



Department of Chemistry

CHM 1220(1225)

(PS) Chemical Structure, Bonding and Reactivity

4(3) Semester Hours Credit Hours:

M, W, F 12:50 –1:45 p.m.

100 General Lectures

Instructor: Dr. Maryfran Barber

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Hours: 2:30-3:30 Mondays, Wednesdays,
and by appointment

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Course Description, Prerequisites, Co-requisite

Introduction to the principles of chemistry.

Prerequisites: passing score on chemistry placement exam or a grade of “C” or better in CHM 1040 or CHM 1020; placement beyond MAT 095.

Please Note: If you have not placed into CHM 1220 on the placement exam OR passed CHM 1040 or CHM 1020 with a C or better OR the equivalent of these at a different institution, you will be removed from the class shortly after the drop deadline.

Pre- or Co-requisite: CHM 1230

Required Resources

1. You are required to have **web access** and to be able to print documents.

The Adamany Undergraduate Library provides web access at no charge; printing is available at the Adamany Undergraduate Library for a fee per page.

2. You are required to have your **WSU e-mail address** working by noon Wednesday, September 4, 2013.

*To activate your account, go to www.webmail.wayne.edu. Your **access id** is a 6-character code composed of two letters followed by four digits (e.g. bx1234). Your initial password is your Wayne State University personal ID (the 000 number). Once you have activated your account, click on Account Management in order to customize your account, by changing your password and setting an address to which all messages are forwarded.*

3. You are required to create an account on **OWL2**, the publisher’s website.

You will use this site to complete part of your homework. You will need a passkey to register. It is included in the package from the CengageBrain microsite or from the bookstore. It can also be purchased on-line at the microsite.

*It is important to follow the registration directions **very carefully**. They are included in this syllabus.*

4. You are required to create an account on **ALEKS**, a learning website.

You will use this site to complete part of your homework. For this semester there is no fee.

5. You are required to have register an **i>Clicker 2** unit (aka “clicker”) by class time on Wednesday, September 4, 2013. To register your unit, log onto Blackboard to the section for this class. Click on Register my i>clicker and enter the serial number.

6. You will need a basic **scientific calculator**.

The calculator should have the basic arithmetic functions, scientific notation and the ability to raise numbers to exponents, take roots, do logarithms and antilogarithms (inverse logs). You will need to bring your calculator to all exams and should bring it to all lectures and quiz classes. You are not permitted to share calculators during exams.

The calculator may not be programmable or graphing.

6. You are expected to check for e-mail messages and Blackboard Announcements on a regular basis (at a minimum once between class lectures).

Recommended Resources

General Chemistry, 10th Edition, Ebbing/Gammon, Houghton Mifflin, 2012.

Study Guide for General Chemistry, 10th Edition, Ebbing/Gammon, Larry Krannich, Houghton Mifflin, 2012.
Highly recommended. Includes terms and definitions, diagnostic test (with answers), summary of major concepts and operational skills, additional problems (with answers), post-test (with answers) for each chapter.

Solutions Manual for General Chemistry, 10th Edition, Ebbing/Gammon, David Bookin, Houghton Mifflin, 2012.
Includes detailed solutions to in-chapter exercises and odd-numbered end-of-chapter problems. It also contains answers to the Review Questions.

Attendance

Attendance is required at all course functions. Absence from lecture can result in the loss of 150 points (exams) or any credit given for participation. Absence from quiz class can result in the loss of credit given for participation.

Lectures

Before lecture:

The lecture content will follow the Course Outline unless changes are announced.

Your best preparation is to read the chapter one section at a time doing the examples and exercises, then, doing the problems for those sections located at the end of the chapter. THEN proceed to complete the homework on OWL for that chapter. After completing the chapter, make an outline or concept map identifying the key concepts and their relationship to one another. Making your own set of notes is critical. It is especially helpful if you can outline the types of problems in the chapter and annotate the outline with how to distinguish the various types of problems as well as what to watch out for.

During lecture:

Lectures will be used to present, clarify and practice important topics and skills. Attending lecture, participating and taking good notes is essential to your success in the class and so, ***attendance is required.***

Questions will be addressed during lecture, however, because of the size of the class and time limitations, your quiz section is probably a more effective place to receive ample attention to your questions.

We will use the i>Clicker 2 units as part of instruction on regular basis. It is a remote control unit that allows students to enter answers and for them to be collated within seconds. The questions may cover content or opinion or self-assessment.

You are responsible for learning all material presented in the lectures and in assigned portions of the text. While most material will be covered in lectures and in the text, some material may be covered only in a lecture or only in the text.

Lectures are recorded (audio is combined with all projected content), then posted on Blackboard under Content. This is called lecture capture. To obtain the file, click on Content, then on the file posted for the date you want.

I also post the slides that I use and write on during lecture.

After lecture:

Redoing and organizing your notes (and re-working examples) within a few hours of lecture is your most effective study practice. After a chapter is completed, create a new synthesized set of notes for that chapter. You'll use that to prepare for the exam (and the MCAT, PCAT, etc.). You will need to be able to identify various types of problems and solve them, so making an outline of the types of problems and how to distinguish them is very helpful. It can also help to note what to be careful with for each type of problem. Another very effective practice is to solve OWL problems more than once.

Lecture and Quiz Class Environment

Together we are responsible for a learning environment for everyone during both lectures and quiz class.

Behaviors that detract from this will not be tolerated.

Quiz Class

The primary purposes of the quiz section are
to practice problem solving;
to explore questions; and
to clarify material covered during lecture.

The more actively you participate, the more you will learn. Raising questions and helping to address those of others is an important part of the learning process. Attendance and participation is required.

Homework

Homework is an essential part of learning chemistry. You will use two different websites for your homework. They each have a different purpose. ALEKS will build the required content mastery for the new material and then help you to master it. OWL will give you more practice, worded differently and provide additional explanation, visualization, tutorials.

OWL2 is the Cengage website for homework. OWL is located at <http://login.cengage.com>

There are very specific directions included with this syllabus that must be followed when registering on OWL included later in the syllabus.

You will complete your homework on OWL. You can purchase access to OWL (if you did not get it with your text book) at <http://cengagebrain.com/micro/1-1KGKH1B>.

