

AP Chemistry Unit 5

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Title Section

Department of Curriculum and Instruction



Belleville Public Schools

Curriculum Guide

AP Chemistry 11,12

UNIT 5 - KINETICS

Belleville Board of Education

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Board Approved:

Unit Overview

Topics include:

Rate of reaction

Rate Law

Integrated rate law

Rate constant

Activation energy and catalysts

Enduring Understanding

Enduring Understandings:

1. In these lessons students learn what the science of chemistry means and how will we approach learning chemistry through a combination of didactic and practical exercises. A learning schedule and procedures are imperative to create a safe, structured, and enthusiastic learning environment. In this first unit students will receive necessary information from instructor regarding applicable classroom and lab policies of the school.
2. All our surroundings and every object solid, liquid, and gas is matter. Matter can be classified and identified by their properties whether extensive properties or intensive properties. Extensive properties are dependent upon how much matter is present while intensive are dependent on type of material. We can classify matter by their physical properties and can then explore physical changes where matter changes phase although the chemical composition remains the same.

Essential Questions

Essential Questions:

1. How does the temperature affect the rate of a reaction?
2. How does concentration affect the rate of reaction?
3. How do elementary reactions occur?
4. Why aren't all reactions occurring in one step?
5. How does the presence of a catalyst affect the rate of a reaction?

Exit Skills

Skills Checklist:

1. Calculate the rate law using the method of initial rates.
2. Determine instantaneous rate.
3. Deduce the units of rate constant.
4. Graph experimental data and deduce the integrated rate law.
5. Calculate the activation energy.
6. Compare and contrast activation energy and the presence of a catalyst.
7. Relate concentration and time.

New Jersey Student Learning Standards (NJSL-S)

[NextGen Science Standards](#)

SCI.HS-PS1	Matter and Its Interactions
SCI.HS-PS2.B	Types of Interactions
SCI.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
SCI.HS-PS1.A	Structure and Properties of Matter
SCI.HS-PS1.B	Chemical Reactions
SCI.HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
	Developing and Using Models
SCI.HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
SCI.HS-PS1.C	Nuclear Processes
SCI.HS-PS4.B	Electromagnetic Radiation
SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity.
SCI.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
SCI.HS-ESS3-5	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
SCI.HS-ESS2.D	Weather and Climate
SCI.HS-ESS3.D	Global Climate Change
SCI.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
SCI.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
SCI.HS-ETS1.B	Developing Possible Solutions

Interdisciplinary Connections

Please list all and any additional **Interdisciplinary Connections/Cross-Curricular** New Jersey Student Learning Standards that link to this unit, and which are not included in the NJSLs section above.

LA.RH.11-12	Reading History
MA.N-RN.A	Extend the properties of exponents to rational exponents.
MA.N-RN.B	Use properties of rational and irrational numbers.
MA.N-Q.A	Reason quantitatively and use units to solve problems.
LA.RST.11-12	Reading Science and Technical Subjects
LA.WHST.11-12	Writing History, Science and Technical Subjects

Learning Objectives

1. Apply the knowledge of five factors that influence reaction rate in order to analyze reaction rate problems
2. Apply the collision theory to interpret the rate of reaction
3. Apply the method of initial rates to determine the rate law
4. Compare and contrast the units of rate constants
5. Diagram, and choose the correct order of reaction from experimental data
6. Relate temperature and rate
7. Will students be able to calculate activation energy
8. Relate activation energy and the presence of a catalyst
9. Compare and contrast time and concentration

