

Adult Basic Education
Science

Chemistry 2102C

Solutions and Organic Chemistry

Study Guide

Prerequisites: Chemistry 1102
Chemistry 2102A
Chemistry 2102B

Credit Value: 1

Text: *Chemistry*. Mustoe, Jansen, et al; McGraw-Hill Ryerson; 2004.

Chemistry Concentration

Chemistry 1102
Chemistry 2102A
Chemistry 2102B
Chemistry 2102C
Chemistry 3102A
Chemistry 3102B
Chemistry 3102C

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To the Student

I. Introduction to Chemistry 2102C

Chemistry 2102C is the fourth course in the Chemistry Concentration in the Adult Basic Education program. **Chemistry 1102, 2102A and 2102B are pre-requisites to Chemistry 2102C.**

The first part of this course introduces (or reviews) the basic concepts of solutions. It goes on to explore how to calculate the concentrations of solutions and how to apply your stoichiometry skills (developed in 2102A) to chemical reactions that involve solutions.

The second part of this course introduces organic chemistry, the study of molecular compounds of carbon. You will discover the amazing variety of organic compounds in your body and your life. You will come to appreciate the need for a systematic naming scheme. You will learn how to name organic compounds and how to draw their structures. You will discover how the classification of organic molecules into different family groups depends on the type of bonding and atoms present.

The knowledge and skills that you acquire in this course are essential for the remainder of the ABE Chemistry courses. **Therefore, Chemistry 2102C is a pre-requisite for all remaining chemistry courses in the chemistry concentration.**

The text book for this course is *Chemistry*; Mustoe, Jansen, et al; McGraw-Hill Ryerson; 2004. You will also need to use a scientific calculator as you work through the problems in this course.

To the Student

II. Use of Science Study Guides

Before beginning this course, ensure you have the text and any other resources needed (*see the information in the Introduction to this course for specifics*).

As you work through the Study Guide, you will see that it is divided according to the Units listed in the Table of Contents. When you open a unit it will have the following components:

Reading for this Unit:

Here you will find the chapters, sections and pages of the text you will use to cover the material for this unit. Skim the sections of the textbook, look at the titles of the sections, scan the figures and read any material in the margins. Once you have this overview of the unit, you are ready to begin. Do not be intimidated by the content. You will work through the text, section by section, gaining knowledge and understanding of the material as you go.

References and Notes	Work to Submit
<p>This left hand column guides you through the material to read from the text. Read any highlighted notes that follow the reading instructions. The symbols   direct you to the questions that you should complete when finished a reading assignment..</p>	<p>You come across three (3) headings in this right hand column.</p> <p>Writing: This section comprises your notes for the unit. Here you will find either written questions or references to specific questions or problems from your text. You may want to write out each question followed by the answer. This material should be checked by your instructor before moving on to the next unit. Mathematical problems should have their solutions checked <u>as you go</u>.</p> <p>Laboratory: This section indicates if there is a Core Lab that should be completed for the unit. Let the instructor know in advance that you will be ready for the lab. A lab report should be submitted for each Core Lab. Your instructor will provide guidelines as to how s/he wants the report written.</p> <p>Assignment: This section indicates if there is an assignment that should be completed for the Unit. The information in the “References and Notes” column will indicate how you obtain the assignment. These assignments frequently relate the science content to technology, society and the environment.</p>

To the Student

III. Recommended Evaluation

Written Notes	10%
Labs/Assignments	20%
Test(s)	20%
Final Exam (<i>entire course</i>)	<u>50%</u>
	100%

The overall pass mark for the course is 50%.

Unit 1 - Introduction to Solutions

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit: *Chemistry*

Chapter 7: Introduction: page 236

Section 7.1: pages 237 - 241

Section 7.2: pages 243 - 254

References and Notes

Read 'Types of Solutions', pages 237 - 241. Then answer questions 1.1 - 1.6 

Read 'Factors that Affect Rate of Dissolving and Solubility', pages 243 - 252. Then answer questions 1.7 - 1.13 

Note:

Make sure you understand the difference between solubility and rate of dissolving. **Solubility** refers to the amount of solute that will dissolve and **rate of dissolving** refers to how fast it dissolves.

Work to Submit

Writing:

- 1.1 Define solution, solvent, and solute.
- 1.2 Explain the difference between a concentrated and a dilute solution.
- 1.3 Define aqueous solution.
- 1.4 Define miscible and immiscible.
- 1.5 Explain the difference between a saturated and unsaturated solution.
- 1.6 Explain the difference between soluble, insoluble, and slightly soluble.
- 1.7
 - a) What is meant by rate of dissolving?
 - b) List three factors that affect the rate of dissolving of a solute in a solvent.
- 1.8 Explain why most ionic solids dissolve in water.