ALEKS

ALEKS a learning website located at <http://login.aleks.com>

The first thing you will do is take a comprehensive assessment. You don't need to study. Don't use other resources. This will establish your base line course mastery. You will build from there.

Please note: ALEKS uses artificial intelligence in order to assist your learning. Gaming the system or having anyone else complete an assignment for you will cause the program to give you more problems. It is also quite good at detecting things like using other resources.

There are two types of assignments on ALEKS: objectives and assessments. There will be one, two or three objectives per chapter. There is one assessment before each exam.

OWL assignments and ALEKS objectives will receive either 5-points or zero-points toward your final grade. In order to receive 5-points, you must complete 80% by the deadline given.

ALEKS assessment will receive 10 points when completed by the deadline.

You must complete all homework by 11:59 p.m. the Wednesday before the exam in order to qualify for the exam. If you do not, you will receive a zero on the exam.

All technology fails at some time. If there is a technological issue with your quiz, you will need to contact OWL Help and/or me in time to still complete your quiz by the deadline.

I strongly suggest you begin the homework as soon as it is available, but after doing some problems in from the text.

Examinations

Five examinations (150 points each) will be given during the semester.

You must qualify for each exam by completing all homework (even for prior exams)
by 11:59 p.m. the Wednesday before the exam.
If you do not, you will receive a zero on the exam.

Examination dates have been set (see attached course outline). You are required to take examinations at the scheduled times. **There are no makeup exams.** If you miss an exam for any reason, you will receive a grade of zero for that exam. The missing score will be replaced with the percent you earn on the cumulative final exam.

There is **assigned seating** during exams that will be explained before the first exam.

You must **write your exam in ink** only. If you do not, you will receive a zero on the exam.

Your **WSU OneCard** may be requested at examinations

Your **calculator** will be checked for compliance. If you are found using a calculator that is programmable or graphing, the calculator will be collected and you will receive a zero on your exam. If your calculator is collected, you may see Dr. Barber in her office to pick up your calculator.

During exams, you are required to stay in the exam room for thirty-five minutes (until 1:25 p.m.). If you come after the first student has left the exam room, you will not be allowed to take the exam.

Exams are returned during class the Monday after the exam. Please review your exam as soon as it is returned.

Any question regarding must be submitted by the 2nd Monday after the exam. To request this review use the Request for Exam Review form that is posted on Blackboard under Exam Materials.

A cumulative final examination (300 points) will be given from 10:40a.m.–1:10 p.m. Monday, April 29, 2013 in 100 General Lectures.

Each exam will have the following Academic Integrity Pledge on the cover page:

Academic Integrity Pledge

During the exam I will

- turn off my cell phone and put it on the floor
- close all books, notebooks, etc. and put them under the seat in which I sit
- use only a permitted calculator (no graphing or programmable calculators are permitted)
- write only in ink
- keep my eyes down and focused on my own paper
- keep my answers covered
- sit in the area assigned to my section
- stop writing and put down my pen when the end is announced

During the exam I will not

- have any papers other than those provided
- have any writing on my clothing or person or desk
- talk to anyone other than a TA or the instructor

I understand that the **minimum consequence** of any behavior contrary to this pledge is that I will receive a **zero on this exam** that will not be replaced by the percent earned on my final exam.

Name (sign) _____

Blackboard

Blackboard is a web-based resource for courses. In this course we use Blackboard for primarily for three reasons: announcements, course resources and to post exam and homework grades..

Blackboard is located at **<http://blackboard.wayne.edu>**

To login use your Wayne State userid (two letters + four numbers, e.g. bx1234). If you have used Blackboard in the past, your password remains the same. If you have not, your password is your WSU personal ID (the 000 number).

Once you login, the courses for which you are registered will be listed. You will note that there are two listings for CHM 1220/1225:

One is for Section 001 with all students from every quiz section. This site is used for announcements, lecture slides, course materials and grades.

The second site is specific to your section. This site will be used for communications from your TA and may not be available until week 2.

Assistance

You will benefit the most if you seek assistance **as soon as possible**. Don't wait until just before an exam or after you've had difficulty with one or more exams. The following are some of the resources available to you in addition to the lecture, your quiz session and the Blackboard web site.

Academic Success Center Tutors:

Located at 2100 David Adamany Library, the Center provides free tutoring as well as programs that address testing skills, study skills, note-taking skills, math anxiety, etc.

Supplemental Instruction:

This course will have SI support. The SI leader will schedule hours each week. The schedule will be determined by the second week of class and posted on Blackboard. SI sessions are participative. Everyone is encouraged to attend. In the past, students who regularly attend have had higher exam averages than other students.

Chemistry Learning Center: These are generally scheduled from 9:35-5:00 Monday through Friday in the south end of the Chemistry Department Atrium. They are free of charge. The schedule will be posted on Blackboard

as soon as it is available (usually in week 2) and will list the name of the TAs for each time. While a TA for this course will be best able to help you, any TA can assist with General Chemistry questions.

TA Office Hour:

Your TA will establish an office hour and will announce this in quiz class.

Dr. Barber's office hours: I will be available Mondays and Wednesdays from 2:30-3:30 p.m and by appointment. I am most available by e-mail. When you send a message I need you to put CHM 1220 or CHM 1225 in the subject line (otherwise it goes to spam). I also need you to include your full name and your section number in the body of the message. Please see e-mail protocol (attached).

Lecture Capture:

Each lecture is captured. The audio is synchronized with everything that is projected. The file is then posted on Blackboard under Content. You may view/listen to any lecture online using the link on Blackboard under Content for the date you want.

Publisher web sites:

Cengagebrain.com has material available at no additional cost.

Special Provisions

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services (SDS) for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I am happy to meet with you privately during my office hours to discuss your needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Please be aware that a delay in getting SDS accommodation letters for the current semester may hinder the availability or facilitation of those accommodations in a timely manner. Therefore, it is in your best interest to get your accommodation letters as early in the semester as possible.

Religious holidays

Because of the extraordinary variety of religious affiliations of the University student body and staff, the Academic Calendar makes no provisions for religious holidays. However, it is University policy to respect the faith and religious obligations of the individual. Students with classes or examinations that conflict with their religious observances are expected to notify their instructors well in advance so that mutually agreeable alternatives may be worked out. You must notify the instructor within the first two weeks of classes if there will be any conflicts during the semester.

