

CHM 1010

Prince George's Community College

FALL 2009

SECTION 11984 (LD05)

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To facilitate e-mail communication with me, please include the code **CCGP07** in either the subject or the first line of any e-mails to me during the fall 2009 semester. Use your Owl Mail e-mail address when sending messages to me.

**OFFICE HOURS:** Mon 9-11 AM, 1:30-2:30 PM; Wed 1:30-2:30 PM; Fri 10-11 AM and by appointment

**REQUIRED MATERIALS:**

\*Principles of General Chemistry, Silberberg, McGraw-Hill, 2007 (or another general chemistry textbook for reference)

\*Exploring the Chemical World, Gage/Sinex/Basili, 2003 version (lab manual is available to download: [http://academic.pgcc.edu/psc/chm101/exploring\\_chemical\\_world.htm](http://academic.pgcc.edu/psc/chm101/exploring_chemical_world.htm))

\*scientific calculator (TI-83 or TI-84 graphing calculator strongly urged; it will be used for lab and class assignments)

**What is This Chemistry Course Like?**

This section of CHM 101 will be structured differently than what you may expect. We want you to "discover" chemistry concepts through lab exploration and interaction with fellow students and the instructor. It is an exciting way to learn chemistry.

The *laboratory portion* of this course is time to discover chemistry concepts and practice science process and learn new skills. Many times concepts will be introduced and explored in the lab first. You will discuss what you see and do with other members of the class and the instructor. **You are responsible for all information learned here.** There are four labs that are designated as **performance labs**. On the days when you are engaged in a performance activity the instructor will be evaluating your understanding and skills. You generally work as an individual for these tasks.

The *lecture/discussion* portion of the course will have varied activities. Sometimes the instructor will provide information to extend or clarify what is learned in the laboratory. Sometimes you will engage in classroom activities that allow you to discover concepts in a way similar to your activities in lab. We will practice understanding through problem solving. You need to keep good notes on discussion from lab and lecture/discussion periods.

You are free to ask questions at anytime on material we are discussing or material related to it. Bring your calculator and text with you to class. Exams and quizzes will be given during the lecture/discussion time. We will use this time to go over assigned problems from the chapters in the text.

**How Will You Be Assessed?**

Below is a list of the assessments for this semester.

3	1 hour exams @ 100 points each	300 points
4	quizzes (best 4 of 5 will be counted) @ 25 each	100
1	comprehensive final exam	200
3	performance labs @ 75 points each	225
1	project	100
	attendance/participation/group work	<u>75</u>
	Total	1000 points

At the end of the semester, you will have the opportunity to make-up any ONE exam. If you miss an exam for any reason that will be the exam you will make-up. Since two quizzes will be dropped, there is no make-up for quizzes.

### **What Do You Need to Do to Be Successful In this Chemistry Class?**

Attend (in mind and body) all class sessions. Arrive on time and stay for the whole time. Experience shows that you will not be successful if you are not present. If you arrive late, let the instructor know so you can be registered as present.

- Read and use your syllabus packet. Not only does this provide the lab/discussion schedule but it also provides knowledge and process goals, and textbook problem assignments.
- Read the material in the textbook as it is covered in class. **Do the assigned questions at the end of each chapter as we finish the section. Don't wait until the end of the chapter or the night before the quiz or exam.** This is an excellent way of assessing your understanding of the concepts we have been covering.
- The labs you will be doing are inquiry-based. That means you are investigating, testing, challenging ideas, and learning rather than just following directions to verify something you already know. **Read the lab activity before coming to lab class so that you will be oriented to the task. Do any pre-lab questions before getting to lab.**
- Complete all assignments on time. Points are deducted for late assignments.
- **ASK** if you have a question. Don't wait for revelation... The sooner you address a problem, the easier it is to solve.
- Work with classmates to help clarify your thought processes and as practice.
- Maintain your success record. Use the chart you are given for assignments and point values. Keep it up to date and assess your status now and then.

### **What Do You Do If You Are Absent?**

Get notes from a classmate. If you have difficulty grasping a concept you missed come to office hours for a conference (however, please do not expect a private lecture).

