Your competence will be assessed as you complete the SCC5 objective assessment. This course of study may take up to 18 weeks to complete, depending on your educational background, experience with the subject matter, and the time that you are able to dedicate to your studies.

**Introduction**

This course of study is aligned to the SCC5 objective assessment. The same study materials are utilized in the SCA5 performance assessment. If you have previously completed the SCA5 assessment, then you should have already completed the required study activities found in this course of study. You may wish to review the assignments here, but you are not required to repeat these activities. If you have not yet completed the SCA5 assessment, then please proceed through this course of study in full.

**Overview**

Chemistry is the study of the properties and interactions of matter. The study of chemistry allows you to better understand how chemical transformations of matter occur.

Through successfully completing this course of study, you will show a high level of competence in the study of chemistry. You will be prepared to enter a secondary classroom and lead students in an organized and meaningful learning experience in their study of general chemistry.

**Teaching Dispositions Statement**

Please review the [Statement of Teaching Dispositions](#).

**Outcomes and Evaluation**

There are 4 competencies covered by this course of study; they are listed in the "Competencies for Chemistry (SCC5)" page.

You will complete the following assessments as you work through the course of study.

**Pre-Assessment**

You will complete the following pre-assessment:

- PSC4

**Objective Assessment**

You will complete the following objective assessment:

- SCC5

For specific information about this assessment, click the link under the “Assessment Type” column of your Degree Plan.

**Preparing for Success**
The information in this section is provided to help you become ready to complete this course of study. As you proceed, you will need to be organized in your studies, competent in the indicated areas, and ready to pass the final assessments.

Access Learning Resources

Enroll in or order the learning resources for this course as early as possible to give them time to arrive and give you enough time to become familiar with them.

manually Enrolled Learning Resources

You will need to enroll in or subscribe to several learning resources as a part of this course of study.

Please access your Degree Plan and verify that you have access to the following learning resources. If you do not currently have access, please enroll or renew your enrollment at this time.

\textit{Note: For instructions on how to enroll or subscribe through your Degree Plan, please see the “Acquiring Your Learning Resources” document.}

Chemistry - Section 1 of OWL

Enroll in the Chemistry Learning Resource, which provides access to the following:

- Thinkwell videos
- MAS (Mastery) questions

For this resource to work properly, use Internet Explorer (PCs) or Firefox (PCs or Macs) as your browser. Javascript should be enabled. Jmol applets and Flash should be working in your browser. The "Introduction to OWL" activities within this resource help set up your computer to work with this resource.

After enrolling, you will receive an e-mail describing how to log in. After logging in, choose "Assignment List" from the left-hand column. Complete the activities in the "Introduction to OWL" folder to be sure your computer is compatible with this resource.

After logging into the OWL Chemistry resource, this 4.5 minute recording will help you navigate around: \textit{http://wgu.connectpro.acrobat.com/p17663412/}

Chemistry Labs by LateNiteLabs

LateNiteLabs is a simulation program that encourages learning by allowing you to model and experiment with virtual chemicals.

After enrolling, you will receive an e-mail describing how to log in.
The "Science Methods" LabPaq from Hands-On Labs is a physical shipment. This lab kit (LabPaq) is covered by your program lab fee and is required to complete the performance assessment. You may have already enrolled for this resource through a different course. This kit includes a lab manual along with the science equipment, specimens, supplies, and chemicals necessary to complete college laboratory experiments at home. The experiments reinforce science content and teach laboratory techniques.

**Additional Preparation**

There are many different learning tools available to you within your course of study in addition to the learning resources discussed above. Some or all of them may be very useful to you as your progress through this course of study. Take the time to familiarize yourself with them and determine how best to fit them into your learning process.

The following activities and information will help you as you work through this course of study. **Message Boards, Learning Communities, Study Notes, FAQs**

Message boards, learning communities, study notes, and FAQs are available in every course of study.

Use the "**Additional Learning Tools**" document to review these tools.

**Other Preparations**

The SCC5 exam does not require a calculator; however, calculators are permissible and may be helpful. Acquire a graphing calculator and familiarize yourself with how to use it. Refer to the [Science Calculator Guidelines](#) for details regarding acceptable calculators.

**History and Philosophy of Science**

It is important to have an understanding of the history and nature of science. As a science teacher, it is also important that you pass this understanding to your students. There are a number of misconceptions that still dominate science classrooms today. For example, many people still believe there is only one scientific method that describes how science is conducted, or that there is little or no difference between a scientific theory and a hypothesis.

