Syllabus (noun): summary outline of a course of study.

Course Description (from the Bulletin): This is the first semester of the 1-year Chemistry 105/106 course sequence, which is specifically designed to meet the needs of science majors and preprofessional students. Topics covered include: atomic theory, atomic and electronic structure, chemical bonding, mole concept, stoichiometry, states of matter, formulas and equations, solutions and colloids.

Prerequisites: Credit for or concurrent enrollment in Math 104, completion of, or placement in any higher math course.

Class meetings (weekly): 3 hr lecture; 1 hr discussion; 2 hr 10 min lab (5 credits total). Meeting times vary depending upon the section to which you are assigned (See the Course Schedule on pages 9 – 11).

Attendance policy: Students are expected to attend all of their scheduled class sessions. Students will be excused for illness, quarantine, family emergencies, and required University sanctioned activities. If you know about an absence ahead of time it may be possible to arrange an alternative time to make up any missed assignments. Please e-mail your instructors to arrange to make up assignments missed because of an excused absence.

Lecture instructor contact information:

Section A (A09C)	Dr. Yijun Tang	Halsey 442	424-7097	tangy@uwosh.edu
Section B (B09C)	Dr. Jonathan Gutow	Halsey 412	424-1326	gutow@uwosh.edu

Additional discussion and lab instructor contact information:

Sections	Instructor	Office	Phone #	Email Address
A03D	Dr. Jennifer Christus	Halsey 415 & 121	424-7101	schuttlj@uwosh.edu
A01D, A02D, A02L, B11L	Dr. Michael Foley	Halsey 440	424-1314	foleym@uwosh.edu
A03L, A04D, A04L, B10D	Dr. George Olsen	Halsey 444	424-2398	olsengp@uwosh.edu

Office hours: Any of the instructors in this course are happy to meet with you to answer questions related to the course, discuss study strategies, academics, your goals or life in general. All have regularly scheduled ‘drop-in’ office hours that will be posted in the course Canvas site. If you cannot make scheduled office hours, you can arrange an appointment by contacting the instructor you wish to meet.

Required course materials:

- *Textbook*: Chemistry: Atoms First 2e, Flowers et al. OpenStax. This textbook can be read online or downloaded as a pdf for free or purchased as a printed copy from the bookstore.
- *Lab Manual*: Chemistry 105 Lab Manual F23, Gutow & Tang. Available from the bookstore.

- *Online Homework*: ALEKS for general chemistry, McGraw-Hill, 1 semester access code required. Detailed instructions for registration provided separately.
- *Response System*: Registration with the PointSolutions (aka Turning and Echo 360) system. You can use a smartphone or purchase a response clicker. Detailed instructions for registration provided separately.
- *Goggles*: Indirect vented safety goggles (must bear the number Z87.1) are required. Available at the bookstore or from the UW Oshkosh Chemistry Club (sold at the Chemistry Stockroom HS-450). **No goggles? No lab!**
- *Calculator*: Any make with scientific notation, powers, roots, and logarithms. A graphing calculator is not necessary. Cell phones and other internet-enabled devices will not be allowed as calculators on tests and quizzes.

Course objectives and learning outcomes:

CHEM 105 General Chemistry I is an Explore/Nature course (XL) in the University Studies Program. The course meets chemistry requirements for students majoring in science or engineering, or in secondary education with a natural science emphasis, as well as for students preparing for healthcare programs including chiropracty, dentistry, medicine, nursing, pharmacy, physical therapy, and veterinary medicine.

