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**CODE:** CHEM-116

**TITLE:** Chemistry in Life

**INSTITUTE:** STEM

**DEPARTMENT:** Chemistry

**COURSE DESCRIPTION:** This chemistry course for non-science majors will focus on the role chemistry plays in maintaining and improving our quality of life. Topics include environmental issues such as air pollution, acid rain and recycling; the study of energy sources including nuclear power; and health issues such as nutrition and world hunger. The accompanying lab involves the study of common items found in everyday life.

**PREREQUISITES:** MATH 012 or MATH 015 or satisfactory completion of College's foundational studies requirement in computation

**CREDITS:** 4

**LECTURE HOURS:** 3

**LAB/STUDIO HOURS:** 3

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**REQUIRED MATERIALS:**

1. **TEXTBOOK:** Chemistry in Context: Applying Chemistry to Society, 8<sup>th</sup> edition, by, Middlecamp, Keller, Anderson, Bentley, Cann, Ellis; McGraw-Hill Higher education: New York, NY, 2012. See WebAdvisor and College Bookstore for textbook information.
2. **LABORATORY MANUAL:** Chemistry in Life, by S. Azab; Kendall-Hunt Publishing Co: Dubuque, IA, See WebAdvisor and College Bookstore for textbook information.
3. **SAFETY GOGGLES:** New Jersey State Law requires that all students wear appropriate splash and impact-proof safety goggles while performing laboratory experiments or during demonstration of experiments. Safety goggles are available at the College Store.
4. Laboratory Coat

**ADDITIONAL TIME REQUIREMENTS:**

Students must attend their regularly scheduled weekly laboratory class)

**COURSE LEARNING OUTCOMES:**

- Utilize critical thinking skills to learn fundamental concepts from chemistry found in everyday life
- Use the scientific method to perform chemistry-based problem solving. Reinforcement of chemical concepts will be made as hands-on skills are developed in the laboratory program
- Utilize risk assessment
- Analyze the effect man has had on the environment through studies of global warming, the greenhouse effect, and acid rain Identify the benefits of using synthetic versus natural indicators

- Determine the sugar content in common sodas and fruit juices
- Use a Geiger counter to measure radioactive material
- Identify contaminants that may be found in drinking water and analyze its potability
- Research one topic from the course in depth and write a paper to show your research

**GRADING STANDARD:**

<b>A</b>	=	<b>92 – 100%</b>
<b>A-</b>	=	<b>89 - 91%</b>
<b>B+</b>	=	<b>86 - 88%</b>
<b>B</b>	=	<b>82 - 85%</b>
<b>B-</b>	=	<b>79 - 81%</b>
<b>C+</b>	=	<b>76 - 78%</b>
<b>C</b>	=	<b>70 - 75%</b>
<b>D</b>	=	<b>65 - 69%</b>
<b>F</b>	=	<b>&lt;65%</b>

**Unit examination results will be reported as the grade assigned by the faculty calculated to the first decimal place. These grades will be weighed according to course grading policy. In calculating the course grade, 0.5 will round up to the next numerical grade and 0.4 will round down to the next lower numerical grade.**

**COURSE CONTENT:**

Unit 1: Introduction, General Chemical Principles, Air, Atmosphere  
 Unit 2: Air Pollution, Ozone Layer, Global Warming  
 Unit 3: Water, Water Pollution, Acid Rain, Acids and Bases  
 Unit 4: Consumer Chemistry, Nuclear Energy, Plastics, Nutrition

**DEPARTMENT POLICIES:**

1. Students must attend their regularly scheduled weekly laboratory section. Students are not allowed to attend any other lab section for any reason.
2. Students must pass (65% or better) both the lecture and the laboratory portion of the course in the same semester or they will fail the course.

**COLLEGE POLICIES:**

For information regarding:

- ◆ Brookdale's Academic Integrity Code
- ◆ Student Conduct Code
- ◆ Student Grade Appeal Process

Please refer to the **STUDENT HANDBOOK AND BCC CATALOG.**

**NOTIFICATION FOR STUDENTS WITH DISABILITIES:**

Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify, must contact the Disabilities Services Office at 732-224-2730 or 732-842-4211 (TTY), provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or

services, which are appropriate for the college level and are recommended in the documentation, can be approved.

**ADDITIONAL SUPPORT/LABS:**

Learning assistants are available for help for both lab and lecture. The times of availability are posted at the learning assistants' office (MAS 031). For any additional information, please call the Chemistry Department at 732-224-2424.

