowledge of the nature, properties and importance of coordination compounds.**

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1 Identify the components of a coordination compound.**
- 8.2 Define and apply the terms: coordinate covalent bond, central metal, ligand, coordination sphere, coordination number, unidentate, bidentate, polydentate, donor atom, chelate and isomer.**
- 8.3 Construct and write the name of coordination compounds using IUPAC rules.**
- 8.4 Evaluate the geometries associated with the specific coordination numbers in coordination compounds.**
- 8.5 Differentiate and appraise the types of isomerism in coordination compounds and assemble examples of each.**
- 8.6 Examine some important uses of coordination compounds.**



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 9 Nuclear Chemistry

#### General Outcome:

**9.0 The student shall be able to demonstrate a knowledge of the fundamental principles of nuclear structure and nuclear changes.**

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1 Distinguish between nuclear changes and ordinary chemical changes.**
- 9.2 Assess the factors relating to nuclear stability.**
- 9.3 Define and apply the terms: radiation, radioactivity, nuclide, isotope, naturally-occurring, artificial transmutation.**
- 9.4 Write, contrast, and compare nuclide symbols for common types of subatomic particles.**
- 9.5 Write and balance nuclear equations.**
- 9.6 Evaluate the methods used to detect and measure radiation.**
- 9.7 Define half-life and perform calculations involving half-life.**
- 9.8 Construct and write equations that represent nuclear fission and fusion, and discuss some applications of these processes.**
- 9.9 Discuss and assess several uses of radioactive nuclides.**



# BROWARD COMMUNITY COLLEGE

## COURSE OUTLINE

Common Course Number: CHM 1046

### Unit 10 Introduction to Organic Chemistry

#### General Outcome:

**10.0 The student shall: be able to demonstrate a knowledge of some of the aspects of organic chemistry, including types of compounds, some of the rules for their naming and important classes of reactions.**

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 10.1 Differentiate between organic and inorganic compounds.**
- 10.2 Distinguish and write the common functional groups in organic compounds.**
- 10.3 Compose and write the name of simple organic compounds containing the common functional groups.**
- 10.4 Write equations for the simple reactions of the common functional groups.**
- 10.5 Recognize and construct structural isomers of organic compounds**
- 10.6 Identify common functional groups in macromolecular organic and biological compounds.**