This course of study presents the required sequence of learning steps and activities to help you develop competency in the subject area of Chemistry. In this case, your competency will be assessed using an objective exam (SCC4 or 5) and a series of performance tasks (SCA4 or 5). This course of study may take up to fifteen 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

Congratulations on reaching this point in your program! You are now ready to begin your study of chemistry. 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.

Chemistry is very broad and intersects with the study of physics, biology, and the geosciences. It helps you understand and explain the world around you. It helps you understand how soap works, why one pain reliever works better than another, and how to create new and better materials such as extremely strong Kevlar fibers. Chemistry has a range of applications from agriculture and the food industry to medicine and technology. 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.

Competencies

This course of study covers the following competencies:

Competency: Chemical Structure The graduate has a broad understanding of chemical structure and stability.

Competency: Chemical Reactions The graduate has a broad understanding of chemical reactions.

Competency: Stoichiometry The graduate has a broad understanding of stoichiometry.

Competency: Solutions, Rates, and Energy Changes The graduate has a broad understanding of solutions, rates of reaction, and energy changes.

Required Learning Resources


Thinkwell's Chemistry
WGU Statement of Teaching Dispositions

WGU supports the development and demonstration of professional teaching dispositions throughout the course of its Teachers College (TC) licensure programs. All TC students and faculty will demonstrate the following dispositions described in the Teachers College's conceptual framework and code of ethics:

Competent and caring

Respectful and embracing of diversity

Reflective practitioners

Equitable and fair

Professional practice consistent with the belief that all students can learn

Collaborative professionals

Professional leaders and change agents

Please review the "Teacher's College Code of Ethics" found in the WGU Student Handbook (http://kb.wgu.edu/article.asp?article=1489&p=3). Practice the dispositions above while working through this course of study. Reflect on your learning and believe that you will learn the material needed to pass your assessment(s). Care about your education by scheduling time each week to devote to your studies. Collaborate with other teachers by interacting in the message boards, and be a leader of change by making suggestions to improve this learning document.
Preparing for Success

To successfully complete SCC and SCA, you need the appropriate resources to help with your learning. You should also prepare a calendar to schedule times devoted to your studies. Share your calendar with family and friends so they are aware of your obligations.

Topics

Acquire Learning Resources

Arrange to obtain the learning resources listed in the "Required Learning Resources" section so there will be no delays in your studies. These items are essential for you, as this document will guide you in the use of these materials. Some of these items must be shipped to you, so be sure that your mailing address information is current. If you click on your name in your AAP, you can check your contact information.

Resources

Order Chemistry
Order the following textbook:


This textbook has a strong emphasis on conceptual learning and problem solving. It is an excellent general chemistry textbook. A new copy of the text includes access to online resources that include animations, flash cards, an interactive periodic table, and practice tests.

Note: The WGU Bookstore has this book available for immediate purchase and delivery. You may shop at other online bookstores, but be sure to order early and use the correct ISBN to get the correct edition.

Enroll in Thinkwell's Chemistry
URL: http://www.thinkwell.com

This web-based resource includes multimedia video lectures, review notes, interactive animations, and sample exercises. Enroll in this resource from the "Learning Resources" tab. You will receive an orientation e-mail within 24 to 48 hours from the time your enrollment is approved. This e-mail will contain your log-in information and instructions for the Thinkwell site. If you do not redeem the user code found in this e-mail, you will not be able to see this course as an option (even if you already have a Thinkwell account).
Enroll in Chemistry Labs (LateNiteLabs)
LateNiteLabs chemistry labs are a simulation program that encourages learning by allowing you to model and experiment with virtual chemicals. This is enrolled through the "Learning Resources" tab within your AAP. You will receive an e-mail with directions on accessing this resource online. Your mentor will need to approve this learning resource.

Science Methods LabPaq
URL: https://web5.wgu.edu/aap/content/labpaq_sciencemethods.pdf

The LabPaq self-contained laboratory 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.

Note: This resource is only available to students in a program with a version of 200810 or newer. These programs include a required one-time lab fee payment.

This resource is ordered by submitting the LabPaq Liability Release Form at the link above. Follow the directions at the top of the form to receive this resource. Fax, mail, or, preferably, attach this form to an e-mail and send to learning@wgu.edu. They will process your lab order and your materials will ship within five to seven business days.

Please check your package as soon as it arrives. If there are any missing or damaged items, you will need to notify the Learning Resources Department right away. Two weeks after shipment, Hands-On Labs will be unable to make exchanges or supply replacements for items.

Calculator
URL: http://kb.wgu.edu/article.asp?article=1803&p=3

The SCC4/5 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 at the above link for details regarding acceptable calculators.

