

Warren County School District

PLANNED INSTRUCTION

COURSE DESCRIPTION

Course Title: Advanced Organic Chemistry – Honors

Course Number: 00334

Course Prerequisites: Completion of Academic Chemistry with an 80% average or higher or permission.

Course Description:

This honors course deals with concepts of molecular structure, atomic and intermolecular bonding and the resulting properties of organic compounds. An emphasis is placed on the recognition and classification of major functional groups and the nomenclature and structure of organic molecules. Additional concepts include chemical and physical properties as a function of molecular mass, structural arrangement and intermolecular forces, isomers, reactions, reaction mechanisms, and synthesis/preparation of organic compounds. A final exam is required.

Suggested Grade Level: Grade 12

Length of Course: X One Semester Two Semesters Other
(Describe)

Units of Credit: 0.5 (Insert *NONE* if appropriate.)

PDE Certification and Staffing Policies and Guidelines (CSPG) Required Teacher Certification(s)

(Insert certificate title and CSPG#) Chemistry

Certification verified by WCSD Human Resources Department:

 X Yes No

Board Approved Textbooks, Software, Materials:

Title:

Publisher:

ISBN #:

Copyright Date:

Date of WCSD Board Approval:

BOARD APPROVAL:

Date Written: _____ September 2009

Date Approved: _____

Implementation Year: _____

Suggested Supplemental Materials: (List or insert **None**)

Course Standards

PA Academic Standards: (List by Number and Description)

3.1 Unifying Themes

12B Apply concepts of models as a method to predict and understand science and technology.

12C Assess and apply patterns in science and technology.

3.2 Inquiry and Design

12B Evaluate experimental information for appropriateness and adherence to relevant science processes.

3.4 Physical Science, Chemistry and Physics

12A Apply concepts about the structure and properties of matter.

12B Apply and analyze energy sources and conversions and their relationship to heat and temperature.

WCSD Academic Standards: (List or **None**)

None

Industry or Other Standards: (List, Identify Source or **None**)

None

WCSD EXPECTATIONS

WCSD K-12 Expectations for instruction in writing, reading, mathematics and, technology have been developed and revised annually. The teacher will integrate all WCSD Expectations into this planned instruction.

SPECIAL EDUCATION AND GIFTED REQUIREMENTS

The teacher shall make appropriate modifications to instruction and assessment based on a student's Individual Education Plan (IEP) or Gifted Individual Education Plan (GIEP).

SPECIFIC EDUCATIONAL OBJECTIVES/CORRESPONDING STANDARDS AND ELIGIBLE CONTENT WHERE APPLICABLE

(List Objectives, PA Standards #'s, Other Standards (see samples at end))

S11.A The Nature of Science

S11.A.1 Reasoning and Analysis

S11.A.1.1 Analyze and explain the nature of science in the search for understanding the natural world and its connection to technological systems.

PA Standards References: 3.1.10.A, 3.2.10.A, 3.1.10.E

	Performance Indicators
A.	S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs (i.e., the law of universal gravitation, how light travels, formation of moons, stages of ecological succession).
B.	S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws.
C.	S11.A.1.1.3 Evaluate the appropriateness of research questions (e.g., testable vs. not-testable).
D.	S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws).
E.	S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars).

S11.A.1.2 Identify and analyze the scientific or technological challenges of societal issues; propose possible solutions and discuss implications.

PA Standard References: 3.2.10.A, 4.3.10.B

	Performance Indicators
A.	S11.A.1.2.1 Explain and explain scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy).
B.	S11.A.1.2.2 Use case studies (e.g., Wright brothers' flying machine, Tacoma Narrows Bridge, Henry Petoskey's Design Paradigms) to propose possible solutions and analyze economic and environmental implications of solutions for real-world problems.

S11.A.1.3 Describe and interpret patterns of change in natural and human-made systems.

