

# **GROTON PUBLIC SCHOOLS**

## **Groton, Connecticut**



# **SCIENCE CURRICULUM**

## **Chemistry in the Community**

### **(ChemCom)**

### **11<sup>th</sup> grade**

**Revision Approved June 2011**

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## **Groton Public Schools Pre-K–12 Science Curriculum Philosophy**

Science education should awaken the natural sense of excitement and wonder in each child and facilitate a realization that science knowledge is power in our ever-changing world.

### **General Beliefs:**

The purpose of the Groton Public Schools (GPS) science instructional program is to develop scientific literacy in all students. The scientifically literate person:

- Is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations;
- Understands key concepts and principles of science;
- Is familiar with the natural world and recognizes both its diversity and unity; and
- Applies scientific knowledge and ways of thinking for individual and social purposes.

The teaching of science in GPS is coordinated for Grades K–12, aligned with both state and national content standards and performance outcomes. The curriculum reflects the belief that all students can learn science. The curriculum considers the multicultural backgrounds and various abilities, achievement levels, interests, and learning styles of students. Educational strategies, methods, technologies, and resources are to be varied in order to ensure and promote the independence of students as learners. Students, teachers, parents, and community members all share the responsibility for education in GPS.

### **Reasons for Learning Content:**

Science education prepares students for a global society in which environmental, social, and economic issues are related to science, mathematics, and technology. Therefore, the curriculum emphasizes the process skills of an inquiry based science program designed on a continuum through all content standards.

### **Teaching Strategies:**

Scientific literacy is best achieved by meeting the individual needs of students using an assortment of developmentally appropriate, student-centered activities. Instruction actively engages students in learning and encourages enjoyment of the scientific process, while developing an understanding of important concepts and skills. Teaching strategies and methods may include individualization, remediation, flexible grouping, collaborative learning, lateral expansion, and acceleration as deemed appropriate. Furthermore, inquiry based experiences, hands-on explorations, laboratory experiences, demonstrations, field experiences, student discourse, and the use of all forms of available technologies and community resources are considered components of the learning process.

**Assessment:**

Effective assessment is an ongoing process of monitoring student learning, guiding further instruction, and improving the program. It aligns with instructional strategies and curriculum content. A variety of formal and informal assessment options are implemented to provide opportunities for success for students with different learning styles and to provide broad information about student learning. Examples include journals, projects, teacher observation, models, self-evaluations, quizzes, laboratory reports, and various digital tools to demonstrate student understanding.

**Technology:**

The ability to utilize technology as a tool is an essential life skill. As it evolves, technology plays a role in providing up-to-date content and variety in instructional strategies and assessment techniques in order to prepare all students for their future in the world community.

**21<sup>st</sup> Century Learning Experiences:**

Common learning experiences include opportunities to demonstrate collaborative learning, critical thinking, problem solving, global citizenship, digital literacy, creativity and innovation.

## **The Connecticut Common Core of Learning**

The Groton Public Schools Science Curriculum aligns with the Connecticut Common Core of Learning. The Common Core provides a set of high expectations for all K–12 students to develop to their fullest potential. It recognizes that students have different levels of readiness, interests, and aspirations. However, it sets no limits on anyone and provides all students the opportunity to achieve within one common core.

The Common Core provides students with the knowledge and intellectual tools to apply scientific skills, processes, and methods of inquiry to real world settings. It develops young people who are free to ask questions, seek information, and validate explanations in thoughtful and creative ways. The students will understand the relationship of science to other curriculum areas and transfer knowledge across subject areas.

The Common Core outlines skills, strategies, and competencies needed to meet the scientific demands of the 21<sup>st</sup> Century.

## **The Learning Environment**

An inquiry based program requires a learning environment that promotes student engagement in hands-on and minds-on scientific activities. The support of the Groton Public Schools K–12 Science Curriculum through appropriate facilities and resources is essential:

### **Resources**

- Teacher resources
- Equipment and supplies
- Present and emerging technologies
- Print resources
- Teacher training
- Consumables

### **Facilities**

- Adequate wiring for emerging technologies
- Sufficient electrical outlets
- Sinks
- Safety equipment
- Ample laboratory work and storage space
- Furniture that accommodates instructional needs of a diverse population of students
- Meet OSHA related lab standards (see appendix)

### **Management**

- Flexible grouping
- Cooperative learning teams
- Teacher as facilitator
- Supportive learning environment

### **Safety**

- Appropriate equipment and teacher training
- OSHA lab standards

### **Adequate Funding**

- To implement and maintain the program at the highest standard

### **As a result of this learning environment, the students will be equipped to:**

- Work successfully using flexible grouping situations
- Experience inquiry based science that will develop the skills of synthesizing, predicting, hypothesizing, and evaluating
- Become scientifically literate life-long learners

## **Program Goals**

*It is the goal of the Groton Public Schools Science Program that our graduates know the basic concepts of, and the interrelationships among, biology, chemistry, physics, and earth and space sciences, and will be able to apply scientific skills and processes to real-world settings.*

To meet this goal, students will:

- Understand and apply basic concepts, principles and theories, chemistry, physics, and earth and space sciences and their interrelationships.
- Recognize and participate in scientific endeavors which are evidence-based and encourage inquiry that leads to a greater understanding of the world.
- Identify and solve problems through scientific exploration, including the formulation of hypotheses, design of experiments, use of technology, analysis of data and drawing of conclusions.
- Select and properly use appropriate laboratory technology, equipment, and materials.
- Understand and utilize, when appropriate, existing and emerging technologies.
- Analyze the possibilities and limits of science and technology in order to make and defend decisions about societal issues.
- Understand that the way in which scientific knowledge is formulated is crucial to the validity of the knowledge.

