Syllabus

Course Code: Chem 102 **Title: General Chemistry II**

Institute: STEM **Department: Chemistry**

Course Description: A continuation of CHEM 101, the student will investigate the areas of kinetics, equilibrium, nuclear reactions, thermochemistry, electrochemistry, carbon chemistry and transition metal and organic chemistry using a problem solving approach to bring about understanding.

Prerequisites: : grade of C or higher in CHEM 101 and in MATH 151.

Corequisites: None

Credits: 5 **Lecture Hours: 4** **Lab/Studio Hours: 3**

Required Textbook/Materials:

Face to Face students:
Textbook: Chemistry: The Science In Context, 6th ed. by Gilbert, Kriss, Foster, et. al.,

Laboratory Manual: Laboratory Experiments for Chemistry: The Central Science, 14th ed by Brown, LeMay, et. al.

Safety Goggles: New Jersey state law requires that all students wear appropriate splash and impact proof safety goggles while performing laboratory experiments. They are available at the College Store

Laboratory Coat: available at the College Store

Calculator: Any scientific or graphing calculator will suffice

Fully Online students:
Textbook: Chemistry: The Science In Context, 6th ed. by Gilbert, Kriss, Foster, et. al.,

Science Interactive Lab Kit purchased from manufacturer

Calculator: Any scientific or graphing calculator will suffice

Additional Time Requirements: None

Additional Support/Labs:
See https://www.brookdalecc.edu/academic-tutoring/

Department tutoring by may be available depending upon staffing

Course Learning Outcomes:

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1. Utilize critical thinking skills to learn fundamental chemical concepts from inorganic chemistry. (Critical Thinking)
2. Perform chemistry-based problem solving. Reinforcement of chemical concepts will be made as hands-on skills are developed in the laboratory program. (Critical Thinking, Problem Solving, Mathematical Skills Competency)
3. Determine the speeds at which reactions take place. (Mathematical Skills Competency, Problem Solving Competency)
4. Calculate the pH at different points of a titration (Mathematical Skills Competency, Problem Solving Competency)
5.Determine the enthalpy and entropy of a reaction (Critical Thinking, Problem Solving, Mathematical Skills Competency)
6. Name organic compounds (Critical Thinking, Problem Solving)
7. Write nuclear reactions (Critical Thinking, Problem Solving)

Course Content:

Unit 1: Chemical Kinetics and Chemical Equilibrium

Unit 2: Acids and Bases and Acid-Base Equilibrium & Solubility Equilibrium

Unit 3: Thermochemistry, Entropy, Free Energy, and Electrochemistry

Unit 4: Organic Chemistry and Nuclear Chemistry

CHAPTERS: **13 and 14**

NAME OF UNIT 1: Chemical Kinetics and Introduction to Chemical Equilibrium

UNIT OBJECTIVE: To illustrate the importance of the speed of a chemical reaction and its impact on how old chemical bonds are broken and new bonds are made. Also to show the fundamentals of manipulating a the yield of chemical reaction that don't go to completion

Learning Objectives	**Recommended Learning Experiences**
1. Define chemical kinetics and describe the factors that influence the rate of chemical reactions	**READ**: 13.2 **DO:** 13.19, 27
2. Represent reactions with rate expressions and explain how to monitor the concentration of species in a reaction	**READ:** 13.2 **DO:** 13.33, 35
3. Explain the importance of and calculate, the rate law, the overall order of a reaction, and the rate constant	**READ:** 13.3 **DO:** 13.41, 43, 47, 49, 127 part A
4. Use the integrated rate law and graph data to calculate the concentration of reactants and products at a particular time during the reaction	**READ:** 13.3 **DO:** 13.61, 63, 75
5. Describe the relationship between the temperature and speed using the Arrhenius equation	**READ:** 13.4 **DO:** 13.85, 87, 89
6. Explain the parts of a reaction mechanism and how to determine if a mechanism is plausible	**READ:** 13.5 **DO:** 13.97, 99, 105