As part of a liberal arts curriculum this course has a number of goals. The primary goal is to introduce students to the language and the elementary theories of chemistry, to provide training and practice in analytical reasoning and problem solving, and to serve as the basis for further studies in the sciences. This fits well into the liberal arts curriculum because it teaches skills which are generally useful and specific models that are widely applicable. Learning to use these models is extremely good practice for solving unfamiliar problems as well as thinking analytically, critically and creatively. A few of the things these models are used for are understanding the chemical reactions involved in living, the shapes of biomolecules, environmental issues such as climate change, developing new drugs, and designing solid-state electronics. After taking this course you should be able to:

1. Describe the make-up of matter in terms of its sub-atomic, elemental, and molecular composition.
2. Extract useful chemical information from the periodic table.
3. Use the results of quantum mechanics and models of chemical bonding to predict the structure and some properties of substances.
4. Use the concepts of atomic mass, molecular mass and concentration to quantify the amount of a substance in a sample.
5. Use abstract representations of chemical reactions combined with mathematical concepts to make qualitative and quantitative predictions and conclusions about the outcome of chemical reactions.
6. Describe the difference between real and ideal gas behaviors and perform quantitative calculations for gases that behave ideally.
7. Combine abstract representations of chemical reactions with thermodynamic information to quantitatively track energy flow and spontaneity in chemical reactions.
8. Describe how intermolecular forces impact phase transitions, solubility and adhesion.

9. Work cooperatively with others to critically analyze abstract and physical (laboratory) problems, as well as accurately record observations and data.

Course components:

Each week you will have at least five ways to learn chemistry. Success in this fast-paced and challenging course requires good attendance and a significant investment of time in addition to scheduled class hours. Remember that this is a 5 credit course, so will require almost twice as much work as a 3 credit course. Learning later material depends on understanding earlier material, so it is important to keep up. You should visit the instructors during office hours or make an appointment to clear up points of confusion or to explore topics beyond the scope of the class or textbook.

Homework:

You will get credit for work completed in ALEKS. ALEKS is an intelligent tutoring system that will help you efficiently practice chemistry problem solving. ALEKS will not make you work on topics you already know, but will require you to practice topics until you can reliably solve related problems. When you start using ALEKS you will take an adaptive quiz called an Initial Knowledge Check to determine what you already know/understand. Take this Initial Knowledge Check seriously so that you do not have to work on exercises for topics you have already mastered prior to this course. Based on your performance, ALEKS may assign you some math exercises, so you will be ready to do chemistry problems.

The ALEKS homework will be due twice a week. Each assignment is called an objective and consists of a number of topics to learn. Access to the next objective starts as soon as you complete the previous one. The material for each objective is too difficult to learn in one large chunk the night the objective is due. You should plan to work on ALEKS homework most days of the week. Most students that pass the course spend 4 – 8 hours spread throughout each week working in ALEKS. This work is often broken up into 20 – 40 minute blocks depending on available time and stamina.

Some objectives will be followed by Knowledge Checks. These will quiz you on topics you have already learned, to see if you have forgot any. ALEKS will help you review for the exams by adding any topics you have forgot back into your learning path. Topics that the Knowledge Check determines you have remembered are added to your list of mastered topics.

Open Pie periods allow you to work on any topic for which you have learned the prerequisite topics. Open Pie is a good time to go back to old topics you have not completed or to work ahead. There is also a review option that lets you practice topics you have mastered.

50% of your ALEKS grade is determined by the fraction of topics you learn by each objective deadline. 30% of your ALEKS grade is determined by the fraction of all the topics you learn (in your “pie”) by the end of the semester. 20% of your ALEKS grade is determined by the fraction of all the topics you master by the end of the semester. Therefore, it is to your advantage to take all Knowledge Checks and to continue working on topics you have not learned even after the topic due date has passed.

In addition to the required ALEKS homework you may find the end-of-chapter problems in the text useful additional practice for topics you want to work on more. Specific problems will be suggested in course Canvas site. Answers provided in an appendix of the text.

Reading/Studying:

Research on successful students shows that they do more than just the required homework. You should spend additional time reading the text, reviewing and annotating your notes, getting additional help on topics you do not understand, learning vocabulary, etc. Two key things that will make your studying more effective are to read the textbook sections and start the homework before the material is covered in class. This will make class time more useful to you by helping you focus on which topics confuse you and allowing you to ask better questions.

