CP/HONORS CHEMISTRY

Performance Indicators
Essential Questions
Suggested Activities
Suggested Resources

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Facilitators:

Becky Ashe
Amanda Davis
Elizabeth Matlock
Theresa Nixon
Leslie Rines

Chemistry CP and Chemistry Honors

The curriculum for Chemistry CP and Honors is outlined in the following document. Because both courses are first year introductions to Chemistry, the same foundational content must be covered. It is assumed the Honors Chemistry student will be more advanced in mathematics skills and able to move more quickly and deeper into the chemistry concepts outlined. For interpretation of what is required content for each course, the curriculum committee made the following differentiation:

For Chemistry CP—identified Essential (E) indicators are required for this course. Teachers are encouraged to include lessons that cover indicators identified as Important (I) and Compact (C), but their mastery is not expected.

For Chemistry Honors—all indicators identified as Essential (E) AND Important (I) are expected to be mastered by students in this course. Compact (C) indicators are encouraged to be covered, but mastery is not expected.

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UNIT I
LAB SKILLS and MEASUREMENT
(5%)

Performance Indicators

Lab Skills and Calculations of Measurement:

(E) (2.3) a. The student will be able to respond appropriately to lab safety situations. (2.0)

(E) (2.4) b. The student will be able to infer/select the correct unit to be used in a measurement. (2.0)

(I) (4.2) c. The student will be able to distinguish between precision and accuracy. (2.0)

(E) (2.4) d. The student will be able to calculate percentage error given laboratory and reference material data. (2.0)

(E) (2.4) e. The student will be able to use factor label/dimensional analysis in problem solving. (2.0)

(E) (1.2) f. The student will be able to transform quantities from standard notation to scientific notation. (2.0)

(E) (1.2) g. The student will be able to use significant digits to express final calculations. (2.0)

Essential Questions

1. What does a “safe” lab look like?

2. (Honors) How does one know how precise or accurate his/her results are?

3. What are the most common measurements used in lab and how can one go from one to another?

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UNIT II
MATTER and the ATOM
(10%)

Performance Indicators

Properties of Matter and Atomic Structure:

(E) (3.4) a. The student will be able to compare and contrast elements, compounds, solutions, and heterogeneous mixtures. (2.0)

(E) (2.4) b. The student will be able to manipulate the density formula to solve density problems. (2.0)

(E) (2.2) c. The student will be able to distinguish between physical and chemical properties and changes. (2.0)

(E) (1.1) d. The student will be able to apply the law of conservation of mass/energy to chemical equations and problems. (2.0)

(E) (2.2) e. The student will be able to differentiate between atomic mass, atomic number, mass number, and isotope; also, state the charge, relative mass, and location of protons, neutrons, and electrons. (1.0)

(I) (1.3) f. The student will be able to identify the historical scientific contributions made to the development of modern atomic theory. (1.0)

Essential Questions

1. What are the differences between elements, compounds, solutions, and heterogeneous mixtures?

2. What does an atom look like inside and how do we know?

3. How does the density of a substance affect its behavior?

4. What information can the periodic table give about an atom?

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UNIT III
PERIODIC TABLE
(5%)

Performance Indicators

Organization and Trends of the Periodic Table:

(I) (1.3) a. The student will be able to recognize the contributions made by Mendeleev and Moseley in the development of the modern periodic table. (1.0)

(E) (2.2) b. The student will be able to locate any element according to group and period number. (1.0)

(E) (2.2) c. The student will be able to recognize family names and series. (1.0)

(E) (2.2) d. The student will be able to locate metals, nonmetals, and metalloids on the periodic table. (1.0)

(E) (2.2) e. The student will be able to identify periodic trends, electro negativity, ionization energy, atomic radius, and electron affinity. (1.0)

(E) (2.2) f. The student will be able to predict most common oxidation states. (1.0)

Essential Questions

1. How are elements arranged on the periodic table?

2. How does the arrangement of the elements help predict behavior of the elements?

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UNIT IV
QUANTUM MECHANICS and BONDING
(10%)

Performance Indicators

Quantum Levels and Chemical Bonding:

(I) (2.4) a. The student will be able to identify a correct orbital diagram for an element. (1.0)

(E) (2.4) b. The student will be able to identify a correct electron configuration for an element. (1.0)