10. Why did climate change in the last two centuries?

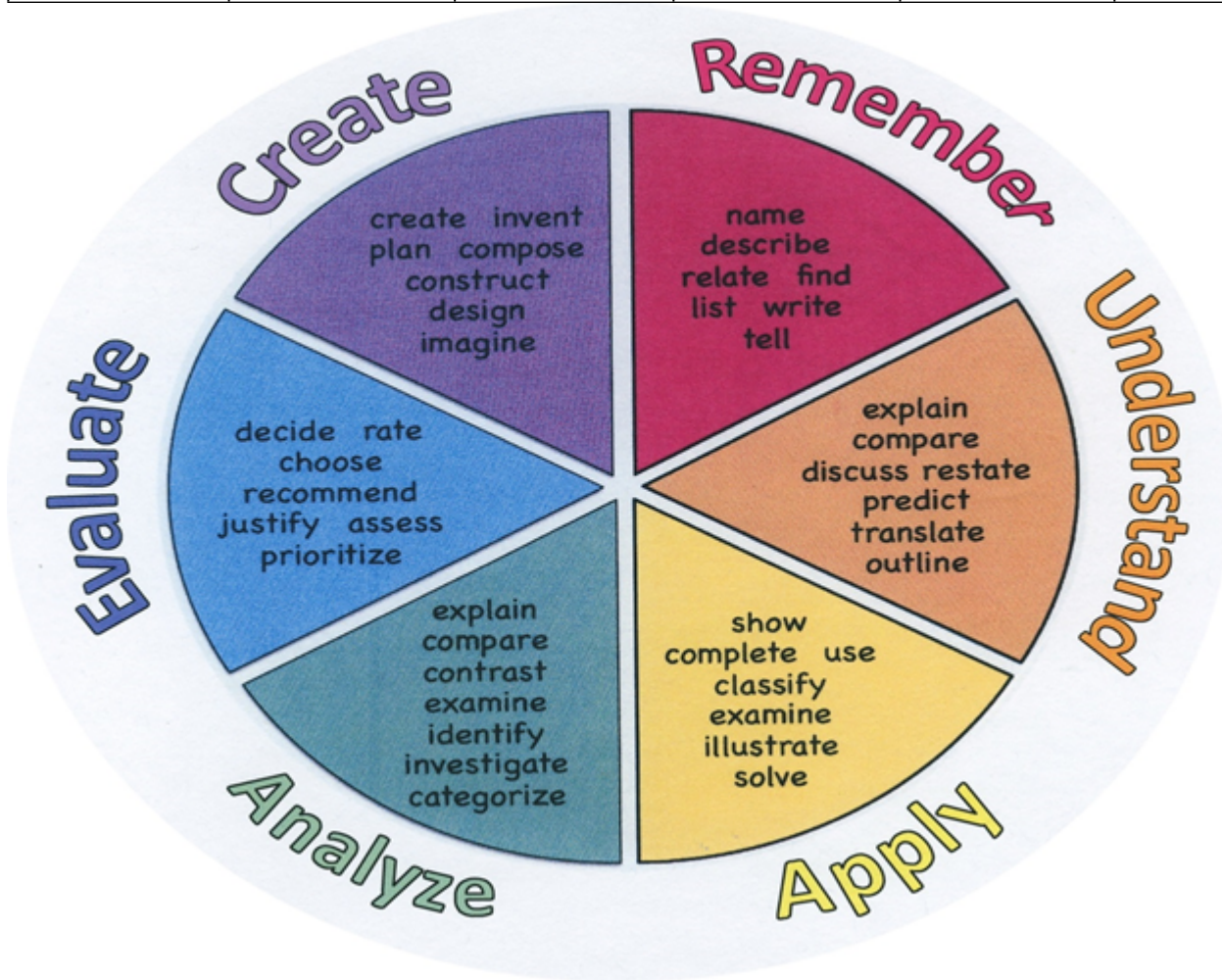
11. What are the effects of climate change?

12. Propose LOCAL (BELLEVILLE, NJ) solutions to climate change.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make
Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan

State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

- What situations in ordinary life could help to master this unit?
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- Investigate reaction rate factors.
 - Debate the differences between homogeneous and heterogeneous reactions.
 - Build a gas collector apparatus.

Assessment Evidence - Checking for Understanding (CFU)

Student must be able to identify rate determining step. (Formative)

Students must be able to convert rate laws and to integrated rate laws. (Formative)

Students must be able to compare and contrast units for rate constants. (Formative)

Unit Test/Quiz (Summative)

Benchmark #2 (Benchmark)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's

- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Chemistry - The Central Science: AP Edition; 12th Edition.

Pearson: Brown, Lemay, Bursten, Murphy, and Woodward 2012

Albert.io

AP Collegeboard

Ancillary Resources

1. Teacher and Publisher supplied powerpoints, notes, laboratory guides, and worksheets
2. Textbooks
3. Resource Manuals
4. Internet Resources
5. Computer and smartboard Activities

Technology Infusion

Use pH meters to measure reaction rate.

Use spectrophotometers to measure reaction rate.

Use virtual labs to measure reaction rate.

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AP Collegeboard

What **Technology Infusion** and/or strategies are integrated into this unit to enhance learning? Please list all hardware, software and strategies. Please find a technology pedagogy wheel for assistance while completing this section.

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
 Photostory 3
 Kid Story Builder
 Music Maker Jam
 Paint A Story
 Office 365
 MS PowerPoint
 Stack 'Em Up
 NqSquared Numbers
 Physamajig
 Xylophone 8

Wikipedia
 Skydrive
 Lync
 SkyMap
 Skype
 Office 365
 Puzzle Touch
 Easy QR
 Memorylage
 Life Moments
 Word Cloud Maker

Where's Waldo?
 MS Excel
 Flipboard
 Office 365
 Nova Mindmapping

Ted Talks
 Record Voice Pen



Originally taken from <http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg>
 And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CS.9-12.8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible.
CS.9-12.8.1.12.AP.9	Collaboratively document and present design decisions in the development of complex programs.
CS.9-12.8.2.12.EC.1	Analyze controversial technological issues and determine the degree to which individuals, businesses, and governments have an ethical role in decisions that are made.
CS.9-12.8.2.12.EC.2	Assess the positive and negative impacts of emerging technologies on developing countries and evaluate how individuals, non-profit organizations, and governments have responded.
WRK.9.2.12.CAP.2	Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
WRK.9.2.12.CAP.10	Identify strategies for reducing overall costs of postsecondary education (e.g., tuition assistance, loans, grants, scholarships, and student loans).
TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.DC.2	Compare and contrast international differences in copyright laws and ethics.

