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Scavenger Hunt- Original Lesson Plan
1/26/19

Balancing Chemical Equations

Grade/ Grade Band: 8th/ 6-8	**Topic:** Chemistry	**Lesson #** 25 **in a series of** 27 **lessons**
Brief Lesson Description: In this lesson, students will be writing out chemical equations (both chemical and molecular formulas) and balancing the equations.		
Performance Expectation(s): Students will be able to write a chemical formula given the molecular formula. Students will be able to write a molecular formula given the chemical formula. Students will be able to balance a chemical equation using the coefficients (number of molecules). Students will be able to define the law of conservation as it pertains to the atoms in a chemical reaction.		
Narrative / Background Information		
Prior Student Knowledge: Prior to this lesson students have practiced writing chemical formulas and molecules based on atoms provided. Students have experience locating elements on the periodic table, counting the number of atoms within a chemical formula, and multiplying by the coefficient to give the number of atoms total in a molecule. Students have also discussed the law of conservation as it pertains to energy and resources.		
NGSS/ Common Core Standards		
Science & Engineering Practices: HS-PS1-7.- Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	**Disciplinary Core Ideas:** PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions CCSS.ELA-LITERACY.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.	**Crosscutting Concepts:** CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). MP.2 Reason abstractly and quantitatively.
Possible Preconceptions/Misconceptions: Students may come into the lesson thinking that an equation is already balanced and there is no need to follow the law of conservation. A student may also believe that the amount of atoms in a molecule will not affect the substance chemically.		
LESSON PLAN – 5-E Model		
ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions: The class will begin with students copying the focus question off of the board, “What is the law of conservation and how could this be applied to atoms?”. Once copied, students will attempt an answer (it is okay if this answer is wrong, the purpose of the focus question is to get students thinking about the topic at hand).		

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:
Students will be given cut outs of atoms (shaped as circles with the symbol of the element in the center). The instructor will have their own set on the board to move around (magnets). Together, the class will construct the reactants for the reaction in this lesson's lab. Each lab group will be combining Hydrochloric acid (HCl) and Sodium Bicarbonate (NaHCO3). Once these molecular formulas are in front of the students the instructor will give 5 minutes to rearrange these atoms to produce three new products. Students are told that all three products are safe and that they have worked with them before.
The instructor will give instructions for the lab and students will work in their groups.

Lab Materials (per group):

- Safety goggles
- 1 vial holder
- 1 white spoon
- Vial holder
- 1 Jar of Sodium Bicarbonate
- 1 120mL plastic bottle
- 1 stopper and 60 cm tubing
- 2 syringes
- 1 250 mL plastic cup
- 1 well tray
- 1 bulb pipette
- 2 hand lenses

Lab Materials (for the class):

- Diluted solution of Hydrochloric acid
- Limewater concentrate
- Notebook sheet (analysis)
- Lab sheet

Lab Procedure:

1. Gather all materials listed on the material sheet
2. Place three level spoons for sodium bicarbonate into the 120mL bottle.
3. Use the syringe labeled with an "l" to get 10 mL of limewater from the lab station
4. Place 10 mL of limewater in the vial
5. Insert the bottle and vial into the cavities of the vial holder
6. Using the other syringe in the lab materials get 5 mL of hydrochloric acid (caution). Be sure to place the syringe in the 250 mL cup provided to prevent spills.
7. Draw 30 mL of air into that same syringe to get ot all of the liquid of HCl.
8. Slowly, put the acid and air into the bottle using the tubing not connected to the limewater. Observe, then record findings in your lab notes.

(Also see attached sheet for lab instruction)

Once finished students will clean up and answer the analysis questions.

EXPLAIN: Concepts Explained and Vocabulary Defined:

This portion of the lesson will consist of lecture and practice. Students will be learning about chemical reactions, reviewing how to write formulas (both chemical and molecular), and practices how to balance chemical equations.

Topics covered in lecture:

- Review:

    - What is a chemical reaction?
    - Evidence of a reaction
    - Difference between a physical and chemical reaction
    - Writing chemical and molecular formulas
    - How to read a chemical formula
    - Difference between a subscript and a coefficient
- Reading a chemical equation
- Manipulating atoms from the reactant to the product side
- Law of conservation of Energy
- Balancing chemical equations using coefficients

Example Practice Problems (given in increasing difficulty for students)

1. _____MnS + _____HCl ----> _____H_2S + _____$MnCl_2$
2. _____ Xe + _____F_2 ----> _____XeF_6
3. _____$NaHCO_3$ ----> _____Na_2CO_3 + _____CO_2 + _____H_2O

Vocabulary:

- Law of Conservation- energy can neither be created nor destroyed; rather, it can only be transformed or transferred from one form to another.
- Atom- the basic unit of a chemical element.
- Element- each of more than one hundred substances that cannot be chemically interconverted or broken down into simpler substances and are primary constituents of matter.
- Compound- made up or consisting of two or more existing parts or elements.
- Molecule- a group of atoms bonded together, representing the smallest fundamental unit of a chemical compound that can take part in a chemical reaction.
- Chemical Reaction- the rearrangement of atoms to form a new substance
- Reactants- a substance that takes part in and undergoes change during a reaction.
- Products- is a substance that is formed as the result of a chemical reaction.

