

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 72

Meetings (Length of Unit): 2 Weeks

<i>Desired Results ~ What will students be learning?</i>
<u>Standards of Learning/ Standards</u>
CH.3b 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 b) balancing chemical equations;
<u>Essential Understandings/ Big Ideas</u>
The concepts developed in this standard include the following: <input type="checkbox"/> Conservation of matter is represented in balanced chemical equations. A coefficient is a quantity that precedes a reactant or product formula in a chemical equation and indicates the relative number of particles involved in the reaction.
<u>Key Essential Skills and Knowledge</u>
In order to meet this standard, it is expected that students will <input type="checkbox"/> transform word equations into chemical equations and balance chemical equations.
<u>Vocabulary</u>
coefficient, combination, compound, decomposition, double replacement, element, molecule, product, reactant, single replacement, subscript, Avogadro's number, chemical equation, chemical formula, chemical reaction, coefficient, synthesis, combustion, conservation of matter, molar mass, mole, molecular mass

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 [Conservation of Matter Lab](#) and the final unit assessment. Mastery will result in score 90 out of 100 points on the [Conservation of Matter 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

"Law of Conservation of Mass does not apply to atoms."

Students may be able to repeat the Law of Conservation of Mass, but see no problem with atoms disappearing or appearing to balance equations.

"Elements can form other elements."

Several students when questioned about the appearance of copper on magnesium ribbon in copper sulfate remarked that the brown solid came from the magnesium. They thought it was somehow present in the magnesium even though they agreed that magnesium was an element.

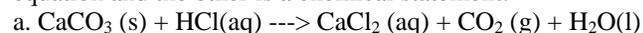
"All solutions are pure liquids."

Most students, early in the year, do not distinguish between a solution and a pure liquid. Teachers and textbooks perpetuate this notion by labelling solutions as 0.1 M CuSO₄ before students understand anything about molarity. It would probably be better to label such a solution as "CuSO₄ solution" and to demonstrate for students how such solutions are prepared. One could also demonstrate that when a pure liquid is evaporated there is no residue, but when a solution is evaporated there is often a residue.

"There is such a thing as an unbalanced chemical equation."

An equation, by definition, is an expression in which the components on either side of the equality sign are identical. For example, in the equation $4x = 32$, we are told that multiplication of x by 4 yields the quantity 32. It follows that x must be 8, and that the equation can be rewritten as $4 \times 8 = 32$.

A chemical equation is not a mathematical equation in the strict sense. The left side of the equation represents the reactants and the right side the products. They are joined by an arrow or "yields" sign that, for all intents and purposes, may be taken as an equality sign. The chemical equation is an expression of the Law of Conservation of Matter. Equal numbers of atomic representations must appear on both sides of the arrow. In the expressions given below, one is a chemical equation and the other is a chemical statement:



In expression (a), the number of chlorine atoms and hydrogen atoms are unequal on both sides of the arrow. Placing a 2 in front of the HCl in the expression achieves the desired (and required) equality. Hence, expression (b) fulfills the definition of an equation, but expression (a) does not. Expression (b) is often called a "balanced chemical equation," and expression (a) is called an "unbalanced chemical equation." Strictly speaking, expression (a) is not an equation at all since the equality requirement is not fulfilled, and expression (b) is an equation and therefore does not need the adjective "balanced" since it is a redundancy, by definition. Common usage allows us to call both expressions equations, but according to our definition, there is no such thing as an unbalanced equation.

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

Learning Experiences/ Best Practice

- To demonstrate conservation of matter, place a large candle on a triple-beam balance, and carefully measure its mass so that the balance is balanced. Light the candle and wait for about one minute. What happens to the mass of the candle, and how can you tell? Where did the missing mass go? Blow out the candle, and invert a large jar over the candle. Rebalance the candle and jar, then remove the jar, light the candle, and replace the jar. The candle should burn for several seconds before running out of air and burning out. What happens this time? Why doesn't the mass of the candle/jar change now?
- Introduce chemical reactions by demonstrating some chemical reactions in class. Reactions can be done as a teacher demonstration or performed by students. The following reactions are fun examples to try. (See the Selected Web Resources on page 3 of this document for detailed instructions.)
 - Turn water into "wine," "milk," and "beer" using common chemicals.
 - Mix calcium chloride, baking soda, water, and phenol red in a resealable bag.
 - React copper wire (Cu) with a silver nitrate solution (AgNO₃).
 - React a metal such as magnesium (Mg) or zinc (Zn) with hydrochloric acid (HCl).
- Guided practice: teach students to balance polyatomic ions first, hydrogen and oxygen last. Have students tally atoms on each side of the yield sign and add coefficients until tallies match. Advanced students may skip this step. Correct misconceptions that coefficients can be added in the middle of a compound or those subscripts can be changed
- Activity: "Balancing Equations Shuffle" Choose volunteers to wear placards that say "A+", "B-", "C+" and "D-" to represent the different reactants of 4 of the types of reactions. Start the music and have them stop when rearranged (like Musical Chairs) Identify the types of reactions, predict the products
- Teach students "BrINClHO_F" to help students remember the seven diatomic atoms

Labs

[Balancing Chemical Equations](#)

[Types of Reactions, Predicting Products of Chemical Reactions Lab](#)

[Predicting Products and Reactants](#)

[Balancing Chemical Equations](#)

[Conservation of Matter and Balancing Chemical Equations](#)

POGIL Activities

[Balancing Chemical Reactions](#)

Technology Integrations

PhET Simulations:

[Balancing Chemical Equations](#)

Games

[Balancing Act Game](#)

Gizmos

[Chemical Equations](#)

[Balancing Chemical Equations](#)

Resources

VDOE Lesson Plans

[Matter and Energy: Equations and Formulas](#) (PDF) / ([Word](#))

[Predicting Products and Writing Equations](#) (PDF) / ([Word](#))

Review Power Points

[Balancing Chemical Equations](#)

Videos

[Balancing Chemical Equations](#)

Selected Web Resources

[Water into wine, milk, beerCalcium chloride/baking soda reaction](#)

[AgNO₃ + Cu](#)

[Mg +HCl](#)

[Reaction types](#)

["Old Foamy"](#)

[Chemical reactions](#)

[Type of Chemical Reactions](#)

[Fuel cells](#)

[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.