21st Century Skills/Interdisciplinary Themes

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century/Interdisciplinary Themes** that will be incorporated into this unit.

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

Please list only the **21st Century Skills** that will be incorporated into this unit.

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Please remember: Effective educational **Differentiation** in a lesson lies within content, process, and/or product.

Please identify the ones that will be employed in this unit.

Differentiations:

- Small group assignments (to prepare a unit 1review of key concepts)
- Extra time to complete assignments (completed at home)
- Pairing oral instruction with visuals (College Board videos of Unit 1Review)
- Repeat directions (Rephrase the problem on mixtures giving real-life examples)
- Use manipulatives (building atoms)

- Multisensory approaches (youtube videos on Unit 1)
- Preview content & concepts (percent composition of students in AP chem class)
- Student(s) work with an assigned partner (Complete a lab on flame test)
- Visual presentation (flame test lab video)

Hi-Prep Differentiations:

- Alternative formative and summative assessments (debating atomic trends exceptions)
- Leveled rubrics (writing rubric with siblings that took a science class in college)
- Project-based learning (propose a new project for low prep students)
- Problem-based learning (design solution for climate change)

Lo-Prep Differentiations

- Choice of books or activities (choose an article on Newsela on global warming)
- Cubing activities (apply the cubic method to atomic trends)
- Reading buddies (pair Lo-prep and Hi-prep students)
- Varied supplemental materials (Youtube videos on electron configuration)

Special Education Learning (IEP's & 504's)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

Measure the surface area of a cube.

- behavior management plan (Cubing activities (apply the cubic method to the periodic table)
- computer or electronic device utilizes (Varied supplemental materials (Youtube videos on climate change)
- modified assignment format (Reading buddies (pair Lo-prep and Hi-prep students)
- student working with an assigned partner (Students must be able to build atomic models)
- Use open book, study guides, test prototypes (choose an article on Newsela on global warming)

English Language Learning (ELL)

Please identify the **English Language Learning** adaptations that will be employed in the unit, using the ones identified below.

Students are provided with a glossary in their native language of climate change.

Spanish-speaking students may utilize the Spanish Edition of a Textbook to solve Unit 5 problems.

Measure surface area of a cube.

- using videos, illustrations, pictures, and drawings to explain or clarify (Students are provided with videos in their native language on climate change.)
- allowing the use of note cards or open-book during testing (Students are provided with glossary in their native language)
- providing study guides (Students are provided with a glossary in their native language on climate change)

At Risk

Please identify Intervention Strategies that will be employed in the unit, using the ones identified below.

Measure surface area of a cube.

- teaching key aspects of a topic. Eliminate nonessential information ((electron configuration exceptions are omitted))
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required (electron configuration exceptions are omitted)
- having peers take notes or providing a copy of the teacher's notes (videos from College Board provided)
- tutoring by peers (climate change discussed by peers)
- using videos, illustrations, pictures, and drawings to explain or clarify (Students provided access to virtual labs)

Talented and Gifted Learning (T&G)

Please identify the **Talented and Gifted** adaptations that will be employed in the unit, using the ones identified below.

Measure surface area of five cubes with a face in common.

- Advanced problem-solving (Students must be able to analyze Schrodinger Equation)
- Allow students to work at a faster pace (Princeton Review problems are solved)

- Cluster grouping (to propose original solutions of climate change)
- Complete activities aligned with above grade level text using Benchmark results (Students must be able to analyze Schrodinger Equation)
- Higher order, critical & creative thinking skills, and discovery (exceptions of electron configuration are underlined and discussed)
- Using atomic models to identify the shape, the bond angle and the hybridization of molecules.

Sample Lesson

Unit Name: Kinetics

NJSLS: SCI.HS-PS1 &2 &3 & 4; SCI.HS.ESS3.D

Interdisciplinary Connection: Vocabulary and algebra contents

Statement of Objective: Students will demonstrate the ability to propose how to identify the factors affecting reaction rate with 90% accuracy.

Anticipatory Set/Do Now: What do you know about a catalyst?

Learning Activity: Lecture - Factors affecting reaction rate.

Small groups activities: identify the factors affecting the rate of reaction between solid Calcium Carbonate and Hydrochloric acid.

Final review: reaction rate definition

Student Assessment/CFU's: Survey, written report, Exit ticket

Materials: Chromebook, lab equipments, several chemicals.

21st Century Themes and Skills: Critical thinking and Problem Solving

Differentiation/Modifications:

Students must be able to identify five factors affecting reaction rate. (Gifted and Talented)

Students must be able to identify three factors affecting reaction rate . (Special Ed)

Integration of Technology: Chromebook PowerPoint Presentation

