**CHEM 1311 - Lower Division ACGM Spring 2012 Course Description**

Fundamental principles of chemistry for majors in the sciences, health sciences, and engineering; topics include measurements, fundamental properties of matter, states of matter, chemical reactions, chemical stoichiometry, periodicity of elemental properties, atomic structure, chemical bonding, molecular structure, solutions, properties of gases, and an introduction to thermodynamics and descriptive chemistry.

(*http://www.thecb.state.tx.us/aar/undergraduateed/workforceed/acgm.htm)*

**University of North Texas Course Description**

CHEM 1311 is the first in a two-course survey of general chemistry concepts.

Fundamental concepts, states of matter, periodic table, structure and bonding, stoichiometry, oxidation and reduction, solutions, and compounds of representative elements.

*(CHEM 1410: General Chemistry for Science Majors course description from the 2011-12 University of North Texas Course Catalog)*

**Hours of Credit:** Three (3)

**Required Co-requisite**

* CHEM 1111: General Chemistry I for Science Majors Laboratory must be taken concurrently.

**Suggested Co-requisite**

* MATH 2312: Pre-Calculus is strongly suggested to be taken concurrently.

**Prior Knowledge and Prerequisites**

* Prior to enrolling in this course, students must satisfy Texas Success Initiative (TSI) requirements set by the institution as described in Coordinating Board rule (Texas Administrative Code, Chapter 4, Subchapter C).
* MATH 1314: College Algebra is required.

Students who expect to be successful in CHEM 1311 should exhibit the following Texas College and Career Readiness Standards skills. Only the specific standards and performance expectations pertinent to the course are listed on the following pages.

**Science College and Career Readiness Standards**

1. **Nature of Science: Scientific Ways of Learning and Thinking**
2. Cognitive skills in science
3. Scientific inquiry
4. Collaborative and safe working practices
5. Current scientific technology
6. Effective communication of scientific information
7. **Foundation Skills: Scientific Applications of Mathematics**
	1. Basic mathematic conventions
	2. Mathematics as a symbolic language
	3. Understand relationships among geometry, algebra, and trigonometry
	4. Scientific problem solving
	5. Scientific application of probability and statistics
	6. Scientific measurement
8. **Foundation Skills: Scientific Applications of Communication**
	1. Scientific writing
	2. Scientific reading
	3. Research skills/information literacy
9. **Science, Technology, and Society**
	1. Interactions between innovations and science
	2. Social ethics
	3. History of science
10. **Cross-Disciplinary Themes**
	1. Matter/States of matter
	2. Energy (thermodynamics, kinetic, potential, energy transfers)
	3. Change over time/equilibrium
	4. Classification
	5. Measurements and models
11. **Chemistry**
	1. Matter and its properties
	2. Atomic structure
	3. Periodic table
	4. Chemical bonding
	5. Chemical reactions
	6. Chemical nomenclature
	7. The mole and stoichiometry
	8. Thermochemistry
	9. Properties and behavior of gases, liquids, and solids

**Mathematics College and Career Readiness Standards**

1. **Numeric Reasoning**
2. **Algebraic Reasoning**
3. **Measurement Reasoning**
4. **Probabilistic Reasoning**
5. **Statistical Reasoning**
6. **Functions**
7. **Problem Solving and Reasoning**

**Cross-Disciplinary Standards**

1. **Key Cognitive Skills**
	1. Intellectual curiosity
	2. Reasoning
	3. Problem solving
	4. Academic behaviors
	5. Work habits
	6. Academic integrity
2. **Foundational Skills**
	1. Reading across the curriculum
	2. Writing across the curriculum
	3. Research across the curriculum
	4. Use of data
	5. Technology

**Student Learning Objectives**

*(based on topics listed by the ACS Exams Institute)*

1. Students will be able to apply measurements, scientific notation and significant figure rules to all algorithmic-based problems.

2. Students will be able to perform all types of elementary conversions.

3. Students will be able to identify and describe matter and subatomic particles of isotopes.

4. Students will be able to write and be able to determine chemical/empirical formulas for most inorganic compounds and select groups of organic compounds.

5. Students will be able to name most inorganic compounds and select groups of organic compounds.

6. Students will be able to balance chemical equations and identify the major types of chemical reactions.

7. Students will be able to solve basic stoichiometry problems.

8. Students will be able to identify oxidation numbers of all atoms in common compounds.

9. Students will be able to identify the components contributing to the chemistry (solubility, acids/bases, etc.) of most compounds.

10. Students will be able to determine concentrations of various solutions considering molarity and molality with stoichiometric relationships.

11. Students will be able to solve thermochemical equations.

12. Students will be able to write electron configurations and understand basic quantum number rules.

13. Students will be able to differentiate between ionic and covalent bonding and know the identifying factors of each.

14. Students will be able to explain the periodic trends including, but not limited to, atomic radius, ionization energy, electron affinity, and electronegativity

15. Students will be able to draw Lewis structures, including isomers, resonance, and determine formal charges.

16. Students will be able to apply VSEPR theory to determine the electronic and molecular topology of simple compounds.

17. Student will be able to solve gas laws and gas stoichiometry problems.

18. Student will be able to describe common physical and chemical properties of solids, liquids, and gases.

19. Students will assess the concepts of intermolecular forces and how these forces affect structure and function of molecules

**Class Policies and Practices**

1. You should enroll in both lecture (with recitation) and a lab (with lecture). Students receive separate grades for the two courses. Dropping either course does NOT automatically drop a student from the other course.

2. Calculators are permitted for use in class and on exams. Calculators may never be shared during an exam.

3. By University regulations, a grade of “I” cannot be given as a substitute for a failing grade in a course.

4. There are no “extra credit” assignments given to an individual that are not available to the entire class.

5. Attend class—lectures and recitations, labs and lecture for labs. You are responsible for all information presented in class regardless of your attendance. Some of the information discussed in class is not in your textbook and you are still very much responsible for this information! No make-up work is provided. If you fail to attend an exam (regardless of excuse), the same percentage as your final exam grade will be calculated in its place.