It is recommended that all students in secondary science education programs obtain a TI-83+, TI-84+, or TI-Nspire (non-CAS) graphing calculator. These models are allowed on all WGU math and science exams; they are relatively inexpensive and easy to learn. They include scientific notation, advanced functions, and graphing capability; and they are the most popular calculators on the market and in the classrooms. Thus, you are more likely to encounter them in your future school. They also come with the ability to connect with the calculator-based laboratory (CBL) and calculator-based ranger (CBR) portable data collection devices. These devices allow you to collect data on motion, light, temperature, and voltage and are essential in any middle or high school science classroom.

Participate in the Course of Study Message Board
The message boards are an important part of the WGU experience. In the lower right-hand corner of the course of study screen there is a message board area. Throughout your studies, you will want to follow the questions, observations, and responses of the other students and the
expert advice of the course mentor. If you have questions of your own, do not hesitate to use this resource to get those answered as you develop your competencies.

Please take the time now to ask a question about this course. If you do not have any questions, then introduce yourself to the course mentor and other students currently working through this course of study.

**Science Notebook**
As you engage in the activities throughout this course of study, you will be answering questions, completing exercises, sketching out concepts, and so forth. You can take these notes online through the web-enabled course of study, or use a paper or electronic journal. A notebook or study journal makes your learning more active. It also provides an excellent source of important materials to review prior to demonstrating your competence through the assessment.
History and Philosophy of Science

It is important to have an authentic 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.

Topics

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 and 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.

Resources

NSTA's Position on the Nature of Science
URL: http://www.nsta.org/about/positions/natureofscience.aspx

The National Science Teachers Association (NSTA) is an organization, based on membership, which 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 website above and add to your science notebook a summary of NSTA's position on the nature of science.

NSES Standard on the History and Nature of Science
URL: http://www.nap.edu/openbook.php?record_id=4962&page=200

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 website above and write down a summary of how science is a human endeavor and how science distinguishes itself from other bodies of knowledge.

Understanding the Nature of Science
Read chapter 1 in Chemistry. Why are there many different versions of the scientific method? What is a scientific model? How is matter organized? How is science a human endeavor?

Scientific Inquiry
URL: http://www.nsta.org/about/positions/inquiry.aspx
A strong misconception exists that there is a single series of steps called "the scientific method" that is used by all scientists. In reality, scientists use many different strategies and methods to solve problems and add to the body of scientific knowledge. Write down NSTA's position on scientific inquiry after reviewing the above website.

**Scientific Inquiry Lab**

In the lab manual of LabPaq, read pages 1-11 about using this kit, pages 12-16 about presenting lab information, and pages 17-29 about equipment and lab techniques. You will need to learn the proper technique for using all supplies.

Written records are a crucial part of the science discipline. They help scientists recall and share the details of their experiments. The style used in writing lab reports or scientific papers is different from less formal writing. Make sure you understand the difference between lab notes and a lab report. Pages 12-16 of the lab manual review this information.

Here are a few helpful hints on scientific writing style.

- Be clear, concise, and complete.
- Include enough detail that someone else with similar skills could duplicate the results.
- Use a standard format.
- Use passive voice (i.e., "The flask was filled" rather than "I filled the flask.").
- Use the proper verb tense (i.e., results that are still true today should be in the present tense).
- Scientific names should be italicized.
- Data is plural for datum.
- Spectra is plural for spectrum.
- Species is singular and plural.
- Numbers greater than 10 or associated with measurements should be written as numerals.
- Numbers 10 or less or that begin a sentence should be spelled.
- Numbers associated with measurements should not start a sentence.
- Metric measurements should be abbreviated without periods (i.e., mm).

Complete "Experiment 1: The Scientific Method" in the Science Methods LabPaq. After completing the lab, send your lab report to the course mentor to verify your findings.
Measurement

Making observations and collecting data are fundamental to science. All measurements include three important parts: the quantity, the units, and the uncertainty of the measurement. Nearly everything in science is based on measurements, and all measurements are an approximation. 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.

Resources

SI System of Units
URLs:

Metric Units and Converting Between Them http://www.purplemath.com/modules/metric.htm


In this activity, you will review the most common system of units used in science—the SI system. In 1960, an international agreement created a system of units called the SI system, which was based on the metric system.

Review the first website on metric units. Make sure you understand the basics of the metric system. Make sure you can convert between the variously-sized units, such as from centimeters to kilometers. This website only covers length, mass, and volume units. However, as you progress through your science courses, you will learn about many other units, such as temperature, time, electric current, amount of substance, luminous intensity, etc.

