

Unit 05: Kinetics

Content Area:

Course(s):

Time Period: **Year**

Length: **180**

Status: **Published**

Unit 5

Unit Title:	Kinetics
Suggested Duration:	3 weeks

Interdisciplinary Connections

Interdisciplinary Connections
Reading and Writing Companion Standards for History, Social Studies, Science and Technical Subjects <ul style="list-style-type: none">▪ Grades 9-10▪ Grades 11-12
Math Practices: https://www.nj.gov/education/standards/math/Index.shtml
Science Practices: https://www.nj.gov/education/standards/science/Index.shtml
Find and paste appropriate <u>Companion Standards or Practices</u> here.

Mathematics—Metric conversions, solving for an unknown, interpreting graphs

Language Arts- Reading scientific documents for comprehension, writing conclusions, writing lab reports

Social Studies—Historical events leading to scientific discoveries and/or revisions

Foreign Language – Chemical nomenclature relates to the learning of any language

Technology Integration

Technology Integration
Northern supports the integration of the SAMR Model : a framework which extends learning through the use of technology. The installation of interactive boards, the purchase of softwares and subscriptions, and the investment in 1:1 laptops and various other instructional technologies are examples of Northern's commitment to enhancing students' learning and preparing the 21st century learner for college and careers.

- *Use of Atomic Emission Spectroscopes*
- Vernier Computer-based probes and software
- ViewBoard for presentation of information and interactive activities
- United Streaming/Discovery Education
- Laptops/Computer Lab—web based project
- AP Classroom.

Standard(s) Addressed

Course Skills

TRA-3.A Explain the relationship between the rate of a chemical reaction and experimental parameters.

TRA-3.B Represent experimental data with a consistent rate law expression.

TRA-3.C Identify the rate law expression of a chemical reaction using data that show how the concentrations of reaction species change over time.

TRA-4.A Represent an elementary reaction as a rate law expression using stoichiometry

TRA-4.B Explain the relationship between the rate of an elementary reaction and the frequency, energy, and orientation of molecular collisions.

TRA-4.C Represent the activation energy and overall energy change in an elementary reaction using a reaction energy profile.

TRA-5.A Identify the components of a reaction mechanism.

TRA-5.B Identify the rate law for a reaction from a mechanism in which the first step is rate limiting.

TRA-5.C Identify the rate law for a reaction from a mechanism in which the first step is not rate limiting.

TRA-5.D Represent the activation energy and overall energy change in a multistep reaction with a reaction energy profile.

ENE-1.A Explain the relationship between the effect of a catalyst on a reaction and changes in the reaction mechanism.

STAGE I Desired Results

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<i>Objective (Transfer)</i>
<i>Unit 4 focused on chemical changes; in Unit 5 students will develop an understanding of the rates at which chemical changes occur and the factors that influence the rates. Those factors include the concentration of reactants, temperature, catalysts, and other environmental factors. Chemical changes are represented by chemical reactions, and the rates of chemical reactions are determined by the details of the molecular</i>

collisions. Rates of change in chemical reactions are observable and measurable. When measuring rates of change, students are measuring the concentration of reactant or product species as a function of time. These chemical processes may be observed in a variety of ways and often involve changes in energy as well. In subsequent units, students will describe the role of energy in changes in matter.

Mastery

Big Ideas/Understandings

Students will understand that...

BIG IDEA 3: TRANSFORMATIONS (TRA)

At its heart, chemistry is about the rearrangement of matter. Understanding the details of these transformations requires reasoning at many levels as one must quantify what is occurring both macroscopically and at the atomic level during the process. This reasoning can be as simple as monitoring amounts of products made or as complex as visualizing the intermolecular forces among the species in a mixture. The rate of a transformation is also of interest, as particles must move and collide to initiate reaction events.

BIG IDEA 4: ENERGY (ENE)

Energy has two important roles in characterizing and controlling chemical systems. The first is accounting for the distribution of energy among the components of a system and the ways that heat exchanges, chemical reactions, and phase transitions redistribute this energy. The second is in considering the enthalpic and entropic driving forces for a chemical process. These are closely related to the dynamic equilibrium present in many chemical systems and the ways in which changes in experimental conditions alter the positions of these equilibria.