# Science Content Standards

Groton Public Schools

## **The Nature of Science:**

Students will experience an inquiry based learning environment in which they are free to ask questions, seek information, and validate explanations in thoughtful and creative ways. Students also will understand that the processes, ways of knowing and conceptual foundations of science are interdependent and inextricably bound.

## **Earth Science:**

Students will understand the structure, processes and forces that shape our ever changing universe. Students will understand the dynamic processes that effect changes to the atmosphere, hydrosphere and geosphere of our planet.

## **Chemistry:**

Students will know the types and phases of matter and how energy interacts with each. Students will understand that the structure of matter determines the interrelationships with other forms of matter. Students will be able to carry these concepts into global patterns and system seen on our planet.

## **Physics:**

Students will understand that energy and matter are not created or destroyed but can be transformed or transferred throughout the universe. Students will understand the relationships that exist between electricity, electromagnetic energies and magnetism.

## **Global Interdependence:**

Students will understand the interrelationships between the matter and energy in the spheres and the use of resources by society. Students will evaluate the pros and cons of technology's effects on our environment.

## **Proposed Text:**

Chemistry in the Community (ChemCom 4th Edition)

W.H. Freeman and Company

- With instructional resource components of the ChemCom program

## **Evidence of Student Learning:**

The course will use student, teacher, and text designed labs, quizzes, tests, multi-media projects, supplemental text reading and teacher constructed materials to evaluate student performance.

Assessments are designed to differentiate according to students' learning styles, interests, communication skills, etc.

# Groton Public Schools

## Curriculum Map

### INTRODUCTION

Course Title: **CHEMISTRY IN THE COMMUNITY**

Curriculum Area and Grade: **SCIENCE – CHEMISTRY – TARGETED TO 11<sup>TH</sup> GRADE**

#### Course Purpose:

Chemistry in the Community (ChemCom) is an introductory chemistry course that will allow students to realize the important role of chemistry in their everyday lives. ChemCom creates a need-to-know in the minds of students through utilization of science and technology issues. Students will develop and use knowledge of matter and its chemical properties to make informed decisions about the application of science and technology to enhance the quality of their lives.

#### Major Learning Goals and Understandings:

##### By Unit:

- 1) Water chemistry is important in our everyday lives.
- 2) Earth's resources can be used wisely by understanding the properties of matter.
- 3) Understanding the energy stored in carbon bonds demonstrates the value of petroleum resources and the need for alternative energy sources.
- 4) Properties of atmospheric gases affect our living environment.
- 5) The chemical industry applies chemical reactions to produce a variety of materials, goods, and services.
- 6) Understanding atomic structure helps us understand the benefits and threats of nuclear technology.
- 7) You can use chemistry to explain and evaluate the foods that people decide to eat.

##### Spiraled throughout the units:

- **Atomic and Molecular Structure** -The periodic table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure.
- **Chemical Bonds** - Biological, chemical and physical properties of matter result from the ability of atoms to form chemical bonds.
- **Conservation of Matter** - The conservation of atoms in chemical reactions (balancing equations) leads to the principle of conservation of matter.
- **Organic Chemistry and Biochemistry** - The bonding characteristics of carbon allow the formation of many different organic molecules of varied sizes, shapes and chemical properties, and provide the biochemical basis of life.

<b>Units/Theme/Chapter/Concept and # of Weeks</b>	
36 weeks for AB schedule (80 minute periods M, W, TH, F/69 minute class periods T)	
1. Water: Exploring Solutions – 7 weeks	2. Materials: Structure and Uses – 6 weeks
3. Petroleum: Breaking and Making Bonds – 5 weeks	4. Air: Chemistry and the Atmosphere – 6 weeks
5. Industry: Applying Chemical Reactions – 4 weeks	6. Atoms: Nuclear Interactions – 4 weeks
7. Food: Matter and Energy for Life - 4 weeks	

**Mappers/Authors: N.Gilliam, M. Harris, F. Marcille**

### **UNIT 1 - Water: Exploring Solutions**

<b>Part 1 - UNIT 1 Water: Exploring Solutions</b>			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 7 weeks

<b>Big Idea (BI) and Essential Questions (EQ)</b>
<ul style="list-style-type: none"> <li>• <b>BI – Water chemistry is important in our everyday lives.</b></li> <li>• <b>EQ</b> <ul style="list-style-type: none"> <li>EQ1: What is Chemistry?</li> <li>EQ2: How is water related to Chemistry?</li> <li>EQ3: Why is water important to us? How does water’s structure explain its unique properties for sustaining life?</li> <li>EQ4: Why are there people without enough water to drink?</li> <li>EQ5: Is it possible to provide enough clean water for everybody? How?</li> </ul> </li> </ul>