NSTA supports the use of the metric system in classrooms. Review the second website for the official position of the NSTA on the use of the metric system.

Note: Section 1.3 of Chemistry also discusses units of measurement. Sections 1.7 and 1.8 discuss temperature and density respectively.

Dimensional Analysis
URLs:

Cancelling and Converting Units http://www.purplemath.com/modules/units.htm

Metric Mishap Caused Loss of NASA Orbiter http://www.cnn.com/TECH/space/9909/30/mars.metric.02/

In science, it is often necessary to convert numbers given in one set of units into another set of units. The best method to use for this conversion is called dimensional analysis, which is often referred to simply as canceling units.
Review the first website about converting units. Make sure you can convert between common units. For example, you should be able to convert from meters (SI unit) to miles (English unit).

Review the second website as an example of the importance of using correct units during science. NASA lost a $125 million Mars orbiter because measurement units were not consistent.

Note: Section 1.6 of Chemistry also discusses dimensional analysis.

**Measurement Lab**
Complete "Experiment 2: Measurement: Length, Mass, Volume, Density, and Time" in the Science Methods LabPaq. 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.

**Uncertainty, Precision, and Accuracy**
URL: http://www.chem.tamu.edu/class/fyp/mathrev/mr-sigfg.html

Review the website above for an overview of the differences between the terms precision and accuracy. Keep in mind that precision and accuracy are typically relative (i.e., A is more accurate than B). However, sometimes the terms are used as an absolute (i.e., A is accurate). How would you decide if something is "accurate" or "inaccurate"?

Note: Section 1.4 of Chemistry also discusses the uncertainty in measurement.

**Rounding and Significant Digits**
URL: http://www.purplemath.com/modules/rounding.htm

Review the website above for an overview of rounding and significant digits. Why are measurements always estimations? To what degree can you estimate when making a measurement? What are significant figures, and why are they important? How do you add, subtract, multiply, and divide with significant figures?

Note: Section 1.5 in Chemistry also discusses significant figures and calculations.

**Scientific Notation**
URL: http://www.purplemath.com/modules/exponent3.htm

Scientific notation is of particular importance in science. Review the website above for an overview of scientific notation. Post a practice problem on the message board that requires other students to manipulate numbers written in scientific notation. Try working a problem that another student posted.

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 or too small to be displayed on the calculator, you can use scientific notation to express the result.
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.

**Experimental Error Lab**
Complete "Experiment 3: Experimental Errors and Uncertainty" in the Science Methods LabPaq. After completing the lab, send your lab report to the course mentor to verify your findings.

**Thinkwell 1.1 and 1.2**
URL: http://www.thinkwell.com

Complete Thinkwell sections 1.1 and 1.2. Make sure you pass the associated Thinkwell exercises with an 80% or better.
Atoms and Molecules

Chemistry surrounds you. The entire universe is made of matter, and chemistry is the branch of science that describes the atoms and the interactions between atoms that make up matter. Chemistry describes everything from how the sun produces energy to your ability to think and process information. 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?

Topics

Classification of Matter

Complete the activities within this topic to gain an understanding of how matter is classified. How are atoms, elements, compounds, and mixtures related?

Resources

Section 1.9 in Chemistry
Review section 1.9 in Chemistry.

Dichotomy Chart
A dichotomy is a chart that helps differentiate between an element, a compound, a heterogeneous mixture, and a homogenous mixture. Try to think of different properties that will help you distinguish them.

Using your dichotomy, open your fridge and see if you can find an element, a compound, and a homogenous mixture. Now have someone name a substance. Without looking at your chart, see if you can group it.

Post a list of a few substances on the message board so that other students can practice classifying them. Try to classify the substances posted by other students.

Atomic Structure

Think about what you have learned previously in school about atoms. Make a drawing of an atom...
and label the parts you remember. This is just your initial model, not necessarily the full scientific model. You will revisit this model after engaging in the activities and will have a chance to modify it.

**Resources**

**Sections 2.1-2.7 in Chemistry**
Read sections 2.1-2.7 in Chemistry.

Make a chart with the following headings and fill it out as you read through the chapter:

<table>
<thead>
<tr>
<th>Particle</th>
<th>Location</th>
<th>Mass</th>
<th>Charge</th>
</tr>
</thead>
</table>

**What Do You Already Know?**
What do you already know about the following individuals?

Democritus
Dalton
Rutherford
Thompson
Millikan
Bohr

Add to your science notebook a description of what you know about each of these people. Keep space for what you will learn about them while you view Thinkwell and other web pages.

