BROWARD COLLEGE
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Course Outline

Course Title: General Chemistry 1
Common Course Title: CHM1045
Effective Term: Fall 2017 (Aug 21, 2017)
Credit Hours: 3 Units

Next Review : Aug 1, 2020
Contact Hour Breakdown: *(Per 16 week Term)*
Total: 48
Lecture: Lab:
Clinic: Other:

Requirements

Pre-requisite(s) with minimum grade required
MAC1105 (C)
AND
Pre/Co-requisite(s) with minimum grade required
CHM1045L (C)

Course Description:

This is the first course in a two semester sequence, CHM1045 and CHM1046. This sequence includes two laboratories: CHM1045L to be taken concurrently with CHM1045 and CHM1046L to be taken with CHM1046. This sequence is for students who have already had high school chemistry. Topics covered include: chemical measurements, stoichiometry, atomic structure periodic table, chemical bonding, inorganic compounds, nomenclature, formula writing, gases, liquids, solids, solutions acid-base chemistry and ionic reactions and some descriptive chemistry of non-metals. To enroll, it is strongly recommended that students have had previous chemistry at the high school or college level. If a student has not had prior experience in a chemistry course the CHM1040/CHM1041/CHM1046 sequence is highly recommended.

Course Outline

UNITS

Unit 1 : Reading and Writing in Chemistry

General Outcome
1.0 The student shall be able to clearly communicate in writing information derived from course related readings about the major concepts and themes in the chemical sciences.

Specific Learning Outcomes
1.1 Demonstrate in writing the ability to analyze, evaluate, compare, and/or extract data relevant to chemistry from course related readings.
1.2 Evaluate the validity of information from a variety of sources, including but not limited to such sources as electronic, print sources, and data bases.
1.3 Demonstrate with the use of equations, diagrams, drawings, concept maps, and/or other methods the connections among chemical concepts.
1.4 Demonstrate the ability to use the appropriate technology to carry out course requirements.

Unit 2 : Introduction and Measurement

General Outcome
2.0 The student shall be able to demonstrate knowledge of the nature of chemistry; its classification, properties, types of changes of matter, and scientific measurements.

Specific Learning Outcomes
2.1 Define chemistry and evaluate its modern applications and impact on complex systems such as the environment, medicine, industry, and technology.
2.2 Distinguish among factual data, laws, theories, and hypotheses in the scientific method to create knowledge and solve problems that benefit humanity and its environment.
2.3 Differentiate between pure substances and mixtures, and correctly use specific terms such as elements, compounds, atoms, molecules, homogeneous, heterogeneous, phases and solutions.
2.4 Interpret chemical symbols and formulas, in order to determine the information they convey.
2.5 Differentiate between chemical and physical properties and changes, and between intensive and extensive properties.
2.6 Perform calculations using scientific notation and significant figures and to analyze their answers for correctness.
2.7 Distinguish and apply the common metric/SI units for mass, length, volume, and energy and the prefixes from tera- through pico-.
2.8 Perform conversions among metric units and between certain English and metric units using dimensional analysis and analyze their answers for correctness.
2.9 Interconvert temperatures among Celsius, Fahrenheit, and Kelvin scales.
2.10 Read with critical comprehension experimental data to solve problems involving density and specific gravity; analyze and interpret their answers for correctness.

Unit 3 : Atomic Structure and Periodicity

General Outcome
3.0 The student shall be able to describe the structure and components of atoms and apply these concepts to the information contained in the Periodic Table, as well as construct knowledge of present day models from classical experiments.

Specific Learning Outcomes
3.1 Analyze the historical development of the atomic concept leading to the modern view of the atom.
3.2 Differentiate the fundamental sub-atomic particles and their properties.
3.3 Apply the mass number and atomic number to determine the number of protons, neutrons and electrons in a given nuclide.
3.4 Explain the basis of the atomic mass system and calculate atomic masses from isotopic masses and abundances.
3.5 Identify the regions of the electromagnetic spectrum and perform calculations involving frequency, wavelength and energy.
3.6 Interpret the four quantum numbers and relate them to the electronic structure of the atom.
3.7 Formulate and write electronic configurations utilizing Pauli's Exclusion Principle, the Aufbau Principle, and Hund's Rule.
3.8 Write valence electron configurations and use orbital diagrams to predict paramagnetism, diamagnetism, and bonding behavior.
3.9 Employing the Periodic Law, analyze the Periodic Table to interpret terms such as period, group, representative or main group elements, and transition and inner transition elements.
3.10 Categorize elements in the Periodic Table as metals, non-metals, or metalloids, and compare and contrast the general properties of these classifications.
3.11 Use the Periodic Table to predict trends in ionization energies, electron affinities, electronegativities, and atomic and ionic sizes.

Unit 4 : Bonding

General Outcome
4.0 The student shall be able to explain concepts of ionic and covalent bonding, including the ability to predict formulas, molecular shapes and infer properties due to shape, such as polarity.

Specific Learning Outcomes
4.1 Differentiate between ionic and covalent bonding modes, and compare and contrast the properties of ionic and covalent substances.
4.2 Predict which combinations of elements tend to bond ionically and which tend to bond covalently.
4.3 Use the concept of valence electrons and the octet rule to construct ions and molecules from atoms. Write Lewis structures for those ions and molecules.

4.4 Write resonance contributing forms and calculate formal charges.
4.5 Apply the valence shell electron pair repulsion theory (VSEPR) to predict shapes of molecules from molecular formulas.
4.6 Predict the presence and direction of dipoles in covalent molecules.
4.7 Apply the valence bond theory to account for hybrid orbitals, multiple bond formation, and molecular geometry as predicted by VSEPR.
4.8 (Optional) Apply the molecular orbital theory to write MO configurations for molecules and to calculate bond order.