(E) (2.4) c. The student will be able to identify correct Lewis dot diagrams for an element or compound. (1.0)

(E) (2.4) d. The student will be able to determine the quantum numbers for an electron for any given atom. (1.0)

(E) (2.2) e. The student will be able to identify maximum number of electrons per given orbital and/or energy levels. (1.0)

(E) (2.2) f. The student will be able to identify the location of the *s*, *p*, *d*, and *f* blocks on the periodic table. (1.0)

(E) (2.4) g. The student will be able to solve for any variable in the equations c = f x lambda and E = hf. (1.0)

(E) (2.2) h. The student will be able to distinguish between ionic and covalent bonding. (1.0)

(I) (2.2) i. The student will be able to state the hybridization for any given atom in a compound. (3.0)

(E) (2.2) j. The student will be able to recognize the shapes of molecules using the VSEPR model. (3.0)

Essential Questions

1. How does one choose which of the different diagrams and models of an element to work with (i.e., orbital, electron configuration, Lewis dot)?

2. What is the significance of quantum numbers?

3. What are the uses for the equation c = f x lambda and E = hf?

4. How can you predict what kind of bond two or more elements will form?

5. How can you predict the shape of a molecule?

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UNIT V
FORMULAS AND EQUATIONS
(15%)

Performance Indicators

Naming and Writing Formulas and Equations:

(E) (2.4) a. Given the name, the student will be able to identify the formula for a compound; given the formula, the student will be able to identify the name for: common acids, ionic binary, ionic ternary, and binary molecular compounds. (3.0)

(E) (1.2) b. The student will be able to use the stock system to recognize formulas for the transition metal compounds. (3.0)

(E) (2.4) c. The student will be able to identify the correct coefficient to balance a chemical equation. (3.0)

(E) (2.4) d. The student will be able to identify and predict the products for the five basic types of reactions: synthesis, decomposition (analysis), single replacement, combustion and double replacement. (3.0)

(I) (2.4) e. Using solubility rules and activity series, the student will be able to predict whether a reaction will occur. (3.0)

Essential Questions

1. What is the relationship between the formula and name of a compound?

2. How do you know when a chemical equation is balanced?

3. What are the characteristics used to differentiate between the five basic types of reactions?

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UNIT VI
THE MOLE AND STOICHIOMETRY
(20 %)

Performance Indicators

The Mole and Mathematical Relationships:

(E) (2.2) a. The student will be able to define a mole in terms of particles, using Avogadro's number, volume, and mass. (3.0)

(E) (2.4) b. The student will be able to give a formula for a compound, calculate its molar mass and/or its percentage composition. (3.0)

(E) (2.4) c. The student will be able to use the percent composition to find empirical formula for a compound. (3.0)

(E) (2.4) d. Given the empirical formula and molecular mass, the student will be able to determine the molecular formula. (3.0)

(E) (2.4) e. Given the amount of one substance involved in a reaction in terms of molar mass, molar volume, or number of particles, the student will be able to calculate the amount of any other substance involved in the reaction in terms of molar mass, molar volume, or number of particles. (3.0)

(E) (2.4) f. The student will be able to identify a limiting reactant, calculate the amount of a product and calculate the amount of excess reactant remaining. (3.0)

Essential Questions

1. Describe a mole of particles as many ways as you can.

2. What are the relationships between formula, mass, percent composition, empirical, and molecular formulas?

3. How can knowing the amount of any of the substances in a reaction allow you to predict the outcomes of the reaction?

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UNIT VII
KINETIC THEORY, GAS LAWS, and ENERGY
(15%)

Performance Indicators

Kinetic Theory, Gas Laws, and Energy:

(E) (2.4) a. The student will be able to apply the Kinetic Theory to the phases of matter. (2.0)

(E) (2.4) b. The student will be able to calculate changes in pressure, temperature, or volume of a gas given a change in one of these properties (Boyle's, Charles, Combined Gas Laws). (2.0)

(E) (2.4) c. Given the value of R, the student will be able to use the ideal gas law to calculate any variable. (2.0)

(E) (2.4) d. Given a water vapor pressure chart, the student will be able to apply Dalton's Law to the gas laws. (2.0)

(I) (2.4) e. Given a reaction occurring at conditions other than standard, the student will be able to determine the volume of a product from the mass of a reactant. (2.0)

(E) (2.2) f. The student will be able to distinguish between heat and temperature. (2.0)

(IE (2.2) g. The student will be able to distinguish between kinetic and potential energy. (2.0)

(E) (1.4) h. The student will be able to solve calorimetry problems. (2.0)

(I) (2.4) i. The student will be able to calculate rate, mass or density using Graham's Law. (2.0)

(I) (2.5) j. The student will be able to give mercury level and atmospheric pressure of an open-ended manometer, and determine the gas pressure. (2.0)

Essential Questions

1. What is the role of the Kinetic Theory in explaining the different states of matter?

2. How does the change in value of a single variable like pressure, temperature, or gas volume, affect each of the major gas laws?