<b>Part 2 - Standards</b>	
<b>Standards for this unit</b>	<b>Key (GLE) Content Knowledge and Concepts/Skills</b>
<b>Part 3 - Common Assessments</b>	
ChemCom Unit 1 – Water Pre and Post Test are posted at Q:\ChemCom\  <a href="#">Unit 1 Pre-Post Test</a>  <a href="#">Unit 1 Dipstick Quiz</a>  Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipstick  Formative assessment probe: “What’s in the bubbles Grandma?” by Page Keeley  <a href="#">Grandma Boiling Water</a>	
<b>Part 4 - Common/Assured Learning Experiences</b>	
1.) Foul Water lab pgs. 8-13 in ChemCom text 2.) Water Testing lab pgs. 35-38 in ChemCom text  <a href="#">1B Water testing lab</a>  3.) Constructing a Solubility Curve lab pgs. 49-51 (SAFETY CONCERN: use KNO <sub>3</sub> in place of succinic acid). See ChemCom activities workbook and ( <a href="#">1C3 Lab sol curve KNO3.docx</a> ) for teacher-created lab instructions and worksheet. 4.) Water Softening lab pgs. 76-79 in ChemCom text. 5.) Distinguishing Fact vs. Opinion – utilizing news articles within the ChemCom text, have students use graphic organizer ( <a href="#">Graphic Organizer</a> ) to identify facts and opinions in the newspaper articles. (pgs. 4-5, 6, 22, 69, 70-71, 72-73, 74, 85 in ChemCom text) 6.) Culminating Activity: “Putting It All Together: Fish Kill – Finding the Solution” mock town council meeting with role playing, pgs. 85-89 in ChemCom text. See textbook for two-year water quality data for four scenarios.  <a href="#">Unit 1 - Scenario 1 Fish Kill data</a> <a href="#">Unit 1 - Scenario 2 Fish Kill data</a> <a href="#">Unit 1 - Scenario 3 Fish Kill data</a> <a href="#">Unit 1 - Scenario 4 Fish Kill data</a>  7.) Field Trip to Groton Utilities Water Treatment Facility	

## Part 5 - Teacher Notes

### General notes:

- Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
- Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text; use instructor CD ROM
- The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual representation of phases of matter and demonstration of lab techniques for ‘Foul Water’

### Embedded Technology –

Shared files at Q:\ChemCom\Unit Powerpoints and Flipcharts contain ActiveInspire applications and PowerPoint-Promethean presentations, worksheets and labs.

Water molecule simulation:

<http://workbench.concord.org/database/activities/202/html#overview>

### Embedded Literacy –

- A Short History of Nearly Everything, Bill Bryson, Ch. 9, “The Mighty Atom”
- The New York Times Daily Lesson Plan:  
<http://learning.blogs.nytimes.com/2007/07/10/wondrous-water/>
- “Water: A really strange molecule” from Chemistry for Dummies, Wiley Publishing Inc.
- What’s the Connection to me?

<http://waterplanetchallenge.discoveryeducation.com/wpc/index.cfm/featured-resources/gulf-oil-spill/whats-the-connection-to-me/whats-the-connection-to-me-high-school/>

## UNIT 2 - Materials: Structure and Uses

Part 1 - UNIT 2 Materials: Structure and Uses			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 6 weeks
<b>Big Idea (BI) and Essential Questions (EQ)</b>			
<ul style="list-style-type: none"><li>• <b>BI - Earth’s resources can be used wisely by understanding the properties of matter.</b></li><li>• <b>EQ</b><ul style="list-style-type: none"><li>EQ1: What does an atom look like?</li><li>EQ2: How does the position of an element on the periodic table determine its chemical and physical properties?</li><li>EQ3: How does the distribution of the Earth’s resources affect the wellbeing of a region?</li><li>EQ4: How can matter be modified to make it more useful?</li><li>EQ5: How can pure carbon exist in different forms with varying properties?</li></ul></li></ul>			

<b>Part 2 - Standards</b>		
<b>Standards for this unit</b>	<b>Key (GLE) Content Knowledge and Concepts/Skills</b>	
<p><i>Bold Face indicates priority standards</i></p> <p><b>11.1—The periodic table displays the elements in increasing atomic number; relates properties to atomic structure</b></p> <p>11.2—Biological, chemical and physical properties of matter result from the ability of atoms to form chemical bonds</p> <p><b>11.3—The conservation of atoms in chemical reactions leads to the principle of conservation of matter.</b></p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. The quantum model of the atom.</li> <li>2. The patterns on the periodic table.</li> <li>3. Where elements are found on Earth and renewable and non-renewable resources.</li> <li>4. The number of atoms in a compound.</li> <li>5. The law of conservation of mass and energy.</li> <li>6. A chemical equation must be balanced to be a true statement.</li> <li>7. The basic types of chemical reactions.</li> <li>8. Avogadro’s number and the mole.</li> <li>9. What alloys are and their importance.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Distinguish between chemical and physical properties and changes.</li> <li>2. Distinguish metals, non-metals and semi-metals (metalloids) by their properties.</li> <li>3. Identify groups on the periodic table (halogens, noble gases).</li> <li>4. Relate position on the periodic table to trends in size, electronegativity, ion charge, and bonding.</li> <li>5. Write balanced chemical equations.</li> <li>6. Solve conversion problems using mole conversions.</li> <li>7. Calculate Percent Composition.</li> <li>8. Explain the Law of Conservation of Matter using balanced chemical equations.</li> <li>9. Calculate % composition by mass.</li> <li>10. Describe how applying a coating can change the properties of a material.</li> <li>11. Describe the three major parts of the earth; distinguish between renewable and non-renewable resources</li> </ol>

### Part 3 - Common Assessments

See Q:\ChemCom\2 Pre-Post Test.docx for Unit 2 Pre and Post Tests.