**Study Groups**

You are strongly encouraged to form study groups. Practicing the language of chemistry by “talking” chemistry with others is a very easy and painless way to help you understand the concepts covered in this course.

### *Policy statements*

**ODA compliance:** In cooperation with the Office of Disability Accommodation (ODA) reasonable accommodations for qualified students with registered disabilities will be made. If applicable, please present your request, with written verification from the ODA, prior to the first exam

**Scholastic dishonesty:** The University expects every student to maintain a high standard of individual integrity for work done. Scholastic dishonesty is a serious offense, which includes, but is not limited to, cheating on a test or other class work, plagiarism (the appropriation of another’s work and the unauthorized incorporation of that work in one’s own work), and collusion (the unauthorized collaboration with another person in preparing college work offered of credit). In cases of scholastic dishonesty, the faculty member responsible for the class may initiate disciplinary proceedings against the student. In *this* class all UNT procedures will be followed and the necessary paperwork will be filed with the Dean of Students. In the case of an infraction, a penalty will be recommended by the professor of this course to the Dean of Students, who may impose an additional university penalty.

**Disclaimer: The professor of this course reserves the right to alter at any time any of the information presented on this syllabus at her discretion. If you are not in class, you may miss important information that directly affects your grade in this course!**

Grades are not wages. They are not intended to reflect how hard you worked or how good your intentions were. They are intended to reflect your mastery of the material relative to this class, other classes (elsewhere and else-when), and to reflect what I believe you ought to have achieved to attain a particular grade.

**Course Texts and Materials**

 1. Moore, Stanitski, and Jurs (2008). *Chemistry: The Molecular Science*,

 Third Ed. (iBook available from Thomson Learning)

 2. Scientific Calculator

**Grade Practices: Assessments and Assignments**

Keep all returned assignments in case there is any discrepancy regarding your final course grade! Your average is based on the number of points you receive out of the total possible points. Possible points will be obtained from your homework, exams, and other exercises when deemed appropriate.

Your letter grade in this course will be based on the following scale:

A = 90 – 100%; B = 80 – 89%; C = 70 – 79%; D = 60 – 69%; F < 60%.

**Approximate percentages:**

Homework (4 electronic assignments corresponding to the 4 unit exams): 20%

Quizzes (10 Blackboard quizzes over lecture material given during recitations): 15%

Exams (4 unit exams given during lecture): 40%

Cumulative Final Exam: 25%

**Method of Instruction**

1. Lecture – 75%
	1. Lecture is defined as a method of instruction in which the instructor has full responsibility for presenting material orally and visually.
	2. Lectures will take place in the form of formal lectures.
	3. Students will be expected to come to class ready to contribute to the class discussion.
	4. Students will be expected to listen and respond appropriately to each other’s comments.
2. Recitation – 25%
	1. Recitation is defined as a method of instruction in which students work in groups to discuss pertinent issues in chemistry and solve problems related to the current lectures for the week.
	2. All students participate in facilitating small group discussions during recitation time.
	3. Students are expected to attend recitation and are expected to be prepared with appropriate problem-solving tools on hand.
	4. Students are expected to work together as a team to answer questions or solve problems posed by the instructor.