Unit 1 - Introduction to Solutions

References and Notes	Work to Submit
<p>Note: <i>Recall that you learned earlier in this course that water is polar.</i></p> <p>Note: <i>The phrase like dissolves like is often used to describe which solute will dissolve in which solvent.</i></p> <p>Note: <i>Recall that an electrolyte is a solute that forms an aqueous solution that will conduct electricity. A non-electrolyte is a solute that forms an aqueous solution that will not conduct electricity.</i></p> <p><i>See your instructor to discuss any additional work, including review, that may be required for this unit.</i></p>	<p>Writing:</p> <p>1.9 Copy and complete the following general statements about solubility:</p> <p>(a) Polar substances dissolve in _____ solvents but do not dissolve in _____ solvents.</p> <p>(b) Non-polar substances dissolve in _____ solvents but do not dissolve in _____ solvents.</p> <p>1.10 Why is sodium chloride an electrolyte, while sucrose is a non-electrolyte?</p> <p>1.11 List the three factors that affect solubility.</p> <p>1.12 Complete question # 6(a) - (d) in the Section Review, page 254.</p> <p>1.13 Complete questions 24 and 25 in the Chapter 7 Review, page 278.</p>

Unit 2 - Solutions and their Concentrations

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit: *Chemistry*

Chapter 7: Section 7.3: pages 255 - 270
 Section 7.4: pages 271 - 276

References and Notes	Work to Submit
<p><i>Refer to the Introduction to Section 7.3 on page 255 to answer question 2.1</i>  </p> <p><i>Read 'Molar Concentration', page 266 and study the sample problems on page 266 - 267. Then complete questions 2.2 - 2.4</i>  </p> <p><i>Read Section 7.4, pages 271 - 273 and study the Sample Problem on page 272. Then answer questions 2.5 - 2.7</i>  </p> <p><i>See your instructor to discuss any additional work, including review, that may be required for this unit.</i></p>	<p>Writing:</p> <p>2.1 Define concentration.</p> <p>2.2 a) Define molar concentration. b) What is the formula for molar concentration?</p> <p>2.3 Complete Practice Problems 19 - 24, page 268.</p> <p>2.4 Complete the Section Review problem # 3, page 270.</p> <p>2.5 Define standard solution.</p> <p>2.6 Complete Practice Problems 25 - 27, page 273.</p> <p>2.7 Complete questions 1, 2 and 4 in the Section Review, page 276.</p>

Unit 3 - Solution Stoichiometry

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit: *Chemistry*

Chapter 8; Introduction: page 280
 Section 8.1: pages 281 - 286
 Section 8.2: pages 288 - 298
 Section 8.3: pages 299 - 307

References and Notes

Refer to page 283 to answer question 3.1  

Read carefully 'Soluble or Insoluble: General Solubility Guidelines', page 285. Then complete question 3.2  

Note:

You will be provided with a table like Table 8.1 in the text when you do your test on this unit.

Read the introduction to Section 8.2, p. 288, and 'Double Displacement Reactions that Produce a Precipitate', p. 289. Study the Sample Problem, 'Predicting the Formation of a Precipitate', p. 289 - 290. Then complete questions 3.3 - 3.4  

Work to Submit

Writing:

- 3.1 Define precipitate.
- 3.2 Complete Practice Problems 1 - 3 on page 286.
- 3.3 What is a precipitation reaction?
- 3.4 Complete Practice Problem 4, p. 290.

Unit 3 - Solution Stoichiometry

References and Notes	Work to Submit
<p><i>Read pages 292 - 293 and study the Sample Problem, 'Writing Net Ionic Equations', p.293 -294. Then complete questions 3.5 - 3.6 □□</i></p>	<p>Writing:</p> <p>3.5 a) Define spectator ions. b) Define net ionic equation.</p>
<p><i>Read pages 299 - 301 and study Sample Problem , 'The Concentration of Ions', p. 301 - 302. Then complete questions 3.7 - 3.9 □□</i></p>	<p>3.6 Complete Practice Problems 5 and 6, p.294.</p> <p>3.7 Define dissociation equation.</p> <p>3.8 Complete Practice Problems 7 - 8, p. 300.</p> <p>3.9 Complete Practice Problems 11 - 13, p. 302.</p>
<p><i>See your instructor to discuss any additional work, including review, that may be required for this unit.</i></p>	

Unit 4 - Introduction to Organic Compounds

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit: *Chemistry*

Chapter 9: Introduction: page 320
Section 9.1: pages 321 - 323
Section 9.2: pages 324 - 330
Section 9.3: pages 331 - 355

References and Notes

Read the introduction to Chapter 9, page 320, and Section 9.1, pages 321 - 323. Then answer questions 4.1 - 4.2  

Read pages 324 - 326 and study Figure 9.5. Then answer questions 4.3 - 4.4  

Read pages 325 -326 and study figure 9.7, page 326. Then answer questions 4.5 and 4.6  

Note:

*The possibility of more than one structure for a single molecular formula is **isomerism**. It is a key reason for the tremendous diversity of organic compounds.*

Work to Submit

Writing:

- 4.1 Define:
 - (a) organic compound
 - (b) hydrocarbon
- 4.2 Complete Section Review questions 1, 3, and 5.
- 4.3 What are the three key properties of carbon that allow it to form so many compounds?
- 4.4 What is a structural diagram?
- 4.5 Define and give an example of each of the following:
 - (a) complete structural diagram
 - (b) condensed structural diagram
 - (c) line structural diagram
 - (d) expanded molecular formula
 - (e) isomers
- 4.6 Complete question 3 in the Section Review, page 330.