Discussion:

Discussion sections provide an opportunity to reinforce lecture material in a smaller group setting. Class time will be spent working in small groups on exercises provided by the instructor. Occasionally, new material will be presented, which will not be re-covered in lecture, but will be on the exams and homework. Credit for Discussion will be based on participation. Attendance and honest effort on the in-class exercises will earn a 100% for the day.

Lecture:

Lectures meet Tuesdays and Thursdays in HS – 109 from 9:40 – 11:10 A (Section A: Dr. Tang) or 1:20 – 2:50 (Section B: Dr. Gutow). In lecture you will listen to descriptions of important concepts, take notes, ask questions and use the response system to participate in interactive exercises. Make sure to bring your calculator and phone/clicker to each lecture.

Laboratory:

“Hands-on” laboratory work is an essential part of chemistry. In the lab you will experience directly some of the relationships discussed in the lecture, learn experimental techniques, and solve chemical problems. You will learn to use scientific instruments, and make careful observations. Bring your lab manual, goggles, and calculator to the laboratory. The chemistry laboratory can be a dangerous place. A strict dress code and other safety regulations will be enforced. See the lab manual for further details.

**Anyone who is pregnant or has a history of serious allergies MUST inform their laboratory instructor BEFORE entering the lab to do any work.

Peer Educator Sessions (optional):

A peer educator, a student who has successfully completed Chem 105 and 106, will offer optional problem-solving sessions. Times will be announced in class and provided in the course Canvas site.

Tutoring (optional):

The UW Oshkosh Center for Academic Resources offers free, confidential tutoring to all UWO students. CAR is located in the Student Success Center, suite 102. Check their website www.uwosh.edu/car for more information or to contact a tutor. Many students have used this in the past and found it extremely helpful!

Accommodations:

The University of Wisconsin Oshkosh supports the right of all enrolled students to a full and equal educational opportunity. It is the University’s policy to provide reasonable accommodations to students who have documented disabilities that may affect their ability to participate in course activities or to meet course requirements. Students are expected to inform instructors of the need for accommodations as soon

as possible by presenting an Accommodation Plan from either the Accessibility Center, Project Success, or both. Reasonable accommodations for students with disabilities is a shared instructor and student responsibility. The Accessibility Center is part of the Dean of Students Office and is located in 125 Dempsey Hall. For more information, email accessibilitycenter@uwosh.edu, call 920-424-3100, or visit the Accessibility Center Website.

Grading

Attendance: Regular attendance is essential to successfully passing the course. An unexcused absence during a scheduled laboratory, discussion or exam will result in a zero-point score for that laboratory, discussion or exam. **There are no makeups for exams**.

The reason for any **excused** absence from an exam, discussion, or laboratory session must be presented to your instructor (in advance if possible). Assignments and tests missed for a valid reason will not be counted against you, but you will be responsible for material covered in your absence. Advance notice of a pending absence will often make it possible to arrange for an alternate time for an exam or attendance in another lab or discussion section. **If you miss more than one exam for any reason, you will receive an incomplete or a failing grade depending on the circumstances.**

Grade Calculation:

Exams (4 exams).....52%
ALEKS Homework.....15%
Discussion (participation, two lowest dropped).....10%
Lecture Response Questions (1 pt ea up to 30 pts, ~50 pts available).....3%
Laboratory.....20%
Total 100%

Grading Scale

The minimum percentage necessary for each grade range is listed below. These cutoffs will not be adjusted upward, but the instructor reserves the right to lower them.

Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Minimum %	91	88	83	79	74	70	66	62	58	54	52	0

Grades will be posted in Canvas as they become available, so you may check your current course grade at any time during the semester. It is your responsibility to verify that all scores are entered properly. Misgraded assignments or exams must be returned to your instructor for possible regrading no later than one week following their return to you. You are responsible for checking that your final score is correct. Save all work until the final course grade has been determined.

Laboratory Grade

Laboratory work is completed in small groups to assist students in gaining teamwork and leadership skills. Points are earned through pre-lab assignments (Canvas quizzes due by 8A on day lab meets), short laboratory reports (generally completed during lab), and lab quizzes.