**Misconceptions**
The structure of atoms is often misunderstood by new chemistry students. While the planetary model of the atom is a great visualization for beginning students, it too often remains the model that students rely on later in their study of chemistry. To really understand the complex concepts...
that will be covered in this course of study, you need to have a solid understanding of the atomic structure. Make sure you understand the inaccuracies of the planetary model of the atom.

**Thinkwell 1.3-1.5**
URL: http://www.thinkwell.com

Complete Thinkwell sections "Early Atomic Theory" (1.3), "Atomic Structure" (1.4), and "The Periodic Table" (1.5). Make sure you pass the associated Thinkwell exercises with an 80% of better. Also, make sure you add notes about the scientists listed in the "What Do You Already Know?" activity.

**Web Practice**
URLs:


Studying the history of scientific models and the individuals that contributed to them will give you a better understanding and appreciation for the nature of science. Review the given websites for an overview of the history of the atom.

Write a description of one of the atomic models. Then describe why scientists believed it was true along with what evidence caused them to replace the theory with a new one. Post your descriptions to the message board.

**Naming Compounds**

Complete the activities within this topic to gain an understanding of naming chemical compounds. 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.

**Resources**

**Section 2.8 in Chemistry**
Read section 2.8 in Chemistry.

**Ion Flash Cards**
Make an information card with the learning topic written on the front. Write the chemical formula for each of the listed monatomic and polyatomic ions on one side of the information card. Use tables 2.3, 2.4, and 2.5 in your book. On the other side of the information card, write the name of the ion. Memorize the name with the ion. Take turns covering up each half and then say what is missing. Practice by writing each different ion, saying the name as you write it.
The key to this learning topic is rote memorization. It may help to make Post-it® 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.

**Practice Problems From Chapter 2**
You will notice that there are slight differences between how each kind of compound is named. Make sure you practice naming each kind. Complete problems 55, 57, 59, 61, 63, 65, and 67 on page 72 of Chemistry. The answers are in the back of the book.

**Thinkwell 1.6**
URL: http://www.thinkwell.com

Complete Thinkwell section "Chemical Nomenclature" (1.6). Make sure you pass the associated Thinkwell exercises with an 80% or better. Write the rules for naming the mentioned compounds in your notes.
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 these 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?

Topics

Stoichiometry

Complete the activities within this topic to gain an understanding of stoichiometry. You will learn how to convert between moles, molecules, grams, and elements.

Resources

Chapter 3 of Chemistry

Read chapter 3 in Chemistry. Make yourself a series of questions using the periodic table. Find the number of neutrons of some elements. For example, try "Fe." You have the mass number and you have the atomic number; how many neutrons are there?

Grams of One Compound to Another Compound

Write down the steps for each type of conversion on the information card. Remember, this learning topic takes things one step higher. You need to practice converting between different types of compounds.

For example, $2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$ Convert grams of $\text{H}_2$ to grams of $\text{O}_2$

Remember, you can only convert from one compound to another compound using moles! Do not do a gram-to-gram conversion. First, convert grams of the first compound to moles, then use the balanced equation of moles of that first compound to moles of the second.

Practice Problems From Chapter 3

Complete problems 33, 35, 37, 39, 53, 55, 57, 59, 61, 83, 85, and 87 at the end of chapter 3 in
Chemistry.

**Thinkwell 1.7-1.9**
URL: http://www.thinkwell.com

Complete Thinkwell sections 1.7-1.9. Make sure you pass the associated Thinkwell exercises with an 80% or better.

**Message Board Problem**
Create and post a stoichiometry problem to the message board so that other students can practice solving it. Try solving problems that other students have posted.
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:

How do the different types of chemical reactions compare?
What is a redox reaction, and how do you balance them?
What are common examples of redox reactions?

Topics

Introduction to Solutions

Complete the activities within this topic to gain an understanding of solutions. A solution is a homogenous mixture of two or more substances.

Resources

Sections 4.1-4.3 in Chemistry
Read sections 4.1-4.3 in Chemistry.

Thinkwell 1.10
URL: http://www.thinkwell.com

Complete Thinkwell section 1.10. Make sure you complete the associated Thinkwell exercises with an 80% or better.

Types of Reactions

Complete the activities within this topic to gain an understanding of the various types of reactions, including precipitation, acid-base, and oxidation-reduction reactions. What are the similarities and differences between the different types of reactions?

Resources

Sections 4.4-4.10 in Chemistry
Read sections 4.4-4.10 in Chemistry.
Practice Problems From Chapter 4
Complete practice problems 71 and 72 at the end of chapter 4 in Chemistry.

Once you get the terms straight in your head, it may be of help to remember these acronyms:
LEO the lion says GER (Loose Electrons Oxidize and Gain Electrons Reduce).