**The Nature of Science**

Science is more than a body of knowledge that describes the way the world behaves. Science is also a way of thinking and investigating. It is inseparable from society and technology. As you progress through this course, pay special attention to the history of science and the individuals that contributed to science. It is through these accounts that you will increase your understanding of the complexities of the nature of science.

**NSTA's Position on the Nature of Science**

The National Science Teachers Association (NSTA) is an organization that holds conferences, publishes literature, and works with teachers from kindergarten through college in an attempt to improve science education. If you are not already a member, you are encouraged to become one.
Review the following website:

- "The Nature of Science"

In your science notebook, answer the following question:

- What is NSTA's position on the nature of science?

**NSES Standard on the History and Nature of Science**

The National Science Education Standards (NSES) were produced by the National Research Council. NSTA supports these standards and has been engaged in an effort to implement the standards across the country.

Review the following website:

- "History and Nature of Science"

In your science notebook, answer the following questions:

- How is science a human endeavor?
- How does science distinguish itself from other bodies of knowledge?

**Understanding the Nature of Science**

Read the following sections in the Chemistry text:

- section 1.1 ("Chemistry: An Overview")
- section 1.2 ("The Scientific Method")

In your science notebook, answer the following questions:

- What are two of the fundamental concepts of chemistry?
- Why are there many different versions of the scientific method?
- What is a scientific model?

**Scientific Inquiry**

Review the following website:

- "Scientific Inquiry"

In your science notebook, answer the following question:

- What is NSTA's position on scientific inquiry?

**Scientific Inquiry Lab**

In the lab manual of LabPaq, read the following pages:
Complete the following experiment in the Science Methods LabPaq:

- experiment 1 ("The Scientific Method")

After completing the lab, send your lab report to the course mentor to verify your findings.

**Measurement**
In this topic, you will learn about the uncertainty of measurements, including accuracy and precision, and you will learn about the use of significant figures as a means for communicating the uncertainty of the numbers you use.

**Scientific Notation**
Review the following website:

- "[Exponents: Scientific Notation](#)"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 1.3d ("Scientific Notation using a Calculator")

Make sure you are comfortable entering numbers in scientific notation into your calculator and performing operations with them. Typically, if you multiply numbers that are too large on your calculator, it will show the results in scientific notation. It will probably look something like this: 6.4E17.

If you have a TI-83 or TI-84 calculator, you can also press the "Mode" button and specifically select scientific notation.

**Uncertainty, Precision, and Accuracy**
Review the following section in the *Chemistry* text:

- section 1.4 ("Uncertainty in Measurement")

In your science notebook, answer the following question:

- How would you decide if something is "accurate" or "inaccurate"?

**Rounding and Significant Digits**
Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 1.5 ("Significant Figures and Calculations")

**SI System of Units**
Review the following website:

- "Metric Units and Converting Between Them"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 1.6b ("Unit Conversions: Metric")

Review the NSTA website for the official position of the NSTA on the use of the metric system.

**Dimensional Analysis**

Review the following website:

- "Canceling/Converting Units"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 1.6c ("Unit Conversions: Metric/English")

To appreciate the importance of units, read the following story in the Chemistry text:

- "Chemical Connections: Critical Units!" (p. 8)

**Measurement Lab**

Complete the following experiment in the Science Methods LabPaq:

- experiment 2 ("Measurement: Length, Mass, Volume, Density, and Time")

After completing the lab, send your lab report to the course mentor to verify your findings.

*Note: Experiment 3 describes how to calculate percent error.*

**Experimental Error Lab**

Complete the following experiment in the Science Methods LabPaq:

- experiment 3 ("Experimental Errors and Uncertainty")

After completing the lab, send your lab report to the course mentor to verify your findings.

**Atoms and Molecules**

Chemistry is the branch of science that describes atoms, and the interactions between atoms, that make up matter. During this subject, you will review the foundations necessary for studying chemical reactions. As you complete this section, consider the following questions:

- How do the fundamental atomic particles relate to each other?
• What is the historical evolution of the atomic model?
• How are ions formed and named?

**Classification of Matter**
This topic will help you understand how matter is classified. How are atoms, elements, compounds, and mixtures related?

**Section 1.9 in Chemistry**

Complete all MAS questions in the following section of the OWL Chemistry resource:

• section 1.9 ("Classification of Matter")

**Atomic Structure**
The view of the atom has changed over time. In this topic, you will trace the historical evolution of the atomic model, ending with an understanding of the current model.

