Richmond Public Schools

Department of Curriculum and Instruction

Curriculum Pacing and Resource Guide – Unit Plan

Course Title/ Course #: EOC Chemistry/2802 or EOC Pre AP Chemistry/ 2804

Unit Title/ Marking Period # (MP):2

Start day: Day 57

Meetings (Length of Unit): 3 Weeks

Desired Results ~ What will students be learning?

Standards of Learning/ Standards

CH.3a,c-d & CH.6 a-b

CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include

a) nomenclature;

c) writing chemical formulas;

d) bonding types;

CH.6 The student will investigate and understand how basic chemical properties relate to organic chemistry and biochemistry. Key concepts include

a) unique properties of carbon that allow multi-carbon compounds; and

b) uses in pharmaceuticals and genetics, petrochemicals, plastics and food.

Essential Understandings/ Big Ideas

The concepts developed in this standard include the following:

- Chemical formulas are used to represent compounds. Subscripts represent the relative number of each type of atom in a molecule or formula unit. The International Union of Pure and Applied Chemistry (IUPAC) system is used for naming compounds.
- When pairs of elements form two or more compounds, the masses of one element that combine with a fixed mass of the other element form simple, whole-number ratios (Law of Multiple Proportions).
- Compounds have different properties than the elements from which they are composed.
- The empirical formula shows the simplest whole-number ratio in which the atoms of the elements are present in the compound. The molecular formula shows the actual number of atoms of each element in one molecule of the substance.
- Lewis dot diagrams are used to represent valence electrons in an element. Structural formulas show the arrangements of atoms and bonds in a molecule and are represented by Lewis dot structures.
- Bonds form between atoms to achieve stability. Covalent bonds involve the sharing of electrons between atoms. Ionic bonds involve the transfer of electrons between ions. Elements with low ionization energy form
- The bonding characteristics of carbon contribute to its stability and allow it to be the foundation of organic molecules. These characteristics result in the formation of a large variety of structures such as DNA, RNA and amino acids.
- Carbon-based compounds include simple hydrocarbons, small carbon-containing molecules with functional groups, complex polymers, and biological

molecules.
- Petrochemicals contain hydrocarbons, including propane, butane, and octane.
- There is a close relationship between the properties and structure of organic molecules.
- Common pharmaceuticals that are organic compounds include aspirin, vitamins, and insulin.
- Small molecules link to make large molecules called polymers that have combinations with repetitive subunits. Natural polymers include proteins and nucleic acids. Human-made (synthetic) polymers include polythene, nylon and Kevlar.

Key Essential Skills and Knowledge

In order to meet this standard, it is expected that students will
- name binary covalent/molecular compounds.
- name binary ionic compounds (using the Roman numeral system where appropriate).
- predict, draw, and name molecular shapes (bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal).
- write the chemical formulas for certain common substances, such as ammonia, water, carbon monoxide, carbon dioxide, sulfur dioxide, and carbon tetrafluoride.
- use polyatomic ions for naming and writing formulas of ionic compounds, including carbonate, sulfate, nitrate, hydroxide, phosphate, and ammonium.
- draw Lewis dot diagrams to represent valence electrons in elements and draw Lewis dot structures to show covalent bonding.
- use valence shell electron pair repulsion (VSEPR) model to draw and name molecular shapes (bent, linear, trigonal planar, tetrahedral, and trigonal pyramidal).
- recognize polar molecules and non-polar molecules.
- describe how saturation affects shape and reactivity of carbon compounds.
- draw Lewis dot structures, identify geometries, and describe polarities of the following molecules: CH_4, C_2H_6, C_2H_4, C_2H_2, CH_3CH_2OH, CH_2O, C_6H_6, CH_3COOH.
- recognize that organic compounds play a role in natural and synthetic pharmaceuticals.
- recognize that nucleic acids and proteins are important natural polymers.
- recognize that plastics formed from petrochemicals are organic compounds that consist of long chains of carbons.
- conduct a lab that exemplifies the versatility and importance of organic compounds (e.g., aspirin, an ester, a polymer).

Vocabulary

Organic Compounds	Compound	Base	Carbon Dioxide,
Natural Pharmaceuticals	Binary Compounds	Prefixes	Sulfur Dioxide,
Synthetic Pharmaceuticals	Pure substance	Subscripts	Carbon Tetrafluoride
Nucleic Acids	Nomenclature	Ionic Compounds	Carbonate
Proteins	Chemical Reaction	Coefficients	Sulfate
Natural Polymers	Chemical Equation	Polyatomic ions	Nitrate
Petrochemicals Are Organic	Reactants	Diatomic Ions	Hydroxide
Carbon	Products	Ammonia,	Phosphate
Aspirin	Yield	Water,	Ammonium
Ester	Acid	Carbon Monoxide,	Covalent Compounds

Assessment Evidence ~ What is evidence of mastery? What did the students master & what are they missing?

Assessment/ Evidence

Evidence of Mastery: Students will display mastery by consistently scoring at a "C" or above range on all assessments. Success and mastery will also be shown by increasing scores from the beginning of the unit to the end of the unit. Overall mastery of the content and successful learning of the Targeted Objectives will be measured by assessing the Lab Journal for the Organic Chemistry Lab and the final unit assessment. Mastery will result in score 90 out of 100 points on the predicting product virtual Lab Rubric and the final assessment scores at or above "C".

Other Possible Assessments

- Group Discussions
- Student Reports
- Teacher-Created IA Test/Quiz
- Writing Assignment

Possible Learning Gaps

• The term salt refers to all ionic compounds.