If you are absent on the day of an exam with a documented excuse **YOU MUST CALL** as soon as you know you will be absent. A make-up exam will be scheduled for the end of the semester. No call, No make-up! *There are no make-ups for the performance labs.*

### **Where Can You Get Help?**

Your first and best source of help is your instructor! Make use of my office hours. If you cannot come during the scheduled times, talk to me and I will try to arrange an alternate time.

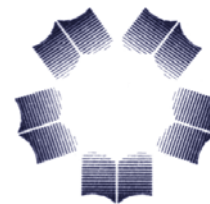
PGCC offers additional help at the Tutoring Center. You can schedule half hour appointments with tutors by phone or in person. Detail about the Tutoring Center appear later in this syllabus.

If you can, form study groups with your classmates. This is a great way to sharpen your thoughts and get practice in a less threatening way.

The Physical Science Department has a great web page filled with information and resources for students. There are downloadable handouts on using the graphing calculator and Excel, links to get to free software sites, career information, and much more. Be sure to go and take a look and make use of the resources at: [academic.pgcc.edu/psc](http://academic.pgcc.edu/psc).

Don't miss the science area computer lab, Chesapeake Hall 309, available to any science student when the lab is open (hours of operation will be posted throughout Chesapeake Hall).

## Some Information You Need to Know About the Science College Classroom at PGCC...



In the Science, Technology, Engineering, and Mathematics Division, we have sets goals toward excellence for our students, faculty, and programs. While you are in class it is important to focus on the tasks at hand and to make the environment safe and conducive to learning for everyone. To accomplish our goals, there are some assumptions and policies you should be aware of.

- You are an adult and it is assumed that you will act accordingly. This means being on time for class, conducting yourself appropriately while in class, being prepared for class (reading the syllabus/schedule), participating in course activities, completing assignments on time, and taking responsibility for your own performance. You may have a complicated life but you must earn a grade on merit, not on extenuating circumstances. Instructors will assist you within reason but you must take the initiative to seek help if needed.
- If you must leave a class early or miss class time, please let the instructor know. YOU are responsible for making up any missed material.
- PGCC has an "Academic Dishonesty" policy and unethical academic behavior (cheating, plagiarism, etc.) is not tolerated. There are serious ramifications for the student(s) involved.

### CODE OF CONDUCT

The Prince George's Community College Code of Conduct defines the rights and responsibilities of students and establishes a system of procedures for dealing with students charged with violations of the code and other rules and regulations of the college. A student enrolling in the college assumes an obligation to conduct himself/herself in a manner compatible with the college's function as an educational institution. Refer to the 2009-2010 Student Handbook, beginning on page 37, for a complete explanation of the Code of Conduct, including the Code of Academic Integrity and the procedure for dealing with disruptive student behavior.

### CODE OF ACADEMIC INTEGRITY

The college is an institution of higher learning that holds academic integrity as its highest principle. In the pursuit of knowledge, the college community expects that all students, faculty, and staff will share responsibility for adhering to the values of honesty and unquestionable integrity. To support a community committed to academic achievement and scholarship, the Code of Academic Integrity advances the principle of honest representation in the work that is produced by students seeking to engage fully in the learning process. The complete text of the Code of Academic Integrity is in the 2009-2010 Student Handbook (pages 39-41) and posted on the college's website.

- No food or drink is allowed in classrooms that serve as laboratories (all rooms on the 2<sup>nd</sup> and 3<sup>rd</sup> floors of Chesapeake Hall). Please observe this ban unless exceptions are approved by the instructor.
- Cell phones and beepers must be turned off or set to vibrate while in class. Only emergency calls can justify leaving a class in session. Phones cannot be used in the classroom during instruction of any type (lab, discussion, recitation, lecture).