**History of the Atomic Model**

The following individuals helped advance understanding of the atomic model:

• Democritus
• Dalton
• Rutherford
• Thomson
• Millikan
• Bohr (you will learn more in section 7.4)
• de Broglie (you will learn more in chapter 7)

Read the following sections in the *Chemistry* text:

• section 2.1 ("The Early History of Chemistry")
• section 2.2 ("Fundamental Chemical Laws")
• section 2.3 ("Dalton's Atomic Theory")
• section 2.4 ("Early Experiments to Characterize the Atom")
• section 2.5 ("The Modern View of Atomic Structure: An Introduction")
• section 2.6 ("Molecules and Ions")
• section 2.7 ("An Introduction to the Periodic Table")

Review the following website:

• "The Models of the Atom"

Watch the following Thinkwell videos:

• "Early Discoveries and the Atom: Democritus, Dalton, Thomson"
• "Understanding Electrons: Millikan"
• "Understanding the Nucleus: Rutherford"
• "Modern Atomic Structure"
Atomic Particles

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 2.4d ("Dalton and the Atomic Theory")
- section 2.5b ("Atomic Composition")

Naming Compounds

This topic will help you understand how chemical compounds are named. You need to become familiar with all of the common nomenclature in order to progress in chemistry. This is similar to memorizing the alphabet before you try to read.

Nomenclature

Read the following section in the Chemistry text:

- section 2.8 ("Naming Simple Compounds")

Watch the following Thinkwell videos:

- "Describing Chemical Formulas"
- "Naming Chemical Compounds"
- "Organic Nomenclature"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 2.8 ("Naming Simple Compounds")

Many students find that making flash cards helps with learning the rules. For example, you could make flash cards of the terms mentioned in Table 2.3 and Table 2.4 on page 58, as well as Table 2.5 on page 62. It may help to make sticky notes with the different ions and put them around your house.

If you have any memory tricks, post them to the message board so that other students can benefit.

Stoichiometry

Stoichiometry is the study of the quantities of substances that take part in a chemical reaction. During chemical reactions, the amount of each substance and the total electrical charge is always conserved. You will learn how to use fundamental laws of chemistry to balance chemical equations. As you complete this section, consider the following questions:

- How do you balance chemical equations?
- How do you calculate the molar mass from atomic mass?
- How can you calculate a compound's empirical formula from percent composition?
- What are the different stoichiometry relationships that you can calculate?
This topic will help you understand stoichiometry. You will learn how to convert between moles, molecules, grams, and elements.

**Chemical Equations**

Read the following chapter in the *Chemistry* text:

- chapter 3 ("Stoichiometry")

In your notebook, write down the definitions to empirical formula and molecular formula, as described in section 3.7. Give examples of each.

Watch the following Thinkwell videos:

- "An Introduction to Chemical Reactions and Equations"
- "CIA Demonstration: Magnesium and Dry Ice"
- "Balancing Chemical Equations"

To cement your understanding, view the following recorded calls after you have read the material:

- "Stoichiometry I"
- "Stoichiometry II"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- chapter 3 ("Stoichiometry")

**Chemical Reactions**

Chemical reactions are the application of chemistry. In order to fully understand these reactions, it is important to understand some of the underlying concepts that drive chemical reactions. As you complete this section, consider the following questions:

- What are redox reactions, and how are they balanced?
- What are common examples of redox reactions?

**Introduction to Solutions**

This topic will help you understand solutions. A solution is a homogenous mixture of two or more substances.

**Read Sections 4.1- 4.4 in Chemistry**

Read the following sections in the *Chemistry* text:

- section 4.1 ("Water, the Common Solvent")
- section 4.2 ("The Nature of Aqueous Solutions: Strong and Weak Electrolytes")
- section 4.3 ("The Composition of Solutions")
- section 4.4 ("Types of Chemical Reactions")
Watch the following Thinkwell videos:

- "Properties of Solutions"
- "CIA Demonstration: The Electric Pickle"
- "Concentrations of Solutions"

In your science notebook, answer the following questions:

- What makes water a good solvent?
- What makes a substance a strong electrolyte?
- How is the strength of a solution determined?

**Types of Reactions**

This topic will help you understand the various types of reactions, including precipitation, acid-base, and oxidation-reduction reactions. What are the similarities and differences among the different types of reactions?