Essential Questions

Why are some reactions faster than other reactions?

How long will a marble statue last?

How can a sports drink cure a headache?

Why does bread rise?

Acquisition

Students will know . . .

[See “essential knowledge” in each topic of College Board CED for Unit 5](#)

Students will be skilled at . . .

In prior units, students developed their ability to describe symbolic and quantitative information from representations (e.g., Lewis structures, chemical reactions) that illustrate both the particulate and macroscopic level of a chemical phenomenon. In Unit 5, students will build on these explanations and representations by constructing and describing rate laws consistent with experimental evidence. To that end, students will collect data by spectrophotometry and choose an appropriate mathematical routine to determine how concentration varies with time during the course of a reaction. In addition, students will examine proposed reaction mechanisms to determine if there is a match between observed experimental data and constructed rate law expressions. Students will learn to identify any intermediates or catalysts that are included in the reaction mechanism, as well as the rate-determining step, and be able to justify their claims. To do so, students must learn to construct and analyze energy profiles for chemical reactions and identify how such profiles may change with the addition of a catalyst.

STAGE II Assessment Evidence

STAGE II Assessment Evidence	
Common Summative Assessments	Common Formative Assessments
Tests Quizzes Laboratory Reports and analyses	Exit Slips Quizzes Homework Problems Participation in class discussions and in performance of lab experiments Laboratory notebook AP Classroom Unit checks
Modifications	
How are the evaluations/assessments modified/accelerated? (i.e.: alternate assessment). All courses follow a balanced assessment system with Practice, Assessments, Evaluations.	

Modifications on 504 plans may be submitted at ([SSD](#)), prior to testing. Both exclusion **statements** and

[extensions](#) exist for each standard to accommodate different paces.

STAGE III Learning Plan

STAGE III Learning Plan
Organize plan by weeks
5.1 Reaction Rates 5.2 Introduction to Rate Law 5.3 Concentration Changes Over Time 5.4 Elementary Reactions 5.5 Collision Model 5.6 Reaction Energy Profile 5.7 Introduction to Reaction Mechanisms 5.8 Reaction Mechanism and Rate Law 5.9 Steady-State Approximation 5.10 Multistep Reaction Energy Profile 5.11 Catalysis
Modifications
How are the activities modified/differentiated? (i.e.: abridged text)

Modifications on 504 plans may be submitted at ([SSD](#)), prior to testing. Both exclusion [statements](#) and [extensions](#) exist for each standard to accommodate different paces.

Specific Resources for Unit

Specific Resources for Unit
Attached Affirmative Action Compliance Checklist

Selected College-Board practice problems

Chang, Raymond and Goldsby, Kenneth A. Chemistry, 13th Edition. New York, McGraw-Hill. 2019

The College Board. AP Chemistry Guided Inquiry Experiments: Applying the Science Practices. 2013.

Demmin, Peter and David Hostage. AP Chemistry, Fifth Edition. New York: D&S Marketing Systems, Inc., 2005

Vonderbrink, Sally. Laboratory Experiments for Advanced Placement Chemistry. Batavia: Flinn Scientific, 2001.

POGIL Activities for High School Chemistry, Batavia: Flinn Scientific, 2012, AP Classroom

Diversity, Equity, & Inclusion

Diversity, Equity & Inclusion

Provide a brief description of how this unit addresses DE&I.

Career Readiness (9.2), Life Literacies and Key Skills (9.4) Standards

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.2	Attend to financial well-being.
WRK.K-12.P.3	Consider the environmental, social and economic impacts of decisions.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.7	Plan education and career paths aligned to personal goals.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Climate Change Education

ClimateChange Education

Enduring Understandings/Core Ideas

Performance Expectations

Math and ELA- Provide a brief description of a lesson or activity that relates to Climate Change. All other Content Team copy and paste the Core Idea and Performance Expectation from NJDOE link above.