## Additional Useful Information

### IMPORTANT DATES

No classes - College closed - Labor Day	Saturday-Monday, September 5-7
Last day to apply for fall graduation	Tuesday, September 15
Last day to change from "credit to audit" or "audit to credit" for full-semester classes	Friday, September 25
No classes - College Enrichment Day	Tuesday, October 27
Last day to withdraw from full semester classes	Friday, November 20
Advance registration for spring 2010	Monday-Wednesday November 30-December 2
Begin open registration spring 2010	Thursday, December 3

### DELAYED COLLEGE OPENINGS:

When the College announces a delayed opening, all classes with at least 45 minutes of class time remaining at the time of the opening will be held. For example, in the event of a 10 a.m. opening, a 9:30-10:45 a.m. class will be held. This procedure applies to all credit classes.

### COLLEGE RESOURCES and SERVICES

#### DISABILITY SUPPORT SERVICES

Students requesting academic accommodations are required to contact the Disability Support Services Office (B-124) or call (301) 322-0838 (voice) or (301) 322-0122 (TTY) to establish eligibility for services and accommodations. Students with documented disabilities should discuss the matter privately with their instructors at the beginning of the semester and provide a copy of their Student/Faculty Accommodation Form.

For many more college services and resources such as the Learning Resource Center and the Tutoring Center go to:

[http://academic.pgcc.edu/~bqage/Add\\_coll\\_info\\_094.pdf](http://academic.pgcc.edu/~bqage/Add_coll_info_094.pdf)

This schedule is subject to change based on contingencies such as weather. Exact dates for labs and assessments will be announced in class. If you are absent, be sure to check with the instructor or classmates to determine schedule changes or additions. **Always** have your laboratory manual with you in class.

Week/Dates	Lecture/Discussion Topics	Lab	Assessments
1 08/31-09/04	Introduction to Chemistry Measurement	Safety and Equipment Measurements	
2 09/09-09/11 No Class on 09/07	Properties and Classification of Matter Elements, Compounds, Mixtures	Looking at and Describing Matter Kinds of Matter Separations I	Quiz 1
3 09/14-09/16	Symbols, formulas Physical vs chem changes Conservation of matter Chemical Nomenclature	Surfaces, Graphing, Volume	Performance Lab #1
4 09/21-09/25	Chemical Reactions	Investigation of Chemical Reactions I	Quiz 2
5 09/28-10/02	The Mole Concept Stoichiometry	Moles. Molecules, Formulas	Exam 1
6 10/05-10/09	Energy	Ins and Outs of Energy in Systems	Quiz 3

Week/Dates	Lecture/Discussion Topics	Lab	Assessments
7 10/12-10/16	Atomic Structure and Periodic Trends	Spectroscopy Discovering Periodic Trends	Quiz 4
8 10/19-10/23	Bonding		Performance Lab #2
9 10/26-10/30	Molecular Geometry, VSEPR Hybridization	It's all in the Shape	Exam 2
10 11/02-11/06	Gas Laws	Behavior of Gases	
11 11/09-11/13	Intermolecular Forces Properties of Liquids and Solids	Uncovering Properties of Liquids and Solids	Quiz 5
12 11/16-11/20 <i>11/20 is the last day to withdraw</i>	Phase Changes		Performance Lab #3
13 11/23 No class on 11/25 and 11/27	Solutions	Investigating Solutions	
14 11/30-12/04	Solutions/Colligative Properties	Exploring Acids and Bases	Exam 3
15 12/07-12/09	Acids and Bases		
16 12/11			Final Exam 12/11 11:00 AM

**SUGGESTED TEXTBOOK READINGS AND PROBLEMS**  
**Principles of General Chemistry, Silberberg**

Below are suggested readings and practice problems at the end of chapters. The problems should be done at home after we complete the discussion of the material in class. Bring the worked problems to class on discussion days. You will not be graded on these but working on them greatly enhances your chances for success in CHM 101 and sometimes exam questions are selected (or modified) from these assignments.