**Acid-Base Reactions**

Read the following section in the *Chemistry* text:

- section 4.8 ("Acid-Base Reactions")

Watch the following Thinkwell videos:

- "Acid-Base Reactions"
- "Acid-Base Titrations"
- "Solving Titration Problems"

To increase your knowledge of $K_a$ and Equilibrium, watch the following [webinar](#)

Complete all required MAS questions in the following section of the OWL Chemistry resource:

- section 4.8

**Oxidation-Reduction Reactions**

Read the following sections in the *Chemistry* text:

- section 4.9 ("Oxidation-Reduction Reactions")
- section 4.10 ("Balancing Oxidation-Reduction Equations")

Watch the following Thinkwell videos:

- "Oxidation-Reduction Reactions"
- "Oxidation Numbers"
- "Balancing Redox Reactions by the Oxidation Number Method"
- "Balancing Redox Reactions Using the Half-Reaction Method"
"Corrosion and the Prevention of Corrosion"

Review the following website:

"The Six Types of Chemical Reaction"

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 4.9 ("Oxidation-Reduction Reactions")
- section 4.10 ("Balancing Oxidation-Reduction Equations")

It may be helpful to remember the following mnemonic:

- LEO the lion says GER ("Loose Electrons Oxidize" and "Gain Electrons Reduce")

Practice Identifying Reactions

Write down the types of reactions using the information from "The Six Types of Chemical Reaction" website.

Practice identifying them. Make a card with the six reaction types. Work the practice problems at the bottom of the screen.

Chemical Energy

Thermochemistry is the branch of chemistry that studies the amount of heat energy gained or lost during a chemical reaction. An interesting and important relationship is present between energy, work, and heat. But be careful; this relationship and an understanding of the definition of heat are often misunderstood. It is usually best to think of heat as energy transferred because of a difference in temperature. As you complete this section, consider the following questions:

- What is the difference between temperature and heat?
- How are heat and energy related?
- How do chemical reactions involve the transfer of heat?

Thermochemistry

This topic will help you understand thermochemistry. What is the relationship between energy, work, and heat? What is enthalpy? How does a calorimeter work?

The Nature of Energy

Read the following section in the Chemistry text:

- section 6.1 ("The Nature of Energy")

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 6.1 ("The Nature of Energy")
Work the practice problems.

In your science notebook, define the following terms:

- endothermic reaction
- exothermic reaction

**Enthalpy and Calorimetry**

Read the following section in the *Chemistry* text:

- section 6.2 ("Enthalpy and Calorimetry")

Watch the following Thinkwell videos:

- "Heats of Reaction: Enthalpy"
- "CIA Demonstration: Thermite Reaction"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 6.2 ("Enthalpy and Calorimetry")

**Hess's Law**

Read the following section in the *Chemistry* text:

- section 6.3 ("Hess's Law")

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 6.3b ("Hess's Law: One Reaction")

**Experiment 9: Caloric Content of Food**

Complete the following experiment in the Science Methods LabPaq:

- experiment 9 ("Caloric Content of Food")

Be sure to review the Laboratory Techniques, Basic Safety, and Potential Laboratory Hazards described at the beginning of the Science Methods LabPaq manual.

**Periodicity**

The periodic table may be the greatest tool ever used by chemists. It was originally used to describe patterns observed in properties of elements before it eventually became apparent that
it can also be used to predict patterns in elements. As you complete this section, consider the following question:

- How can the periodic table be used to predict the size, electronegativity, and ionization energy of elements?

**Periodic Trends**

This topic will help you understand the periodic table. While you are certainly not expected to memorize the periodic table, you should be able to read it fluently, and you should know the most common atoms without having to constantly refer to the periodic table.

**Contributors to Our Understanding of the Atom**

Review the following sections in the Chemistry text:

- section 7.1 ("Electromagnetic Radiation")
- section 7.2 ("The Nature of Matter")
- section 7.3 ("The Atomic Spectrum of Hydrogen")
- section 7.4 ("The Bohr Model")
- section 7.5 ("The Quantum Mechanical Model of the Atom")

Review the contributions by the following individuals:

- Democritus
- Dalton
- Rutherford
- Thomson
- Millikan
- Bohr
- de Broglie

**Periodic Trends in Atomic Properties**

Read the following section in the Chemistry text:

- section 7.12 ("Periodic Trends in Atomic Particles")

Watch the following Thinkwell videos:

- "Periods and Atomic Size"
- "Ionization Energy"
- "Electron Affinity"
- "An Introduction to Electronegativity"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 7.12 ("Periodic Trends in Atomic Particles")

**Ionic and Covalent Bonding**
A chemical bond is the energy that holds atoms together. As you complete this section, consider the following questions:

- What is the difference between ionic and covalent bonding?
- How do atomic size, ionization energy, and electronegativity contribute to chemical bond formation?
- How can you use the Lewis dot structures and VSEPR to predict the geometry of molecules?

**Chemical Bonding**

This topic will help you understand chemical bonding. As you review the activities, think about how ionic and covalent bonds compare. What is bond energy?