Attendance in laboratory is mandatory. Two unexcused absences from lab or a score of less than 50% in the laboratory component will result in a failing grade for this course, regardless of exam scores. If you miss a lab, you may attend another lab during the same week, if space allows. To attend another lab session, you must verify the switch with both your normal lab instructor and the instructor of the lab you will attend. Do not expect laboratory experiences to directly correlate with concurrent lecture topics.

Online Homework (ALEKS) Grade

The overall ALEKS grade will be calculated as: 20% for fraction of mastery of topics by the end of the semester; 30% for the fraction of topics learned (pie progress) by the end of the semester and 50% for fraction of topics completed by assigned deadlines.

Response System Questions Grade

You will receive one point for each question answered correctly; up to a maximum of 30 (at least 50 will be asked over the course of the semester).

Exam Grading, Schedule and Policies

Exams will be primarily multiple choice with no partial credit. Each exam will contain questions on material covered in the weeks preceding the exam. Much of the material in the class is cumulative, and you will need to use material tested on earlier exams to answer more sophisticated questions asked on later exams. Additionally, core topics from earlier exams will be reviewed on later exams. More information on the core topics can be found at the end of the syllabus.

Bring your own calculator for all exams. Exams 1-3 and Exam 4 Part 1 will 90 minutes each. The exams will be held over two days. You will take the exam either during your scheduled class time or at the Testing Center in the basement of Polk Library. You will need your student ID in order to take the exam at the Testing Center. Exam 4 Part 2 will be administered in HS-404 during your laboratory section the last week of the semester.

Dates, times, and information for the 90-minute exams:

	Classroom During Class Time	Testing Center (90 min between 8 AM-4:30 PM, Polk 2)	Number of Questions
Exam 1	Thursday, Sept. 28	Thursday, Sept. 28 or Friday, Sept. 29	30 (all new material)
Exam 2	Tuesday, Oct. 24	Monday, Oct. 23 or Tuesday, Oct. 24	35 (30 new material + 5 core topic review)
Exam 3	Thursday, Nov. 16	Thursday, Nov. 16 or Friday, Nov. 17	35 (30 new material + 5 core topic review)
Exam 4 Part A	Thursday, Dec. 14	Thursday, Dec. 14 or Friday, Dec. 15	30 (all new material)
Exam 4 Part B	During scheduled lab time (Dec. 11-15)	N/A	20 (all core topic review)

All exam questions are weighted equally. The computer scan sheets for multiple choice exams will not be returned to you. Make sure that you record your answers on the exam as well as the scan sheet. You must check the posted answer keys to verify that your score was entered properly.

No radios, MP3 players, headsets or other recording or transmitting devices may be used during exams. Caps with bills must have bills turned to back of head.

Early exams will be offered for students who cannot attend the exam during the scheduled day. Students who need to take an early exam must sign up with the instructor the week before the exam.

Course policies

Classroom Decorum:

Be courteous to your fellow classmates. While pertinent questions are encouraged, talking and whispering during lecture are disruptive and annoying to nearby students trying to listen to the lecture.

Cell Phones must be silenced and put away except when using them to respond to in-class questions. This means absolutely no "texting" during class.

Computers may be used to take notes, but do not use them for e-mail, videos, game playing, etc. during class as it is disruptive and annoying to nearby classmates trying to listen to the lecture.

E-mail etiquette:

Your instructors will happily respond to your emails as fast as they can. Please be sure to include "CHEM105:" at the beginning of your subject line, so that we know what the email is referring to. In the body include as much information as you can provide about what you are asking, and your name. Instructors will try to answer emails within 1 business day. If an instructor does not reply within 1 business day, there is a chance that they missed your email, so please forward the email again. We do not respond to emails that include "text speak".

Academic Misconduct:

The University of Wisconsin-Oshkosh is built upon a strong foundation of integrity, respect, and trust. All members of the university community have a responsibility to be honest and the right to expect honesty from others. Any form of academic dishonesty is unacceptable to our community and will not be tolerated.