Academic Honesty

You are expected to exhibit academic honesty and integrity at all times. Cheating or any other form of academic dishonesty is abhorrent to the academic process and will not be tolerated. Cheating will result in severe punishment and may lead to expulsion from the University according to the rules of the College of Liberal Arts and Science and Wayne State University.

In addition, Plagiarism and Cheating (edited statement from the DOSO's web site): Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (<http://www.doso.wayne.edu/student-conduct-services.html>). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

- Cheating: Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student's test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.
- Fabrication: Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.

- Plagiarism: To take and use another's words or ideas as one's own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.
- Other forms of academic misbehavior include, but are not limited to: (a) unauthorized use of resources, or any attempt to limit another student's access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an un-administered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

Course Drops and Withdrawals:

In the first two weeks of the (full) term, students can drop this class and receive 100% tuition and course fee cancellation. After the end of the second week there is no tuition or fee cancellation. Students who wish to withdraw from the class can initiate a withdrawal request on Pipeline. You will receive a transcript notation of WP (passing), WF (failing), or WN (no graded work) at the time of withdrawal. No withdrawals can be initiated after the end of the tenth week. Students enrolled in the 10th week and beyond will receive a grade. Because withdrawing from courses may have negative academic and financial consequences, students considering course withdrawal should make sure they fully understand all the consequences before taking this step. More information on this can be found at: <http://reg.wayne.edu/pdf-policies/students.pdf>

Grading

The final grade will be based on a total of 1220 points according to the following scheme:

Initial ALEKS Assessment (<i>if completed by September 3, 2013</i>)	80
OWL Homework (<i>5 points for each chapter with 80% or better score</i>)	150
ALEKS Objectives (<i>5 points for each chapter with 80% or better score on time</i>)	115
ALEKS Assessments before exams (<i>10 points</i>)	50
Participation	20
Exams (<i>sum of scores of five exams @ 150</i>)	750
Cumulative Final Exam (<i>@300; note this percent may also replace your lowest exam percent</i>)	300
Total points	1465

Your final grade will be assigned according to the number of points you have earned:

Points	Grade	Points	Grade	Points	Grade	Points	Grade
>= 93.000%	A	>= 87.000%	B+	>= 77.000%	C+	>= 67.000%	D+
>= 90.000%	A-	>= 83.000%	B	>= 73.000%	C	>= 63.000%	D
		>= 80.000%	B-	>= 70.000%	C-	>= 60.000%	D-
						< 60.000%	E

Course Objectives

CHAPTER 7

1. **Relating wavelength and frequency of light.** Given the frequency of light, calculate the wavelength, or vice versa.
2. **Calculating the energy of a photon.** Given the frequency or wavelength of light, calculate the energy associated with one photon.
3. **Determining the wavelength or frequency of a hydrogen atom transition.** Given the initial and final principal quantum numbers for an electron transition in the hydrogen atom, calculate the frequency or wavelength of light emitted. You need the value of R_H .
4. **Applying the de Broglie relation.** Given the mass and speed of a particle, calculate the wavelength of the associated wave.
5. **Using the rules for quantum numbers.** Given a set of quantum numbers n , l , m_l , and m_s , state whether that set is permissible for an electron.

CHAPTER 8

1. **Applying the Pauli exclusion principle.** Given an orbital diagram or electron configuration, decide whether it is possible or not, according to the Pauli exclusion principle.
2. **Determining the configuration of an atom using the building-up principle.** Given the atomic number of an atom, write the complete electron configuration for the ground state, according to the building-up principle.
3. **Determining the configuration of an atom using the period and group numbers.** Given the period and group for an element, write the configuration of the outer electrons.
4. **Applying Hund's rule.** Given the electron configuration for the ground state of an atom, write the orbital diagram.
5. **Applying periodic trends.** Using the known trends and referring to a periodic table, arrange a series of elements in order by atomic radius or ionization energy.

CHAPTER 9

Note: A periodic table is needed for skills 1, 2, 3, 5 and 6.

1. **Using Lewis symbols to represent ionic bond formation.** Given a metallic and a nonmetallic main-group element, use Lewis symbols to represent the transfer of electrons to form ions of noble-gas configurations.
2. **Writing electron configurations of ions.** Given an ion, write the electron configuration. For an ion of a main-group element, give the Lewis symbol.
3. **Using periodic trends to obtain relative ionic radii.** Given a series of ions, arrange them in order of increasing ionic radius.
4. **Using electronegativities to obtain relative bond polarities.** Given the electronegativities of the atoms, arrange a series of bonds in order by polarity.
5. **Writing Lewis formulas.** Given the molecular formula of a simple compound or ion, write the Lewis electron-dot formula.
6. **Writing resonance formulas.** Given a simple molecule with delocalized bonding, write the resonance description.
7. **Using formal charges to determine the best Lewis formula.** Given two or more Lewis formulas, use formal charges to determine which formula best describes the electron distribution or gives the most plausible molecular structure.
8. **Relating bond order and bond length.** Know the relationship between bond order and bond length.
9. **Estimating ΔH from bond energies.** Given a table of bond energies, estimate the heat of reaction.

CHAPTER 10

1. **Predicting molecular geometries.** Given the formula of a simple molecule, predict its geometry, using the VSEPR model.
2. **Relating dipole moment and molecular geometry.** State what geometries of a molecule AX_n are consistent with the information that the molecule has a nonzero dipole moment.
3. **Applying valence bond theory.** Given the formula of a simple molecule, describe its bonding, using valence bond theory.
4. **Describing molecular orbital configurations.** Given the formula of a diatomic molecule obtained from first- or second-period elements, deduce the molecular orbital configuration, the bond order, and whether the molecular substance is diamagnetic or paramagnetic.