**How Electronegativity Affects Bonding**

Read the following sections in the *Chemistry* text:

- section 8.1 ("Types of Chemical Bonds")
- section 8.2 ("Electronegativity")
- section 8.3 ("Bond Polarity and Dipole Moments")

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 8.2 ("Electronegativity")
- section 8.3 ("Bond Polarity and Dipole Moments")

**How Ionization Energy Affects Bonding**

Read the following sections in the *Chemistry* text:

- section 8.4 ("Ions: Electron Configurations and Sizes")
- section 8.5 ("Energy Effects in Binary Ionic Compounds")
- section 8.6 ("Partial Ionic Character of Covalent Bonds")

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 8.4 ("Ions: Electron Configurations and Sizes")

**Valence Electrons and Chemical Bonding**

Watch the following Thinkwell videos:

- "Valence Electrons and Chemical Bonding"
- "Ionic Bonds"
- "CIA Demonstration: Conductivity Apparatus-Ionic versus Covalent Bonds"

Covalent bonding is determined by atomic size, ionization energy, and electronegativity.

In your science notebook, list each term. Next to each term, write why the characteristic would
make two atoms share an electron instead of trading the electron.

**Molecular Structure**

This topic will help you understand the Lewis structure and VSEPR model. Practice first with individual atoms and then combine the individual atoms into molecules.

**Lewis Dot Structures**

Read the following sections in the *Chemistry* text:

- section 8.10 ("Lewis Structures")
- section 8.11 ("Exceptions to the Octet Rule")
- section 8.12 ("Resonance")

Watch the following Thinkwell videos:

- "Lewis Dot Structures for Covalent Bonds"
- "Predicting Lewis Dot Structures"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 8.10e ("Lewis Structures: Interpret")

**Molecular Geometry and the VSEPR Theory**

Read the following section in the *Chemistry* text:

- section 8.13 ("Molecular Structure: The VSEPR Model")

Watch the following Thinkwell videos:

- "Valence-Shell Electron-Pair Repulsion Theory"
- "Molecular Shapes for Steric Numbers 2-4"
- "Molecular Shapes for Steric Numbers 5 & 6"
- "Predicting Molecular Characteristics Using VSEPR Theory"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 8.13e ("Molecular Geometry from Lewis Structure: 2, 3 or 4 Pairs")

**Solids, Liquids, and Gases**

In this section, you will study both intramolecular bonding and intermolecular forces. As you complete this section, consider the following questions:

- How is the structure of a substance related to its physical characteristics?
- What kind of energy transformation takes place during changes of state?
- What is the ideal gas law, and how is it used to solve problems?
- What is the importance of standard temperature and pressure?
Gases
This topic will help you understand gases. What happens when you heat a can of soda? What happens when you put a balloon in the cold? How do the gas laws of Boyle, Charles, and Avogadro combine to form the ideal gas law?

The Ideal Gas Law

Read the following sections in the *Chemistry* text:

- section 5.1 ("Pressure")
- section 5.2 ("The Gas Laws of Boyle, Charles and Avogadro")
- section 5.3 ("The Ideal Gas Law")

Watch the following Thinkwell video:

- "The Ideal Gas Law"

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 5.3d ("Ideal Gas Law: Calculate P, V, and T")
- section 5.3e ("Combined Gas Law: Calculate P2, V2, and T2")

Real Gases

Read the following sections in the *Chemistry* text:

- section 5.4 ("Gas Stoichiometry")
- section 5.5 ("Dalton's Law of Partial Pressure")
- section 5.6 ("The Kinetic Molecular Theory of Gases")
- section 5.7 ("Effusion and Diffusion")
- section 5.8 ("Real Gases")
- section 5.9 ("Characteristics of Several Real Gases")
- section 5.10 ("Chemistry in the Atmosphere")

Watch the following Thinkwell video:

- "The Kinetic-Molecular Theory of Gases"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 5.8a ("Real Gases: Qualitative")

Self Study

In your science notebook, write the $PV = nRT$ equation, and then write what each variable stands for.

How does changing one variable affect the other variables?
How can you relate the following two systems together?

- $PV/T = PV/T$

**Experiment 5: Properties of Gases**

Complete the following experiment in the Science Methods LabPaq:

- experiment 5 ("Properties of Gases")

Be sure to review the Laboratory Techniques, Basic Safety, and Potential Laboratory Hazards described at the beginning of the Science Methods LabPaq manual.

**Liquids and Solids**

This topic will help you understand liquids and solids.