PA Standard References: 3.1.10.C, 3.1.10.E, 4.8.10.A

	Performance Indicators
A.	S11.A.1.3.1 Use appropriate quantitative data to describe or interpret

	change in systems (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).
B.	S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g., chemical reactions, human body, food webs, tectonics, homeostasis).
C.	S11.A.1.3.3 Describe how changes in physical and biological indicators (e.g., soil, plants, or animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams).
D.	S11.A.1.3.4 Compare the rate of use of natural resources and their impact on sustainability.

S11.A.2 Processes, Procedures and Tools of Scientific Investigations

S11.A.2.1 Apply knowledge of scientific investigation or technological design to develop or critique aspects of the experimental or design process.

PA Standard References: 3.2.10.B, 3.2.10.D

	Performance Indicators
A.	S11.A.2.1.1 Critique the elements of an experimental design (e.g., raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data, and drawing conclusions) applicable to a specific experimental design.
B.	S11.A.2.1.2 Critique the elements of the design process (e.g., identify the problem, understand criteria, create solutions, select solution, test/evaluate, and communicate results) applicable to a specific technological design.
C.	S11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understanding of experimental limits.
D.	S11.A.2.1.4 Critique the results and conclusions of scientific inquiry for consistency and logic.
E.	S11.A.2.1.5 Communicate results of investigations using multiple representations.

S11.A.2.2 Evaluate appropriate technologies for a specific purpose, or describe the information the instrument can provide.

PA Standard References: 3.7.10.B, 3.8.10.B

	Performance Indicators
A.	S11.A.2.2.1 Evaluate appropriate methods, instruments, and scale for precise quantitative and qualitative observations (e.g., to compare properties of materials, water quality).
B.	S11.A.2.2.2 Explain how technology (e.g., GPS, spectroscope, scanning electron microscope, pH meters, probe interface, imaging technology, telescope) is used to extend human abilities and precision.

S11.A.3 Systems, Models and Patterns

S11.A.3.1 Analyze the parts of a simple system, their roles, and their relationships to the system as a whole.

PA Standard References: 3.1.10.A, 3.1.10.E, 4.3.10.C

	Performance Indicators
A.	S11.A.3.1.1 Apply systems analysis, showing relationships (e.g., flowcharts, concept maps), input and output, and measurements to explain to explain a system and its parts.
B.	S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a change in one part of a system on the system as a whole.
C.	S11.A.3.1.3 Use appropriate quantitative data to describe or interpret a system (e.g., biological indices, electrical circuit data, automobile diagnostic systems data).
D.	S11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g. heating, motor, food production) and identify the resources necessary for operation of the system.

S11.A.3.2 Compare observations of the real world to observations of a constructed model.

PA Standard References: 3.1.10.B, 3.2.10.B, 4.1.10.B, 4.6.10.A

	Performance Indicators
A.	S11.A.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior.
B.	S11.1.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes.
C.	S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of object within the solar system, life spans, size of atomic particles, topographic maps).

S11.A.3.3 Compare and analyze repeated processes or recurring elements in patterns.

PA Standard References: 3.1.10.C, 3.2.10.B

A.	S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification, chemical periodicity, geological order, or astronomical order.
B.	S11.A.3.3.2 Compare stationary physical patterns (e.g., crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties.
C.	S11.A.3.3.3 Analyze physical patterns of motion to make predictions or draw conclusions (e.g., solar system, tectonic plates, weather systems, atomic motion, waves).

S11.C. Physical Sciences

S11.C.1 Structure, Properties, and Interaction of Matter and Energy

S11.C.1.1 Explain the relationship between the structure and properties of matter.

PA Standard References: 3.4.10.A

	Performance Indicators
A.	S11.C.1.1.1 Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., proton, neutrons, electrons).
B.	S11.C.1.1.2 Explain the relationship between the physical properties of a substance and its molecular or atomic structure.
C.	S11.C.1.1.3 Explain the formation of compounds (ionic and covalent) and their resulting properties using bonding theories .

D.	S11.C.1.1.4 Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.
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S11.C.2 Forms, Sources, Conversion, and Transfer of Energy

S11.C.2.1 Analyze energy sources and transfer of energy, or conversion of energy.