Thinkwell 1.11 and Others
URL: http://www.thinkwell.com

Complete Thinkwell sections 1.11, 1.12, 1.18.1-1.18.3, and 1.37. Make sure you complete the associated Thinkwell exercises with an 80% or better.

Note: Be careful; section 1.18 is an area students often think they understand before they really do. Make sure you are passing the Thinkwell exercises before you move on!
Thermochemistry

Thermochemistry is the branch of chemistry that studies the amount of heat energy gained or lost during a chemical reaction. There is an interesting and important relationship between energy, work, and heat. But be careful; this relationship and an understanding of the definition of heat are very 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?

Topics

Thermochemistry

Complete the activities within this topic to gain an understanding of thermochemistry. What is the relationship between energy, work, and heat? What is enthalpy? How does a calorimeter work?

Resources

Sections 6.1-6.3 in Chemistry
Read sections 6.1-6.3 in Chemistry.

Practice Problems From Chapter 6
Complete practice problems 17-55 at the end of chapter 6 in Chemistry.

Thinkwell 1.45
URL: http://www.thinkwell.com

Complete Thinkwell section 1.45. Make sure you work the practice problems and define endothermic and exothermic reactions. The key to these problems is to keep straight where the heat is going (remember, there is no such thing as cold—it just means that heat is leaving). Make sure you complete the associated Thinkwell exercises with an 80% or better.
**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. The amount of information that can be gleaned from the periodic table is truly amazing. 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?

**Topics**

**Periodic Trends**

Complete the activities within this topic to gain an understanding of 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.

**Resources**

**Chapter 7 of Chemistry**

Skim sections 7.1-7.5 and read sections 7.6-7.13 in Chemistry.

**Periodic Trends**

URL:

Using the Google search linked above, find a periodic table that you like, print it out, and draw the directions for each trend. Use different colors of markers to draw the trends. Post your periodic table somewhere that you can see it often. Learn why these trends are so important.

If you find a periodic table that you really like, post a link to it on the message board so other students can benefit.

**Practice Problems From Chapter 7**

Complete the odd problems from 85-101 on page 324 of Chemistry. The answers are in the back of the book.

**Thinkwell 1.13**
Complete Thinkwell section "Periodicity" (1.13). Make sure you pass the associated Thinkwell exercises with an 80% or better.
Chemical Bonding

A chemical bond is the energy that holds atoms together. There is ionic bonding, where an electron moves from one atom to another, creating a positively-charged atom and a negatively-charged atom, which then attract each other because of their opposite charges. There is also covalent bonding, where two atoms share a pair of electrons. And there is polar covalent bonding, which is somewhere between ionic and covalent bonding. In polar covalent bonding, the two atoms share a pair of electrons, but they share the electrons unevenly. 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?

Topics

Chemical Bonding

Complete the activities within this topic to gain an understanding of chemical bonding. As you review the activities, think about how ionic and covalent bonds compare. What is bond energy?

Resources

Sections 8.1-8.9 in Chemistry
Read sections 8.1-8.9 in Chemistry. Covalent bonding is determined by atomic size, ionization energy, and electronegativity. Next to each term, write why the characteristic would make two atoms share an electron instead of trading the electron. Make sure you write it in your own words. Try to make the material make sense as you write it. Do not memorize something that you do not understand. It will only make things more difficult later.

Thinkwell 1.14
URL: http://www.thinkwell.com

View the Thinkwell lecture and complete the Thinkwell exercises for the section "Valence Electrons and Chemical Bonding" (1.14). Make sure you complete the associated Thinkwell exercises with an 80% or better.

Molecular Structure
Complete the activities within this topic to gain an understanding of the Lewis structure and VSEPR model. Practice first with individual atoms and then combine the individual atoms into molecules.

Resources

Sections 8.10-8.13 in Chemistry
Read sections 8.10-8.13 in Chemistry.

Molecular Structure Practice Problems
URL: http://www.chem.purdue.edu/gchelp/vsepr/example222.html

Answer the questions on the above web page.

Complete a, b, c, d, and e on page 361 of Chemistry.

Thinkwell 1.15 and 1.16
URL: http://www.thinkwell.com

View the Thinkwell lecture and complete Thinkwell exercises for 1.15 and 1.16. Make sure you pass the exercises with an 80% or better.
Solids, Liquids, and Gases

In this section, you will study both intramolecular bonding and intermolecular forces. As the names imply, intramolecular bonding is the chemical bonding that takes place within a molecule to hold the atoms together, and intermolecular bonding takes place between molecules to hold them together into liquids and solids. 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?

Topics

Gases

Complete the activities within this topic to gain an understanding of 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?