[Unit 2 Pre-Post Test](#)

Science Skill Building “Dipsticks” (using Active Inspire) are posted at Q:\ChemCom\Dipsticks

[Unit 2 A Dipstick](#)

[Unit 2 B Dipstick](#)

### Part 4 - Common/Assured Learning Experiences

- 1.) Metal or Nonmetal lab pgs. 97-99 in ChemCom text: see ChemCom activities workbook

[Metal or Nonmetal lab](#)

- 2.) Converting Copper lab pgs. 116-117 in ChemCom text: see ChemCom activities workbook

- 3.) Relative Reactivities of Metals lab pgs. 118-120 in ChemCom text; see ChemCom activities workbook

- 4.) Striking It Rich lab pgs. 158-160 in ChemCom text; see ChemCom activities workbook for lab procedure and *Appendix 1.5* for lab data table and follow-up questions.

[Striking It Rich lab](#)

- 5.) <http://www.discoveryeducation.com/teachers/free-lesson-plans/periodic-table-of-the-elements-transition-metals-ii.cfm>

- 6.) Culminating Activity: “Putting It All Together: Making Money” pgs. 171-172 in ChemCom text; Students design and present a new coin design for the US half-dollar. Peer assessment may be applied to student presentations. Assignment and grading rubric is provided as *Appendix 1.6*.

[Coin Design Project Assignment](#)

[Coin Project Grading Rubric](#)

## Part 5 – Teacher Notes

### General Notes –

Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book

Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text; use instructor CD-ROM.

-The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual representation of phases of matter and demonstration of lab techniques for ‘Foul Water’

### Embedded Technology –

- Interactive applet for student exploration of atomic structure.

[Build-an-atom](#)

- Shared files at Q:\ChemCom\Unit Powerpoints and Flipcharts contain ActiveInspire applications and PowerPoint-Promethean presentations.

[2B Lecture](#)

[2 B and C Lecture](#)

- Chemical reaction simulation

<http://mw2.concord.org/public/part2/chemreact/page1.cml>

- Introduction to the mole and gram to mole conversions.

[The Chemistry Mole](#)

- For student research for the coin project, the US Mint web site has a virtual tour and specifications for and examples of coins; go to <http://www.usmint.gov/>

- Interactive Periodic Table: [www.chemcool.com](http://www.chemcool.com)

Web elements Periodic table: [www.webelements.com](http://www.webelements.com) (Narration for reluctant readers and ELLs)

### Embedded Literacy –

- Teaching and learning with the New York Times, “Transforming the Alchemists”  
<http://www.nytimes.com/2006/08/01/science/01alch.html?ref=chemistry>

### UNIT 3 - Petroleum: Breaking and Making Bonds

Part 1 - UNIT 3 Petroleum: Breaking and Making Bonds			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 5weeks

Big Idea (BI) and Essential Questions (EQ)
<ul style="list-style-type: none"> <li>• <b>BI - Understanding the energy stored in carbon bonds demonstrates the value of petroleum resources and the need for alternative energy sources.</b></li> <li>• <b>EQ</b> <ul style="list-style-type: none"> <li>EQ1: What is petroleum and why is it useful?</li> <li>EQ2: Why is it necessary to refine petroleum prior to use?</li> <li>EQ3: In what ways do we utilize petroleum in everyday life? Could we survive without petroleum products?</li> <li>EQ4: How is it that the nations that possess the most petroleum are not necessarily the nations who consume the most petroleum?</li> <li>EQ5: What properties are important in considering substitutes for petroleum?</li> </ul> </li> </ul>

Part 2 - Standards		
Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <p>11.2—Biological, chemical and physical properties of matter result from the ability of atoms to form chemical bonds.</p> <p><b>11.5—The bonding characteristics of carbon allow for the formation of many different organic molecules.</b></p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. Petroleum is a mixture of different hydrocarbons.</li> <li>2. The structure of a hydrocarbon.</li> <li>3. The names of the first ten alkanes.</li> <li>4. The structure of isomers and the effect of straight and branched chains on properties of a compound.</li> <li>5. The Law of Conservation of Energy and how energy is converted in everyday processes.</li> <li>6. The difference between an endothermic and exothermic reactions.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Name, identify, draw and assemble models of organic molecules.</li> <li>2. Interpret boiling point data of different alkanes and isomers of alkanes.</li> <li>3. Draw the Lewis dot structure and structural formula for simple alkanes</li> <li>4. Explain the process of fractional distillation.</li> <li>5. Balance chemical equations for the combustion of hydrocarbons.</li> <li>6. Analyze current and historic environmental data relating carbon dioxide</li> </ol>

	<ol style="list-style-type: none"> <li>7. The concepts of Heat of Combustion and Specific Heat.</li> <li>8. How polymers are formed and the role they play in plastic production.</li> <li>9. Identify alternative forms of energy</li> </ol>	<p>concentration to global climate change and draw conclusions from these findings.</p> <ol style="list-style-type: none"> <li>7. Explain octane rating and evaluate the past and present additives that were used to increase the octane rating of gasoline.</li> <li>8. Relate functional groups to chemical and physical properties of a molecule.</li> <li>9. Evaluate existing and developing alternative energy sources and determine which would be most appropriate for use in the near future. (risk, benefit, cost)</li> </ol>
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### **Part 3 - Common Assessments**

See Q:\ChemCom\3 Pre-Post Test.docx for Unit 3 Pre and Post Tests.