PA Standard References: 3.4.10.B

	Performance Indicators
B.	S11.C.2.1.2 Describe energy changes in chemical reactions.

ASSESSMENTS

PSSA Assessment Anchors Addressed: The teacher must be knowledgeable of the PDE Assessment Anchors and/or Eligible Content and incorporate them into this planned instruction. Current assessment anchors can be found at pde@state.pa.us.

Formative Assessments: The teacher will develop and use standards-based assessments throughout the course.

Portfolio Assessment: _____ Yes No No

District-wide Final Examination Required: _____ Yes No No

Course Challenge Assessment (Describe):

REQUIRED COURSE SEQUENCE AND TIMELINE

(Content must be tied to objectives)

Content Sequence	Dates
I. Review of Chemical Bonding	Two Weeks
A. Create Lewis Dot structures for ionic and covalent compounds.	

- B. Using Lewis Dot structures, determine molecular geometry and hybridization of covalent compounds.
 - C. Differentiate between sigma and pi bonds and demonstrate the formation of these bonds.
- II. Introduction to Organic Chemistry Two Weeks
- A. Describe the differences between organic and inorganic compounds.
 - B. Describe the different types of isomerism including structural, positional, and functional.
 - C. Identify compounds that are isomers and classify the type of isomerism exhibited.
 - D. Laboratory activity: Model building. (*suggested*)
- III. Chemistry of hydrocarbons including alkanes, alkenes, alkynes, aromatic compounds, monomers/polymers. Four Weeks
- A. Nomenclature
 - 1. Given a structural formula, name the compound.
 - 2. Given a name, draw the structural formula.
 - B. Physical properties of hydrocarbons
 - 1. Using structural formulas, determine relative melting points, boiling points, and solubility from a group of hydrocarbons.
 - 2. Demonstrate how the structure of a compound affects the physical properties.
 - C. Chemical properties of hydrocarbons
 - 1. Describe preparations methods and write the chemical equations for the synthesis of various hydrocarbons.
 - 2. Describe basic reactions of hydrocarbons and write the chemical equations for these reactions.
 - 3. Show simple synthesis reactions involving hydrocarbons.
 - D. Laboratory activity: chemical and physical properties of hydrocarbons.
- IV. Chemistry of Functional Derivatives including alkyl halides, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives. Eight Weeks
- A. Identify the various functional groups.
 - B. Nomenclature
 - 1. Given a structural formula, name the compound.
 - 2. Given a name, draw the structural formula.
 - C. Physical properties of functional derivatives.
 - 1. Using structural formulas, determine relative melting points, boiling points, and solubility from a group of hydrocarbons.
 - 2. Demonstrate how the structure of a compound affects the physical properties.
 - D. Chemical properties of functional derivatives.
 - 1. Describe preparations methods and write the chemical equations for the synthesis of various functional derivatives.
 - 2. Describe basic reactions of functional derivative groups and write the chemical equations for these reactions.
 - E. Formulate complex multi-step synthesis using all reactions and preparations learned throughout the course.
 - F. Laboratory Activities (*suggested*)
 - 1. Physical and chemical properties of functional derivatives.
 - 2. Preparation of esters.
 - 3. Preparation of aspirin.

Objectives:

- 1. Evaluate scientific processes by collecting data and applying knowledge to physical models to interpret data.
- 2. Assess and apply patterns in organic nomenclature and reactions.
- 3. Evaluate data correctly to form conclusions.

4. Characterize and identify organic compounds and reactions.

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WCSD STUDENT DATA SYSTEM INFORMATION

1. Is there a required final examination? X Yes No
2. Does this course issue a mark/grade for the report card?
 X Yes No
3. Does this course issue a Pass/Fail mark? Yes X No
4. Is the course mark/grade part of the GPA calculation?
 X Yes No
5. Is the course eligible for Honor Roll calculation? X Yes No
6. What is the academic weight of the course?
 No weight/Non credit Standard weight
 X Enhanced weight (Advanced course credit)