Resources

Chapter 5 in Chemistry
Read chapter 5 in Chemistry. Pay special attention to sections 5.1-5.3, and work all of the example problems in these sections.

Thinkwell 1.44
URL: http://www.thinkwell.com

View the Thinkwell lectures and complete the Thinkwell exercises for "Ideal Gas Law and Kinetic-Molecular Theory of Gases" (1.44). Make sure you complete the associated Thinkwell exercises with an 80% or better.

Self Study
Write the PV = nRT equation, and then write what each one of the letters stands for. How does changing one variable affect the other variables? Also, make sure you understand how to relate two systems together: PV/T = PV′/T.
**Experiment 5: Properties of Gases**
Complete Experiment 5. See LabPaq for directions.

**Liquids and Solids**

Complete the activities within this topic to gain an understanding of liquids and solids. As mentioned previously, intermolecular forces are the forces that hold molecules together. While a polar covalent bond holds two hydrogen atoms together with an oxygen atom to form a water molecule, it is a hydrogen bond that holds water molecules together to form liquid water or ice.

**Resources**

**Sections 10.1-10.7 in Chemistry**
Read sections 10.1-10.7 in Chemistry.

**Experiment 4: Separation of a Mixture of Solids**
Complete Experiment 4. See LabPaq for directions.

**Properties of Ionic Compounds**
URL: http://en.wikipedia.org/wiki/Ionic_compound

Review the "Ionic Compound" website above and section 10.7 in Chemistry. List the properties of an ionic crystal. Include the melting temperature, electricity conduction, hardness, and brittleness.

**Thinkwell 1.19-1.21**
URL: http://www.thinkwell.com

Complete the Thinkwell lectures and exercises for "Intermolecular Forces" (1.19), "Physical Properties of Liquids" (1.20), and "Solid State: Structure and Bonding" (1.21). Make sure you complete the associated Thinkwell exercises with an 80% or better.

**Changes of State**

Think about the energy going into a block of ice. What do you think happens to the temperature? Try drawing a graph that shows how the temperature increases. As you complete the activities for this topic, compare your graph to the one in the text. Why might your graph be different?

**Resources**

**Sections 10.8 and 10.9 in Chemistry**
Read sections 10.8 and 10.9 in Chemistry. Work all of the example problems in these sections.
Particle Organization
You already know quite a bit about this learning topic. Make a chart like the one below and fill in what you already know. Fill in the rest with information from your text.

Phase Change Worksheet
URL: http://www.sciencebyjones.com/phase_change_diagram.htm

Print out the phase change diagram for water from the website above for review. Review figure 10.44 in Chemistry. Make sure you can explain what this diagram is demonstrating.

Try to redraw your diagram without looking. How much could you remember? Fill in the extra places and try again. Also, talk to yourself about what is happening with the energy at each of the phase changes.

Experiment 9: Caloric Content of Food
Complete Experiment 9. In this experiment, you will gain an understanding of calories. See LabPaq for details.
Solutions

To give the proper definition of a solution, a number of other terms need to be defined first. It is easiest to start at the beginning. An element is a substance that contains only one type of atom, such as hydrogen (H). A compound is a substance that contains more than one type of element, such as water (H2O). A mixture is a substance that contains two or more substances, such as sugar dissolved in water, which contains both water molecules and sucrose. If the substances in a mixture are evenly spread throughout, it is called a homogenous mixture, or a solution. As you complete this section, consider the following questions:

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

Topics

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.

Resources

Sections 1.9 and 4.1-4.3 in Chemistry
Review sections 1.9 and 4.1-4.3 in Chemistry. There is one liquid that is termed the universal solvent. What would you expect that to be? Why?

Sections 11.1-11.3 in Chemistry
Read sections 11.1-11.3 in Chemistry. The key to this learning topic is to keep the solute and solvent straight. Remember, any of the forms of matter can act as a solute or a solvent.

Solution Composition Chart
Create and complete the following chart.

Solutions Practice Problems
Complete problems 21 and 29 on pages 171-172; and problems 27, 29, and 31 on page 520 of Chemistry. Do the problems first with the information card close at hand, and then work on them.
until you are able to do them without the information card.

**Thinkwell 1.22 and 1.23**  
URL: http://www.thinkwell.com

Complete Thinkwell sections "Characterizing Solutions" (1.22) and "Effects of Temperature and Pressure on Solubility" (1.23). Make sure you complete the associated Thinkwell exercises with an 80% or better.

**Factors That Affect Solubility**  
Review section 11.3 in Chemistry. In your notebook, list the factors that affect solubility and describe why they do so.

