ARISE Curriculum Guide

Chemistry: Topic 18—Reation Rates and Kinematics

ChemMatters

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Articles for Student Use

Element X: Dec. 1987, pp. 8-9.
Matches. Striking Chemistry at Your Fingertips: Dec. 2002, pp. 14-16.
Polywater: Dec. 1987, pp. 10-13.
Robert Bunsen—more than a burner designer: Oct. 1984, pp. 14-15.
Tapping Saltwater for a Thirsty World: Oct. 2002, pp. 4-7.

Articles for Teacher Use

Number and Topic:	6. Chemical Names and Formulas/Compounds and Elements 8. Chemical Reactions 11. Thermochemistry 16. Covalent Bonds, Molecular Shapes and Intermolecular Forces 18. Reaction Rates and Kinetics
Source:	*ChemMatters*, Feb. 2003, pp. 8-10, "The Explosive History of Nitrogen"
Type of Material:	Student Journal Article
Building on:	Basic chemical knowledge
Leading to:	Discussion of bonding in nitrogen compounds and elemental nitrogen, thermochemistry and reaction rates.
Links to Physics:	Matter, energy, entropy
Links to Biology:	
Good Stories:	What caused a terrible explosion aboard a cargo ship loaded with ammonium nitrate on April 16, 1947, killing 576 people?
Activity Description:	Article deals with explosive nitrogen-containing compounds and the chemical reasons that underlie their explosive nature.

Number and Topic:	**6. Chemical Names and Formulas/Compounds and Elements** **8. Chemical Reactions** **12. Gases/Gas Laws/Kinetic Theory** **18. Reaction Rates and Kinetics and Kineticsand Kinetics**
Source:	*ChemMatters*, Sep. 2001, pp. 7-9, "Ozone: Molecule with a Split Personality"
Type of Material:	Student Journal Article
Building on:	Elements and compounds, chemical reactions, gases
Leading to:	Reaction rates, chemical kinetics
Links to Physics:	Atoms
Links to Biology:	Animals, plants, photosynthesis, ecosystems
Good Stories:	Lots of excellent "real-life" connections such as sunburn and pollution
Activity Description:	The article describes how ozone is both formed and destroyed in the stratosphere and how it is formed in our immediate breathable atmosphere by the action of sunlight on various pollutants. It explains why ozone in the stratosphere is good, while ozone at street level is harmful. It discusses what is actually happening to earth's protective layer of ozone and why.

Number and Topic:	**6. Chemical Names and Formulas/Compounds and Elements** **8. Chemical Reactions** **13. Electrons in Atoms** **17. Water, Aqueous Solutions** **18. Reaction Rates and Kinetics** **22. Redox/Electrochemistry**
Source:	*ChemMatters*, Oct. 1994, pp. 13-15, "Iron for Breakfast"
Type of Material:	Student Journal Article and Activity
Building on:	Chemical names and formulas, electrons in atoms
Leading to:	Catalysis, redox reactions
Links to Physics:	Magnetism
Links to Biology:	Hemoglobin, the function of iron in human biology
Good Stories:	
Activity Description:	Article relates the nature of iron in human metabolism and the biological effects of having too much or too little.

Number and Topic:	**8. Chemical Reactions** **18. Reaction Rates and Kinetics**
Source:	*ChemMatters*, Feb. 1998, pp. 12-14, "Ozone—Out of Bounds"
Type of Material:	Student Journal Article
Building on:	Chemical reactions
Leading to:	Reaction rates
Links to Physics:	Electromagnetic spectrum
Links to Biology:	
Good Stories:	
Activity Description:	Article describes how ozone is produced in our atmosphere from VOCs (volatile organic compounds) and nitrogen oxides, explaining how complex the process can be.

Number and Topic:	**8. Chemical Reactions** **18. Reaction Rates and Kinetics**
Source:	*ChemMatters*, April 1994, pp. 13-15, "Designer Catalysts"
Type of Material:	Student Journal Article
Building on:	Chemical reactions
Leading to:	Discussion of catalysis and catalysts, activation energy
Links to Physics:	
Links to Biology:	Enzymes
Good Stories:	Contains futuristic thoughts about possible new catalytic applications.
Activity Description:	Article discusses catalysts, what they are, and how they operate in both chemical and biological systems.