**Class Schedule**

**General Chemistry I for Science Majors**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **General Chemistry ISLO #** | **OnlineAssignments** | **Textbook****Readings** | **Texas CCRSs CHEMISTRY** | **Supporting CCRSs** |
| **Lecture Topics** **(4 Weeks)** |  |  |  |  |
| **1.1 Matter****SLO 18** |  | 1.4-1.8 | **A. Matter and its properties****1. Know that physical and chemical properties can be used to describe and classify matter.****2. Recognize and classify pure substances (elements, compounds) and mixtures.****I. Properties and behavior of gases, liquids, and solids****1. Understand the behavior of matter in its various states: solid, liquid, gas.** | **PHYSICS****A. Matter****2. Understand states of matter and their characteristic.****4. Understand the concept of density.****CROSS-DISCIPLINARY THEMES****Classification****1. Understand that scientists categorize things according to similarities and differences.** |
| **1.2 History****SLO 14****SLO 18** |  | 1.9-1.12 | **C. Periodic table****1. Know the organization of the periodic table.** | **ENVIRONMENTAL SCIENCE****SCIENCE, TECHNOLOGY, and SOCIETY****C. History of science****1. Understand the historical development of major theories in science.****2. Recognize the role of people in important contributions to scientific knowledge.** |
| **General Chemistry I****SLO #** | **OnlineAssignments** | **Textbook****Readings** | **Texas CCRSs CHEMISTRY** | **Supporting CCRSs** |
| **1.3 Atomic Structure****SLO 3****SLO 13****SLO 18** | Quiz 1 | 2.1-2.2, 2.5-2.6, 2.9 | **B. Atomic structure****1. Summarize the development of atomic theory. Understand that models of the atom are used to help us understand the properties of elements and compounds.** | **SCIENTIFIC WAYS OF KNOWING AND LEARNING****Current scientific technology****1. Demonstrate literacy in computer use.****CROSS-DISCIPLINARY THEMES****Matter/states of matter****1. Know modern theories of atomic structure.****2. Understand the typical states of matter (solid, liquid, gas) and phase changes among these.** |
| **1.4 Significant Figures****SLO 1****SLO 2** |  | 2.4 |  | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).** |
| **1.5 Dimensional Analysis****SLO 1****SLO 2** | Quiz 2 | 1.4, 2.3 |  | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****PHYSICS****A. Matter****4. Understand the concept of density.** |
| **1.6 Nomenclature****SLO 5****SLO 8** |  | 3.1-3.3 | **F. Chemical nomenclature****1. Know formulas for ionic compounds.****2. Know formulas for molecular compounds.** | **SCIENTIFIC WAYS OF KNOWING AND LEARNING****E. Effective communication of scientific information****2. Use essential vocabulary of the discipline being studied.** |
| **1.7 Hydrocarbons****SLO 5** | Quiz 3HW 1 due | 3.4-3.6 | **J. Basic structure and function of biological molecules: proteins, carbohydrates, lipids, nucleic acids****1. Understand the major categories of biological molecules: proteins,** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****carbohydrates, lipids, and nucleic acids.** |  |
| **Exam 1**  |  |  |  |  |
|  |  |  |  |  |
| **Lecture Topics (4 Weeks)** |  |  |  |  |
| **2.1 Moles and Percentage Composition****SLO 1****SLO 2****SLO 4****SLO 5** |  | 2.7-2.8, 3.8-3.11, 4.7 | **G. The mole and stoichiometry****1. Understand the mole concept.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****and algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****2. Use a function to model a real-world situation.** **Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.** |
| **2.2 Balancing Equations****SLO 5****SLO 6****SLO 8** | Quiz 4 | 4.1-4.4 | **E. Chemical reactions****1. Classify chemical reactions by type. Describe the evidence that a chemical reaction has occurred.** | **CROSS-DISCIPLINARY THEMES****Measurements and models****1. Use models to make predictions.** |
| **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****2.3 Stoichiometry****SLO 1****SLO 2****SLO 5****SLO 6****SLO 7** |  | 4.5-4.6 | **G. The mole and stoichiometry****1. Understand the mole concept.****2. Understand molar relationships in reactions, stoichiometric calculations, and percent yield.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****2. Use a function to model a real-world situation.** **Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.** |
| **General Chemistry I****SLO #** | **Online****Assignments** | **Textbook****Readings** | **Texas CCRSs CHEMISTRY** | **Supporting CCRSs** |
| **2.4 Reactions****SLO 5****SLO 6****SLO 8****SLO 9** | Quiz 5 | 5.1-5.5 | **E. Chemical reactions****1. Classify chemical reactions by type. Describe the evidence that a chemical reaction has occurred.****2. Describe the properties of acids and bases, and identify the products of a neutralization reaction.****3. Understand oxidation-reduction reactions.** | **CROSS-DISCIPLINARY THEMES****Measurements and models****1. Use models to make predictions.****2. Use scale to relate models and structures.****3. Demonstrate familiarity with length scales from sub-atomic particles through macroscopic objects.** |
| **2.5 Solutions****SLO 1****SLO 2****SLO 5****SLO 7****SLO 9****SLO 10** |  | 3.7, 5.6-5.8 | **I. Properties and behavior of gases, liquids, and solids****1. Understand the behavior of matter in its various states: solid, liquid, gas.****2. Understand properties of solutions.****5. Know properties of liquids and solids.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****mathematical problem.****2. Use a function to model a real-world situation.****Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.** |
| **2.6 Thermochemistry****SLO 1****SLO 2****SLO 6****SLO 7****SLO 11****SLO 19** | Quiz 6 | 6.1-6.10 | **H. Thermochemistry****1. Understand the Law of Conservation of Energy and processes of heat transfer.****2. Understand energy changes and chemical reactions.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****2. Use a function to model a real-world situation.** **Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.****PHYSICS****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****Mechanical Energy****1. Understand potential and kinetic energy.****2. Understand conservation of energy.****PHYSICS****Thermodynamics****1. Understand the gain and loss of heat energy in matter.****2. Understand the basic laws of thermodynamics.****ENVIRONMENTAL SCIENCE****Energy****1. Understand energy transformations.****2. Know the various sources of energy for humans and other biological systems.****CROSS-DISCIPLINARY THEMES****Energy (thermodynamics, kinetic, potential, and energy transfers)****1. Understand the Laws of Thermodynamics.****2. Know the processes of energy transfer.** |
| **2.7 Review** | HW 2 due |  |  |  |
| **Exam 2** |  |  |  |  |
| **Lecture Topics (3 Weeks)** |  |  |  |  |
| **General Chemistry I****SLO #** | **Online****Assignments** | **Textbook****Readings** | **Texas CCRSs CHEMISTRY** | **Supporting CCRSs** |
| **3.1 Quantum** **SLO 12** |  | 7.1-7.5 |  | **PHYSICS****Oscillations and waves****3. Understand wave terminology: wavelength, period, frequency, amplitude.****CROSS-DISCIPLINARY THEMES****Matter/states of matter****1. Know modern theories of atomic structure.** |
| **3.2 Electron Configuration****SLO 12****SLO 14****SLO 15****SLO 16** | Quiz 7 | 7.6-7.13 | **C. Periodic table****1. Know the organization of the periodic table.****2. Recognize the trends in physical and chemical properties as one moves across a period or vertically through a group.** | **CROSS-DISCIPLINARY THEMES****Measurements and models****1. Use models to make predictions.****2. Use scale to relate models and structures.** |
| **3.3 Bonding****SLO 5****SLO 12****SLO 13****SLO 15** |  | 8.1, 8.3-8.7 | **D. Chemical bonding****1. Characterize ionic bonds, metallic bonds, and covalent bonds. Describe the properties of metals and ionic and covalent compounds.****F. Chemical nomenclature****1. Know formulas for ionic compounds.****2. Know formulas for molecular compounds.****I. Properties and behavior of gases, liquids, and solids****7. Describe intermolecular forces.** |  |
| **General Chemistry I****SLO #** | **Online****Assignments** | **Textbook****Readings** | **Texas CCRSs CHEMISTRY** | **Supporting CCRSs** |
| **3.4 Lewis Structures****SLO 5****SLO 8****SLO 12****SLO 13****SLO 15****SLO 16** | Quiz 8 | 8.2, 8.8-8.10, 9.1-9.2 | **J. Basic structure and function of biological molecules: proteins, carbohydrates, lipids, nucleic acids****1. Understand the major categories of biological molecules: proteins, carbohydrates, lipids, and nucleic acids.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****C. Understand relationships among geometry, algebra, and trigonometry****4. Understand basic geometric principles.****CROSS-DISCIPLINARY THEMES****Classification****1. Understand that scientists categorize things according to similarities and differences.** |
| **3.5 Hydridization****SLO 12****SLO 15****SLO 16** | Quiz 9HW 3 due | 9.3-9.6 |  | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****C. Understand relationships among geometry, algebra, and trigonometry****4. Understand basic geometric principles.** |
| **Exam 3** |  |  |  |  |
|  |  |  |  |  |
| **Lecture Topics (3 Weeks)** |  |  |  |  |
| **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****4.1 Gases****SLO 1****SLO 2****SLO 17****SLO 18****SLO 19** |  | 10.2-10.7 | **I. Properties and behavior of gases, liquids, and solids****1. Understand the behavior of matter in its various states: solid, liquid, gas.****3. Understand principles of ideal gas behavior and kinetic molecular theory.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and algorithms.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****C. Understand relationships among geometry, algebra, and trigonometry****2. Understand that a curve drawn on a defined set of axes is fully equivalent to a set of algebraic equations.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****2. Use a function to model a real-world situation.** **Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.** |
| **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****4.2 Partial Pressure****SLO 1****SLO 2****SLO 17****SLO 18****SLO 19** | Quiz 10 | 10.8-10.9 | **I. Properties and behavior of gases, liquids, and solids****4. Apply the concept of partial pressures in a mixture of gases.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****2. Use a function to model a real-world** **General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****situation.** **Communication and Representation****Language, terms, and symbols of mathematics****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.** |
| **4.3 Phases and Changes****SLO 10****SLO 18****SLO 19** |  | 11.1-11.6 | **I. Properties and behavior of gases, liquids, and solids****6. Understand the effect of vapor pressure on changes in state; explain heating curves and phase diagrams.****7. Describe intermolecular forces.** |  |
| **4.4 Heat Curves****SLO 1****SLO 2****SLO 18****SLO 19** | Quiz 11 | 11.7-11.9 | **I. Properties and behavior of gases, liquids, and solids****5. Know properties of liquids and solids.****6. Understand the effect of vapor pressure on changes in state; explain heating curves and phase diagrams.** | **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Basic mathematics conventions****1. Understand the real number system and its properties.****2. Use exponents and scientific notation.****3. Understand ratios, proportions, percentages, and decimal fractions, and translate from any form to any other.****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****4. Use proportional reasoning to solve problems.****5. Simplify algebraic expressions.****6. Estimate results to evaluate whether a calculated result is reasonable.****7. Use calculators, spreadsheets, computers, etc., in data analysis.** **FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****Mathematics as a symbolic language****1. Carry out formal operations using standard algebraic symbols and formulae.****2. Represent natural events, processes, and relationships with algebraic expressions and algorithms.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATICS****D. Scientific problem solving****1. Use dimensional analysis in problem solving.****FOUNDATION SKILLS: SCIENTIFIC APPLICATIONS OF MATHEMATIC****F. Scientific measurement****1. Select and use appropriate Standard International (SI) units and prefixes to express measurements for real-world problems.****2. Use appropriate significant digits.****3. Understand and use logarithmic notation (base 10).****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****MATHEMATICS STANDARDS** **Measurement Reasoning****Measurement involving physical and natural attributes****1. Select or use the appropriate type of unit for the attribute being measured.****Systems of measurement****1. Convert from one measurement system to another.****2. Convert within a single measurement system.** **Problem Solving and Reasoning****Mathematical problem solving****1. Analyze given information.****2. Formulate a plan or strategy.****3. Determine a solution.****4. Justify the solution.****5. Evaluate the problem solving process.****Real world problem solving****1. Formulate a solution to a real world situation based on the solution to a mathematical problem.****2. Use a function to model a real-world situation.** **Communication and Representation****Language, terms, and symbols of mathematics****General Chemistry I Online Textbook Texas CCRSs CHEMISTRY Supporting CCRSs****SLO # Assignments Readings****SLO #****1. Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem.****2. Use mathematical language to represent and communicate the mathematical concepts in a problem.****3. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing.****PHYSICS****Thermodynamics****1. Understand the gain and loss of heat energy in matter.** |
| **4.5 Applications** | HW 4 due |  |  |  |
| **Exam 4** |  |  |  |  |
|  |  |  |  |  |
| **Review (1 week)** |  |  |  |  |
|  |  |  |  |  |
| **Final Exam**  |  |  |  |  |