7. Draw reaction coordinates for reactions that have single and multiple elementary steps. Label the important parts of the graph	**READ:** 13.5 **DO:** 13.9
8. Define a catalyst and describe its impact on chemical reactions and reaction coordinates	**READ:** 13.6 **DO:** 13.109
9. Distinguish between the differences between uni- and bi-directional chemical reactions. Define chemical equilibrium in terms of the dynamics occurring at the microscopic and macroscopic level	**READ:** 14.1 **DO:** 14.6, 15
10. Write equilibrium expressions for homo and heterogeneous chemical reactions.	**READ:** 14.2 and 14.6 **DO:** 14.27, 29, 31, 33, 63, 65
11. Calculate Kc from Kp and vice versa.	**READ:** 14.3 **DO:** 14.25, 37, 41
12. Manipulate equilibrium constant expressions. Calculate K for a multistep reaction.	**READ:** 14.4 **DO:** 14.45, 47, 49, 51
13. Explain the importance of the reaction quotient (Q) in any reaction governed by equilibrium principles	**READ:** 14.5 **DO:** 14.55, 57, 59
12. Use Le Chatelier's Principle to determine which way a reaction may shift if a stress is added to a reaction at equilibrium	**READ:** 14.7 **DO:** 14.75, 77, 81
13. Predict the concentrations or pressures of reactants and products for a chemical equation at any time during the reaction.	**READ:** 14.8 **DO:** 14.85, 87, 91

Unit : #2 Acids, Bases and Solubility Equilibria. Chapters 15 and 16

LEARNING OBJECTIVES	RECOMMENDED PRACTICE EXERCISES
1. Identify conjugate acid-base pairs and their relative strengths for Bronsted Acids and Bases	Read: 15.2 Do: 15.15, 16, 25, 27
2. Explore the acid-base properties of water using the ion product constant Kw	Read: 15.3 Do: 15.29-30
3. Calculate pH and pOH	Read: 15.3 Do: 15.35, 37
4. Write ionization constant expressions for weak acids and weak bases. Calculate pH of weak bases, weak acids and % ionization	Read: 15.4 and 15.5 Do: 15.43, 45, 51, 55, 57, 59
5. Write reactions, calculate pH for polyprotic acids	Read: 15.6 Do: 15.67, 69
6. Determine the relationship between Molecular structure and the strengths of Acids.	Read: 15.7 Do: 15.17
7. Determine the acid-base properties of salt solutions through the use of hydrolysis reactions.	Read: 15.8 Do: 15.73-75

8.	Identify, calculate the pH of, and describe how to prepare buffer solutions	Read 16.2, 16.3 Do: 16.11, 13, 19, 23, 25
9.	Calculate pH during acid-base titrations	Read: 16.4 Do: 16.41, 45, 47
10.	Understand how indicators function and Select appropriate indicators for a given titration.	Read: 16.4 Do: 16.37
11.	Identify Lewis Acids and Bases	Read: 16.5 Do: 16.51, 53
12.	Understand the formation of Complex Ions and why hydrated metal ions act as acids	Read 16.6-16.8
13.	Understand solubility equilibria and solve related problems	Read 16.8 Do: 16.83, 85, 95, 101, 103

Unit III

Chapters: 5, 17 (including Ch 4.9).& 18

Name of Chapters: Thermochemistry, Thermodynamics and Electrochemistry

Student will be able to:

1. Define, give units for, and perform calculations dealing with energy and work. Apply the law of conservation of energy.	Read: 6.1-6.2 Problems: 6.9, 11, 15
2. Differentiate between system, surroundings, and universe. Contrast the 3 types of systems Distinguish endothermic and exothermic . processes. Calculate internal energy and enthalpy changes.	Read: 6.3-6.4 Problems: 6.31, 35, 37
3. Identify terms associated with calorimetry and perform calculations for calorimetry	Read: 6.6 Problems: 6.57, 63, 69
4. Explain and apply Hess's Law	Read: 6.7 Problems: 6.73, 75, 77, 127
5. Use standard enthalpy of formation to calculate standard enthalpy of reactions	Read: 6.8 Problems: 6.85, 89, 93
6. Explain how to determine whether a reaction (process) is spontaneous and explain and apply the concept of entropy	Read: 17.1 Problems: 17.17, 19, 23, 25
7. State the second and third laws of thermodynamics and be able to calculate entropy changes	Read 17.2-17.4 Problems: 17.27, 17.35, 17.37