[Unit 3 Pre-Post Test](#)

Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipsticks

[Unit 3 Dipstick](#)

#### Part 4 - Common/Assured Learning Experiences

- 1.) Lab demonstration Separation by Distillation; see ChemCom text pages 178-179.
- 2.) Modeling Alkanes Activity pgs. 185-189 in ChemCom text: see *Q:\ChemCom* for teacher-developed student worksheet.

[Modeling Alkanes](#)

- 3.) Observation of a Candle Lab.

[Candle Observation lab](#)

- 4.) Combustion lab pgs. 202-207 in ChemCom text; see ChemCom activities workbook.

[Combustion Lab](#)

- 5.) Article and video clip about plastics.

<http://science.howstuffworks.com/plastic.htm>

- 6.) NEED.org Energy Flows.

<http://www.need.org/needpdf/Energy%20Flows.pdf>

- 7.) Alternate Energy Poster.

[Alternative Energy Poster](#)

## Part 5 - Teacher Notes

### General notes-

- Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
- Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text; use instructor CD-ROM.
- The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual demonstration of lab techniques.
- The NEED Project provides energy workbooks and materials for six hands-on workstations for students to investigate energy conversions and alternative energy sources. Materials are available in the third floor prep room.

### Embedded Technology –

- Shared files at Q:\ChemCom contain ActiveInspire applications and PowerPoint-Promethean presentations.

#### [Modeling Alkanes](#)

- For supplemental visuals, the American Petroleum Institute’s web site has a well-organized introduction to all phases of petroleum production; go to
- <http://www.adventuresinenergy.org/index.html>

### Embedded Literacy –

- The Why Files: <http://whyfiles.org/2011/methane-on-the-menu-in-the-gulf-of-mexico/>
- Teaching and learning with the New York Times,
- <http://learning.blogs.nytimes.com/2011/03/23/teaching-and-learning-about-energy-with-the-new-york-times/>

## UNIT 4 - Air: Chemistry and the Atmosphere

Part 1 - UNIT 4 Air: Chemistry and the Atmosphere			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 6 weeks

### Big Idea (BI) and Essential Questions (EQ)

- **BI – Properties of atmospheric gases affect our living environment.**

- **EQ**

EQ1: What is the relationship between the pressure, volume and temperature of a gas?

EQ2: How does the composition of the Earth's atmosphere affect its properties and behavior?

EQ3: How do humans interfere with the natural carbon cycle? What are the environmental effects of this human interference? Is global warming real?

EQ4: What are the major causes and consequences of acid rain?

EQ5: How can air pollution be controlled?

<b>Part 2 - Standards</b>		
<b>Standards for this unit</b>	<b>Key (GLE) Content Knowledge and Concepts/Skills</b>	
<p><i>Bold Face indicates priority standards</i></p> <p>11.2 Biological, chemical and physical properties of matter result from the ability of atoms to form chemical bonds.</p> <p><b>11.4 Chemical reaction rates depend on factors that influence the frequency of collisions of reactant molecules.</b></p> <p><b>D6 - Describe the pattern of movement of molecules in all phases of matter as described by the Kinetic Molecular Theory.</b></p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. Earth's atmosphere is a mixture of gases.</li> <li>2. Pressure is a force applied over an area.</li> <li>3. The relationship between temperature, pressure and volume of gases; Charles', Boyle's and the Ideal Gas Laws.</li> <li>4. Coefficients in balanced chemical equations indicate relative quantities.</li> <li>5. The electromagnetic spectrum and give examples of each.</li> <li>6. The carbon cycle and greenhouse gases.</li> <li>7. Acid-base ion concentrations and pH.</li> <li>8. Causes and effects of acid rain.</li> <li>9. Sources and effects of air pollution.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Graphically depict atmospheric gas pressure and temperature.</li> <li>2. Describe pressure, temperature and volume in terms of the kinetic molecular theory.</li> <li>3. Calculate properties of gases using the ideal gas law.</li> <li>4. Calculate volumes of gases in chemical reactions.</li> <li>5. Arrange electromagnetic radiation in order of wavelength and energy.</li> <li>6. Explain the major steps of the carbon cycle and identify the sources of greenhouse gases.</li> <li>7. Describe the chemical basis of acid rain.</li> <li>8. Explain the pH scale in terms of ion concentrations.</li> <li>9. Distinguish between primary and secondary sources of air pollutants.</li> </ol>

### Part 3 - Common Assessments

See Q:\ChemCom\Common Assessments for Unit 4.

[Unit 4 Pre-Post Test](#)

See Q:\ChemCom\Common Assessments for Midterm and Final Exam.

[Midterm ChemCom Foundations](#)

[Midterm CP chemcom Part1](#)

[Midterm CP ChemCom Parts 2-3](#)

[KEY midterm CP chemcom Scantron](#)

[Final ChemCom Foundations First Page](#)

[Final ChemCom Foundations Second Page](#)

[CP ChemCom Final Exam Part 1](#)

[CP ChemCom Final Exam Part 2](#)

Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipsticks

[Unit 4 Dipstick](#)

## Part 4 - Common/Assured Learning Experiences

1.) Exploring Properties of Gases lab; see ChemCom text pages 248-251.

[Pre-Lab  
Properties of Gases](#)

2.) Graphing Atmospheric Data pgs. 252-253 in ChemCom text.