TOPIC	CHAPTER	SECTIONS	PROBLEMS
Measurement	1	1.2-1.5	9-10, 14, 23, 29, 31, 42, 46, 48, 50, 54, 56
Characteristics of Matter and Atomic Structure (basic)	1	1.1	1, 3, 5
	2	2.1-2.5, 2.9	1, 4, 6, 7, 23, 25, 79, 82, 85, 104
Compounds and Nomenclature	2	2.7-2.8	42, 47, 59, 65, 69
Chemical Reactions	3	3.3	36, 37, 39
	4	4.1- 4.5	4, 5, 8, 23, 25, 27, 37
Moles	3	3.1-3.3	2, 6, 7, 9, 11, 13, 15, 17, 19, 24, 25, 27, 29, 31
Stoichiometry	3	3.4-3.5	41, 43, 45, 47, 49, 53, 59, 65, 67, 69
	4		13, 15
Energy in Chemical Processes	1	1.4	19, 34
	6	6.1-6.2, 6.4	3, 8, 10, 67
Atomic Structure (electronic)	7	7.1-7.4	1, 2, 7, 11, 15, 27, 38
	8	8.1-8.3	2, 21, 30, 31
Atomic Properties and Periodic Trends	8	8.4-8.5	8, 33, 34, 35, 39, 41, 43, 45, 47, 57, 74
Bonding	9	9.1-9.5	6, 8, 10, 12, 16, 18, 24, 28, 29, 43, 46, 48, 50, 52, 54
Molecular Geometry	10	10.1-10.3	1, 3, 5, 7, 9, 11, 17, 26, 28, 32, 34, 36, 38, 44, 51, 53
Hybridization	11	11.1-11.2	1, 5, 7, 9, 11, 20, 21
Gases	5	5.1-5.6	1, 4, 6, 8, 14, 16, 18, 20, 22, 24, 28, 31, 35, 41, 44, 48, 54, 57, 66, 71, 104

Phase Changes and Intermolecular Forces	12	12.1-12.3	1, 2, 4, 5, 7, 11, 14, 16, 24, 25, 28, 30, 32, 36, 38
Liquids and Solids	12	12.4-12.6	47, 51
Solutions	13	13.1-13.5	2, 4, 6, 8, 17, 29, 31, 41, 43, 45, 64, 66,
Acids and Bases	4	4.4	
	18	18.1-18.3, 18.8	4, 5, 16, 18, 24, 28, 32, 84, 88

## **GENERAL COURSE OUTCOMES FOR CHM 1010** (specific goals are listed after this page)

Upon successful completion of this course a student will be able to:

- perform, analyze, and report on a variety of laboratory measurements with appropriate precision and accuracy.
- collect, process, display, and evaluate data, employing scientific tools such as the graphing calculator, spreadsheet, and appropriate software.
- explain and analyze the energetics associated with physical and chemical processes.
- apply the correct chemical symbolism and nomenclature to chemical species and reactions.
- compare the characteristics and explain the behavior of matter on a microscopic scale; analyze ideal gas systems qualitatively and quantitatively.
- explain the concepts of chemical reactivity and apply these concepts to various chemical systems; determine the stoichiometry of reactions and apply it to chemical computations.
- characterize the components and structures of atoms on the basis of historical and modern research; analyze and explain atomic properties on the basis of periodic trends.
- explain the conditions and forces that govern chemical bonds and apply these concepts to the formation of bonds, electron arrangements and molecular geometries and in describing intermolecular interactions.
- characterize electrolyte and non-electrolyte solutions; determine the solubilities of solutes and the concentrations of solutions.

### **CHEMISTRY 101**

### **Knowledge and Process Goals**

Please note that specific goals are presented under the anticipated week of discussion or first exposure. As with all things in life, the timing is subject to change.

#### **WEEK 1:**

1. List and apply the steps in scientific investigation; articulate the purpose and nature of science and of chemistry in particular. Appreciate the role chemistry plays in the economy and everyday life (a goal that spans all weeks of the course).
2. Classify a statement as theory, belief, hypothesis, truth or fact.
3. Understand the nature of measurement, measurement standards and significant figures as measures of degrees of uncertainty. Appreciate the importance of measurement in all science. Know the metric units for length, volume, and mass. Be able to accurately measure these parameters for any object given measuring devices of varied precision. Distinguish