WEBSITE: <https://www.brookdalecc.edu/stem-institute/chemistry/>

**UNIT 1**

<b>Chapter:</b>	0 and 1
<b>Name of Unit:</b>	The Air Around Us
<b>Unit Objective:</b>	Identify the regions and composition of the atmosphere and study problems regarding air pollution
<b>Lab Experiments:</b>	Basic Chemical Laboratory Techniques Experiment 2 – Partial Pressures of Oxygen and Nitrogen in air Experiment 15 – Paper Chromatography Experiment 1 – Chemical Reactions

<b>LEARNING OBJECTIVES</b>	<b>OBTAINING THE OBJECTIVES</b>
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**Chapter 0**

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| 1. Examine Chemistry's role for a sustainable future. | READ 0.1-0.7 |
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**Chapter 1**

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|--|---|
| 1. Examine the composition of air and the reasons for local and regional variance  | READ: 1.1 – 1.4                         |
| 2. Interpret air quality data in terms of concentration units (% , ppm, ppb) and pollution levels                        | READ: 1.2<br>QUESTIONS: 2, 3, 5, 6(abc) |
| 3. Evaluate conditions significant in risk assessment  | READ: 1.4                               |
| 4. Classify the general regions of the atmosphere with respect to altitude   | READ: 1.5                               |
| 5. Differentiate among elements, compounds, and mixtures   | READ: 1.6<br>QUESTIONS:15               |
| 6. Examine the differences between atoms and molecules, between symbols for elements and formulas for chemical compounds | READ: 1.7<br>QUESTION: 13, 14,16        |

7. Name select chemical compounds and elements READ: 1.8
8. Interpret chemical formulas and be able to balance chemical equations READ: 1.9  
QUESTIONS: 18- 23

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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9. Analyze factors behind air quality and the chief components of air pollution READ: 1.10 – 1.14  
QUESTIONS: 34,36-38,46
10. Analyze the involvement of automobile emissions with air pollution READ: 1.10 – 1.12  
QUESTION: 42

## UNIT 2

- Chapter:** 2 and 3
- Name of Unit:** The Ozone Layer and Global Warming
- Unit Objective:** To learn about ozone depletion and global warming
- Lab Experiments:** Experiment 9 – Freezing Point Depression  
Experiment 4 – Light and Chemical Reactions: Testing Sunscreens

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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### Chapter 2

1. Investigate the chemical nature of ozone, the ozone layer, and factors affecting its READ: 2.1  
QUESTIONS: 1,2, 4, 5, 7a
2. Explore the basics of atomic structure: i.e. protons, neutrons, and electrons, and shells READ: 2.2  
QUESTIONS: 8-11
3. Differentiate atomic number from mass number READ: 2.2  
QUESTIONS: 12
4. Demonstrate how the octet rule determines READ: 2.3

- the formation of either ionic or covalent compounds. Write simple Lewis structures      QUESTION: 13-15
5. Interpret the electromagnetic spectrum in terms of frequency, wavelength, and energy      READ: 2.4, 2.5  
 QUESTIONS: 17-19, 21
6. Examine the interaction of radiation with matter, including biological sensitivity      READ: 2.5 – 2.8  
 QUESTIONS: 39
7. Review how the ozone layer protects against harmful UV radiation      READ: 2.6 – 2.8
8. Analyze the Chapman Cycle and the role of nature in ozone depletion      READ: 2.6, 2.8, 2.9  
 QUESTION: 47
9. Explore the complexities of collecting and analyzing data for ozone depletion      READ: 2.8  
 QUESTION:

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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10. Demonstrate the advantages of CFC's in consumer products and understand their role in ozone depletion      READ: 2.9 – 2.11  
 QUESTIONS 23-25
11. Analyze why there are seasonal variations in ozone depletion as well as global variations      READ: 2.10  
 QUESTION: 45,48
12. Evaluate the factors manufacturers of CFC's and their substitutes must meet, and summarize the political dimensions of CFC regulations      READ: 2.11
13. Explore possible substitutes for CFC's      READ 2.12

### Chapter 3

14. Investigate the greenhouse effect in Terms of energy balance      READ: 3.1, 3.2  
 QUESTIONS: 2, 6a,8
15. Relate Lewis structures and molecular geometry to absorption of IR radiation      READ: 3.3, 3.4  
 QUESTIONS: 11,12,15,17

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| 16. Summarize the contributions human activities make to the carbon cycle                       | READ: 3.5<br>QUESTION:                 |
| 17. Calculate the molar mass of elements and compounds  | READ: 3.6, 3.7<br>QUESTION: 21, 22, 24 |
| 18. Use the ratio (by mass) of an element within a compound to solve problems                   | READ: 3.7                              |
| 19. Examine the greenhouse gases and their sources  | READ: 3.8<br>QUESTIONS:                |
| 20. Investigate the contributions made by and limitations of computer models of climatic change | READ: 3.9<br>QUESTIONS: 33             |