**Saturated and Supersaturated**  
URL: http://preparatorychemistry.com/Bishop_supersaturated.htm

Create a diagram that shows the progression as you add a solid solute to a solvent until it is saturated, heat the solution, add more solute, and then allow the solution to cool. Your diagram should show the stages as it moves between the states of unsaturated, saturated, and supersaturated. Review the website above if you need help.
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?

Topics

Reaction Rate

Complete the activities within this topic to gain an understanding of reaction rate. There are many factors that determine the rate of a reaction. List the conditions that are necessary for chemical reactions. Define a reaction rate. Provide examples of slow and fast reactions. How does this information relate to the periodic table? Can you see when you look at the electrons which elements will undergo reactions more readily?

Resources

Sections From Chapter 12 in Chemistry
Read sections 12.1-12.2 and 12.6-12.8 in Chemistry.

Chapter 13 in Chemistry
Read chapter 13 in Chemistry.

Thinkwell 1.24-1.26 and 1.47-1.48
URL: http://www.thinkwell.com

View the Thinkwell lectures and complete the exercises for 1.24-1.26 and 1.47-1.48. Make sure you complete the associated Thinkwell exercises with an 80% or better.

Reaction Rate Chart
Fill out the chart.
There are four ways that reactions are affected. Think about the opposites of each. 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. Electrochemistry is an important example of the applications of chemistry. For example, a battery is designed specifically to convert chemical energy into electrical energy. Electrolysis is used to produce important materials used in society, such as aluminum. As you complete this section, consider the following questions:

What is the conductivity of electrolytes and non-electrolytes?

How are electrochemical cells used?

Topics

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?

Resources

Section 4.2 in Chemistry
Review section 4.2 in Chemistry. Which conducts electricity better: salt water or distilled water? Why?

Sections From Chapter 17 in Chemistry
Read sections 17.1-17.2 and 17.5-17.7 in Chemistry. Pay special attention to sections 17.1 and 17.2.

Thinkwell 1.34-1.38
URL: http://www.thinkwell.com

View the Thinkwell lectures and complete the exercises for sections 1.34-1.38. Make sure you complete the associated Thinkwell exercises with an 80% or better. Note that you have already completed Thinkwell section 1.37. However, you should review it again here.
Nuclear Chemistry

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. Radioactivity is the natural and spontaneous transformation of one nucleus into a different and more stable nucleus. Radioactivity can be a useful tool and a powerful weapon. 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?

Topics

Nuclear Chemistry

Complete the activities within this section to gain an understanding of nuclear chemistry. What do you think when you hear of radioactive decay? What do you think is happening to the atom? Draw a comic strip showing what you think might be happening.

Resources

Chapter 18 in Chemistry
Read chapter 18 in Chemistry. Pay special attention to sections 18.1 and 18.6.

Thinkwell 1.39-1.41
URL: http://www.thinkwell.com

View the video lectures and complete the exercises for Thinkwell sections 1.39-1.41. Make sure you complete the associated Thinkwell exercises with an 80% or better.

Fusion and Fission
The key is to remember the difference between fusion and fission.

Think about what the word fuse means to you. 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 Experiment 13. In this experiment, you will gain an understanding of radioactive decay.
See LabPaq for details.

**Fusion Practice Problems**
Complete problems 13 and 14 on page 867 of Chemistry.
Organic Molecules

Organic chemistry is the study of the compounds of carbon. Chemists have discovered more than 10 million organic compounds. In order to study these organic compounds, they need to be organized. 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 question:

What are functional groups, and what are the most common functional groups?

Topics

Organic Chemistry

There are five types of functional groups you need to know: alcohols, aldehydes, ketones, organic acids, and esters. Make five flash cards and write the name of the functional group on the front. On the back, write any information you learn about these groups.

Resources

Sections 22.1-22.4 in Chemistry
Read sections 22.1-22.4 in Chemistry.

Thinkwell 1.42 and 1.43
URL: http://www.thinkwell.com

Complete Thinkwell sections 1.42 and 1.43. Make sure you complete the associated Thinkwell exercises with an 80% or better.
Hazards

Mention "chemistry" to a group of children and they quickly ask if they get to blow anything 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?

Topics

Hazards

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

Resources

Qualitative Analysis of Household Products
Perform the LateNiteLab "Qualitative Analysis of Household Products" lab. List the chemical properties you just learned about on the information card. What chemicals should not be mixed?

