CHEM-101H: HONORS INTRODUCTION TO INORGANIC CHEMISTRY

Cuyahoga Community College

Viewing: CHEM-101H : Honors Introduction to Inorganic Chemistry

Board of Trustees:
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Academic Term:
Fall 2021

Subject Code
CHEM - Chemistry

Course Number:
101H

Title:
Honors Introduction to Inorganic Chemistry

Catalog Description:
Introduction to the fundamental principles of chemistry including states of matter, atomic structure, bonding, chemical reactions, thermodynamics, ionization, equilibria, gas laws, solutions, acid-base chemistry, and nuclear chemistry. The principles of chemistry will be applied to medicine, nutrition, and the environment. Laboratory work will illustrate chemical theories.

Credit Hour(s):
4

Lecture Hour(s):
3

Lab Hour(s):
3

Requisites

Prerequisite and Corequisite
ENG-101H Honors College Composition I; or ENG-1010 College Composition I with a grade of "B" or higher; and MATH-0955 Beginning Algebra or appropriate score on Math placement test; or departmental approval.

Outcomes

Course Outcome(s):
Apply the core principles of chemistry to the health careers, everyday life, and/or other scientific studies.

Essential Learning Outcome Mapping:
Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):
1. Describe the fundamental principles of atomic theory and the atomic structure of the elements including principle energy levels, sub-energy levels, orbitals, and electronic configurations.
2. Describe the properties of supercritical fluids as related to purification processes.
3. List the properties of solids and hygroscopic solids and application of solids as liquid crystals and biomaterials.
4. Describe energy changes in endothermic and exothermic reactions, energy diagrams, and bond dissociation energies.
5. Classify and describe the states of matter and chemical and physical changes.
6. Differentiate between covalent and ionic compounds based on composition and chemical and physical properties.
7. Name ionic and covalent compounds and determine the chemical formulas.
8. Determine the use of covalent compounds in the atmosphere and in polymer formation.
9. Describe acid and base chemistry including pH and buffer solutions.
10. Define chemical equilibrium and equilibrium constants.

11. Explain the principles of nuclear chemistry including nuclear decay reactions, fission, fusion, measurement of radiation, and half-life.
12. Discuss the properties of liquids including vapor pressure, viscosity, and surface tension.

Course Outcome(s):

Apply problem solving skills in a careers in the health sciences, advanced scientific studies, and/or applications in daily life.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Calculate density and specific gravity.
2. Convert between International System of Units (SI)/Metric system and English units and standard and scientific notation.
3. Express the uncertainty in measurements using significant figures.
4. Solve problems by balancing chemical equations and using Avogadro's number, mole concept, stoichiometry, theoretical yield, and percent yield.
5. Examine the relationship between pressure, temperature, volume, and moles as defined by the gas laws.
6. Determine the concentrations of solutions and predict effect of temperature and pressure on solubility.
7. Construct resonance structures, Lewis structures, and valence shell electron pair repulsion (VSEPR) models.
8. Deduce the polarity of covalent molecules based on the molecular three-dimensional structure.

Course Outcome(s):

Apply fundamental knowledge of chemistry to analyze reactions and properties and develop critical thinking skills such as deducing, predicting, and determing the causes of physical observations and various chemical reactions.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Explain atomic size, structure, physical properties, chemical properties, and the bonding of elements using periodic trends.
2. Deduce the effects of concentration, temperature, and catalysts on reaction rates.
3. Apply LeChatlier's Principle to predict responses to stresses in equilibrium.
4. Determine the intermolecular forces for compounds and the effect of the forces on the melting point, boiling point, and solubility.

Course Outcome(s):

Apply fundamental chemical principles to the fields of medicine, food science, and the environment.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.

Objective(s):

1. Describe the composition of bones including the presence of minerals.
2. Determine the functions of ions in the cell as related to ionic compounds.
3. Relate acid-base chemistry to the development of acid rain.
4. Apply the concepts of energy and chemical reactions to the energy content of food and body homeostasis.
5. Name the gases in the atmosphere and their chemical properties.
6. Describe the use of radioactivity in medical imaging and radiocarbon dating.
7. Relate the properties of liquids and gases to oxygen transport and delivery systems in the body.