CHAPTER 11

1. **Calculating the heat required for a phase change of a given mass of substance.** Given the heat of fusion (or vaporization) of a substance, calculate the amount of heat required to melt (or vaporize) a given quantity of that substance.
2. **Calculating vapor pressures and heats of vaporization.** Given the vapor pressure of a liquid at one temperature and its heat of vaporization, calculate the vapor pressure at another temperature. Given the vapor pressures of a liquid at two temperatures, calculate the heat of vaporization.
3. **Relating the conditions for the liquefaction of gases to the critical temperature.** Given the critical temperature and pressure of a substance, describe the conditions necessary for liquefying the gaseous substance.
4. **Identifying intermolecular forces.** Given the molecular structure, state the kinds of intermolecular forces expected for a substance.
5. **Determining relative vapor pressure on the basis of intermolecular attraction.** Given two liquids, decide on the basis of intermolecular forces which has the higher vapor pressure at a given temperature or which has the lower boiling point.

6. **Identifying types of solids.** From what you know about the bonding of a solid, classify it as a molecular, metallic, ionic, or covalent network.
7. **Determining the relative melting points based on types of solids.** Given a list of substances, arrange them in order of increasing melting point from what you know of their structures.
8. **Determining the number of atoms per unit cell.** Given the description of a unit cell, find the number of atoms per cell.
9. **Calculating atomic mass from unit-cell dimension and density.** Given the edge length of the unit cell, the crystal structure, and the density of a metal, calculate the mass of a metal atom.
10. **Calculating unit-cell dimension from unit-cell type and density.** Given the unit-cell structure, the density, and the atomic weight for an element, calculate the edge length of the unit cell.

CHAPTER 5

1. **Converting units of pressure.** Given the pressure of a gas in one unit of pressure (Pa, mmHg, or atm), convert to another unit of pressure.
2. **Using the empirical gas laws.** Given an initial volume occupied by a gas, calculate the final volume when the pressure changes at fixed temperature; when the temperatures changes at fixed pressure; and when both pressure and temperature change.
3. **Deriving empirical gas laws from the ideal gas law.** Starting from the ideal gas law, derive the relationship between any two variables.
4. **Using the ideal gas law.** Given any three of the variables P , V , T , and n for a gas, calculate the fourth from the ideal gas law.
5. **Relating gas density and molecular weight.** Given the molecular weight, calculate the density of a gas for a particular temperature and pressure; or, given the gas density, calculate the molecular weight.
6. **Solving stoichiometry problems involving gas volumes.** Given the volume (or mass) of one substance in a reaction, calculate the mass (or volume) of another produced or used up.
7. **Calculating partial pressures and mole fractions of a gas in a mixture.** Given the masses of gases in a mixture, calculate the partial pressures and mole fractions.
8. **Calculating the amount of gas collected over water.** Given the volume, total pressure, and temperature of gas collected over water, calculate the mass of the dry gas.
9. **Calculating the rms speed of gas molecules.** Given the molecular weight and temperature of a gas, calculate the rms molecular speed.
10. **Calculating the ratio of effusion rates of gases.** Given the molecular weights of two gases, calculate the ratio of rates of effusion; or, given the relative effusion rates of a known and unknown gas, obtain the molecular weight of the unknown gas.
11. **Using the van der Waals equation.** Given n , t , V , and the van der Waals constants a and b for a gas, calculate the pressure from the van der Waals equation.

CHAPTER 12

1. **Applying Henry's law.** Given the solubility of a gas at one pressure, find its solubility at another pressure.
2. **Calculating solution concentration.** Given the mass percent of solute, state how to prepare a given mass of solution. Given the masses of solute and solvent, find the molality and mole fractions.
3. **Converting concentration units.** Given the molality of a solution, calculate the mole fractions of solute and solvent; and given the mole fractions, calculate the molality. Given the density, calculate the molarity.
4. **Calculating vapor-pressure lowering.** Given the mole fraction of solute in a solution of nonvolatile, undissociated solute and the vapor pressure of pure solvent, calculate the vapor-pressure lowering and vapor pressure of the solutions.
5. **Calculating boiling-point elevation and freezing-point depression.** Given the molality of a solution of nonvolatile, undissociated solute, calculate the boiling-point elevation and freezing-point depression.
6. **Calculating molecular weights.** Given the masses of solvent and solute and the molality of the solution, find the molecular weight of the solute. Given the masses of solvent and solute, the freezing-point depression, and K_f , find the molecular weight of the solute.
7. **Calculating osmotic pressure.** Given the molarity and the temperature of a solution, calculate its osmotic pressure.
8. **Determining colligative properties of ionic solutions.** Given the concentration of ionic compound in a solution, calculate the magnitude of a colligative property; if i is not given, assume the value based on the formula of the ionic compound.

CHAPTER 14

1. **Applying stoichiometry to an equilibrium mixture.** Given the starting amounts of reactants and the amount of one substance at equilibrium, find the equilibrium composition.
2. **Writing equilibrium-constant expressions.** Given the chemical equation, write the equilibrium-constant expression.
3. **Obtaining an equilibrium constant from reaction composition.** Given the equilibrium composition, find K_c .
4. **Using the reaction quotient.** Given the concentrations of substances in a reaction mixture, predict the direction of reaction.
5. **Obtaining one equilibrium concentration given the others.** Given K_c and all concentrations of substances but one in an equilibrium mixture, calculate the concentration of this one substance.
6. **Solving equilibrium problems.** Given the starting composition and K_c of a reaction mixture, calculate the equilibrium composition.
7. **Applying LeChatelier's principle.** Given a reaction use Le Chatelier's principle to decide the effect of adding or removing a substance, changing the pressure, or changing the temperature.

CHAPTER 15

1. **Identifying acid and base species.** Given a proton-transfer reaction, label the acids and bases, and name the conjugate acid-base pairs.
2. **Identifying Lewis acid and base species.** Given a reaction involving the donation of an electron pair, identify the Lewis acid and the Lewis base.
3. **Deciding whether reactants or products are favored in an acid-base reaction.** Given an acid-base reaction and the relative strengths of acids (or bases), decide whether reactants or products are favored.
4. **Calculating concentrations of H_3O^+ and OH^- in solutions of strong acid or base.** Given the concentration of a strong acid or base, calculate the hydronium-ion and hydroxide-ion concentration.
5. **Calculating the pH from the hydronium-ion concentration, or vice-versa.** Given the hydronium-ion concentration, calculate the pH; or given the pH, calculate the hydronium-ion concentration.