[Graphing Atmospheric Data Assessment](#)

3.) Carbon Dioxide Levels lab; see pgs. 287-289 in ChemCom text; see ChemCom activities workbook

[Trends in CO<sub>2</sub>](#)

4.) Human activity and World climate change.

[Global Warming Venn](#)

5.) Making Acid Rain lab; see text pgs. 301-302 in ChemCom text.

[Making Acid Rain](#)

6.) Lab Demonstration “Cleansing Air”; see text pgs. 325 and 4F-G.

## Part 5 - Teacher Notes

### General notes-

- Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
- Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text; use instructor CD-ROM for worksheets and visuals.

### Embedded Technology –

- Shared files at Q:\ChemCom\Unit Powerpoints and Flipcharts contain ActiveInspire applications and PowerPoint-Promethean presentations.

[Temperature and Measurement](#)

[Gas Laws](#)

- <http://www.climatecrisis.net/index.php> has excellent support materials for the film “An Inconvenient Truth.”
- PHET simulation: Acids and bases.

[Acid-base-solutions](#)

[Greenhouse](#)

### Embedded Literacy –

- The Why Files <http://whyfiles.org/2011/trash-does-burning-beat-burying/>
- Teaching and learning with the New York Times,  
<http://learning.blogs.nytimes.com/category/science/>
- Girls Gone Green, by Lynn Hirshfield (Penguin.com) tells the story of real girls making a difference in environmental protection and global warming.

## UNIT 5- Industry: Applying Chemical Reactions

Part 1 - UNIT 5 Industry: Applying Chemical Reactions (Section A)			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 4 weeks

Big Idea (BI) and Essential Questions (EQ)
<ul style="list-style-type: none"> <li>• <b>BI - The chemical industry applies chemical reactions to produce a variety of materials, goods, and services</b></li> <li>• <b>EQ</b> <ul style="list-style-type: none"> <li>EQ1: Why is the chemical industry important?</li> <li>EQ2: How does the chemical industry transform elements and compounds into other useful materials?</li> <li>EQ3: Why is nitrogen such an important element in industrial chemistry?</li> <li>EQ4: What are the practical applications of electrochemistry?</li> <li>EQ5: What is the significance of the term “dynamic” in dynamic equilibrium?</li> </ul> </li> </ul>

Part 2 - Standards		
Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. A majority of everyday items have been manufactured, processed, or altered from their original form.</li> <li>2. The manufacture and sale of fertilizer is a multibillion dollar business that affects the lives of nearly everyone, from workers, to farmers, food producers and consumers.</li> <li>3. The importance relationship between nitrogen, the nitrogen cycle, and fertilizer.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify everyday items they use that have been manufactured, processed, or altered from their original forms.</li> <li>2. Evaluate and test different fertilizers for elements and ions needed by growing plants.</li> <li>3. Explain the nitrogen cycle.</li> </ol>

### Part 3 - Common Assessments

See Q:\ChemCom\Common Assessments for Unit 5.

[5 Pre-Post Test](#)

Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipsticks

[Unit 5 Dipstick](#)

### Part 4 - Common/Assured Learning Experiences

1. Distinguishing Fact vs. Opinion – utilizing news articles within the ChemCom text, have students use graphic organizer ([Graphic Organizer](#)) to identify facts and opinions in the newspaper articles. pgs. 340 - 341 in ChemCom text
2. Fertilizer Components lab pgs. 346 – 349 in ChemCom text  
see ChemCom activities workbook
3. Phosphates lab pgs. 353 – 355 in ChemCom text  
see ChemCom activities workbook

#### **Video clips about the industrial process**

\*\*\**The World of Chemistry* and *TV Ontario's Videotapes* are good sources listed by the ChemCom text, Discovery Channel's *How It's Made* (many different episodes from which to choose) may also be a good resource.

- Specifically *The World of Chemistry* has some great clips on the energy released when breaking nitrogen bonds (explosions).
- Field study Project Oceanography local water quality testing (Nitrogen Levels)
- Guest speaker – an industrial chemist, electroplating or electrolysis worker, silversmith, etc. would all be excellent for an in-class presentation and Q&A.

## Part 5 - Teacher Notes

### General Notes-

- Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
- Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text
- The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual representation of phases of matter and demonstration of lab techniques.
- Refer to ChemCom CD ROM for additional support materials.
- Use Powerpoint, and/or Promethean Board as resources where appropriate to infuse technology and enhance the curriculum.

### Embedded Technology

- [http://mw.concord.org/modeler/articles/modeling\\_ch7.pdf](http://mw.concord.org/modeler/articles/modeling_ch7.pdf)

### Embedded Literacy

- Students research careers in chemistry or other sciences at links such as

[http://chemistry.about.com/lr/science\\_careers/503247/2/](http://chemistry.about.com/lr/science_careers/503247/2/)

<http://chemistry.about.com/od/educationemployment/a/chemistprofile.htm>

- American Chemical Society's site

[http://portal.acs.org/portal/acs/corg/content?\\_nfpb=true&\\_pageLabel=PP\\_SUPERARTICLE&node\\_id=1188&use\\_sec=false&sec\\_url\\_var=region1&\\_uuid=88caeb2c-094f-4e70-aad3-83a76b3e7c13](http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_SUPERARTICLE&node_id=1188&use_sec=false&sec_url_var=region1&_uuid=88caeb2c-094f-4e70-aad3-83a76b3e7c13)