- between accuracy and precision. Perform unit conversions between English and Metric systems and within each system.
4. Distinguish among the terms mass, weight, volume, density. Determine the volume of regular and irregularly shaped objects. Define matter and give example of matter and non-matter.
  5. Perform density calculations (determine D, M or V given appropriate data). Understand the role of density in determining whether an object will sink or float in water. Know that objects that sink displace their own volume and object that float displace their own mass

### WEEK 2-3

1. Know the physical properties (state, color, odor, density, solubility, luster, hardness, malleability, ductility, melting and boiling points, conductivity of heat and electricity...) and chemical properties (does it react...) and appreciate their importance in chemistry. Classify property as chemical or physical.
2. Distinguish between physical and chemical changes, recognize each type, and give examples of each.
3. Know methods for separating mixtures and when they are appropriate. Design schemes for and perform separations on mixtures containing 2, 3 or 4 components.
4. Understand that mixtures can be separated by physical means whereas compounds require chemical means to separate and form them.
5. Understand the nature of an element, compound, mixture, atom, molecule or formula unit. Classify a substance as one of the above.
6. Know the chemical symbols and names for a list of common elements indicated by the instructor.
7. Interpret the information conveyed by a chemical formula (understand the meaning of subscripts and coefficients). Understand Law of Definite Proportions.
8. Understand the Law of Conservation of Matter and its implications in physical and chemical changes.
9. Know mass, location, and charge of three main sub-atomic particles. Know the meaning of and be able to determine atomic number, atomic mass, and mass number. Understand the concept of isotopes. Determine the number of each of the sub-atomic particles in a specific atom using atomic number, mass number, and/or the periodic table.
10. Distinguish among types of compounds from the formula and name the compound using IUPAC rules for nomenclature. Included in these compound types are: binary ionic, binary covalent, ionic containing polyatomic ions, binary acids, oxyacids. Write the formula for the above types given the name. Know the stock system and common names of certain common substances.
11. Know the names, formulas, and charges of common polyatomic ions from the list provided by the instructor.
12. Construct simple graphs that illustrate the response of one variable with change in another variable. Be able to assign values and properly space, label, and plot the data on the graph. Understand the concept of slope and its calculation. Relate the shape of a curve to the type of equation that describes the relationship between variables.
13. Be able to determine the regression equation that describes a set of data.

#### WEEK 4:

1. Understand chemical equations as representations of chemical changes. Be able to balance equations by inspection and explain the necessity for balancing them.
2. Distinguish among types of chemical reactions (synthesis (combination), analysis (decomposition), single and double replacement, redox). Be able to classify a reaction by type. Understand the nature of combustion. Interpret and use additional reaction symbolism (aq, l, s,  $\Delta$ ...)
3. Make reasonable predictions of products of single and double replacement reactions given reactants. Apply solubility rules to predict phases/states of reactants and products.

#### WEEK 5

1. Understand the concept of a mole.
2. Determine molar mass of an element or compound using a periodic table.
3. Solve problems involving percent composition using the mole concept.
4. Distinguish between empirical and molecular formulas. Determine empirical or molecular formulas given percentage composition by mass or actual masses of component elements of a compound and experimentally determined molar masses.
5. Use the mole concept to determine the mass of a single atom or molecule.
6. Understand the mole concept in relation to chemical equations. Perform mole to mole, mole to gram or gram to mole, and gram to gram conversions using stoichiometric relationships.
7. Understand the concept of limiting reactant and solve problem that involve a limiting reactant.
8. Use of the mole concept to determine theoretical yield or percentage yields.
9. Understand that a more active metal can replace a less active one in a compound. Use this information and observations of single replacement reactions to develop a reactivity series.

#### WEEK 6

1. Understand the concept of energy and the Law of Conservation of Energy.
2. Know the classes of energy - potential and kinetic- and give examples of each. Understand the interconvertibility of energy types.
3. Understand heat as a form of energy; know units of heat energy- joule, calorie. Recognize kilocalorie as related to food energy. Convert among energy units.
4. Distinguish between the terms heat and temperature.
5. Know and interconvert temperature scales of Fahrenheit, Celsius, and Kelvin.
6. Explain the relationship of heat content of matter to motion of particles. Know meaning of absolute zero.
7. Distinguish between exothermic and endothermic processes. Classify a reaction as endo- or exothermic based on  $\Delta H$ .
8. Understand and apply the concept of stability as related to low energy state.
9. Understand the concept of change in enthalpy and how to determine the energy transferred in a chemical process
10. Understand concept of activation energy and determine its value for a reaction from a reaction progress diagram.
11. Understand the concept of entropy.