Number and Topic:	**12. Gases/Gas Laws/Kinetic Theory** **17. Water, Aqueous Solution** **18. Reaction Rates and Kinetics**
Source:	*ChemMatters*, Feb. 2000, p. 16, "Why Do Eggs take Longer to Cook in the Mountains?"
Type of Material:	Student Journal Article including a fun quiz
Building on:	Gases
Leading to:	Colligative properties of solutions
Links to Physics:	Heat, energy
Links to Biology:	Coagulation of proteins
Good Stories:	There is a "fun" quiz at the end of the article.
Activity Description:	Article discusses how pressure varies with altitude and how this affects the boiling point of water, which in turn affects the time required to hard boil an egg.

Flinn ChemTopic Labs

Order Flinn ChemTopic Labs

Demo: Acid in the Eye – Safety
Demo: A Burning Candle - Observations
Demo: Classifying Matter
Demo: Flaming Vapor Ramp—Safety Demo
Lab: Observation and Experiment - Introduction to the Scientific Method
Lab: Separation of a Mixture - Percent Composition
Lab: What is a Chemical Reaction - Evidence of Change
Lab: Common Gases—Physical and Chemical Properties
Lab: Preparing and Testing Hydrogen Gas—A Microscale Approach
Lab: Carbon Dioxide - What a Gas—Microscale Gas Chemistry

ICE LABS

Online Descriptions and Experiments

Number and Topic:	**18. Reaction Rates and Kinetics**
Source:	ICE Laboratory Leadership
Type of Material:	Lab 13. Kinetics: A Study of Reaction Rates
Building on:	8. Chemical reactions 7. Moles.
Leading to:	19. Equilibrium
Links to Physics:	Energy
Links to Biology:	Enzyme systems
Good Stories:	
Activity Description:	To design a procedure to measure the rate or speed of the Mg/HCl reaction. You will then identify two factors other than catalysis to alter the speed of this reaction and examine each factor quantitatively. Have you ever wondered how chemists slow down reactions that are potentially explosive or speed up reactions to synthesize a product in a shorter period of time? In this laboratory activity, we will use a familiar reaction: Mg(s) + 2 HCl(aq) --> MgCl2(aq) + H2(g) To investigate this problem. The rate may be measured in several different ways. For example, it may be expressed as the volume of H2(g) p produced per second or as the mass of magnesium metal used per second.

Technology-Adapted Labs

Number and Topic:	**18. Reaction Rates and Kinetics**
Source:	CHEMISTRY, Nelson, British Columbia Edition 1996. Chapter 5 Solutions. Section 5.3 Reactions in Solution. Investigation 5.2 Page 194. ** Students in the honors chemistry course at Glenbard South use this book. The activity chosen can be used with any level student. How far the teacher takes the post-lab discussion would depend on the level of students in the class. Bill Grosser, Glenbard South High School
Type of Material:	Demo: The Iodine Clock Reaction (with an inquiry twist)
Building on:	Solution chemistry, moles, solution concentration, and student experimental design
Leading to:	Catalysts, reaction rates, net ionic equations
Links to Physics:	Structure of matter, electrons and ions
Links to Biology:	Reaction rates in cells, concentration
Good stories:	This is a classic demonstration. Two colorless solutions turn dark black/purple as time passes. Ancient tales of alchemy can easily be spun by the teacher to hook students.
Activity Description:	What makes this activity engaging is that it is presented with minimal instructions for the students. It is a classic example of a lab that traditionally was done with 10-20 steps for students to follow, but here it has been changed so that student thinking and involvement are increased dramatically. The book gives the students a simple problem: “Make solution A react with solution B in a time of 20 ± 1 seconds.” Students may manipulate any variable they choose. Temperature, concentration, volume etc. can all be changed and their effects measured. Students design their own experiments, collect their own data, and share their data with the class. Learning is assessed by their performance as well as their written work. This is an outstanding lab that really engages the students in an authentic investigation. A set of alternative instructions developed by Mike Heinz (Glenbard South) is included. This activity provides a striking example of how an open-ended investigation is a much more effective learning experience than is a cookbook lab.