Ledyard Public Schools
Science Curriculum

Chemistry

Level-2

1432

Instructional Council Approval June 1, 2005

Atoms and Molecules

Suggested Time - Approximately 8 Weeks

Essential Question

How does the structure of an atom determine the properties of elements and bonding between atoms?

Focus Questions

1. How has the progression of historical theories and discoveries relating to the atom and its parts led to our modern concept of an atom.
   Learning Objectives - The Student will be able to:
   a. explain how the historical progression of atomic model development has led to our present understanding of the atom, its parts and structure. (From Dalton to Quantum Mechanics, including, at least, Thomson, Rutherford, Chadwick, Bohr, Pauli, Heisenberg, and Quantum concepts)
   b. apply key historical concepts to our modern view of the periodic table. (Periodic Table (in order) – The Greeks, Dobereiner, Newlands, Mendeleev, Moseley, Seaborg)

2. What are the characteristics of electrons in an atom?
   Learning Objectives - The Student will be able to:
   a. identify the characteristics of light and the classifications of the electromagnetic spectrum.
   b. explain how excited electrons produce emission spectra
   d. use orbital shapes (s, p, d), Orbital box diagrams (s, p, d, f), quantum numbers and electron configurations (including the noble gas shortcut, outer and complete electron configurations) to characterize the electronic structure of an atom.

3. How does atomic structure account for periodic properties of elements?
   Learning Objectives - The Student will be able to:
   a. determine the relationship between the arrangement of the periodic table and atomic orbitals
   b. predict and compare the periodicity of certain properties of elements (i.e. ionization energy, atomic radius, Ionic radius, electronegativity)
   c. identify the characteristics of the major groups of elements (alkali and alkali earth metals, halogens, noble gases) based on atomic structure.

4. How is the bonding between atoms and the geometry of molecules determined by the interaction of electrons between atoms?
   Learning Objectives - The Student will be able to:
   a. use of Lewis structures to portray valence electrons and ionic and molecular structures.
   b. use the concept of electronegativity to characterize and determine bond types
   c. use VSEPR theory to determine the molecular geometry of molecules. (up to tetrahedral structures including carbon based compounds.

Assessments

Science assessment includes: tests, which assess content knowledge and application, skill acquisition and application of knowledge at all levels of critical thinking; quizzes; formal laboratory assessments as full lab reports, parts of lab reports or quiz type lab assessments; a variety of written, oral and visual presentations; as well as a variety of other individual and group work assessments. All tests must include free response questions (or constructed response) as well as appropriate content and/or skill assessment and, except where inappropriate, must be balanced in terms of the critical thinking skills expected of students. Laboratory reports (or parts) will follow the Ledyard High School standard Laboratory format. Other Laboratory assessments should reflect CAPT Style multiple choice and / or open-ended questions.

Required Activities

The following **types** of laboratory activities are **required**. Titles in parentheses are suggested but not required and lab procedures for these activities are available in the appendix.

A Periodic Trends activity
(Alien periodic table, Imaginary Periodic table, Determining trends in a group)
A Spectra / light Activity
(Flame Tests, Emission Spectra, photoelectric effect, solar cell performance task)
A bonding activity
(Electric Solutions, Ionic/ Covalent Bonds)
An Atom/Atomic Structure activity
(Size of a molecule, Pennium, Beanium)
A molecular modeling activity
(molecular modeling)

****(Meets Ledyard Academic Expectation for Problem Solving)

Resources

Student: **Chemistry, Myers, Oldham and Tocci,** Holt, 2004

Teacher: **Chemistry, Myers, Oldham and Tocci**, Holt, 2004
Including: Study Guide, Test bank, Solutions Manual
Transparencies, Lab manual, Other ancillaries
CRC Handbook of Chemistry and Physics
Merck Index

Curriculum Alignment
with
Connecticut Content Standards and Expected Performances
All areas address State Standards for Scientific Inquiry, Literacy and Numeracy

Focus Question	CT Content Standard	CT Expected Performance
1. The Atom	9.4	D10
2. Electrons	9.4	D10
3. Periodic Properties	9.4	D10
4. Bonding & Geometry	9.4, 9.5, 9.6	D11, D13, D15, D16, D17

States of Matter

Suggested Time - Approximately 4 Weeks

Essential Question

What are the characteristics, interactions and dynamics of matter as a collection of particles?

Focus Questions

1. How are macroscopic properties and behaviors of solids, liquids and gases a manifestation of particle behavior?
   Learning Objectives - The Student will be able to:
   a. use molecular pictures to characterize each of the three phases of matter
   b. use molecular pictures to characterize transitions between phases (i.e. phase changes, equilibrium systems)
   c. use molecular pictures to characterize mixtures of particles.
   d. compare and contrast particle motions in the three phases of matter and their transitions.
   e. identify the different types of particles that make up matter.