## WEEK 7:

1. Know some of the historical aspects of the evolution of our knowledge of atomic structure. Know the atomic model as conceptualized by Bohr and begin an understanding of the modern concept of electron as wave and particle with supporting evidence.
2. Know the relationships among wavelength, frequency, and energy of electromagnetic radiation. Calculate any of these quantities given appropriate data.
3. Construct simple atom diagrams that include electron main energy levels for any atom.
4. Appreciate the development of the periodic table.
5. Know the contributions of Rutherford, deBroglie, Schoedinger, and Heisenberg to the quantum mechanical model of the atom.
6. Understand subshells and differentiate orbitals by energy and shape. Be able to write electron configurations ( $1s^2 2s^2 \dots$ ) and orbital diagrams for elements.
7. Explain the relationship between an element's electronic structure and its location in a "block" on the periodic table.
8. Know and explain the relationship between atomic structure and atomic radius and ionic radius (as periodic trends). Rank atoms and ions based on radius.
8. Understand the concept of ionization energy (potential) and explain the periodic trend in ionization energy (potential). Rank elements and ions based on ionization energies

## WEEK 8

1. Understand the concept of a chemical bond as a force between atoms in a compound (an intramolecular force). Relate the general concept of bond-making to stabilization by reduction of energy content. Relate addition of energy to bond-breaking. Know that atoms bond in order to become more stable.
2. Differentiate between covalent and ionic type bonds. Be able to draw simple atomic diagrams depicting the formation of each type of bond. Identify the bonding in compounds.
3. Relate stability of atoms and ions to octet rule.
4. Draw Lewis dot diagrams for elements.
5. Use Lewis dot diagrams to depict covalent molecules.
6. Relate number of atoms needed to achieve octet rule to chemical formulas.
7. Understand electronegativity and how it changes based on element position on the periodic table. Understand the concept of polar and non-polar bonds. Relate bond polarity to electron density. Determine and illustrate relative bond polarities.
8. Understand and depict double and triple bonds by dot diagrams.
9. Understand the concept of coordinate covalent bond.

## WEEK 9

1. Understand the meaning of VSEPR Theory and use the theory to explain molecular shapes. Given a formula, be able to predict and sketch a molecular model with correct geometry (linear, angular, trigonal planar, pyramidal, tetrahedral, trigonal pyramidal, trigonal bipyramidal, see-saw, T-shaped, square pyramidal, square planar, octahedral).
2. Understand the relationship of molecular shape (geometry) to polarity. Determine and illustrate the polarity of a molecule from bond polarities and/or dipole moments. Rank molecules based on polarity.

3. Utilize the Valence Bond Theory to explain what happens (hybridization) to electrons on a central atom of a compound or ion when bonding occurs. Predict hybridization patterns from molecular geometry.

#### **WEEK 10**

1. Know properties of gases (obtained through observation and manipulation) such as compressibility, indefinite shape and volume, that gases have mass, density is variable, gases flow, some are flammable. Understand through investigation the relationships among volume (V), temperature (T), pressure (P), and moles (n).
2. Relate particle motion to T and P
3. Solve problems involving V, T, P, density, molar mass and n using the combined and ideal gas laws. Understand the concept of standard molar volume.
4. Understand the conditions under which gas laws do not predict gas behavior (non-ideal behavior).
5. Understand the concept of partial pressure and its role in diffusion processes. Solve problems involving partial pressures
6. Know and apply the relationship between molar mass and rate of gaseous diffusion.