Course Outcome(s):

Apply laboratory safety and fundamental laboratory skills to health careers and other scientific studies.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

Objective(s):

1. Demonstrate laboratory safety and proper laboratory techniques.
2. Measure physical quantities including mass, length, and volume.
3. Perform inquiry based laboratory activities.
4. Record observations in a laboratory notebook.
5. Perform experiments in a cooperative group environment.
6. Analyze and report experimental results by applying the concepts of chemistry.
7. Report experimental outcomes and conclusions in oral form.

Course Outcome(s):

Analyze information from sources to reach an informed conclusion.

Essential Learning Outcome Mapping:

Critical/Creative Thinking: Analyze, evaluate, and synthesize information in order to consider problems/ideas and transform them in innovative or imaginative ways.
Information Literacy: Acquire, evaluate, and use information from credible sources in order to meet information needs for a specific research purpose.

Objective(s):

1. Identify information from non-scholarly and scholarly sources.
2. Evaluate information and information sources.
3. Use library and internet resources to explore a topic.

Methods of Evaluation:

1. Exams
2. Cumulative final examination
3. Oral presentations
4. Participation
5. Quizzes
6. Group projects
7. Homework assignments
8. Student papers and written reports
9. Lab evaluations
10. Laboratory reports
11. Evaluation of laboratory skills

Course Content Outline:

1. Chemistry and matter
    a. States of matter
    b. Changes of state
    c. Physical and chemical changes and properties
    d. Extensive and intensive properties
    e. Classification of matter including chemical compounds, elements, and mixtures
2. Measurement
    a. Physical quantities including mass, length, and volume
    b. Units of metric system and the international system of units
    c. Significant figures and rounding numbers
    d. Scientific notation
    e. Conversion of units
    f. Factor-label method of problem solving
    g. Temperature, density, and specific gravity
    h. Scientific method
        i. Observation
        ii. Hypothesis
        iii. Experimentation
        iv. Analysis and conclusions
3. Atomic structure and the periodic table

   a. Atomic theory and structure
   b. Elements, symbols, and isotopes
   c. Periodic table, periods, and groups
   d. Metals, non-metals, and metalloids
   e. Bohr"s theory of the hydrogen atom
   f. Rutherford"s experiment
   g. Electronic structure including shells, subshell, and orbitals
   h. Electronic configurations, electron-dot symbols, and the Aufbau principle
   i. Ionization energy, electron affinity, and electronegativity
   j. Periodic trends and chemical behavior
   k. Electromagnetic spectrum
4. Ionic compounds
   a. Ion formation based on periodic trends
   b. Ionic bonding and octet rule
   c. Nomenclature and properties of ionic compounds
5. Covalent compounds
   a. Covalent bonds and periodic trends
   b. Lewis structures and VSEPR models
   c. Molecular models including ball and stick and space-filling
   d. Nomenclature and properties of covalent compounds
   e. Empirical formulas
   f. Polymer formation
6. Chemical reactions and energy
   a. Law of conservation of mass
   b. Chemical equations and reactions
   c. Avogadro’s number and mole concept
   d. Stoichiometry and mole to mass relationship
   e. Limiting reagent, percent yield, and percent composition
   f. Acid-base reactions
   g. Precipitation reactions, gravimetric analysis, and solubility
   h. Reduction-oxidation reactions
7. Thermodynamics
   a. Law of conservation of energy
   b. Potential and kinetic energy
   c. Enthalphy, endothermic, exothermic reactions
   d. Entropy and Gibb’s free energy
   e. Effects of temperature, concentration, and catalysts on reaction rates
   f. Heat of fusion and heat of vaporization
8. Chemical Equilibrium
   a. Reversible reactions and chemical equilibria
   b. Equilibrium constant
   c. Equilibrium equations
   d. LeChâtelier’s Principle
   e. Effect of temperature, pressure, and concentration on equilibrium
9. Gases and gas laws
   a. Kinetic-molecular theory and ideal gases
   b. Deviation of gases from ideal behavior
   c. Relationships between volume, temperature, pressure, and molar amount
   d. Gas laws and the ideal gas law
   e. Partial pressure and Dalton’s law
   f. Intermolecular forces
   g. Measurement of pressure using a barometer or manometer
10. Solutions and liquids
   a. Vapor pressure, surface tension, and boiling points
   b. Solubility and dependence of temperature and pressure
   c. Calculations of concentrations and dilutions
   d. Colligative properties