8. Define and solve problems involving Gibbs free energy (Gibbs Function)	Read: 17.5 Problems: 17.49, 51, 53, 55
9. Correlate temperature with spontaneity.	Read: 17.6 Problems: 17.57, 17.61, 17.65
10. Use Gibbs Free Energy to predict when a system is in Chemical Equilibrium	Read: 17.7-17.8 Problems: 17.69, 71, 73, 79
11. Balance Redox Equations	Read: 4.8, 18.1 Problems: 4.103, 105, 109, 18.17
12. Write cell diagrams and perform calculations of standard reduction potentials.	Read: 18.2-18.3 Problems: 18.31
13. Relate chemical energy and work. Examine standard hydrogen electrode.	Read: 18.4-18.5 Problems: 18.35, 37
14. Use the Nernst Equation to determine the impact of concentration on cell EMF	Read: 18.6 Problems: 18.91, 99
15. Identify different types of batteries.	Read: 18.7, 18.10
16. Perform calculations involving corrosion and reactions in electrolytic cells	Read: 18.8-18.9 Problems: 18.69, 73

Unit IV

Number of Chapters: 19, 20 & alternate text:

Name of Chapters: Nuclear Chemistry and Organic Chemistry

LEARNING OBJECTIVES		RECOMMENDED QUESTIONS & PROBLEMS
1.	Calculate mass defect and nuclear binding energy	Read: 19.1 Do: 19.17
2.	Identify stable and unstable nuclei	Read: 2.9, 19.2 Do: 19.19, 23
3.	Identify and balance different types of nuclear reactions	Read: 19.2 Do: 19.25, 97, 101
4.	Describe how instruments measure radiation	Read: 19.3 Do: 19.39
5.	Calculate the rate of radioactive decay	Read: 19.4 Do: 19.41
6.	Describe how radiometric (radioactive) dating occurs	Read: 19.5 Do: 19.43, 45, 105
7.	Discuss the biological effects of radiation	Read: 19.6 Do: 19.53, 19.59
8.	Describe how nuclear fission works	Read: 19.8 Do: 19.77, 19.81
9.	Describe how nuclear fusion works	Read: 19.9

ALT = alternate text text = textbook

10.	Identify classes of organic compounds	Read: ALT 19.1 Do: ALT 19.1, 19.3, 19.4 ALT 19.21, 19.22

11.	Be able to draw complete, condensed, and line structures of alkanes	Read: ALT 19.2 Do: worksheets
12.	Differentiate between constitutional/structural isomers	Read: ALT 19.2 Do: ALT 19.2, 19.24
13.	Be able to name alkanes	Read: ALT 19.2, Appendix 7 Do: ALT 19.33
14.	Be able to draw complete, condensed, and line structures of alkenes and alkynes	Read: ALT 19.3 Do: worksheets
15.	Be able to name alkenes and alkynes	Read: ALT 19.3, Appendix 7 Do: worksheets
16.	Determine the products when alkanes, alkenes, and alkynes undergo reactions	Read: ALT 19.3 Do: worksheets
17.	Differentiate between cis- and trans- isomers	Read: ALT 19.3, text 20.2 Do: ALT 19.43, 19.51
18.	Draw, name, and perform reactions involving aromatic compounds	Read: ALT 19.4, Appendix 7 Do: ALT 19.5
19.	Identify functional groups	Read: ALT 19.5-19.7, Appendix 7 Do: 19.97, 19.123, 19.124, 19.126, text 20.1
20.	Identify optical isomers	Read: ALT 19.8, text 20.13, 20.14, 20.17

Department Policies:

1.Students must independently pass the Laboratory portion of the course. Passing is considered 65% or greater. Failing the laboratory portion of the course will result in an automatic Failing grade for the entire course.