## UNIT 6 - Atoms: Nuclear Interactions

Part 1 - UNIT 6 Atoms: Nuclear Interactions			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 4 week

Big Idea (BI) and Essential Questions (EQ)
<ul style="list-style-type: none"> <li>• <b>BI - Understanding atomic structure helps us understand the benefits and threats of nuclear technology.</b></li> <li>• <b>EQ</b> EQ1: How is it possible for scientists to create new elements? EQ2: Why do certain elements, through radioactive decay, transform from one element to another and what roll does half-life play? EQ3: What are the biological effects of overexposure to radiation? EQ4: How are radioisotopes used in the medical industry? EQ5: What balance of risks and benefits does nuclear energy production pose?</li> </ul>

Part 2 - Standards		
Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <p><b>9.4 – Atoms react with one another to form new molecules.</b></p> <p><b>9.6 – Chemical technologies present both risks and benefits to the health and well-being of humans, plants and animals.</b></p> <p>11.2 Biological, chemical and physical properties of matter result from the</p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. Atoms have positively charged nucleus surrounded by negatively charged electrons.</li> <li>2. The electromagnetic spectrum is used to compare and contrast ionizing and nonionizing radiation by focusing on the energies of the various types of radiation.</li> <li>3. Nuclear radiation is a form of ionizing radiation that results from changes in the nuclei of atoms.</li> <li>4. The proton, neutron, and electron are subatomic</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Describe the general structure of the atom.</li> <li>2. Classify radiation as either ionizing or nonionizing.</li> <li>3. Compare and contrast ionizing, nonionizing, and nuclear radiation.</li> <li>4. Explain the differences in subatomic particles</li> </ol>

<p>ability of atoms to form chemical bonds. (refer back to Unit 1)</p> <p>11.1 – The periodic table displays the elements in increasing atomic number; relates properties to atomic structure.</p>	<p>particles.</p> <ol style="list-style-type: none"> <li>5. Isotopes are distinguished by their different mass numbers.</li> <li>6. Radioactive atoms naturally decay.</li> <li>7. The radiation emitted by naturally occurring radioisotopes provides all individuals with a constant but small exposure to radioactivity.</li> </ol>	<p>(proton, neutron, electron).</p> <ol style="list-style-type: none"> <li>5. Represent isotopes using proper isotope notation. Identify common sources of radiation exposure.</li> <li>6. Use a Geiger-Mueller counter to demonstrate the penetrating abilities of the three different types of ionizing radiation.</li> </ol>
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### Part 3 - Common Unit Assessments

See Q:\ChemCom\Common Assessments for Unit 6.

[Unit 6 Pre-Post Test](#)

Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipsticks

[Unit 6 Dipstick](#)

#### Part 4 - Common/Assured Learning Experiences

1. Teachers should focus on the following sections: A.2, A.4, A.5, B.1, B.4, B.5
2. Supplemental Black Box activity pg 416 in ChemCom Teacher's edition
3. Isotope Notation Building Skills 1 pg 421 in ChemCom text; see *Q:\ChemCom* for teacher-developed worksheet.

##### Isotopes

4. Molar Mass and Isotope Abundance Building Skills 2 pg 423 in ChemCom text; see ChemCom activities workbook.
5. Radiation Exposure Standards ChemQuandary 2 pg 430 in ChemCom text; see ChemCom activities workbook.
6. Alpha, Beta, and Gamma Radiation lab pgs. 434 – 438 in ChemCom text; see ChemCom activities workbook.
  - Because this type of equipment is often in short supply, this activity can be presented as a teacher-led demonstration. Because the activity covers a number of important concepts, however, students should at least observe a demonstration.
  - NOTE: The American Nuclear Society has a special program to distribute working Geiger-Mueller counters to schools. A local college or university physics department may have Geiger counters available for loan. (Conn College, Mitchell, UCONN, Pfizer, Dominion?)
7. Nuclear Balancing Act Building Skills 3 pg 441 in ChemCom text; see ChemCom activities workbook.
8. <http://www.discoveryeducation.com/administrators/curricular-resources/digital-curriculum/index.cfm>

## Part 5-Teacher Notes

### General Notes

1. Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
2. Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text  
-The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual representation of phases of matter and demonstration of lab techniques
3. Refer to ChemCom CD ROM for additional support materials.
4. Use Powerpoint, and/or Promethean Board as resources where appropriate to infuse technology and enhance the curriculum.

### Embedded Technology

-PHET applets: Alpha decay, Build an Atom, and Beta decay.

[Alpha-Decay](#)

[Build-an-Atom](#)

[Beta-Decay](#)

[Radioactive-Dating-Game](#)

[PAP-Nuclear-Notes](#)

[PAP-Atomic-Structure](#)

### Embedded Literacy (varied readability levels)

- Radioactive Waste: Resources for Environmental Literacy, by the Environmental Literacy Council and the National Science Teachers Associations, Arlington, VA: NSTA Press, 2007.
- “The Death of Alexander Litvinenko” by Audrey Keown, ChemMatters, Washington, D.C. American Chemical Society, April 2007. pp18-19
- Crisis in Japan: Understanding Nuclear Energy and Reactors

<http://learning.blogs.nytimes.com/2011/03/23/teaching-and-learning-about-energy-with-the-new-york-times/>

<http://learning.blogs.nytimes.com/2011/03/16/crisis-in-japan-understanding-nuclear-energy-and-reactors/>