**Supplementary Materials**

1. Sample Exam One

2. Sample Exam Two

3. Sample Exam Three

4. Sample Exam Four

**Chemistry 1311 Sample Exam One**

*Remember: No work, no credit!*

 1. Chemistry is the study of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 2. Select the physical properties from the list below by placing an X in the preceding blank.

 \_\_\_\_\_ Malleability \_\_\_\_\_ Ferments

 \_\_\_\_\_ Explosive \_\_\_\_\_ Odor

 \_\_\_\_\_ Rusting \_\_\_\_\_ Color

 3. Identify the following as element (E), compound (C), homogenous mixture (S), heterogeneous mixture (M).

 \_\_\_\_\_ gasoline \_\_\_\_\_ granite \_\_\_\_\_ iron

 \_\_\_\_\_ caffeine \_\_\_\_\_ water \_\_\_\_\_ brass

 \_\_\_\_\_ air \_\_\_\_\_ sulfur \_\_\_\_\_ TNT

 4. Convert 12.6 ft to m. Put your answer in decimal notation. (1 in. = 2.54 cm; 1 ft = 12 in.)

 5. Identify the number of significant figures in the following measurements.

 \_\_\_\_\_ 1300 tons \_\_\_\_\_ 80. lb

 \_\_\_\_\_ 4004 mm \_\_\_\_\_ 2.2300 x 1023 amu

 \_\_\_\_\_ 1202 kg \_\_\_\_\_ 8.0860 mL

 \_\_\_\_\_ 000546 kg \_\_\_\_\_ 4.5600 g

 \_\_\_\_\_ 5 beakers \_\_\_\_\_ 4.67 x 10-2 mol

 6. A solid metal sphere has a volume of 8.2 ft3. The mass of the sphere is 355 lb. Find the density of the metal sphere in grams per cubic centimeter. Put your answer in scientific notation.