<b>LEARNING OBJECTIVES</b>	<b>OBTAINING THE OBJECTIVES</b>
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| 21. Envision the national and global implications of a 1.5 – 4.5 °C rise in Earth's temperatures      | READ: 3.9   |
| 22. Examine the ways in which carbon dioxide emissions can be reduced                                 | READ: 3.10<br>QUESTION:                                 |
| 23. Explore how the Kyoto Protocol had an effect on climate change                                    | READ: 3.11  |
| 24. Demonstrate the ability to think critically about the accuracy of news articles on global warming | READ: Chapter 3<br>QUESTIONS: 3,5,7, 18a, 31, 32, 41,42 |

## UNIT 3

- Chapters:** 5 and 6
- Name of Unit:** Waterworld
- Unit Objective:** Understand the reasons for the significance of water to life on Earth and describe acid rain and factors causing it
- Lab Experiments:** Experiment 7 – Testing water  
Experiment 5 – Density and Specific Gravity  
Experiment 3 – Testing for Cations and Anions  
Experiment 8 – Acid-Base Indicators

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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### Chapter 5

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| 1..Explore the unique chemical and Physical Properties of water      | READ 5.1,5.2<br>QUESTIONS:1-4, 35-39 |
| 2. Investigate water use, availability And issues with water quality | READ: 5.3, 5.4<br>QUESTION:          |
| 3. Calculate the molarity of a solution                              | READ: 5.5<br>QUESTION:               |
| 4.Describe different types of solutes And electrolytes               | READ: 5.6<br>Question 25,31,33       |
| 5.Write names and structures For basic ionic compounds               | READ: 5.7<br>QUESTIONS 15, 17-19     |

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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| 6.. Explore the composition of ocean water | READ: 5.8 |
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| 7. Discuss solutions involving covalent compounds  | READ 5.9                  |
| 8. Investigate the Safe Water Drinking, Act the Maximum Contaminant Level Goal (MCLG), and the Maximum Contaminant Level (MCL) | READ 5.10<br>QUESTIONS:   |
| 9. Analyze how municipal water supplies are purified for home use  | READ: 5.11                |
| 10. Explore global issues with water quality.  | READ: 5.12<br>QUESTION 32 |

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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### Chapter 6

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| 11. Apply the definitions of acids, bases, and neutralization  | READ: 6.1 – 6.3<br>QUESTIONS:                |
| 12. Use chemical equations to represent the dissociation of acids and bases  | READ: 6.1, 6.2<br>QUESTIONS: 7,9,20, 22 a,c, |
| 13. Categorize solutions as acidic, basic, Or neutral based on their pH or H <sup>+</sup> concentrations                 | READ: 6.3, 6.4<br>QUESTIONS: 13,14           |
| 14. Analyze acid rain (acid deposition) and the factors causing it   | READ: 6.5 – 6.8<br>QUESTIONS: 3,4            |
| 15. Explore the roles played by sulfur oxides and nitrogen oxides in causing acid rain, and describe regional variations | READ: 6.7 – 6.9<br>QUESTIONS: 10,35,36,45    |
| 16. Compare contributions of man-made emissions with natural emissions   | READ: 6.7 – 6.9<br>QUESTIONS: 23,50          |
| 17. Demonstrate the effects and economic impact of acid rain on materials and the environment                            | READ: 6.10 – 6.13<br>QUESTION:               |

18. Investigate the uncertainties associated with implicating acid rain as the cause for certain environmental degradation READ: 6.10 – 6.13

## UNIT 4

**Chapters:** 7, 9, 11

**Name of Unit:** Consumer Chemistry

**Unit Objective:** Compare the chemistry, and the social and economic issues related to energy sources that include fossil fuels, electricity, and nuclear fission. Study the impact plastics have made on society and understand major issues regarding world hunger, malnutrition, undernourishment, and food chains.