3. How can calorimetry be used to explain reaction energies?

4. (Honors) For what is Graham's law useful?

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UNIT VIII
SOLUTIONS
(10%)

Performance Indicators

Solubility and Solution Properties:

(E) (2.4) a. The student will be able to interpret a solubility graph. (4.0)

(E) (2.4) b. The student will be able to identify solute and solvent for a given solution. (4.0)

(E) (2.4) c. The student will be able to identify the common factors that can increase the rate of solution. (4.0)

(E) (2.4) d. The student will be able to calculate molarity and molality of solutions containing both molecular and ionic solutes. (4.0)

(E) (2.2) e. The student will be able to relate the amount of solute to changes in freezing point and boiling point. (4.0)

(E) (2.2) f. The student will be able to differentiate between saturated, unsaturated, and supersaturated. (4.0)

(I) (2.4) g. The student will be able to calculate freezing point depression and boiling point elevation caused by a solute in a solvent. (4.0)

(C) (2.4) h. The student will be able to use colligative properties to determine the molar mass of a solute. (4.0)

(I) (2.4) i. The student will be able to solve state change problems using heat of fusion and heat of vaporization values. (4.0).

Essential Questions

1. What is the difference between molarity and molality?

2. What factors affect what will dissolve in something else?

3. What is the relationship between saturation of a solution and its phase change points?

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UNIT IX
ACIDS, BASES, and SALTS
(5%)

Performance Indicators

Properties of Acids, Bases, and Salts:

(E) (2.2) a. The student will be able to define acids and bases by the Arrhenius and Brønsted-Lowery theories. (4.0)

(E) (5.4) b. The student will be able to identify characteristics of acids and bases. (4.0)

(I) (1.2) c. The student will be able to calculate, given the hydronium ion concentration, the pH, pOH, and $[OH^-]$. (4.0)

(E) (1.2) d. Given the pH of a substance, the student will be able to identify it as acidic or basic. (4.0)

(C) (2.4) e. The student will be able to calculate the equilibrium constant for a weak acid or weak base from experimental information. (4.0)

(C) (1.2) f. The student will be able to use the equilibrium constant and other information to calculate the pH of a solution of a weak acid or weak base. (4.0)

(E) (2.5) g. The student will be able to calculate the concentration of an acid or base using information from a titration experiment. (4.0)

Essential Questions

1. What are the common features of acids and bases?

2. What is the difference in acids or bases according to Arrhenius, Brønsted-Lowery, and pH?

3. (Honors) How can pH be calculated?

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UNIT X
NET IONIC EQUATIONS AND REDOX REACTIONS
(5%)

Performance Indicators

Net Ionic Equations and Redox Reactions:

(C) (2.2) a. The student will be able to write net ionic equations.

(C) (2.2) b. The student will be able to define spectator ions.

(C) (2.2) c. The student will be able to differentiate between oxidation and reduction.

(C) (2.2) d. The student will be able to identify oxidizing and reducing agents.

(C) (2.2) e. The student will be able to identify oxidation and reduction reactions.

(C) (2.2) f. The student will be able to identify a correctly balanced redox equation.

Essential Questions

1. Why are spectator ions accounted for in reactions?

2. What are the differences in characteristics of reactants and products in oxidation and reduction reactions?

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UNIT XI
ORGANIC CHEMISTRY
(5%)

Performance Indicators

Naming and Identification of Organic Molecules:

(C) (2.2) a. The student will be able to identify the systematic name of alkanes, alkenes, and alkynes from the structural formula.

(C) (2.4) b. The student will be able to write the structural formula for alkanes, alkenes, and alkynes.

Essential Questions

How can you identify alkanes, alkenes, and alkynes?