2. How does the Kinetic Theory of Gases explain the behavior of gas particles?
   Learning Objectives - The Student will be able to:
   a. explain the characteristics of a gas as a collection of particles.
   b. use the Kinetic Theory to explain the behavior of gas particles (gas laws).
   c. apply the Kinetic Theory to the structure and motion of particles in liquids and solids.

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Required Activities

Cold Packs ****
A Boyle's Law laboratory activity

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Gas Law Activity
(Charles' Law, Molar volume - The reaction of Magnesium with Hydrochloric acid)

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All areas address State Standards for Scientific Inquiry, Literacy and Numeracy

Focus Questions	CT Content Standard	CT Expected Performances
1. Matter as Particles	9.1	D1, D2, D3
2. Kinetic Theory	9.1	D1, D2, D3

Chemicals and Chemical Reactions

Suggested Time - Approximately 6 Weeks

Essential Question

What are the characteristics of chemicals and the nature of chemical reactions?

Focus Questions

1. How are basic mathematical skills used in chemical calculations?
   Learning Objectives - The Student will be able to:
   a. use significant figures in all calculations.
   b. utilize dimensional analysis in all chemical calculations
   c. assess the precision and accuracy of experimental data.
   d. apply the mole concept to determine quantities of substances

2. What are the conventions for naming chemical compounds and writing formulae?
   Learning Objectives - The Student will be able to:
   a. demonstrate a knowledge of atoms, molecules, elements, compounds and the structure of the periodic table using molecular pictures where appropriate.
   b. name and write formulas for chemical compounds, including: metallic and nonmetallic binary compounds; polyatomic ions and organic molecules including alkanes, alkenes and alkynes.

3. What are the characteristics of chemicals and chemical reactions?
   Learning Objectives - The Student will be able to:
   a. differeniate between of the chemical and physical properties of matter.
   b. explain how chemical and physical transformations occur as well as the energies associated with these transformations. (including the conservation of energy)
   c. compare, contrast and identify the characteristics of chemical reactions (energy, products, reactants, types of reactions))
   d. explain the process of polymerization and the properties and uses of polymers.
   e. explain how the chemical structure of polymers affects their physical properties.

4. How does a chemical equation quantitatively show the relationships between the numbers of particles and the quantities of substances in a chemical reaction?
   Learning Objectives - The Student will be able to:
   a. balance chemical equations.
   b. calculate reacting ratios, quantitative relationships, limiting reactants and percent yields of reactions, using principles of stoichiometry.
   c. calculate the concentration of a solution (molarity)

Assessments

Science assessment includes: tests, which assess content knowledge and application, skill acquisition and application of knowledge at all levels of critical thinking; quizzes; formal laboratory assessments as full lab reports, parts of lab reports or quiz type lab assessments; a variety of written, oral and visual presentations; as well as a variety of other individual and group work assessments. All tests must include free response questions (or constructed response) as well as appropriate content and/or skill assessment and, except where inappropriate, must be balanced in terms of the critical thinking skills expected of students. Laboratory reports (or parts) will follow the Ledyard High School standard Laboratory format. Other Laboratory assessments should reflect CAPT Style multiple choice and / or open-ended questions.

Required Activities

CAPT Synthetic Polymer Performance Task****
Fire Extinguisher (Former CAPT Performance Task)****

The following **types** of laboratory activities are **required**. Titles in parentheses are suggested but not required and lab procedures for these activities are available in the appendix.

Introductory Laboratory activities (at least 2)
(Aluminum-Copper chloride, Esterification, Conservation of Mass, Reaction Rate, Distillation, Chromatography, Strike it Rich, Al-$CuCl_2$ Observation)
A Stoichiometry activity
(The Behavior of Copper in a Solution of Silver Nitrate , The Copper cycle)
An Acid/Base activity
(Determining the concentration of an Unknown Acid, pH changes during titration)
A Precipitation reaction activity (Precipitation Reactions, Colored Precipitates)
A Redox activity
(The reactivity of metals, The Corrosion of Iron, Oxidation states of Manganese, A hydrogen peroxide rainbow)
A Polymer activity
(Esterification, Slime, GlueP, Physical Characteristics of Polymers, Nylon)

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Focus Question	CT Content Standard	CT Expected Performance
1. Mathematical Skills	9.4	D10, D12, D14
2. Nomenclature	9.4, 9.5	D13, D16
3. Chemicals & Reactions	9.1, 9.2, 9.5, 9.6	D3, D14, D16, D17
4. Stoichiometry	9.4, 9.5	D12, D14