**Properties of Liquids**

Read the following sections in the *Chemistry* text:

- section 10.1 ("Intermolecular Forces")
- section 10.2 ("The Liquid State")

Watch the following Thinkwell video:

- "Properties of Liquids"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 10.1i ("Intermolecular Forces: Effects")

**Experiment 4: Separation of a Mixture of Solids**

Complete the following experiment in the Science Methods LabPaq:

- experiment 4 ("Separation of a Mixture of Solids")

**Properties of Ionic Solids**

Read the following section in the *Chemistry* text:

- section 10.7 ("Ionic Solids")

Watch the following Thinkwell video:

- "CIA Demonstration: The Conductivity of Molten Salts"

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 10.7b ("Ionic Crystals")
In your science notebook, list the properties of an ionic crystal. Include the general melting temperature, electricity conduction, hardness, and brittleness.

**Changes of State**

As temperature and pressure change, so does the phase of a substance. Diagrams can be made to show these phase changes.

**Phase Changes**

Read the following section in the *Chemistry* text:

- section 10.8 ("Vapor Pressure and Changes of State")

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 10.8a ("Phase Changes and Energy Flow: Particulate")
- section 10.8d ("Intermolecular Forces and Vapor Pressure")
- section 10.8q ("Heating Curves: Interpret")

**Phase Diagrams**

Read the following section in the *Chemistry* text:

- section 10.9 ("Phase Diagrams")

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 10.9c ("Phase Diagrams: Interpret")

**Particle Organization**

In your science notebook, make a chart like the one below and fill in what you already know. Fill in the rest with information from the *Chemistry* text.

<table>
<thead>
<tr>
<th>Particle Organization (draw a picture)</th>
<th>Density</th>
<th>Compressibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Solutions**

As you complete this section, consider the following questions:

- How can solids, liquids, and gases be solutes or solvents?
- Why is water such an important solvent?
- What is a concentrated solution, and how do you make a solution of a specific
concentration?

**Solutions**

When you think of a solvent, you probably think of a liquid. This is a common perception. But a solvent is anything that can dissolve something else. For example, oxygen is dissolved in nitrogen to make air.

**Review**

In the topic "Classification of Matter," the term *solution* was used to describe a homogeneous mixture.

In the "Introduction to Solutions" topic, you addressed the following questions:

- What makes water a good solvent?
- What makes a substance a strong electrolyte?
- How is the strength of a solution determined?

Review the concepts in these previous topics.

**Types of Solutions**

Watch the following Thinkwell video:

- "Types of Solutions"

In your science notebook, provide examples of solutions, naming the solute and the solvent. Be sure to include examples from all states of matter.

Complete all MAS questions in the following section of the OWL Chemistry resource:

- section 11.2a ("Solution Terminology")

You are responsible for knowing the solution terminology summarized here.

**Solutions Practice Problems**

Practice calculating a solution's concentration. This can be done several ways. Section 11.1 in the *Chemistry* text works through many methods.

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 11.1a ("Mass Percent")
- section 11.1f ("Molarity: Mass Percent and Density")

Parts per million (ppm) is another way to show concentration of a solution. Parts per million can refer to a ratio of masses. For example, if a solution is 1ppm then there is one gram of solute per 1000 kilogram of solution.

**Solution Composition Chart**
Watch the following Thinkwell videos:

- "Molarity and the Mole Fraction"
- "Molality"

In your science notebook, complete the following chart:

<table>
<thead>
<tr>
<th>Units</th>
<th>How You Find It</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>Molarity</td>
<td></td>
</tr>
<tr>
<td>Parts Per Million</td>
<td></td>
</tr>
</tbody>
</table>

**Factors That Affect Solubility**

Watch the following Thinkwell videos:

- "Energy and the Solution Process"
- "Temperature Change and Solubility"
- "Pressure Change and Solubility"

Read the following section in the *Chemistry* text:

- section 11.3 ("Factors Affecting Solubility")

In your science notebook, list the factors that affect solubility and describe why they do so.

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 11.2b ("Solution Formation")
- section 11.2f ("Intermolecular Forces and Solubility")

**Chemical Kinetics and Equilibrium**

Chemical kinetics is the study of the factors that determine the rate of reaction. Chemical reactions are the application of chemistry. In order to fully understand these reactions, it is important to understand some of the underlying concepts that drive chemical reactions, such as chemical kinetics and chemical equilibrium. As you complete this section, consider the following questions:

- What are chemical reactions that have slow reactions?
- Why is reaction rate important?
- What affects reaction rates?

**Reaction Rate**

This topic will help you understand reaction rates. There are many factors that determine the rate of a reaction.

**Definition**
Read the following section in the *Chemistry* text:

- section 12.1 ("Reaction Rates")

Watch the following Thinkwell videos:

- "An Introduction to Reaction Rates"
- "Rate Laws: How the Reaction Rate Depends on Concentration"

In your science notebook, answer the following questions:

- What is a reaction rate?
- From reviewing Figure 12.1, how does the concentration of reactant affect the reaction rate?