 7. Densities of gases are usually measured in grams per liter. Calculate the mass (in grams) of air given a volume 42.5 L, and a density equal to 1.1837 g/L.

 8. Perform the following operations, and put your answer in scientific notation.

 100. g - 25.5 g = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 170. g / (6.98 x 10-2 L) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 54.6 g / 9.0 mol = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 1.0456 cm × 10.0 cm × 2.5 cm = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 7.45 x 10-1 + 9.56 x 103 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_ 9. Who is known as the father of chemistry?

 A. Dalton

 B. Lavoisier

 C. Democritus

 D. Rutherford

\_\_\_\_\_ 10. Which element below does not exist?

 A. Cl

 B. Fl

 C. Tl

 D. Md

\_\_\_\_\_ 11. Identify the incorrect aspect of Dalton’s atomic theory.

A. All matter is composed of atoms, which are indivisible.

B. All atoms of different elements are different.

C. Atoms combine in small whole number ratios to form compounds of constant composition.

D. Under ordinary laboratory conditions, it is impossible to change the type of atom.

\_\_\_\_\_ 12. What discovery led to a revision of Dalton's atomic theory?

A. neutron

B. electron

C. hydrogen

D. X-rays

\_\_\_\_\_ 13. What discovery led to the altering of Dalton's atomic theory that stated, all atoms of the same element are the same?

A. electron

B. proton

C. isotopes

D. allotropes

14. Circle the correct choice of each of the following:

 The nucleus exists (inside or outside) the atom. The nucleus was found to be composed of two kinds of particles collectively called (protons, electrons, or nucleons). Protons have a charge of (+1, -1, or 0); electrons have a charge of (+1, -1 or 0). In an atom the number of protons (exceeds or is the same as) the number of electrons. The mass of the electron is (more, less, or the same) as the mass of the proton.

15. Complete the table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Element | Nuclear Symbol | Atomic number | Mass number | Number ofprotons | Number ofelectrons | Number of neutrons | Charge |
| carbon |  |  | 12 |  | 6 |  |  |
|  |  | 19 |  |  |  | 21 | 1+ |
|  |  |  |  | 17 | 18 | 18 |  |

16. Calculate the mass in grams (molar mass) for 1.98 x 10-4 mol of Cu2O.

17. Calculate the number of molecules (mx) for 1.98 x 10-4 mol of Cu2O. Put your answer in scientific notation. (1 mol = 6.022 × 1023 mx)

18. Would you need a truck to transport 4.0 × 1025 formula units of Ca(NO3)2? Support your answer, by solving for how many pounds of calcium nitrate you have. (453.6 g = 1 lb; 1 mol = 6.022 × 1023 formula units) *[Yes, I know that you've not seen the use of the term formula unit, but the beauty of using" railroad tracks" is that you can work the problem any way!]*

19. In four moles of Ca(NO3)2 how many moles of nitrogen are there? \_\_\_\_\_\_\_\_\_\_\_\_

20. In one molecule of Ca(NO3)2 how many atoms of O are there? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chemistry 1311 Sample Exam Two**

1. Name the following:

 a. S2F10 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. NO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. NH3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d. ClO- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 e. HSO4- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 f. CN- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 g. Ag3PO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 h. CoI3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 i. HNO3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 j. H3PO4 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 2. Give the formula for the following:

 a. carbonic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. sulfite ion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. hydrogen sulfide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 d. silver nitrite \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 e. nickel(II) carbonate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 f. sodium hydroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 g. hydroiodic acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 h. sulfuric acid \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 i. vanadium(V) fluoride \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 j. hydrogen hydroxide \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 3. Identify the strong acids from questions 1 and 2: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

4. Identify the weak bases from questions 1 and 2: \_\_\_\_\_, \_\_\_\_\_

 5. What are the molecular and empirical formulae of the following?

 Carbon = black

 Hydrogen = white

 Nitrogen = grey

Molecular: \_\_\_\_\_\_\_\_\_\_\_ Empirical: \_\_\_\_\_\_\_\_\_\_\_\_

 6. What is the common charge of each of the following?

 Atom of Na: \_\_\_\_\_ Ion of Ca: \_\_\_\_\_ Ion of Br: \_\_\_\_\_

 7. The formula of potassium sulfide is \_\_\_\_\_\_\_\_\_\_\_\_\_.

Name the cation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Name the anion: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Number of ions total: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Molar mass: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

8. Name Cu2Cr2O7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Which of the following describes the compound Cu2Cr2O7?

 Check all answers that apply.

 \_\_\_ The compound would conduct electricity if molten.

 \_\_\_ The compound would be expected to have a relatively low melting point.

 \_\_\_ The compound is molecular.

 \_\_\_ If the compound dissolved in water it would be a strong electrolyte.

 \_\_\_ The compound is ionic.

9. Perform a percentage composition for xenon trioxide.

10. A compound is found to contain 15.94% boron and 84.06% fluorine by weight. What is the empirical formula?

11. Write the thermochemical equation for the combustion of nonane by including energy (E).

12. The balanced chemical equations and identify the type of redox reaction:

 a. calcium hydroxide and hydrochloric acid

 Type of reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. hydrogen gas and iodine combine to make a compound

 Type of reaction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. What amount of moles does 4.00 g of sulfur hexafluoride represent?