CHAPTER 16

1. **Determining K_a or (K_b) from the solution pH.** Given the molarity and pH of a solution of a weak acid, calculate K_a for the acid. The K_b can be determined in a similar way.
2. **Calculating concentrations of species in a weak acid solution using K_a .** Given K_a , calculate the hydronium-ion concentration and pH of a solution of a weak acid of known molarity. Given K_{a1} , K_{a2} , and the molarity of a diprotic acid solution, calculate the pH and the concentrations of H_3O^+ , HA^- , and A^{2-} .
3. **Calculating concentrations of species in a weak base solution using K_b .** Given K_b calculate the hydronium-ion concentration and pH of a solution of a weak base of known molarity.
4. **Predicting whether a salt solution is acidic, basic, or neutral.** Decide whether an aqueous solution of a given salt is acidic, basic, or neutral.
5. **Obtaining K_a from K_b or K_b from K_a .** Calculate K_a for a cation or K_b for an anion from the ionization constant of the conjugate base or acid.
6. **Calculating concentrations of species in a salt solution.** Given the concentration of a solution of a salt in which one ion hydrolyzes, and given the ionization constant of the conjugate acid or base of this ion, calculate the H_3O^+ concentration.
7. **Calculation the common-ion effect on acid ionization.** Given K_a and the concentrations of weak acid and strong acid in a solution, calculate the degree of ionization of the weak acid. Given K_b and the concentrations of weak acid and its salt in a solution, calculate the pH.
8. **Calculating the pH of a buffer from given volumes of solution.** Given concentrations and volumes of acid and conjugate base from which a buffer is prepared, calculate the buffer pH.
9. **Calculating the pH of a buffer when a strong acid or strong base is added.** Calculate the pH
10. **Calculating the pH of a solution of strong acid and a strong base.** Calculate the pH during the titration of a strong acid by a strong base, given the volumes and concentrations of the acid and base.
11. **Calculating the pH at the equivalence point in the titration of a weak acid by a strong base.** Calculate the pH at the equivalence point for the titration of a weak acid by a strong base. Be able to do the same type of calculation for the titration of a weak base by a strong acid.

CHAPTER 6

1. **Calculating kinetic energy.** Given the mass and speed of an object, calculate the kinetic energy.
2. **Writing thermochemical equations.** Given a chemical equation, states of substances, and the quantity of heat absorbed or evolved for molar amounts, write the thermochemical equation.

3. **Manipulating thermochemical equations.** Given a thermochemical equation, write the thermochemical equation for different multiples of the coefficients or for the reverse reaction.
4. **Calculating the heat of reaction from the stoichiometry.** Given the value of ΔH for a chemical equation, calculate the heat of reaction for a given mass of reactant or product.
5. **Relating heat and specific heat.** Given any three of the quantities q , s , m , and ΔT , calculate the fourth one.
6. **Calculating ΔH from calorimetric data.** Given the amounts of reactants and the temperature change of a calorimeter of specified heat capacity, calculate the heat of reaction.
7. **Applying Hess's law.** Given a set of reactions with enthalpy changes, calculate ΔH for a reaction obtained from these other reactions by using Hess's law.
8. **Calculating the heat of phase transition from standard enthalpies of formation.** Given a table of standard enthalpies of formation, calculate the heat of phase transition.
9. **Calculating the enthalpy of reaction from standard enthalpies of formation.** Given a table of standard enthalpies of formation, calculate the enthalpy of reaction.

CHAPTER 18

1. **Calculating the entropy change for a phase transition.** Given the heat of phase transition and the temperature of the transition, calculate the entropy change, ΔS , of the system.
2. **Predicting the sign of the entropy change of a reaction.** Predict the sign of ΔS° for a reaction to which the rules listed in the text can be clearly applied.
3. **Calculate ΔS° for a reaction.** Given the standard entropies of reactants and products, calculate the entropy of reaction, ΔS° .
4. **Calculating ΔG° from ΔH° and ΔS° .** Given the enthalpies of formation and standard entropies of reactants and products, calculate the standard free-energy change, ΔG° , for a reaction.
5. **Calculating ΔG° from standard free energies of formation.** Given the free energies of formation of reactants and products, calculate the standard free-energy change, ΔG° , for a reaction.
6. **Interpreting the sign of ΔG° .** Use the standard free-energy change to determine the spontaneity of a reaction.
7. **Writing the expression for a thermodynamic equilibrium constant.** For any balanced chemical equation, write the expression for the thermodynamic equilibrium constant.
8. **Calculating K from the standard free-energy change.** Given the standard free-energy change for a reaction, calculate the thermodynamic equilibrium constant.
9. **Calculating ΔG° and K at various temperatures.** Given ΔH° and ΔS° at 25°C, calculate ΔG° and K for a reaction at a temperature other than 25°C.

CHAPTER 19

1. **Balance oxidation reduction reactions in acidic solution.** Using half-reaction method balance first the half reactions, then combining the half reactions, the overall reaction.
2. **Balance oxidation-reduction reactions in basic solution.** Apply basic conditions to an equation balanced in acid.
3. **Describe the components of a voltaic cell.**
4. **Explain the difference between an electrolytic cell and a voltaic (galvanic) cell.**
5. **Calculate the cell potential for a given reaction.**
6. **Determine the relative reducing strength and oxidizing strength of agents.**
7. **Calculate the free energy change from the cell potential and vice-versa.**
8. **Calculate the equilibrium constant from either the free energy change or cell potential.**

Pre-requisite Operational Skills

References to *General Chemistry*, Ebbing/Gammon

CHAPTER 1

1. **Using the law of conservation of mass.** Given the masses of all substances in a chemical reaction except one, calculate the mass of this one substance (Example 1.1).
2. **Using significant figures in calculations.** Given an arithmetic setup, report the answer to the correct number of significant figures and round it properly (Example 1.2)
3. **Converting from one temperature scale to another.** Given a temperature reading on one scale, convert it to another scale – Celsius, Kelvin, or Fahrenheit (Example 1.3).
4. **Calculating the density of a substance.** Given the mass and volume of a substance, calculate the density (Example 1.4).