As college students (and adults) you are expected to observe high standards of integrity and honesty. Representing the work of another as your own is considered academic misconduct. Any assignment (exams) which you are required to do individually should contain only your own work. Students caught cheating on exams, quizzes, or in the laboratory are subject to a grade of F for the assignment and a report being placed in their academic records. A second offense is likely to result in expulsion from the University. For more details see the information on the Dean of Students Office website and the portions of Wisconsin State Law referenced there.

Grading Errors:

To be considered for possible regrading any mistakes must be brought to the attention of your instructor within one week of the time the exam, quiz or project is returned to you.

Final Grade Check:

You are responsible for checking that your final score is correct. Save all papers, exams and quizzes until the final course grade has been determined.

Other Useful Information

RESPECTING THE DIVERSITY OF OUR COMMUNITY: Diversity drives innovation, creativity, and progress. At the University of Wisconsin Oshkosh, the culture, identities, life experiences, unique abilities, and talents of every individual contribute to the foundation of our success. Creating and maintaining an inclusive and equitable environment is of paramount importance to us. This pursuit prepares all of us to be global citizens who will contribute to the betterment of the world. We are committed to a university culture that provides everyone with the opportunity to thrive. Therefore, all members of our community are expected to treat each other with respect and apply intellectually rigorous critical analysis to all their interactions with others (e.g. activities, discussions, arguments, etc...).

STUDENTS RIGHT TO KNOW ACT OF 1990: Students are advised to see the following URL for disclosures about essential consumer protection items required by the Students Right to Know Act of 1990: https://uwosh.edu/financialaid/consumer-information/.

THERE ARE LOTS OF SUPPORT SERVICES ON CAMPUS: If you have an emergency, mental health issue, suffer harassment, have food insecurity, …, see the campus resources information in the class Canvas site.

Course Schedule

Lecture meeting times:

Section A	Dr. Tang	HS-109	T Th 9:40-11:10 AM
Section B	Dr. Gutow	HS-109	T Th 1:20-2:50 PM

Discussion meeting times:

Section	Instructor	Location	Wednesdays	Section	Instructor	Location	Wednesdays
A01D	Dr. Foley	HS 456	9:10-10:10	B08D	Dr. Gutow	HS 457	9:10-10:10
A02D	Dr. Foley	HS 456	10:20-11:20	B09D	Dr. Gutow	HS 457	10:20-11:20
A03D	Dr. Christus	HS 456	11:30 -12:30	B10D	Dr. Olsen	HS 457	11:30 -12:30
A04D	Dr. Olsen	HS 456	12:40-1:40	B11D	Dr. Gutow	HS 457	1:50-2:50

Lab meeting times (all meet in HS 404): Labs do not meet the week of September 4, 2023. Exam 4 Part 2 will be administered during your lab section the week of December 11, 2023.

Monday	Tuesday	Wednesday	Thursday
9:10-11:20 A A01L/Tang	10:20 A–12:30 P B08L/Gutow		10:20 A-12:30 P B09L/Gutow
11:30 A -1:40 P B10L/Gutow	12:40-2:50 P A02L/Foley		12:40-2:50 P A04L/Olsen
		3:00-5:10 P B11L/Foley	3:00-5:10 P A03L/Olsen

Important Dates

- ALEKS Initial Knowledge Check due before completing the ALEKS prerequisite review (due Monday, September 11th). To allow time to work on the prerequisite review try to complete the Knowledge Check by Thursday, September 7th.
- First labs meet week of Monday, September 11th.
- Exam Dates:

Thursday, Sept. 28 or Friday, Sept. 29
Monday, Oct. 23 or Tuesday, Oct. 24
Thursday, Nov. 16 or Friday, Nov. 17
Thursday, Dec. 14 or Friday, Dec. 15
During Lab week of December 11th

- Last date to drop this course without a Late Add/Drop Request Form: Friday, October 20, 2023. Students dropping the course must check out of lab before the drop is considered complete.