**Factors That Affect Reaction Rates**

Read the following sections in the *Chemistry* text:

- section 12.6 ("A Model for Chemical Kinetics")
- section 12.7 ("Catalysis")

Watch the following Thinkwell videos:

- "The Collision Model"
- "The Arrhenius Equation"
- "Catalysts and Types of Catalysts"

In your science notebook, answer the following questions:

- How does temperature affect the reaction rate?
- What two requirements must be satisfied for reactants to collide successfully, causing products to form?
- Can you explain Figure 12.13?

Smaller reactant particles provide a greater surface area. This increases the chances for particle collisions, so the reaction rate increases.

**Equilibrium Shift**

Read the following section in the *Chemistry* text:

- section 13.7 ("Le Châtelier's Principle")

In your science notebook, explain how the following affect equilibrium:

- change in concentration
- change in pressure
Examples of Reactions

Watch the following Thinkwell videos:

- "CIA Demonstration: Elephant Snot"
- "CIA Demonstration: The Cobalt(II)-Catalyzed Reaction of Potassium Sodium Tartrate"
- "CIA Demonstration: The Copper-Catalyzed Decomposition of Acetone"

The Elephant Snot reaction was fast. In your science notebook, list examples of reactions that are fast and some that are slow. Think about reactions that occur around where you live and in the kitchen. Share examples in the message board of fast and slow reactions.

If the penny in the last video was cut into smaller pieces, there would be more surface area of copper. How would this effect the rate of the reaction?

Reaction Rate Chart

In your science notebook, complete the chart to explain the following questions:

- What does each factor do to the reaction rate?
- Why does each factor change the reaction rate?

<table>
<thead>
<tr>
<th>Factor</th>
<th>What It Does</th>
<th>Why It Does It</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reactant Concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation of Particle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particle Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catalyst</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Think about the opposites of each factor. What happens when the particle size gets bigger? What if the size gets smaller?

Electrochemistry

As the name implies, electrochemistry is the study of the interchange of chemical and electrical energy. As you complete this section, consider the following questions:

- What is the conductivity of electrolytes and non-electrolytes?
- How are electrochemical cells used?

Electrochemistry

Complete the activities within this topic to gain an understanding of electrochemistry. What are electrolytes? Why do you think sports drinks often talk about electrolytes? What do you know about the construction, function, and use of electrochemical cells?
Review

In the "Introduction to Solutions" topic, you addressed the following questions:

- What makes water a good solvent?
- What makes a substance a strong electrolyte?
- How is the strength of a solution determined?

Review the concepts in this previous topic.

In your science notebook, answer the following question:

- Which conducts electricity better: salt water or distilled water? Why?

Electrochemical Cells

Read the following sections in the Chemistry text:

- section 18.1 ("Balancing Oxidation-Reduction Equations")
- section 18.2 ("Galvanic Cells")

Watch the following Thinkwell videos:

- "Reviewing Oxidation-Reduction Reactions"
- "Electrochemical Cells"
- "Batteries"
- "CIA Demonstration: The Fruit-Powered Clock"
- "Electrolytic Cells"
- "Corrosion and the Prevention of Corrosion"

Complete all required MAS questions in the following sections of the OWL Chemistry resource:

- section 18.1
- section 18.2

Atomic Changes

The term nuclear often makes people feel uncomfortable. The term really is not as scary as many people think. In fact, nuclear chemistry is really just the study of the nucleus of atoms. In this section, you will learn more about radioactivity. As you complete this section, consider the following questions:

- How do you balance nuclear reactions?
- What processes cause the nucleus of an atom to change?

Nuclear Chemistry

This section will help you understand nuclear chemistry. What do you think when you hear about radioactive decay? What do you think is happening to the atom?
Balancing Nuclear Reactions

Read the following section in the Chemistry text:

- section 19.1 ("Nuclear Stability and Radioactive Decay")

Watch the following Thinkwell video:

- "The Nature of Radioactivity"

Complete all required MAS questions in the following section of the OWL Chemistry resource:

- section 19.1

Nuclear Changes

Read the following section in the Chemistry text:

- section 19.3 ("Nuclear Transformations")

Watch the following Thinkwell video:

- "Stability of Atomic Nuclei"

Complete all MAS questions in the following sections of the OWL Chemistry resource:

- section 19.3a ("Decay vs. Bombardment Reactions")
- section 19.3b ("Nuclear Bombardment and Fission")
- section 19.3c ("Nuclear Bombardment and Fusion")

Fusion and Fission

Read the following section in the Chemistry text:

- section 19.6 ("Nuclear Fission and Nuclear Fusion")

Watch the following Thinkwell videos:

- "Nuclear Fission"
- "Nuclear Fusion"

Remember the difference between fusion and fission. Think about what the word fuse means to you. In your science notebook, draw a picture of something fusing. Fusion is as simple as putting two atoms together.