-Ionic bonds are formed when electron transfer from one atom to another.

• Metal atoms lose electrons and become positively charged while non-metal atoms gain electrons and become negatively charged. These oppositely charged ions are electrostatically attracted to each other, these results in an ionic bond.

- Ionic bonds form between metals and non-metals, while covalent bonds form between non-metals.

• The true nature of a chemical bond is determined using the differences in electronegativities. Bonds have "ionic character" or "covalent character" along a bonding continuum.

-When a substance melts or boils, bonds are broken.

• Bonds are only broken when an ionic compound melts or boils. In a molecular compound, the covalent bonds remain undamaged, only the forces holding the molecules together with other molecules are broken.

-All ionic compounds conduct an electric current.

• When ionic compounds are in the solid state, the ions are held rigidly together and do not conduct electricity.

-When ionic compounds are in the liquid state, they will conduct electricity

Learning Plan ~ What are the strategies and activities you plan to use

Learning Experiences/ Best Practice

- Have students research the compounds used in this lab to find additional similarities in both physical and chemical behaviors.
- Have students do Internet research to find commercial or industrial products (e.g., cleaners, paint) in which each of the ionic compounds are used. Have them create a poster displaying pictures of each product.
- Have students create questions, e-mail them to a chemist with a chemical company, and organize the responses into a report.
- Place the nine unknown solutions into groups according to similar chemical behaviors. Present the groupings to the class, and discuss any differences in groupings. Examine the similarities in the compounds based on their chemical formulas and relate similar chemical formulas to similar chemical behaviors.
- Have students research advanced chromatographic procedures and the uses of these procedures in industry.
- Explain why, in large-scale industrial product manufacturing, the mass of what is produced is always less than the mass of the starting materials. (Investigate this online or interview a representative from a local industry that uses raw materials to manufacture a finished product.)
- Have students research the advanced chemical reactions that occur during saponification
- Have students research the quality control tests that are done in industry to monitor the amount of aspirin contained in tablets. Ask students to present their research and explain the benefits of quality control tests.
- Have students visit industries that utilize titration, e.g., pharmaceutical, water testing, wine making.
- Use overhead with electronegativity values so students can actually determine the difference and relate it to the general rule that an ionic bond is metal/nonmetal and a covalent bond in nonmetal/nonmetal Show how the electron configuration changes when electrons are lost or gained
- Demonstration: conductivity tester with salt vs. sugar in tap water, distilled water and as a solid Use bingo chips on overhead, labeled positive and negative, to illustrate properties of ionic compounds Give examples of ionic compounds and list the properties associated with these compounds. Show students samples of crystals of ionic compounds, colortransparencies or computer images.
- Demonstrate the differences in melting points for ionic compounds vs. covalent compounds (use salt and sugar).

POGIL Activities
Chemical Formulas
Organic Reactions
Polymers

Labs
Bonding Labs
Soap, Slime, and Creative Chromatography
Mystery Anions
Mystery Iron Ions
Aspirin Analysis
A Crystal Lab

Organic Chemistry Labs
Lab 1 - Alkanes
Lab 2 - Alkenes & Alkynes
Lab 3 - Slime Lab
Lab 4 - Halocarbons
Lab 5 - Alcohols
Lab 6 - Aldehydes & Ketones
Lab 7 - Carboxylic Acids
Lab 8 - Esters

Technology Integrations

PhET Simulations:
- Atomic Interactions
- Build a Molecule
- Molecule Polarity
- Molecules & Light
- Molecule Shapes
- Molecule Shapes: Basics

Gizmos
Covalent Bonds
Ionic Bonds

Resources

VDOE Lesson Plans
Properties of Compounds and Chemical Formulas (PDF) / (Word)
Soap, Slime, and Creative Chromatography (PDF) / (Word)
Mystery Anions (PDF) / (Word)
Mystery Iron Ions (PDF) / (Word)
Molecular Model Building (PDF) / (Word)
Aspirin Analysis (PDF) / (Word)
A Crystal Lab (PDF) / (Word)
Formulas and Percent Compositions of Ionic Compounds (PDF) / (Word)
Finding the Formula and Percent Composition (PDF) / (Word)

Review Power Point:
Valence Electrons
Ionic Bonding
Ionic Compound Nomenclature
Metallic Bonding
Covalent Bonding (Molecules)
Binary Molecular Nomenclature
VSEPR and Molecular Geometry
Intermolecular Forces of Attraction
Polymers
Nomenclature, Reactions, & Formulas
Percent Composition, Empirical and Molecular Formulas
Basic Biochemistry - Carbohydrate, Protein and Fat

Videos
What are Ions?
Ionic Bonds
Formulas with Polyatomic Ions
Halogens in Compounds
Naming Ionic Compounds I
Naming Ionic Compound II
Polyatomic Ions
VSEPR Theory
VSEPR Theory II
Organic Molecules

Mr. Christopherson's Website

Cross Curricular Connection

English: Journalists often write about "scientific proof" and some scientists talk about it, but in fact, the concept of proof — real, absolute proof — is not particularly scientific. Science is based on the principle that any idea, no matter how widely accepted today, could be overturned tomorrow if the evidence warranted it. Science accepts or rejects ideas based on the evidence; it does not prove or disprove them. To learn more about this, visit our page describing how science aims to build knowledge.

Math: Calculating mean, median & mode.

Real World: Use everyday ideas to introduce the terms and promote discussion:
– Accuracy and precision are required to succeed at darts and archery.
– A cookery book must contain recipes that are repeatable and reproducible, otherwise no one would want to buy it.