Household Chemistry
Read "Chemical Impact-Household Chemistry" on page 643 of Chemistry. Why is mixing bleach with other cleaning solutions dangerous? Why is mixing bleach with ammonia dangerous?
Conclusion

Congratulations on completing the Chemistry course of study! As you can appreciate, chemistry covers a broad range of topics. 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. Share the connections you made with your students. During your chemistry studies, you performed hands-on labs to apply your new knowledge. Share this experience with your students. What strategies helped you learn the material? Write these down and share with your students when teaching. You now need to demonstrate your competency in chemistry by passing the objective exam and performance assessments.

Topics

Objective Assessment

Take the pre-assessment for the SCC exam. The results will provide a percentage for each of the topics in this course of study. You should then review your notes for topics with low scores. The textbook and Thinkwell 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 SCC exam after passing the pre-assessment.

Resources

Accessing the Pre-Assessment

Log in to your MyWGU Student Portal.

Go to the "My AAP" tab.

In the list below "Course Details," find the assessment you are working on.

In the "Assessment Preparation" column, click "Pre-assessment."

In the window that pops up, click "Click here to refer for this pre-assessment." A request will be sent to your mentor for approval.

Once your mentor has approved your request, return to the "My AAP" tab and click "Pre-assessment" in the "Assessment Preparation" column.

In the window that pops up, click "Click here to take this pre-assessment." You will then begin the pre-assessment.
Accessing the SCC Assessment

Log in to your MyWGU Student Portal.

Go to the "My AAP" tab.

In the list below "Course Details," find the assessment you are working on.

In the "Assessment Scheduled Date" column, click "Schedule Now."

In the window that pops up, click "Search."

A new window will come up. In this window, you can either select a previously-used site or search for a different site approved by WGU. Select the site(s) by clicking on the box beside the name. This will move your selection(s) to the "Selected Sites" box.

Once you have selected at least one site, click "Update."

You will be returned to the previous window, and the site information will now be filled in. Click "Continue."

Enter three different potential dates with the times you can take the assessment. Note: The dates must be at least two weeks from the day you request the assessment.

Click "Continue" once your potential dates and times are filled in.

If there are other considerations you would like to inform the Assessment Delivery Team about, discuss them in the "Other Considerations" box that appears, and then click "Continue." If not, simply click "Continue."

A request will be sent to your mentor for approval.

Once your mentor has approved your request, our Assessment Delivery Team will begin scheduling your assessment at the proctor site that you submitted. Once your assessment has been scheduled, you will receive a confirmation e-mail.

Performance Assessment

Accessing the SCA Performance Assessment

Log in to your MyWGU Student Portal.

Go to the "My AAP" tab.
In the list below "Course Details," find the assessment you are working on.

In the "Assessment Scheduled Date" column, click "Schedule Now."

A new window will come up. If there are other considerations you would like to inform the Assessment Delivery Team about, discuss them in the "Other Considerations" box that appears and then click "Continue." If not, simply click "Continue."

A request will be sent to your mentor for approval.

Once your mentor has approved your request, our Assessment Delivery Team will open the tasks required for the assessment in TaskStream. You will log in to TaskStream to receive the instructions, see the rubric, and submit your assessment for grading.

For your convenience, screenshots showing the instructions for each performance task related to this course of study are available at the links below. Please note that the instructions may change slightly from time to time. For the most up-to-date instructions, evaluation rubrics, and other related material, please log in to TaskStream. You will not have access to these tasks in TaskStream until you request them through your AAP and your mentor approves your request.

TaskStream SCA4/5Task Oxidation States of Manganese

TaskStream SCA4/5Task Solutions

TaskStream SCA4/5Task Titration of Strong Weak Acids

Resources

Task "Solutions" Tip
To complete this task, you will have to calculate the mass, in grams, necessary of an HCl stock solution to make a particular solution with the given concentration. To set up the necessary calculations, think about how you could write the mass of all the parts of the resulting solution. To start, think about how many grams of HCl are in 100 grams of the stock solution and how that can translate into grams of solution. Do not forget to also report how many grams of the solvent will be present, too.

Task "Oxidation States of Manganese" Tip
Occasionally, students have difficulties connecting the burette to the flask. Please make sure you drag the flask to the burette (not the burette to the flask).

Task "Titration of Strong and Weak Acids" Tip
Occasionally students have difficulties connecting the burette to the flask. Please make sure you drag the flask to the burette (not the burette to the flask).
Thinkwell has a demonstration with the calculations worked out for you for an example problem:

1.30.2 CIA Demonstration: Barium Hydroxide-Sulfuric Acid Titration

Click on the "lab preparation with sound"

Remember you are asked to compare the Kas not calculate them. You are welcome to look up the Ka of acetic acid and HCl.

Feedback

If you wish to provide feedback on this course of study, please contact Rob Duncan at rduncan@wgu.edu.

Click here to review University ADA policy.