14. For the following reaction, there is an excess of carbon dioxide allowed to react with 15.5 grams of potassium hydroxide. How many moles of potassium carbonate are formed?

 carbon dioxide(*g*) + potassium hydroxide(*aq*) → potassium carbonate (*aq*) + water (*l*)

15. Write the net ionic equations for the following:

 ammonium carbonate reacts with copper(II) nitrate.

Give the formula of the compound above that does not conduct electricity. \_\_\_\_\_\_\_\_\_\_

16. Given the following Pb2+ + Hg → Pb + Hg2+ use oxidation numbers to identify:

 element oxidized \_\_\_\_\_\_\_\_\_\_\_ reducing agent \_\_\_\_\_\_\_\_\_\_\_

 element reduced \_\_\_\_\_\_\_\_\_\_\_ oxidizing agent \_\_\_\_\_\_\_\_\_\_\_

17. Given the standard enthalpy changes for the following two reactions:

Zn(*s*) + Cl2(*g*) → ZnCl2(*s*)......ΔHºrxn = -415.0 kJ

Pb(*s*) + Cl2(*g*) → PbCl2(*s*)......ΔHºrxn = -359.4 kJ

 What is the standard enthalpy change for the reaction?

Zn(*s*) + PbCl2(*s*) → ZnCl2(*s*) + Pb(*s*)......ΔHºrxn = \_\_\_\_\_\_\_\_\_\_\_

 Is this reaction endothermic? \_\_\_\_\_\_ (Yes or No, choose one!)

18. Using standard heats of formation, calculate the standard enthalpy change for the following reaction. The following heats of formation are in kJ/mol.

H2S(*g*) + 2H2O(*l*) → 3H2(*g*) + SO2(*g*)

-20.6 -285.8 0 -296.8

 Is this reaction endothermic? \_\_\_\_\_\_ (Yes or No, choose one!)

19. The following thermochemical equation is for the reaction of methane(*g*) with water(*g*) to form hydrogen(*g*) and carbon monoxide(*g*).

CH4(*g*) + H2O(*g*) → 3H2(*g*) + CO(*g*) ΔHrxn = +206 kJ

 When 6.42 grams of CH4(*g*) react with excess H2O(*g*) how many kJ of energy is absorbed?

20. A solution is made by dissolving 10.9 g of methanol in enough water to make 240. mL of solution. What is the molarity of the methanol?

21. In an experiment, 40.00 mL of 0.100 M Pb(NO3)2 was mixed with 60.00 mL of 0.300 M NaCl, and a white precipitate of PbCl2 was formed. The precipitate was collected by filtration, dried, and found to weigh 1.068 g. (MW PbCl2 = 278.1 g)

 (a) Write the molecular, ionic, and net ionic equations.

 (b) Calculate the maximum amount of PbCl2 that could precipitate.

 (c) What is the name of the limiting reactant? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 (d) Calculate the percentage yield of PbCl2 in this reaction.

22. Burning of a 0.514 g sample of a C, H, and O containing compound from clover leaves produced the following masses: 0.501 g CO2 and 0.103 g H2O. What is the its empirical formula? The molar mass is 90.04 g. What is its molecular formula? Write a balanced combustion equation for the molecule. Draw the molecule.

**Chemistry 1311 Sample Exam Three**

1. Give the symbols of the two elements present in this star: \_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_.

 

 2. Use Planck’s equation to determine the energy, in J, of radiation of frequency 5.8 x 1015 s-1.

 E = hν (h = 6.63 x 10-34 J/Hz)

3. Draw a complete wave (on top of the one drawn) with lower amplitude and longer wavelength than the line drawn.



 Does the wavelength you drew have lower or higher energy than the one drawn? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 4. Waves can act as particles and particles can act as waves is known as the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

5. Einstein received his Nobel Prize in 1921 for: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 6. Atoms having minimal energy are in their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ state.

7. Energy levels higher than the minimal state are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

 8. The highest energy level of an atom’s electrons are in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ shell.

 9. Match the quantum number with the appropriate description (use the number in parenthesis).

 **Quantum Number Description**

 \_\_\_ *n* (1) spin

 \_\_\_ *l* (2) shape of sublevels

 \_\_\_ *ml* (3) number of energy levels

 \_\_\_ *ms* (4) orientation in space

10. What is the maximum number of orbitals possible for the 3rd energy level? \_\_\_\_\_

11. What is the maximum number of electrons possible for the 3*d* sublevel? \_\_\_\_\_

12. What is the maximum number of electrons possible for the 2*p* sublevel? \_\_\_\_\_

13. What is the maximum number of electrons possible for any orbital? \_\_\_\_\_

14. Identify the first and last elements, by their symbols, which can be represented by the following sets of quantum numbers:

 a. *n* = 1, *l* = 0 \_\_\_\_\_ and \_\_\_\_\_

 b. *n* = 3, *l* = 1 \_\_\_\_\_ and \_\_\_\_\_

 c. *n* = 4, *l* = 2 \_\_\_\_\_ and \_\_\_\_\_

15. Give symbols for two elements in the family that has their highest occupied energy level electron configuration represented by n*s*2n*p*3. \_\_\_\_ and \_\_\_\_\_

16. Match the shape with the appropriate sublevel.

 **SHAPE** **SUBLEVEL**

 \_\_\_\_ cloverleaf *f*

 \_\_\_\_ complex *d*

 \_\_\_\_ spherical *p*

 \_\_\_\_ dumbbell *s*

\_\_\_\_\_ 17. Identify the ion that has 36 electrons and a single negative charge, X-.

\_\_\_\_\_ 18. Identify the ion that has 22 electrons and has two positive charges.

\_\_\_\_\_ 19. Identify the element that has the electron configuration for the neutral atom is 1*s*22*s*22*p*4.

\_\_\_\_\_ 20. Identify the element that has the electron configuration for the neural atom is [Ar]4*s*23*d*104*p*6.