#### **WEEK 11:**

1. Understand and explain the origin of interparticle and intermolecular forces (IMFs) such as ion-ion, London, dipole-dipole, and hydrogen bonding. Explain the relation of IMFs to normal physical state at room temperature. Explain the change in strength of IMFs with change in molar mass, general molecular geometry, and polarity.
2. Distinguish between properties of gases, liquids, and solids, such as: compressibility, relative density, definite or indefinite volume, shape, and particle behavior.
3. Know and explain some of the special properties of liquids such as surface tension, wettability, ease of vaporization, and relative boiling points.

#### **WEEK 12**

1. Discuss the flow of energy and change in entropy in relation to phase change and describe changes in motion and relative distance of particles.
2. Distinguish among the terms heat of fusion (and crystallization), specific heat, heat of vaporization (and condensation). Understand that values are dependent on structure and molar mass.
3. Do calculations involving heat transfer during changes in phase of substances.
4. Understand the contiguousness of liquid and solid particles and the presence of vibrational but not translational motion in solids. Distinguish between amorphous and crystalline solids.
5. Distinguish between amorphous and crystalline solids; distinguish between particles at lattice points and relative melting points of ionic, covalent, molecular, and metallic crystals. Classify a crystal by type based on given characteristics.
6. Explain criteria for electrical conductivity and explain conductivity of metals and non-conductivity of other solids.
7. Understand vapor pressure, boiling point, and conditions that affect boiling point.
8. Explain in terms of an increase in entropy why phase changes requiring energy may occur.

### Week 13

1. Distinguish between types of mixtures with specific regard to particle size (suspensions, colloids, true solutions). Know properties and examples of each.
2. For true solutions, understand and be able to describe the process of solution making for soluble ionic and molecular solids. Explain energy transfer during the solution process. Distinguish between dissociation of ionic compounds and ionization of some molecular compounds. Relate ionization and dissociation to strong, weak, and non-electrolytes.
3. Know and solve problems using solutions concentration expressions, particularly % solution and molarity. Distinguish among dilute, concentrated, saturated, unsaturated, and supersaturated solutions. Be able to calculate number of particles (ions or molecules) in a given solution of known concentration. Calculate solution dilutions.
4. Explain changes in vapor pressure of a solvent with increase in solution concentration. Understand some additional colligative properties such as freezing point depression, boiling point elevation, and osmotic pressure.

### WEEK 14-15:

1. Distinguish between properties of acids and bases.
2. Explain Arrhenius acids and bases. Classify compounds as Arrhenius acids or bases.
3. Distinguish between strong and weak acids. Understand the ionization process. Write equations for the ionization of polyprotic acids.
4. Understand the Bronsted-Lowry definition of acids and bases. Classify compounds as Bronsted-Lowry acids or bases. Identify conjugate acid-base pairs.
5. Understand the Lewis definition of acids and bases. Classify compounds as Lewis acids or bases.
6. Distinguish between acidic and basic anhydrides, especially as an explanation for natural environmental problems.
7. Write balanced neutralization reactions.
8. Understand and write reactions of carbonates and bicarbonates as bases.
9. Understand the concept of pH. Calculate pH, pOH,  $[H^+]$  and  $[OH^-]$ .
10. Understand the concept of buffers. Write equations showing the response of buffers to the addition of acids or bases.

To compute your grade at any time:

$$\text{Your current grade (\%)} = (\text{Your total points} / \text{Total of highest possible to date}) \times 100$$

$$100-90\% = A \quad 89-80\% = B \quad 79-70\% = C \quad 69-60\% = D \quad \text{below } 60\% = F$$

Assessment	Highest Possible Points	Your Points	%
Quiz 1	25		
Quiz 2	25		
Quiz 3	25		
Quiz 4	25		
Quiz 5	(25)		
Exam 1	100		
Exam 2	100		
Exam 3	100		
<b>Drop the two lowest of the five quizzes from the total</b>			
Performance Lab 1	75		
Performance Lab 2	75		
Performance Lab 3	75		
Attendance/Participation	75		
Project	100		
Final Exam	200		
Total	1000		

**Note:** Do not make the mistake of averaging the %s for each assessment to arrive at your overall %. Not all assessments have equal weight and averaging the %s will give a false computation of your overall grade!