    e. Osmosis and dialysis
    f. Colloids
11. Solids
    a. Properties of solids
    b. Solid hydrates and hygroscopic solids
    c. Crystalline and amorphous solids
12. Acids, bases and pH
    a. Bronsted-Lowry acid and bases and conjugates
    b. Amphoteric compounds
    c. Dissociation constants and measuring pH
    d. Acid and base equivalents
    e. Acid strength,pH, and pOH
    f. Buffers and Henderson-Hasselbach equation
    g. Titrations
13. Nuclear chemistry
    a. Radioactivity and radioisotopes
    b. Nuclear decay, transmutation, and half-life
    c. Nuclear fission and fusion
    d. Radioactive decay series and ionizing radiation
    e. Detection and measurement of radiation
14. Applications of chemistry
    a. Helium and the big bang theory
    b. Importance of units in measurement
    c. Liquid crystals
    d. Acid rain
    e. Radiocarbon dating
    f. Irradiation of food
    g. Supercritical fluids
    h. Atmospheric gases and covalent compounds
    i. Nitrogen fixation
    j. Batteries and electroplating
    k. Elements in earth and living systems
15. Applications of chemistry in medicine
    a. Biomaterials in medicine
    b. Composition of minerals in bone structure
    c. Buffers and acids in body fluids
    d. Imaging techniques
    e. Electrolyte balance and ions in the cell
    f. Oxygen inhalation, transport, and delivery
    g. Blood pressure management
    h. Homeostasis
    i. Energy content of food
    j. Body mass index
    k. Elements essential for life
16. Laboratory work
    a. Maintain laboratory notebook
    b. Perform experiments in a cooperative group environment
    c. Operate laboratory equipment
    d. Perform calculations using acquired data
    e. Perform inquiry based experiments and activities
    f. Interpret experimental outcomes and report in oral or written form
17. Information Literacy
    a. Use the library resources to find information
    b. Use internet resources to find information
    c. Determine if resources are scholarly or nonscholarly
    d. Use the information to research a scientific topic

Resources

McMurry, John, David S. Ballantine, Carl A. Hoeger, and Virginia E. Peterson. *Fundamentals of General, Organic and Biological Chemistry.* 8th ed. Upper Saddle River, NJ: Prentice-Hall, 2016.

Denniston, K. J., Joseph Topping and Danae Quirk Dorr. *General, Organic, and Biochemistry.* 9th ed. New York: McGraw-Hill, 2016.

Smith, Janice G. *General, Organic, and Biological Chemistry.* 3rd ed. New York: McGraw-Hill, 2015.

Bettelheim, Frederick A., William H. Brown, Mary K. Campbell, Shawn O. Farrell, and Omar Torres. *Introduction to General, Organic, and Biochemistry.* 11th ed. Belmont: Brooks Cole, 2015.

Stoker, Stephen H. *General, Organic, and Biological chemistry.* 7th ed. Belmont: Brooks Cole, 2015.

Westshore Campus Health Careers and Sciences Department. *Laboratory Experiments for General, Organic and Biochemsitry.* {ts '2017-09-02 00:00:00'}.

Frederick A. Bettelheim, and Joseph M. Landesberg. *Laboratory Experiments for Introduction to General, Organic, and Biochemistry.* {ts '2011-12-31 00:00:00'}.

Charles H. Henrickson, Larry C Byrd, Norman W Hunter. *Lab Manual for General, Organic and Biochemistry.* {ts '2010-01-19 00:00:00'}.

Instructional Services

OAN Number:

Ohio Transfer 36 TMNS

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