Unit 4 - Introduction to Organic Compounds

References and Notes

Study Table 9.1, page 329 and answer question 4.7  

Study Figure 9.11, page 331, and answer questions 4.8 and 4.9  

Use the glossary to answer question 4.10  

Read about alkanes on pages 331 - 344. Then answer questions 4.11 - 4.17  

(Note carefully the prefixes used in naming the alkanes.)

(Study the Sample Problem, 'Complete Combustion of Butane', page 341 - 342, before you do question 4.16.)

Work to Submit

Writing:

4.7 Describe the three common molecular shapes in organic molecules.

4.8 Explain the difference between pure hydrocarbons and hydrocarbon derivatives on the basis of composition.

4.9 Differentiate between aliphatic and aromatic hydrocarbons.

4.10 Define alkanes, alkenes and alkynes.

4.11 What is the general structural formula for alkanes?

4.12 Complete Practice Problems 1 - 3 on page 332.

4.13 List the names for the first ten straight-chain alkanes.

4.14 a) Are alkanes polar or non-polar?
b) Are alkanes soluble in water?

4.15 What happens to the boiling point of alkanes as the number of carbons increases?

4.16 What is the general formula for the complete combustion of hydrocarbons?

4.17 Complete Practice Problem 13 (a) and (b), page 343.

Unit 4 - Introduction to Organic Compounds

References and Notes

Read about alkenes on pages 344 - 352. Then answer questions 4.18 - 4.21  

Read about alkynes on pages 354 - 362. Then answer questions 4.23 - 4.27  

See your instructor to discuss any additional work, including review, that may be required for this unit.

Work to Submit

Writing:

- 4.18 What suffix is used to tell if a hydrocarbon is an alkene?
- 4.19 What is the general formula for an alkene?
- 4.20 Write the complete structural formula for propene (C_3H_6).
- 4.21 How does the boiling point of alkenes compare to the boiling point of alkanes?
- 4.22 Would you expect ethene to dissolve in water? Explain your answer.
- 4.23 What suffix is used to tell if a hydrocarbon is an alkyne?
- 4.24 What is the general formula for an alkyne?
- 4.25 Write the complete structural formula for
 - (a) ethyne (C_2H_2)
 - (b) propyne (C_3H_4)
- 4.26 What trend exists for the boiling points of alkynes with the same number of carbons as the corresponding alkanes and alkenes?
- 4.27 Are alkynes soluble in water? Explain your answer.

Unit 5 - Hydrocarbon Derivatives

To fulfill the objectives of this unit, students should complete the following:

Reading for this unit:	<i>Chemistry</i>
Chapter 10:	Introduction: page 376
	Section 10.1: pages 377 - 384
	Section 10.2: pages 386 - 400

References and Notes	Work to Submit
<p><i>You will find the answers for the questions for this unit in Sections 10.1 and 10.2 of the text. The pages you will need to focus on are shown below:</i></p> <p><i>Pages 377 - 378 for questions 5.1 - 5.2</i>  </p>	<p>Writing:</p> <p>5.1 What is a functional group?</p>
<p><i>Pages 379 - 380 for questions 5.3 - 5.5</i>  </p>	<p>5.2 Create a table for the 10 functional groups showing the different types of compounds, their suffix, and the functional group present.</p> <p>5.3 Why is ethanol ($\text{C}_2\text{H}_5\text{OH}$) soluble in water?</p> <p>5.4 Would you expect methylamide (CH_3NH_2) to dissolve in water? Explain your answer.</p> <p>5.5 Which would you expect to have a higher boiling point, CH_3CHO or $\text{CH}_3\text{CH}_2\text{CHO}$?</p>
<p><i>Page 386 for question 5.6</i>  </p>	<p>5.6 Write the complete structural formula for methanol (CH_3OH).</p>
<p><i>Page 389 for questions 5.7</i>  </p>	<p>5.7 Which would have the higher melting point, C_3H_8 or $\text{C}_3\text{H}_7\text{OH}$?</p>

Unit 5 - Hydrocarbon Derivatives

References and Notes	Work to Submit
<i>Page 396 for questions 5.8</i>  	
<i>Page 399 for questions 5.9</i>  	5.8 Write the complete structural formula for methylamide (CH_3NH_2), and ethylamide ($\text{C}_2\text{H}_5\text{NH}_2$).
<i>Page 421 - 422 for question 5.10</i>  	5.9 Which would have the higher boiling point, C_2H_6 or $\text{C}_2\text{H}_5\text{NH}_2$?
<i>See your instructor to discuss any additional work, including review, that may be required for this unit.</i>	5.10 Complete the following questions from the Chapter 10 Review, pages 421 - 422: #'s 2, 3, 4, 5 (b) and (c), 6, 8.