\_\_\_\_\_ 21. The electron configuration for the ion that has a single positive charge, X+, is 1*s*22*s*22*p*6 is?

\_\_\_\_\_ 22. Identify the ion that has the following electron configuration and a single positive charge, X+: 1*s*22*s*22*p*63*s*23*p*63*d*10.

\_\_\_\_\_ 23. Give the symbol for an anion isoelectronic with Ar.

\_\_\_\_\_ 24. Which of the following has a larger radius? Ca or Ca2+

\_\_\_\_\_ 25. Which of the following has a larger radius? Br or Br-

\_\_\_\_\_ 26. Which of the following has a larger electronegativity? F or Fr

\_\_\_\_\_ 27. Which of the following has larger ionization energy? F or Fr

\_\_\_\_\_ 28. Which of the following has larger electron affinity? F or Fr

\_\_\_\_\_ 29. Atomic radius increases from left to right across a period. T or F

\_\_\_\_\_ 30. Atomic radius decreases from top to bottom down a family. T or F

31. Elements in the same \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (choices: group or period) have similar chemical and physical properties.

32. For the following elements, give the electron configuration, orbital filling diagram, and electron dot (Lewis) structure. (Use the nuclear core method where appropriate.)

 **electron configuration orbital filling diagram Lewis dot structure**

 a. Mg

 b. Mo

 c. Sb

33. Identify the following as metals (M), nonmetals (Nm), or metalloids (L).

 \_\_\_\_\_ shiny, malleable, ductile

 \_\_\_\_\_ some are semi-conductors

 \_\_\_\_\_ dull, brittle in solid state

34. Which one of the following is an isomer of octane? Circle the isomers.



35. Draw the resonating structures for NO3-.

36. Draw the isomers for C4H10.

37. Place a directional arrow indicating the polarity () of each of the following bonded pairs of atoms and then circle the most polar.

I-F

I-Br

38. The following are ionic compounds. Give formula and draw their Lewis structures.

 a. sodium nitride: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. magnesium iodide: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

39. Predict the type of bonding [(A) metal (B) nonpolar covalent (C) polar covalent (D) ionic] that you would expect to find within each substance.

 Electronegativities: Br = 2.8, C = 2.5, Cl = 3.0, F = 4.0, Co = 1.7, K = 0.9, O= 3.5, S = 2.5

 (a) Co(*s*) (b) CoCl2(*s*) (c) CF4(*l*) (d) KCl(*s*) (e) Br2(*l*) (f) SO2(*g*)

 \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

40. Which of the following resonance structures are favored according to their formal charge? \_\_\_\_\_\_



41. Complete the chart below for glycine.



 molecular (mx) geometry mx bond angle hybridization

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_

42. What quantum numbers specify these subshells?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **6*s*** | **5*p*** | **3*d*** |
| ***n* =**  |  |  |  |
| ***l* =**  |  |  |  |

43. Which of the following structures obey the octet rule? Circle them.



44. Label these atomic orbitals according to the names of their shapes.

   

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

45. Of the molecules listed below (Q46), which has the greatest number of valence electrons? \_\_\_\_\_\_\_\_

46. Draw the following Lewis structures showing all bonding and nonbonding electrons. Give the hybridization, electronic shape, electronic bond angle, molecular shape, molecular bond angle, and tell whether it is a polar or nonpolar molecule.

 Lewis structure hybrid electronic shape and angle molecular shape and angle polarity

ONH

SiH4

TeF42-

NH3

SF4

HCN

BCl3

47. In the molecules and ions below identify the hybridization of the central atom.

 \_\_\_\_\_\_\_ **** \_\_\_\_\_\_\_

**** \_\_\_\_\_\_\_ **** \_\_\_\_\_\_

48. Give the hybridization around each carbon.

C 1: \_\_\_\_\_\_\_\_\_\_ C 2: \_\_\_\_\_\_\_\_\_\_ C 3: \_\_\_\_\_\_\_\_\_\_

49. In the molecules below identify the molecular (actual) shape.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

50. In the molecules below identify the electronic (predicted) bond angle.

 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

51. Label the following as cis or trans.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

52. Match the formula to the structure. Place the number of the structure to the left of the formula.



 Counting all the π bonds in all 5 structures above, how many π bonds are there? \_\_\_\_\_\_\_

 The ability of carbon to form long chains is called \_\_\_\_\_\_

**Chemistry 1311 Sample Exam Four**

When solving these problems, your answer must be in the form of Unknown = all the numbers you are either multiplying, dividing, etc. (e.g., V = )

 1. A sample of argon gas weighing 8.29 g occupies how many liters at 323 K and 2.30 atm? PV = nRT, R = .0821 

 2. Automobile air bags use the decomposition of sodium azide (NaN3) as their source of gas for rapid inflation:

 2 NaN3 (s) → 2 Na (s) + 3 N2 (g). What mass in grams of NaN3 is required to provide 50.0 L of N2 at 28 oC and 793 torr.

 (1 atm = 760 torr)

 3. Calculate the pressure of C2H2 that is collected over water at 25 °C when the atmospheric pressure is 768.8 torr? (The vapor pressure of the water at 25 °C is 23.8 mmHg.)

4. A mixture containing 0.568 mol He(*g*) and 0.133 mol Ar(*g*) is confined in a 7.00 L vessel at 25 °C. (a) Calculate the partial pressure of each of the gases in the mixture. (b) Calculate the total pressure of the mixture.

5. How many kilocalories of heat are required to change 22.0 g of ethanol at –50.0 °C to vapor at 100. °C? Also, you must draw a heating curve for ethanol at 1 atm and label all phase changes and the axes, and plot the melting and boiling points.