Topics List:

This summarizes the topics in the reading you should do before class and before attempting the associated homework. See the class schedule/calendar (next page) for the expected dates topics will be addressed in class.

Week Beginning	Topics (numbers are sections to read in OpenStax text)
Sep. 4	**1.1 – 1.3:** Chemistry in Context, Classification of Matter, Physical and Chemical Properties **2.1 – 2.4:** Atoms, Ions, Molecules
Sep. 11	**20.2, 20.4:** Introduction to Nuclear Reactions and Isotopes **3.1 – 3.4:** Light (electromagnetic energy), Electronic Structure of Atoms
Sep. 18	**3.4 – 3.7:** Periodicity, Intro to Ionic vs. Molecular Compounds **4.1 – 4.2:** Ionic and Covalent Bonding
Sep. 25	**4.3:** Naming Binary Compounds **1.4 – 1.6:** Measurements, Uncertainty, Significant Figures (Not on Exam 1) **7.1:** Balancing Chemical Reactions (Not on Exam 1)
Oct. 2	**6.1, 6.3:** Formula Mass, Molarity **7.2 – 7.4:** Chemical Reactions: Classification, Stoichiometry and Yields.
Oct. 9	**7.4, 7.5:** Yields, Quantitative Chemical Analysis **8.1, 8.2:** Gases, Ideal Gas Law
Oct. 16	**8.3, 8.5, 8.6:** Stoichiometry of Gas Mixtures and Reactions **4.4:** Lewis Structures
Oct. 23	**4.5, 4.6:** Formal Charge, Resonance, Molecular Shapes (VSEPR), Polarity
Oct. 30	**4.6:** VSEPR, Polarity **5.1 – 5.3:** Intro to Valence Bond Theory, Hybrid Orbitals, Multiple Bonds
Nov. 6	**9.1 – 9.3:** Chemical Energetics, Enthalpy
Nov. 13	**9.3:** Enthalpy **12.1 – 12.4:** Spontaneity, Entropy, Free Energy (Not on Exam 3)
Nov. 20	**12.1 – 12.4:** Spontaneity, Entropy, Free Energy
Nov. 27	**12.4:** Free Energy **10.1 – 10.2:** Intermolecular Forces, Liquid Properties
Dec. 4	**10.3 – 10.6**: Phase Transitions, Solids, Crystalline Solids
Dec. 11	**10.6:** Crystalline Solids

Course Calendar: *Bold face #'s are sections to read in OpenStax text (ideally before class).*

Week Beginning	ALEKS (Monday)	Lectures (Tuesday)	Discussion (Wednesday)	Lectures (Thursday)	ALEKS (Thursday)	Lab (Days vary)
Sep. 4	--	--	**1.2 – 1.3**	**1.1, 2.1 – 2.4**	Initial Knowledge Check	No Lab
Sep. 11	Prerequisite Review	**20.2, 20.4, 3.1, 3.2**	**3.2, 3.3**	**3.3, 3.4**	Obj 1	Check-in, Safety, Emission Spectra
Sep. 18	Obj 2	**3.4, 3.5**	**3.4, 3.5**	**3.6, 3.7, 4.1, 4.2**	Obj 3 open pie starts	Pre-lab due Periodic Properties
Sep. 25	Obj 4 Knowledge Check Due Tuesday	**4.3**	**1.6, 7.1**	EXAM 1 (through **4.3**)	Obj 5 open pie starts	Pre-lab due Measurements, Significant Figures & Density **1.4 – 1.6**
Oct. 2	Obj 6	**6.1, 6.3, 7.2**	**7.3, 7.4**	**7.2, 7.3, 7.4**	Obj 7 open pie starts	Pre-lab due Transformations of Copper 1
Oct. 9	Obj 8	**7.4, 7.5**	**8.1, 8.2**	***8.1, 8.2***	Obj 9 open pie starts	Lab Quiz 1 Transformations of Copper 2
Oct. 16	Obj 10	**8.3, 8.5, 8.6**	**4.4**	**4.4** Review	Obj 11 open pie starts Knowledge Check due Friday	Pre-lab due Acid Base Titration
Oct. 23	Obj 12 open pie starts	EXAM 2 (through **4.4**)	**4.5**	**4.5, 4.6**		Pre-lab due Gases
Oct. 30	Obj 13	**4.6**	**4.6, 5.1 – 5.2**	**5.1 – 5.3**	Obj 14 open pie starts	Pre-lab due Thermo 1
Nov. 6	Obj 15	**9.1 – 9.2**	**9.3**	**9.3**	Obj 16 open pie starts	Pre-lab due Thermo 2
Nov. 13	Obj 17 Knowledge Check Due Tuesday	**9.3** Review	**12.1 – 12.4**	EXAM 3 (through **9.3**)	Obj 18 open pie starts	Pre-lab due Absorption of light
Nov. 20		**12.1 – 12.4**	Thanks giving break			
Nov. 27	Obj 19	**12.4, 10.1**	**10.1**	**10.1 – 10.2**	Obj 20 open pie starts Knowledge Check due Friday	Pre-lab due Dyes and Intermolecular Forces
Dec. 4	Obj 21	**10.3 – 10.4**	**10.5, 10.6**	**10.5, 10.6**	Obj 22 open pie starts	Checkout LAB QUIZ 2
Dec. 11	Obj 23 Knowledge Check Due Tuesday	**10.6** Review	Review	EXAM 4 Part 1	Open pie continues until 12/17	EXAM 4 Part 2

