

Ledyard Public Schools  
Science Curriculum

Chemistry  
Level-3 and  
Collaborative

1434 & 1434C

Instructional Council Approval June 1, 2005

# Matter & Energy

**Suggested Time** – Approximately 9 Weeks

## **Essential Questions**

1. How are the characteristic properties of matter based on their constituent particles?
2. What are the interactions and dynamics of matter and energy?

## **Focus Questions**

1. How is matter classified based on chemical and physical properties?

**Learning Objectives** - The Student will be able to:

- a. distinguish between elements, compounds, and mixtures (including the use of molecular pictures).
- b. distinguish between heterogeneous and homogeneous mixtures (including the use of molecular pictures).
- c. distinguish between chemical and physical changes of matter
- d. distinguish between chemical and physical properties of matter.

2. How do gases, liquids and solids differ as a collection of particles?

**Learning Objectives** - The Student will be able to:

- a. characterize the states of matter on an atomic / molecular level.
- b. use the Kinetic Theory of Gases to explain the motion of molecules and the properties of a gas.
- c. compare and contrast the motion of molecules in gases, solids and liquids.

3. How is energy related to molecular movement?

**Learning Objectives** - The Student will be able to:

- a. distinguish between types energy transfer in matter and across space
- b. explain how energy transfer occurs in conduction, convection, and radiation
- c. characterize the transformations of energy, including chemical, thermal (heat), radiant, electrical, and kinetic (motion)

## 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

Cold Packs\*\*\*\*

A Boyles Law Activity

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 activities

(Aluminum-Copper chloride, Cornstarch, Identification of an unknown white powder)

An activity that explores chemical and physical properties of matter

(Forensics, Distillation, Drop Size, Strike it Rich, Metal or Nonmetal?,  
How much will dissolve?, The Specific heat of a Metal)

A Density activity

(What is the Thickness, of Aluminum Foil, Mass versus Volume)

A Phase Change activity

(The cooling behavior of a substance, Melting Point)

A Gases/Gas law activity

(Charles Law, Gay-Lussac's Law (inquiry using computers and probeware)

## Resources

**Student: Physical Science, Concepts in Action**, Wyssession, Frank and Yancopoulos,  
Prentice Hall, 2004

**Teacher: Physical Science, Concepts in Action**, Wyssession, Frank and Yancopoulos,  
Prentice Hall, 2004

Including: Study Guide, Test bank, Solutions Manual

Transparencies, Lab manual, Other ancillaries

**Merck Index**

**CRC Handbook of Chemistry and Physics**

### 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. Matter	9.1	D1
2. Matter as Particles	9.1	D1, D2
3. Energy	9.1	D1, D2, D3

# Atomic and Molecular Structure

**Suggested Time** - Approximately 6 Weeks

## **Essential Questions**

1. How does the structure of an atom relate to its properties?
2. How do the structures of atoms allow us to organize the elements?
3. How do atoms bond?

## **Focus Questions**

1. What is the composition and structure of atoms?  
**Learning Objectives** - The Student will be able to:
  - a. identify the parts of an atom and compare the properties of electrons, protons and neutrons.
  - b. describe how scientific experimentation and theories resulted in the discovery of atom parts and the development of modern atomic theory. (including Dalton, Thomson and Rutherford)
  - c. explain the concept of atomic orbitals and energy levels
2. How do the chemical and physical properties of elements allow us to organize them into the periodic table?  
**Learning Objectives** - The Student will be able to:
  - a. compare and contrast physical and chemical properties of elements.
  - b. determine how the properties of elements has led to the development of the periodic table.
  - c. explain how the properties of the elements are related to their atomic structures
3. What are the characteristic properties of ionic and covalent compounds  
**Learning Objectives** - The Student will be able to:
  - a. distinguish between ionic and covalent bonds.
  - b. characterize the formation of ionic and covalent bonds.
  - b. compare the properties of ionic and covalent compounds.
4. What are the structures, characteristics and properties of simple hydrocarbons and common synthetic polymers?  
**Learning Objectives** - The Student will be able to:
  - a. draw the structure of the carbon atom and simple hydrocarbon compounds
  - b. explain how simple monomers are combined to create polymers
  - c. explore and explain the properties and uses of carbon-based polymers based on their chemical structure.

## Assessments

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## Required Activities

CAPT Synthetic Polymer 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.

- A Spectra activity  
(Flame Tests, Emission Spectra)
- A Periodic Trends activity  
(The Reactivity of Alkali Earth Metals, An Alien Periodic Table)
- A Bonding laboratory activity  
(Ionic versus Covalent Bonds, Electric Solutions, Chromatography, Like dissolves Like, Does it Dissolve?, Molecular modeling)
- A polymerization laboratory activity  
(The Physical Characteristics of Polymers, Nylon, Slime, Gluep, Esterification, Saponification)

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

## Resources

**Student:** **Physical Science, Concepts in Action**, Wyssession, Frank and Yancopoulos, Prentice Hall, 2004

**Teacher:** **Physical Science, Concepts in Action**, Wyssession, Frank and Yancopoulos, Prentice Hall, 2004

Including: Study Guide, Test bank, Solutions Manual  
Transparencies, Lab manual, Other ancillaries

**Merck Index & CRC Handbook of Chemistry and Physics**

### **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. Atomic Structure	9.4	D10
2. Periodic Table	9.4	D10
3. Bonding	9.4	D11, D13
4. Polymers	9.4, 9.5, 9.6	D13, D15, D16, D17

# Chemicals and Chemical Reactions

**Suggested Time** – Approximately 4 Weeks

## **Essential Questions**

What are the types and characteristics of chemical reactions?

## **Focus Questions**

1. What are the characteristics of chemical reactions?

**Learning Objectives** - The Student will be able to:

- a. distinguish between reactants and products in chemical reactions.
- b. demonstrate how mass and energy are conserved in a chemical reaction.
- c. balance chemical equations.

2. What are the different types of chemical reactions?

**Learning Objectives** - The Student will be able to:

- a. compare and contrast different types of chemical reactions
- b. explain the chemical composition of acids and bases and the change in pH in neutralization reactions.
- c. characterize combustion reactions of hydrocarbons and their resulting products.
- d. explain how chemical monomers produce various types of polymers

## 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

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.

An Acid - Base Neutralization activity  
(Acid-Base Titration, acid - base indicators, pH)

One of the following types of activities:

A Combustion activity  
(The Peanut Lab, A Candle Lab, Food Lab)

A precipitation activity  
(Precipitation Reactions)

A Redox activity  
(The Activity Series, The Corrosion of Iron, Water Testing,  
Magnesium and Hydrochloric acid, Copper - Silver Nitrate, The Copper cycle)

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

## Resources

**Student:** **Physical Science, Concepts in Action**, Wyssession, Frank and Yancopoulos,  
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**Curriculum Alignment  
with  
Connecticut Content Standards and Expected Performances  
All areas address State Standards for Scientific Inquiry, Literacy and Numeracy**

Focus Questions	CT Content Standards	CT Expected Performances
1. Characteristics of Reactions	9.4, 9.5	D11
2. Types of reactions	9.4, 9.5	D11, D12, D14, D16