**Lab Experiments:** Experiment X – Nuclear Radiation  
Experiment 13 – Polymers  
Experiment XX – Carbohydrates  
Experiment 16 – Properties of Proteins – isolation of milk protein

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
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### Chapter 7

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| 1. Analyze how nuclear fission occurs. Review ways to determine numbers of Protons, electrons, and neutrons of an isotope          | READ: 7.2<br>QUESTIONS: 1-4           |
| 2. Use a mathematical relationship to calculate the amount of energy produced by a fission reaction                                | READ: 7.2<br>QUESTIONS:               |
| 3. Compare and contrast how electricity is produced by a conventional power plant with how it is produced by a nuclear power plant | READ: 7.3<br>QUESTION:10, 12-14       |
| 4. Explore Radioactivity and be able to Write and balance nuclear equations  | READ: 7.4<br>QUESTIONS: 6-8,11, 17,31 |

LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES
5. Use the term “meltdown” and list the safeguards in place to prevent this event. Compare and contrast Chernobyl with Three Mile island	READ: 7.5 QUESTION: 30
6. Understand the effects of radioactivity On living things	READ: 7.6 QUESTION:
7. Explore how nuclear fuel can be used to make weapons	READ: 7.7 QUESTIONS:
LEARNING OBJECTIVES	OBTAINING THE OBJECTIVES

8. Apply the concept of half-life to the use of radioisotopes, radio-carbon dating techniques, and nuclear waste storage

READ: 7.8  
QUESTIONS: 21

9. Examine the issues associated with the production and storage of high-level nuclear waste, and take an informed stand on waste storage

READ: 7.9

10. Investigate the nature of low-level nuclear waste and its storage

READ: 7.9

11. Evaluate the risks and benefits of the use of nuclear power

READ: 7.10-7.11

12. Outline the factors that will allow or oppose the growth of nuclear energy in the future

READ: 7.11

13. Take an informed stand on the use of nuclear power for electricity production

READ: Chapter 7

14. Explore the accuracy and efficacy of news articles on nuclear power

READ: Chapter 7

and nuclear waste issues and think critically about these issues

<b>LEARNING OBJECTIVES</b>	<b>OBTAINING THE OBJECTIVES</b>
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### Chapter 9

15. Use “plastics” as a generic term for a wide range of polymers	READ: 9.1 QUESTION:
16. Explore the nature of plastics and polymers, their typical properties and molecular structure	READ: 9.1 -9.3 QUESTIONS 1,2,7,25
17. Outline the properties of the “Big Six” polymers and describe typical uses of each	READ: 9.4 QUESTIONS: 14,44,45
18. Investigate the six strategies for altering the molecular structure of polymers and their resulting properties	READ: 9.3-9.5 QUESTIONS: 21,22,28
19. Examine the molecular mechanism of addition polymerization and condensation polymerization	READ: 9.2 - 9.5 QUESTIONS:8,11,12
20. Compare the formation of proteins with that of commercial condensation polymers	READ: 9.6 QUESTION:
21. Outline the technical, economic, and political issues in methods for disposing of waste plastic: incineration, biodegradation, reuse, recycling, and source reduction	READ: 9.7-9.8 QUESTION: 37

**LEARNING OBJECTIVES****OBTAINING THE OBJECTIVES****Chapter 11**

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| 26. Evaluate the frequency and regional occurrence of malnutrition and undernourishment                           | READ: 11.1,11.2<br>QUESTION: 1,3,5,7 |
| 27. Examine the distribution of water, carbohydrates, fats, and proteins in the human body and some typical foods | READ: 11.2<br>QUESTION:              |
| 28. Analyze the chemical composition and molecular structure of fats and oils                                     | READ: 11.3-11.4<br>QUESTION: 15,18   |
| 29. Differentiate among saturated, mono-unsaturated, and polyunsaturated fats                                     | READ: 11.3-11.4                      |
| 30. Analyze how saturated and unsaturated bonds affect the melting point of fats                                  | READ: 11.3-11.4<br>QUESTIONS:        |
| 31. Investigate sources of cholesterol and its significance in the diet   | READ: 11.3-11.4<br>QUESTION:         |
| 32. Investigate Olestra as a non-metabolizable fat and list its benefits and costs                                | READ: 11.3-11.4                      |
| 33. Analyze the chemical composition and molecular structure of carbohydrates                                     | READ: 11.5-11.6<br>QUESTION:         |
| 34. Differentiate among the structures and properties of sugars, starches, and cellulose                          | READ: 11.5-11.6<br>QUESTION: 20      |

**LEARNING OBJECTIVES****OBTAINING THE OBJECTIVES**

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| 35. Analyze the chemical composition and molecular structure of amino acids and | READ: 11.7<br>QUESTION: 25,26 |
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proteins

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| 36. Examine the symptoms and cause of phenylketonuria                      | READ: 11.7                       |
| 38. Analyze the effects of selected vitamins and minerals on human health  | READ: 11.8<br>QUESTION: 10,11    |
| 39. Evaluate daily energy requirements and use basal metabolism rate (BMR) | READ: 11.9                       |
| 40. Explore dietary issues   | READ 11.10-11.11<br>QUESTION: 31 |
| 41. Evaluate various strategies for feeding the world's growing population | READ: 11.12                      |