2. Students who have missed 3 labs will automatically fail the Laboratory portion of the course which also means automatically failing the entire course. This also applies to fully online labs.

3.The chemistry department requires the use of Brookdale email. Upon registration all students receive a Brookdale email that remains active for months even after a student has finished courses. It is expected that all students will use their Brookdale email account or Canvas when communicating with instructors. Messages from personal email accounts will not be replied to once a class has started as it is impossible to authenticate identity.

4. Your final grade is not negotiable. Instructors will not engage in a repetitive back and forth conversation (either in person or electronically) with students at the end of or after the semester has ended. If you believe your final letter grade is in error, there is an appeals process that you can initiate a formal grade appeal.

5. The use of generative Artificial Intelligence (AI) in any chemistry course is strictly prohibited. The use of generative Artificial Intelligence will be considered a violation of Brookdale's academic integrity code and may result in severe penalties including automatic failure for the course.

6. Violations of the Academic integrity code will be prosecuted to the highest extent possible which includes the potential of an automatic failure for the course. High ethical standards are required in the Scientific, Medical, and Health Care fields and are taken very seriously. It is your responsibility to know and understand the academic integrity code; ignorance is not an excuse for an academic integrity violation. (The academic Integrity code can be found in the student handbook) ·

7. Students are at all times expected to abide by the student conduct code.

8.Students are required to either on paper or electronically acknowledge that they have reviewed both the department syllabus as well as their instructor's syllabus.

9.Students enrolled in remote or online sections are expected to have basic computer and technology equipment and skills that include but are not limited to: reliable internet, working web camera, ability to download Respondus lockdown browser and other programs, ability to save, edit, and submit documents in common file types.

10. Online students who repeat a course with a lab kit are required to have a full lab kit for the course

Grading Standard:

A = 92 - 100%
A- = 89 - 91%
B+ = 86 - 88%
B = 82 - 85%
B- = 79 - 81%
C+ = 76 - 78%
C = 70 - 75%
D = 65 - 69%
F = <65%

These grades are 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.

College Policies:

As an academic institution, Brookdale facilitates the free exchange of ideas, upholds the virtues of civil discourse, and honors diverse perspectives informed by credible sources. Our College values all students and strives for inclusion and safety regardless of a student's disability, age, sex, gender identity, sexual orientation, race, ethnicity, country of origin, immigration status, religious affiliation, political orientation, socioeconomic standing, and veteran status. For additional information, support services, and engagement opportunities, please visit www.brookdalecc.edu/support.

For information regarding:

- Academic Integrity Code
- Student Conduct Code
- Student Grade Appeal Process

Please refer to the student handbook and 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 Accessibility Services Office at 732-224-2730 (voice) or 732-842-4211 (TTY) to 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.

Mental Health:

24/7/365 Resources:

- Monmouth Medical Center Psychiatric Emergency Services at **(732) 923-6999**
- 2nd Floor Youth Helpline – Available to talk with you about any problem, distress, or hardship you are experiencing. Call or text at **888-222-2228** or visit the website at https://www.2ndfloor.org/

Faculty Counselors:

- Students who need to make an appointment with a faculty counselor can do so by calling 732-224-1822 (non-emergency line) during business hours. Faculty counselors are licensed mental health professionals who can assist students and refer them to other mental health resources.

Diversity Statement:

Brookdale Community College fosters an environment of inclusion and belonging. We promote a safe and open culture, encourage dialogue respecting diverse perspectives informed by credible sources, and uphold the virtues of civil discourse. We celebrate all identities with the understanding that ultimately, diversity, equity, and inclusion cultivate belonging and make us a stronger Brookdale community.

**The syllabus is intended to give student guidance in what may be covered during the semester and will be followed as closely as possible. However, the faculty member reserves the right to modify, supplement, and make changes as the need arise.*