 GIVENS: 1.00 cal = 4.184 J, q = s m ΔT, q = m Hv, q = m Hf

 **specific heat capacities heats points**

 ethanol (*l*) = 27.0  Hv = 853  mp = -118 °C

 ethanol *(g*) = 15.7  Hf = 109  bp = 78 °C

 6. True (T) or False (F)

\_\_\_\_\_ Mixtures of gases are always heterogeneous.

\_\_\_\_\_ Particles of a sample of gases at the same temperature have the same average kinetic energy.

\_\_\_\_\_ Equal volumes of gases contain equal numbers of molecules at STP.

\_\_\_\_\_ The volume of a gas is inversely proportional to the number of moles.

\_\_\_\_\_ The volume of a gas is proportional to the absolute temperature.

\_\_\_\_\_ The volume of a gas is inversely proportional to the pressure.

\_\_\_\_\_ Partial pressure is the pressure a gas in a mixture would exert if it were alone in the container.

\_\_\_\_\_ In solids, the molecules have no translational freedom.

\_\_\_\_\_ In gases, intermolecular forces between molecules are weak.

\_\_\_\_\_ Gases have high density.

\_\_\_\_\_ Gases are easily compressible.

\_\_\_\_\_ Gas pressure is caused by gas molecules colliding with the container or surface.

\_\_\_\_\_ Gas pressure depends on the average kinetic energy of the particles.

\_\_\_\_\_ Temperature rises during a phase change.

\_\_\_\_\_ Water is symmetrical and therefore nonpolar.

\_\_\_\_\_ The heat of vaporization is always less than the heat of fusion of a given substance.

\_\_\_\_\_ The normal freezing point of water is 32 °C.

\_\_\_\_\_ The weaker the attractive forces the higher are the Hf and Hv.

\_\_\_\_\_ The attractive forces in solids are more than in the liquid.

\_\_\_\_\_ Above the critical temperature, no amount of pressure will liquefy the vapor.

\_\_\_\_\_ Changing from a solid to gaseous state without going through the liquid state is called melting.

\_\_\_\_\_ London dispersion forces are formed from attractions between polar molecules.

\_\_\_\_\_ Gas volume depends on the average temperature of the particles.

\_\_\_\_\_ To use the gas law formulas, temperatures must be in units of kelvin.

\_\_\_\_\_ For equal masses of ice and water, ice has the greater volume.

\_\_\_\_\_ For equal volumes of ice and water, water has the larger mass.

\_\_\_\_\_ Water expands when it freezes.

\_\_\_\_\_ Ice floats on water due to the formation of large hexagonal holes formed from ionic bonding.

\_\_\_\_\_ Water has a high relative viscosity when compared to molecules of similar mass.

\_\_\_\_\_ The best solvents for non-polar substances are other non-polar solvents.

7. Circle one choice for each part.

 a. At high altitudes, cooking time must be [increased, decreased].

 b. At high altitudes, the boiling temperature of water is [= 100, > 100, < 100] °C.

8. A gas is considered “ideal” if its temperature is \_\_\_\_\_\_\_\_\_\_\_\_\_ (high, low) and its pressure is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ (high, low). Choose one for each blank.

 9. The lowest possible temperature that can be reached is \_\_\_\_\_ K.

10. Match the instrument to its description.

 \_\_\_\_\_ a. measures blood pressure 1. barometer

 \_\_\_\_\_ b. measures atmospheric pressure 2. manometer

 \_\_\_\_\_ c. measures any pressure 3. sphygmomanometer

11. One mole of any gas at STP will occupy \_\_\_\_\_\_\_\_\_\_ L.

12. Water has several unusual properties that you would not expect for a molecule of its molecular weight. Why is this true? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

13. The scattering of light upon passing through a suspension is known as the \_\_\_\_\_\_\_\_\_\_\_\_ Effect.

14. Colligative properties depend upon the \_\_\_\_\_\_\_\_\_\_ of particles, not the \_\_\_\_\_\_\_\_\_\_ of particles.

15. When all three phases are in equilibrium with each other, the place on a phase diagram where they meet is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

16. At the critical temperature, you can make the vapor a gas by applying the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

17. Match the following types of solids to their description.

\_\_\_\_\_ a. high bp, dissolves in water, conducts 1. metallic solid

\_\_\_\_\_ b. low bp, doesn’t dissolve in water 2. diamond

\_\_\_\_\_ c. “sea of electrons”, conducts 3. Bucky balls

\_\_\_\_\_ d. very high bp, many bonds 4. covalent solid

\_\_\_\_\_ e. solid less dense than liquid, H-bonds 5. graphite

\_\_\_\_\_ f. allotrope of C, cage structure 6. covalent network solid

\_\_\_\_\_ g. allotrope of C, van der Waals forces 7. H2O

\_\_\_\_\_ h. allotrope of C, very strong 8. ionic solid

18. Given the following substances:

 4 moles of sugar, C12H22O11

 3 moles sodium bromide

 3 moles magnesium chloride

 Choose the one that will have the greatest effect on the melting point of water? For your CHOSEN solution, calculate the solution’s new boiling point. (kbp = 0.512 °C; kmp = 1.83 °C)

 The formula for the compound you chose was \_\_\_\_\_\_\_\_\_\_\_.

19. Fill in the blanks.

a. Larger attractive forces between molecules in a pure substance results in that substance having a [lower, higher] boiling point. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. Solutions that contain metal solutes and solvent are called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

c. Pure water is a [good, poor, non-] conductor of electricity. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d. When a non-volatile solute is added to a solvent, freezing points tend to [decrease, increase] and boiling points [decrease, increase]. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e. When one substance does not dissolve in another they are said to be \_\_\_\_\_\_\_\_\_\_\_\_\_.

f. Colligative properties are [physical, chemical] in nature. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

g. Intermolecular attractions are due to attractive forces between [opposite, like] charges. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

h. Pure crystalline substances have [ill, well] defined melting points. \_\_\_\_\_\_\_\_\_\_\_\_\_\_

i. In aqueous solutions, the solvent is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.