5. **Using the density to relate mass and volume.** Given the mass and density of a substance, calculate the volume; or given the volume and density, calculate the mass (Example 1.5).
6. **Converting units.** Given an equation relating one unit to another (or a series of such equations), convert a measurement expressed in one unit to a new unit (Examples 1.6, 1.7, and 1.8).

CHAPTER 2

1. **Writing nuclide symbols.** Given the number of protons and neutrons in a nucleus, write its nuclide symbol (Example 2.1).
2. **Determining atomic weight from isotopic mass and fractional abundances.** Given the isotopic masses (in atomic mass units) and fractional isotopic abundances for a naturally occurring element, calculate its atomic weight (Example 2.2).
3. **Writing an ionic formula, given the ions.** Given the formulas of a cation and an anion, write the formula of the ionic compound of these ions (Example 2.3).
4. **Writing the name of a compound from its formula, or vice versa.** Given the formula of a simple compound (ionic, binary molecular acid, or hydrate), write the name (Examples 2.4, 2.5 and 2.10) or vice versa (Examples 2.5, 2.7, and 2.11).
5. **Writing the name of a binary molecular compound from its molecular model.** Given the molecular model of a binary compound, write the name (Example 2.8).
6. **Writing the name and formula of an anion from the acid.** Given the name and formula of an oxoacid, write the name and formula of the oxoanion; or from the name and formula of the oxoanion, write the formula and name of the oxoacid (Example 2.9).
7. **Balancing simple equations.** Given the formulas of the reactants and products in a chemical reaction, obtain the coefficients of the balanced equation (Example 2.12).

CHAPTER 3

Note: A table of atomic weights is necessary for most of these skills.

1. **Calculating formula weight from a formula or molecular model.** Given the formula of a compound and a table of atomic weights, calculate the formula weight (Examples 3.1 and 3.2).
2. **Calculating the mass of an atom or molecule.** Using the molar mass and Avogadro's number, calculate the mass of an atom or molecule in grams (Example 3.3).
3. **Converting moles of substance to grams and vice versa.** Given the moles of a compound with a known formula, calculate the mass (Example 3.4). Or, given the mass of a compound with a known formula, calculate the moles (Example 3.5).
4. **Calculating the number of molecules in a given mass.** Given the mass of a sample of a molecular substance and its formula, calculate the number of molecules in the sample (Example 3.6).
5. **Calculating the percentage composition from the formula.** Given the formula of a compound, calculate the mass percentages of the elements in it (Example 3.7).
6. **Calculating the mass of an element in a given mass of compound.** Given the mass percentage of elements in a given mass of a compound, calculate the mass of any element (Example 3.8).
7. **Calculating the percentage of C and H by combustion.** Given the masses of CO_2 and H_2O obtained from the combustion of a known mass of a compound of C, H, and O, compute the mass percentage of each element (Example 3.9).
8. **Determining the empirical formula from masses of elements and percentage composition.** Given the masses of elements in a known mass of compound, or given its percentage composition, obtain the empirical formula (Examples 3.10 and 3.11).
9. **Determining the molecular formula from percentage composition and molecular weight.** Given the empirical formula and molecular weight of a substance, obtain its molecular formula (Example 3.12).
10. **Relating quantities in a chemical equation.** Given a chemical equation and the amount of one substance, calculate the amount of another substance involved in the reaction (Example 3.13 and 3.14).
11. **Calculating with a limiting reactant.** Given the amounts of reactants and the chemical equation, find the limiting reactant; then calculate the amount of product (Examples 3.15 and 3.16).

CHAPTER 4

1. **Using the solubility rules.** Given the formula of an ionic compound, predict its solubility in water (Example 4.1).
2. **Writing net ionic equations.** Given a molecular equation, write the corresponding net ionic equation (Example 4.2).
3. **Deciding whether precipitation occurs.** Using solubility rules, decide whether two soluble ionic compounds react to form a precipitate. If they do, write the net ionic equation (Example 4.3).

4. **Classifying acids and bases as strong or weak.** Given the formula of an acid or base, classify it as strong or weak (Example 4.4).
5. **Writing an equation for neutralization.** Given an acid and a base, write the molecular equation and then the net ionic equation for the neutralization reaction (Example 4.5).
6. **Writing an equation for a reaction with gas formation.** Given the reaction between a carbonate, sulfite or sulfide and an acid, write the molecular and the net ionic reactions (Example 4.6).
7. **Assigning oxidation numbers.** Given the formula of a simple compound or ion, obtain the oxidation number of the atoms, using the rules for assigning oxidation numbers (Example 4.7).
8. **Balancing simple oxidation-reduction reactions by the half-reaction method.** Given an oxidation-reduction reaction, balance it (Examples 4.8).
9. **Calculating molarity from mass and volume.** Given the mass of solution and the volume of the solution, calculate the molarity (Example 4.9).
10. **Using molarity as a conversion factor.** Given the volume and molarity of a solution, calculate the amount of solute. Or, given the amount of solute and the molarity of a solution, calculate the volume (Example 4.10).
11. **Diluting a solution.** Calculate the volume of solution of known molarity required to make a specified volume of solution with different molarity (Example 4.11).
12. **Determining the amount of species by gravimetric analysis.** Given the amount of a precipitate in a gravimetric analysis, calculate the amount of a related species (Example 4.12).
13. **Calculating the volume of reactant solution needed.** Given the chemical equation, calculate the volume of solution of known molarity of one substance that just reacts with a given volume of solution of another substance (Example 4.13).
14. **Calculating the quantity of substance in a titrated solution.** Calculate the mass of one substance that reacts with a given volume of solution of known molarity of another substance (Example 4.14).