Core Topics

The topics and skills listed below are fundamental to being able to use the material in this class in courses for which it is a prerequisite, in related areas such as biology and healthcare, and understanding how the physical world around you behaves. This is not a complete list of all the material you will learn about in this course. However, because they are important scaffolding for this and future courses, you will be tested on them repeatedly throughout this course.

Exams 2, 3 and 4 will contain questions reviewing core topics that were learned for previous exams. This will allow you to get credit for learning the topic later than the exam for which it was covered in class. Exam 4 will be in two parts: the first part will cover the new material since exam 3; the second part will have questions related to all the topics on this list, allowing you to earn credit for learning any core topics you missed earlier in the class.

Covered before Exam 1:

1. Use the periodic table to find information about an element's atomic structure and number of valence electrons.
2. Based on chemical formula, determine if a compound is ionic or covalent.
3. Starting with formula, determine charges in ionic compound.
4. Know the formulas and charges of common polyatomic ions. Recognize these in chemical compounds.
5. Know the formulas and names of common strong acids and bases.

Covered before Exam 2:

1. Know metric prefixes (mega, kilo, centi, milli, micro, nano) and calculate metric conversions (ex: milligram to kilogram).
2. Identify the number of significant figures/digits in a measurement and propagate significant figures/digits through calculations involving +, -, x and ÷.
3. Determine chemical formula from a skeletal structure.
4. Calculate molar mass based on chemical formula.
5. Interconvert mass and moles, labelling units correctly in calculation.
6. Interconvert Molarity and moles, labelling units correctly in calculation.
7. Dilution calculation (new concentration, final volume or solvent to add).
8. Write equations for acid-base and dissolution reactions.
9. Use the periodic table and oxidation number rules to assign oxidation numbers to atomic ions and elements in a compound. Note: for atomic ions the oxidation number and ionic charge are the same.
10. Balance a chemical reaction.
11. Use a chemical reaction to relate moles of reactants and products.
12. % yield calculations/limiting reagents.
13. Starting with chemical formula, draw Lewis structure.

Covered before Exam 3:

1. Determine the hybridization and VSEPR shape from a Lewis structure.
2. Identify π and σ bonds. Groups connected by only σ bonds can rotate relative to each other.
3. Thermodynamic calculations of ΔH^{o}_{rxn}, ΔG^{o}_{rxn} and ΔS^{o}_{rxn} from thermodynamic tables.

Covered before Exam 4:

1. Relationship of intermolecular forces to phase, viscosity and capillary rise.