Fission is splitting. Draw a picture of what it means to create a fissure.

Experiment 13: Radioactive Decay
Complete the following experiment in the Science Methods LabPaq:

- experiment 13 ("Radioactive Decay")

**Organic Molecules**

Organic chemistry is the study of the compounds of carbon. Much of organic chemistry is understanding how these organic compounds can be organized and grouped into functional groups, as well as understanding the physical properties and typical reactions of these groups. As you complete this section, consider the following questions:

- What are functional groups?
- What are the most common functional groups?

**Organic Chemistry**

Most organic molecules are fundamentally hydrocarbons, but they have additional atoms or groups of atoms called functional groups. There are common functional groups that exhibit characteristics. In this section, you will learn about their characteristics.

**Functional Groups**

Read the following section in the *Chemistry* text:

- section 22.4 ("Hydrocarbon Derivatives")

While reading, write down common uses of each type of functional group.

There are five types of functional groups you need to know:

- alcohols
- aldehydes
- ketones
- organic acids
- esters

Make five flash cards and write the name of a functional group on the front of each card. On the back, write any information you learn about these groups.

Watch the following Thinkwell videos:

- "Alcohols, Ethers, and Amines"
- "Carbonyl-Containing Functional Groups"

Complete all required MAS questions in the following section of the OWL Chemistry resource:

- section 22.4

**Hazards**
Mention "chemistry" to a group of children and they quickly ask if they get to blow something up. While it may not be surprising that hazardous chemicals exist, the number of hazards associated with many common household chemicals might be surprising. It is important that you have a solid understanding of what some of these hazards might be. As you complete this section, consider the following questions:

- What are the chemical properties of common household chemicals?
- What hazards are associated with common household chemicals?

**Hazards**

Chemicals are all around you. Learning how to use them safely is an important part of becoming a science teacher.

**Qualitative Analysis of Household Products**

Perform the following lab in LateNiteLabs:

- "Qualitative Analysis of Household Products"

List the chemical properties you learned about on the information card.

In your science notebook, answer the following question:

- What chemicals should not be mixed?

**Household Chemistry**

In your science notebook, answer the following questions:

- Why is mixing bleach with other cleaning solutions dangerous?
- Why is mixing bleach with ammonia dangerous?

Share your responses in the message board.

**Final Review**

Congratulations on completing the Chemistry Course of Study! Your studies included chemical structure and reactions, stoichiometry, solutions, rates, and energy changes. As a science teacher, you should comprehend how these topics are related to each other and how chemistry is related to the other branches of science.

During your chemistry studies, you performed hands-on labs to apply your new knowledge. What strategies helped you learn the material? Write these down to share with your students when teaching.

**Assessment Information**

You are ready to take the pre-assessment for the SCC5 exam. The results will provide a percentage for each of the topics in this course of study. You should review your notes for topics with low scores. The *Chemistry* text and Thinkwell resources have quizzes to check your understanding.
Another way to check your understanding is to start with blank paper and write down your understanding of the topic. Pretend you are teaching this topic to a student. You can also post your understanding on the message board for review.

Once you have confidence with your new knowledge, take the pre-assessment again. Schedule the SCC5 exam after passing the pre-assessment.

**Accessing Pre-Assessments**

Complete the following pre-assessment:

- PSC4

For directions on how to receive access to pre-assessments, see the "Accessing Pre-Assessments" page.

**Accessing Objective Assessments**

Complete the following objective assessment:

- SCC5

For directions on how to receive access to objective assessments, see the "Accessing Objective and Outside Vendor Assessments" page.

**Feedback**

WGU values your input! If you have comments, concerns, or suggestions for improvement of this course, please submit your feedback using the following form:

- [Course Feedback](#)

**ADA Policy**

Western Governors University recognizes and fulfills its obligations under the Americans with Disabilities Act of 1990 (ADA), the Rehabilitation Act of 1973 and similar state laws. Western Governors University is committed to provide reasonable accommodation(s) to qualified disabled learners in University programs and activities as is required by applicable law(s). ADA Support Services serves as the principal point of contact for students seeking accommodations and can be contacted at ADASupport@wgu.edu. Further information on WGU’s ADA policy and process can be viewed in the student handbook at the following link:

- [Policies and Procedures for Students with Disabilities](#)