Department of Chemistry
Tentative Course Schedule
CHM 1220/1225 – Fall 2013

Class	Day	Date	Lecture Material (by Chapter)
1	W	August 28	Introduction and 7: Quantum Theory of the Atom
2	F	August 30	7
3	W	September 4	7
4	F	September 6	7/8: Electron Configurations and Periodicity
5	M	September 9	8
6	W	September 10	8
7	F	September 12	Exam I (Prerequisite material, 7, 8)
7	M	September 16	9: Ionic and Covalent Bonding
8	W	September 18	9
9	F	September 20	9/10
10	M	September 23	10: Molecular Geometry and Chemical Bonding Theory
11	W	September 25	10
12	F	September 27	Exam II (Chapters 9, 10)
13	M	September 30	11: States of Matter: Liquids and Solids
14	W	October 2	11
15	F	October 4	5: The Gaseous State
16	M	October 7	5
17	W	October 9	5/12: Solutions
18	F	October 11	12
19	M	October 14	12
20	W	October 16	12
21	F	October 18	Exam III (Chapters 11, 5, 12)
22	M	October 21	14: Chemical Equilibrium
23	W	October 23	14
24	F	October 25	14: Chemical Equilibrium
25	M	October 28	15: Acids and Bases
26	W	October 30	15
27	F	November 1	16: Acid- Base Equilibria
28	M	November 4	16
29	W	November 6	16:
30	F	November 8	Exam IV (Chapters 14, 15, 16)
LAST DAY TO WITHDRAW is November 9th			
31	M	November 11	6: Thermochemistry
32	W	November 13	6
33	F	November 15	18: Thermodynamics and Equilibrium

Class	Day	Date	Lecture Material (by Chapter)
34	M	November 18	18:
35	W	November 20	18:
36	F	November 22	19:Electrochemistry
37	M	November 25	19
38	M	December 2	19
39	W	December 4	Review
40	F	December 6	Exam V (Chapters 6, 18, 19)
41	M	December 9	Review

There are no classes Wednesday, November 27th through Saturday, November 30th, 2013.

The last day to withdraw is Saturday, November 9, 2013.

Study Day is Tuesday, December 10, 2013.

Cumulative Final Examination 10:40 a.m. – 1:10 p.m. Monday, December 16, 2013 100 General Lectures
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Department of Chemistry
CHM 1220/1225 – Fall 2013
Student Grade Record

Exams Record your exam scores here (150 each):

I	II	III	IV	V

ALEKS Objectives Record your scores here (5 points for each that is 80% or more and on time)

7.1	7.2	8.1	8.2	9.1	9.2	10	11	5.1	5.2	12	14.1	14.2	15.1	15.2	16.1	16.2	6.1	6.2	18.1	18.2	19.1	19.2

OWL Homework Record your scores here (5 points for each chapter on which you earned 80% or better score on time).

Intro to OWL	Ch 7	Ch 8	Ch 9	Ch 10	Ch 11	Ch 5	Ch 12	Ch 14	Ch 15	Ch 16	Ch 6	Ch 18	Ch 19

ALEKS Exam Assessments Record your score here (10 points)

#1	#2	#3	#4	#5

Add your Initial ALEKS Assessment (if completed by September 3, 2013)

_____ / 80

Add the sum of your ALEKS Objectives points

_____ / 115

Add the sum of your OWL Homework points

_____ / 70

Add the sum of your ALEKS Assessment points

_____ / 50

Add your participation points

_____ / 20

Add your five exams (note: percent on your final can replace your lowest exam)

_____ / 750

Add your final exam score

_____ / 300

Total points

_____ / 1465

Points	Grade	Points	Grade	Points	Grade	Points	Grade	Points	Grade
>= 93.00000%	A	>= 87.00000%	B+	>= 77.00000%	C+	>= 67.00000%	D+	< 60.000%	E
>= 90.00000%	A–	>= 83.00000%	B	>= 73.00000%	C	>= 63.00000%	D		
		>= 80.00000%	B–	>= 70.00000%	C–	>= 60.00000%	D–		

What is ALEKS?

Assessment and Learning in Knowledge Spaces is a Web-based, artificially intelligent assessment and learning system. ALEKS uses adaptive questioning to quickly and accurately determine exactly what a student knows and doesn't know in a course. ALEKS then instructs the student on the topics she is most ready to learn. As a student works through a course, ALEKS periodically reassesses the student to ensure that topics learned are also retained. ALEKS courses are very complete in their topic coverage and ALEKS avoids multiple-choice questions. A student who shows a high level of mastery of an ALEKS course will be successful in the actual course she is taking.

ALEKS also provides the advantages of one-on-one instruction, 24/7, from virtually any Web-based computer for a fraction of the cost of a human tutor.

Do I need to purchase access? What does it cost?

Your instructor arranged usage of this powerful software for you at no charge this semester 😊

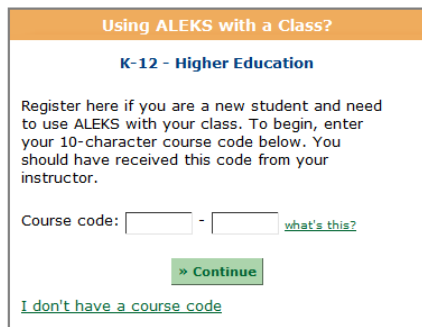
How do I log-in?

- 1) Go to www.aleks.com
- 2) Click on SIGN UP NOW!



The screenshot shows the ALEKS website homepage. At the top is the ALEKS logo and navigation links: LOGIN, ABOUT US, CAREERS, CONTACT US, NEWS, SUPPORT, DOWNLOADS, and social media icons. Below the logo is a search bar. The main content area is divided into sections. On the left, there's a 'REGISTERED USERS' section with fields for LOGIN NAME and PASSWORD, a LOGIN button, and a link for 'Forgot your login info?'. Below that is a 'NEW USER?' section with a 'SIGN UP NOW!' link. A red arrow points to this 'SIGN UP NOW!' link. To the right of the login section is a 'TO LEARN MORE:' section with links for 'Take the Tour' and 'Begin Free Trial'. Below that is a 'WHAT'S NEW:' section with links for 'ALEKS and MHE Join Forces', 'Create Custom ALEKS Reports', and 'K-12 Intervention Courses Now on the iPad'. The bottom of the page features three columns: 'HIGHER EDUCATION' (Instructors - Administrators), 'K-12' (Teachers - Administrators), and 'INDEPENDENT USE' (Parents - Students and Adult Continuing Educ. - Homeschoolers - Tutors). Each column has a brief description of the program and links for 'Free Trial', 'Success Stories', and 'Implementations'.