## UNIT 7 - Food: Matter and Energy for Life

Part 1 - UNIT 7 Food: Matter and Energy for Life			
<b>Grade:</b> 11 (target)	<b>Subject:</b> Science - Chemistry	<b>Course:</b> ChemCom	<b>Length of Unit:</b> 4 weeks

### Big Idea (BI) and Essential Questions (EQ)

- **BI - You can use chemistry to explain and evaluate the foods that people decide to eat.**
- **EQ**
  - EQ1: How is energy transferred, stored, and released by molecules that make up food?
  - EQ2: How does the breakdown of fats compare with the breakdown of carbohydrates in the human body?
  - EQ3: What is the significance of the term “Calorie” in reference to the amount in food items?
  - EQ4: What purpose do food additives serve?
  - EQ5: Why is it important to have an agency like the FDA to regulate the amount and type of additives that can be added to food?

### Part 2 - Standards

Standards for this unit	Key (GLE) Content Knowledge and Concepts/Skills	
<p><i>Bold Face indicates priority standards</i></p> <p>9.5 Due to its unique chemical structure, carbon forms many organic and inorganic compounds.</p> <p><b>11.2 Biological, chemical and physical properties of matter result from the ability of atoms to form chemical bonds. (storing energy)</b></p>	<p>The students will know:</p> <ol style="list-style-type: none"> <li>1. The biological value of food lies in the value of the energy it provides to the body.</li> <li>2. The Food Guide Pyramid provides a guide for planning appropriate food choices.</li> <li>3. Energy in food is stored in chemical bonds.</li> <li>4. Carbohydrates are key energy releasing components in the body.</li> <li>5. Fats are the key energy storage components in the body.</li> </ol>	<p>The students will be able to:</p> <ol style="list-style-type: none"> <li>1. Compare a personal food diary with the Food Guide Pyramid recommendations.</li> <li>2. Evaluate the energy contained in a snack.</li> <li>3. Identify different carbohydrates.</li> <li>4. Differentiate between the role of carbohydrate and fat usage in the body.</li> <li>5. Utilize nutrition labels to determine nutritional content of the product.</li> </ol>

11.5 The bonding characteristic of carbon allows for the formation of many different organic molecules.		
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### **Part 3 - Common Unit Assessments**

See Q:\ChemCom\Common Assessments for Unit 7.

[7 Pre-Post Test](#)

Science Skill Building “Dipsticks” are posted at Q:\ChemCom\Dipsticks

[Unit 7 Dipstick](#)

### **Part 4 - Common/Assured Learning Experiences**

1. Teachers should focus on the following sections: A.1, A.2, A.3, B.1, B.2, B.3
2. Making Decisions – Diet and the Food Pyramid three day inventory of food consumption pgs. 488-489 in ChemCom teacher’s edition.  
- Due to the short duration of this unit, the teacher may choose to have students complete the food inventory over the weekend prior to beginning the unit or shorten the inventory to meet the individual needs of the class.
3. Energy Contained in a Snack lab pgs. 490-491 in ChemCom text; see ChemCom activities workbook.
4. Calories from Fat Building Skills 3 pgs. 509-510 in ChemCom text; see ChemCom activities workbook.
5. Fats in the Diet Building Skills 4 pg. 512 in ChemCom text; see ChemCom activities workbook.
6. Fat-Free Food? Chem Quandary 2 pg 512 in ChemCom text; see ChemCom activities workbook.

## Part 5 - Teacher Notes

### General Notes

1. Refer to ChemCom 4<sup>th</sup> edition – teacher edition of text book
2. Register for instructor access at <http://bcs.whfreeman.com/chemcom5e/default.asp> for additional resources that complement the text  
-The link entitled “Interactive ChemCom Media for teachers and students” is particularly helpful for brief audio visual representation of phases of matter and demonstration of lab techniques
3. Refer to ChemCom CD ROM for additional support materials.
4. Use Projector, PowerPoint, and/or Promethean Board as resources where appropriate to infuse technology and enhance the curriculum.
5. Choose My Plate is a working document that is often updated and revised. The United States Department of Agriculture’s Food Guide website <http://www.choosemyplate.gov/> will be a valuable resource.

### Embedded Technology

Interactive site for researching nutrient content of foods:

<http://www.nal.usda.gov/fnic/foodcomp/search/>

### Embedded Literacy (varied readability levels)

Research and compare-contrast topics such as “How is the global problem of world hunger like an energy crisis?”

<http://www.wfp.org/hunger>

“Obesity: is it just a US problem?”

<http://health.nih.gov/topic/Obesity>

Comparing recommended eating habits around the world:

[http://www.huffingtonpost.com/food-republic/food-pyramids-around-the-world\\_b\\_874409.html#s288487&title=UKs\\_Eatwell\\_Plate](http://www.huffingtonpost.com/food-republic/food-pyramids-around-the-world_b_874409.html#s288487&title=UKs_Eatwell_Plate)

[http://www.foodrepublic.com/2011/06/02/new-myplate-campaign-unveiled?utm\\_source=huffingtonpost.com&utm\\_medium=partner&utm\\_campaign=Food-Pyramids-of-the-World](http://www.foodrepublic.com/2011/06/02/new-myplate-campaign-unveiled?utm_source=huffingtonpost.com&utm_medium=partner&utm_campaign=Food-Pyramids-of-the-World)