Unit 5 : Inorganic Formula Writing and Nomenclature

General Outcome
5.0 The student shall be able to write formulas and name common ionic and covalent substances.

Specific Learning Outcomes
5.1 Determine charges of ions from ionic formulas.
5.2 Write the name, formula, and charge for mono- and polyatomic ions. At a minimum, the following ions should be covered: Li+, Na+, K+, Mg2+, Ca2+, Ba2+, Al3+, O2 , S2 , F , Cl , Br , I , Ag+, Zn2+, Cu+, Cu2+, Fe2+, Fe3+, NH4+, H3O+, OH , SO42 , CO32 , HCO3 , PO43 , HPO42 , H2PO4 , and NO3 .
5.3 Compose the formula and write the name for simple ionic and covalent compounds.

Unit 6 : Stoichiometry

General Outcome
6.0 The student shall utilize the concept of the mole to evaluate numerical relationships involving formulas and balanced equations.

Specific Learning Outcomes
6.1 Illustrate the relationship between Avogadro's number and formula weights (molar mass) of elements and compounds.
6.2 Identify the seven elements that exist as diatomic molecules in their elemental state.
6.3 Apply dimensional analysis to interconvert between the mass of a given substance and the corresponding number of moles.
6.4 Calculate the percent composition of a compound from its formula.
6.5 Read with critical comprehension quantitative analytical data required to calculate the empirical and molecular formula of a compound.
6.6 Balance chemical equations utilizing the mole concept.
6.7 Given a balanced equation construct a diagram to demonstrate the relationship between the number of moles and grams for various substances in a chemical equation. Use those relationships to calculate specific quantities of reactants and/or products involved.
6.8 Evaluate the limiting reagent in a given chemical reaction based on previous stoichiometric calculations involving that reaction.
6.9 Calculate the theoretical yield in a chemical reaction. Determine the percentage yield of a chemical reaction based on quantitative experimental data.

Unit 7 : Gases

General Outcome
7.0 The students shall be able to compare properties and behavior of gases and perform calculations using the gas laws.

Specific Learning Outcomes
7.1 Read experimental data in order to solve problems that involve the application of the gas laws, using the appropriate units.
7.2 Differentiate between ideal and non-ideal gas behavior through the application of the ideal gas law and the Van der Waals equation.
7.3 Evaluate experimental parameters and complete stoichiometric calculations that involve volumes of gaseous reactants and products.
7.4 Analyze the kinetic-molecular theory to construct the gas laws and the general properties of gases, liquids and solids.

7.5 Evaluate the chemistry of the atmosphere. The evaluation can include the composition of the atmosphere, common pollutants, their sources, and environmental effects, as well as the impact of human endeavors on this complex system.

Unit 8 : Liquids and Solids

General Outcome
8.0 The students shall be able to construct and describe the properties of the liquid and solid states.

Specific Learning Outcomes
8.1 Compare and contrast the various intermolecular attractions in liquids and solids and describe their relative strengths.
8.2 Assess molecular packing or intermolecular attractions to demonstrate the general properties of liquids and solids.
8.3 Describe the energy associated with changes in state.
8.4 Differentiate the relationships among temperature, vapor pressure and boiling point.
8.5 Distinguish between amorphous and crystalline solids.
8.6 Evaluate the characteristics of molecular, covalent, ionic and metallic solids.
8.7 Interpret phase diagrams.

Unit 9 : Solutions

General Outcome
9.0 The students shall be able to analyze and evaluate qualitative and quantitative concepts involving solutions.

Specific Learning Outcomes
9.1 Compare the properties of suspensions, colloidal dispersions, and true solutions.
9.2 Describe the processes involved in the formation of solutions.
9.3 Examine and describe the energy changes that are involved in the solution process.
9.4 Assess the effects of changes in temperature and pressure on solubility.
9.5 Read and comprehend experimental data to facilitate the solving of quantitative problems dealing with concentrations of solutions and colligative properties.

Unit 10 : Acid, Bases and Salts

General Outcome
10.0 The students shall be able to compare and contrast the properties, definitions and reactions of acids, bases and salts.

Specific Learning Outcomes
10.1
10.2 Differentiate between the terms strong, weak , and non-electrolytes.
10.3 Compare and contrast the concepts of the Arrhenius, Bronsted-Lowry and Lewis definitions of acids, bases and their reactions.
10.4 Evaluate solubility rules to determine if a specific compound is soluble in water.
10.5 Propose the products of double displacement reactions and write balanced ionic equations.
10.6 Diagram the acid/base titration process and perform calculations related to titrations using experimental data.

Unit 11 : Oxidation-Reduction

General Outcome
11.0 The students shall be able to identify and evaluate information regarding oxidation-reduction chemical reactions.

Specific Learning Outcomes
11.1 Recognize equations as oxidation-reduction and identify oxidizing and reducing agents in the equations.
11.2 Write balanced oxidation-reduction chemical equations.
11.3 Determine experimental parameters, such as concentration, from quantitative experimental data of oxidation-reduction titrations.

11.4 Analyze the activity series and propose the outcome of single displacement reactions based on this information.

Unit 12 : Descriptive Chemistry: Non-Metals

General Outcome
12.0 The students shall be able to compare and contrast the common non-metallic elements and their chemistry.

Specific Learning Outcomes
12.1 Analyze the periodic table of elements and distinguish which are elements classified as non-metals.
12.2 Discuss the relative abundance and major forms of occurrence for important non-metals.
12.3 Illustrate the properties and write out the major reactions of the major non-metallic elements.