- 3) Enter Course Code: **E4WEY - G4WDK**



The screenshot shows the ALEKS registration page for K-12 - Higher Education. It has an orange header with the text 'Using ALEKS with a Class?'. Below the header, it says 'K-12 - Higher Education'. The main text reads: 'Register here if you are a new student and need to use ALEKS with your class. To begin, enter your 10-character course code below. You should have received this code from your instructor.' Below this text is a form for the 'Course code:' with two input fields separated by a hyphen, and a link 'what's this?'. Below the form is a green button with the text '» Continue'. At the bottom, there is a link 'I don't have a course code'.

4) Confirm you are in the right course.

[Confirm Enrollment Information](#)

You are about to register to use ALEKS in the following course. Please check the course details carefully. If the information is correct, click "Continue." If the information is incorrect, click "modify" to enter another course code.

Course:	Chem 1220/1225 (College)
Subject:	General Chemistry (First Semester)
Instructor:	Prof. Barber
School:	Wayne State University
	(modify)
» Continue	

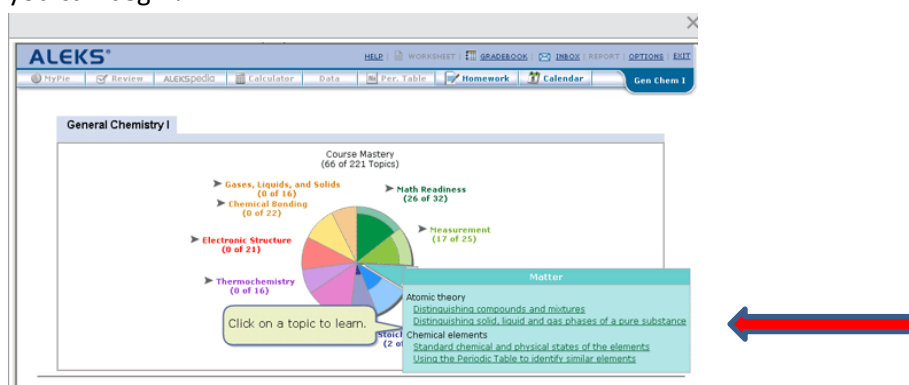
5) Fill out student information webpage

6) Take the Initial Assessment

- You will be asked to solve about 20-30 problems (this will take you anywhere from 30 to 90 minutes – at any time you can logout and log back on, it will keep your place).
- You'll get no help at all, nor should you try to find any. The idea is to find out where you should start learning, and you want ALEKS to get that just right. If you get your friend the chem grad student to help you, or do a lot of googling, you'll just end up with learning that is **way too hard and frustrating**, because you'll be missing important pre-requisites. **If you don't take the assessment seriously, you'll just end up wasting time on material you already know.**
- The assessment is over the entire first-year material, so you can expect to get problems you have no idea how to solve. Don't worry about that. This is a placement test, not a final exam. You're not going to be graded on it, and there's no reward for doing better or penalty for doing worse.

7) Learning Mode

- After the assessment, you will see your ALEKS "pie." This shows you what you already know, what you're ready to learn, and what topics you'll eventually need to learn, and by what dates.
- You can begin working on topics by scrolling over your pie slices, available topics will be hyperlinked and you can begin!



Having technical issues with accessing ALEKS?

DON'T contact Professor Barber or your TA,

DO contact tech support at ALEKS, they are very helpful, accessible and prompt!

Phone: (714) 619-7090

Email: contact us at <http://support.aleks.com>

Hours (Eastern Standard)

Sunday, 4:00 PM to 1:00 AM

Monday - Thursday, 7:00 AM to 1:00 AM

Friday, 7:00 AM to 9:00 PM

<http://login.cengage.com>

The screenshot shows the CengageBrain login page. The user is at the 'Enter Your Code or Key' step. The page has a header with the CengageBrain logo and navigation links. The main content area has a form with a text input field for the code, a 'Continue' button, and a 'Cancel' button. To the right of the input field is an example of a code and key: 'E-TWQN3SEENTXBB' and 'ABCD-2345-6789'. Below the input field is a link: 'I Don't Have an Access Code or Course Key'. The footer shows the copyright year 2013 and the Cengage Learning logo.

Course Key: E-TWQN3SEENTXBB

The screenshot shows the CengageBrain login page. The user is at the 'Confirm Course Information' step. The page has a header with the CengageBrain logo and navigation links. The main content area has a form with a text input field for the course key, a 'Continue' button, and a 'Cancel' button. To the right of the input field is an example of a course key: 'E-TWQN3SEENTXBB'. Below the input field is a link: 'I Don't Have an Access Code or Course Key'. The footer shows the copyright year 2013 and the Cengage Learning logo.

Note: Your e-mail address must use your WSU Access ID (username);
that is 2 letters, 4 numbers

The screenshot shows the CengageBrain login page. The user is at the 'Account Information' step. The page has a header with the CengageBrain logo and navigation links. The main content area has a form with fields for 'First Name', 'Middle Initial', 'Last Name', 'Email Address', 'Confirm Email Address', 'Choose a Password', 'Confirm Password', 'Security Question', and 'Security Answer'. A red arrow points to the 'Email Address' field, which contains the text 'USE WSU ADDRESS'. Below the 'Email Address' field is a link: 'I Don't Have an Access Code or Course Key'. The footer shows the copyright year 2013 and the Cengage Learning logo.



Student Registration Information

Course Enrollment

Begin by going to <http://login.cengagebrain.com>.

Don't Already Have an Account?

1. Click "Create an Account."
2. In the "Enter Code or Course Key" box, submit the course key: **E-TWQNSJLKCTL62**.
3. Provide the "Account Information" when asked.
4. You will land on the "My Home" page at cengagebrain.com, and you will see either an Open button or a Buy button.
 - a. Open = if the course has remaining "try before you buy" days
 - b. Buy = if the course does not have any such remaining days

Already Have an Account?

1. Provide your credentials and click the "Log In" button.
2. In the "Have Another Product to Register?" field, submit your course key: **E-TWQNSJLKCTL62**.
3. You will see a new book appear, with either an Open button or a Buy button.
 - a. Open = if the course has remaining "try before you buy" days
 - b. Buy = if the course does not have any such remaining days

Payment

After registering, you can buy access on myhome.cengagebrain.com (your least expensive option) or purchase an access code from your bookstore.

If you have any difficulties please contact Customer Support at www.cengage.com/support.