ELABORATE: Applications and Extensions:

This lesson can be expanded upon with more complex chemical reactions to balance with more elements and larger compounds. This would be a good time for remediation on the lesson as well, based on ability level students can be given different equations to balance. The instructor could also place a list of equation on the board and tell all students to pick 4 to do. The list is given in increasing order of complexity. Students are told, when picking to challenge themselves and build their skills.

EVALUATE:

Formative Monitoring (Questioning / Discussion)

During the Lab: The instructor will monitor the lab and ask questions as he/she walks around the room. The class will also go over the analysis questions at the end of the lab to be sure the objectives were met and student understanding is occuring.

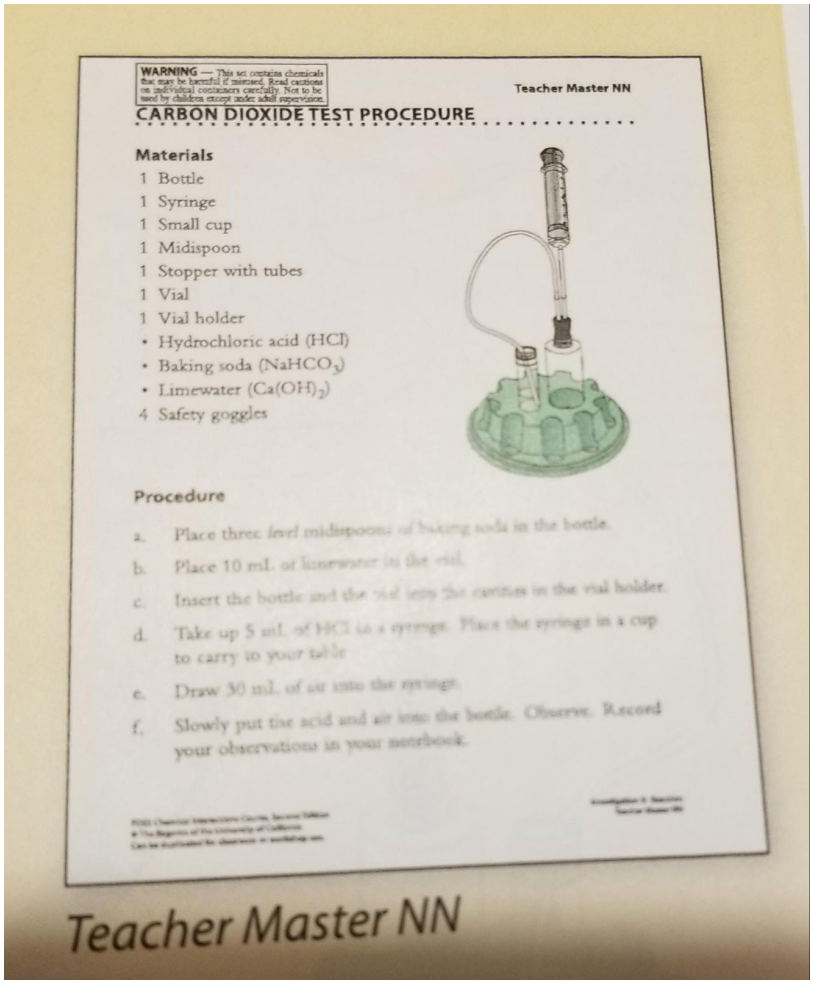
Summative Assessment (Quiz / Project / Report):

This is the final lesson prior to the quiz on investigation 9. Students will have a study guide and take the test. This test will assess all objectives and standards in the lesson.

Resources:

All assessments and assignments can be found on Fossweb.com. All lab materials and curriculum given by FOSS ™.

FOSS (2019). "Chemical Interactions". *The Regents of the University of California.* Received from: fossweb.com



Scavenger Hunt

This lesson is one of the final lessons in a unit on Chemistry. It is an advanced lesson in the unit with a lot of high level science terms, information, and skills needed. I think it would be a nice lesson to incorporate art for students as a different way of understanding that might reach more students. It would also be a way to have students think of science in a different light. My first thought with this lesson is to use the molecular formulas. Students could have something else to represent atoms instead of their own circles and symbols. I was thinking cardboard cutouts or stickers. The standards I was looking at from Common Core and the National Core Arts Standards are listed below. I plan on narrowing them down and adding to this lesson as we progress through the course.

The Arts and Common Core

RI.K.7: With prompting and support, describe the relationship between illustrations and the text in which they appear.
W.K.2: Use a combination of drawing, writing, and dictating to compose informative and explanatory texts in which they name what they are writing about and supply some information about the topic.
RI.1.7: Use the illustrations and details in a text to describe its key ideas.
RI.7.7: Compare and contrast a text to an adiu, video, or multimedia version of the text, analyzing each medium's portrayal of the subject.
W.11-12.2.a: Introduce a topic, organize complex ideas, concepts, and information so that each new element builds on that which preceded it to create a unified whole; include formatting, graphics, and multimedia when useful to aid comprehension.
SL.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, and orally) and explain how it contributes to a topic, text, or issue under study.
SL.K.5: Add drawings or other visual displays to describe as desired to provide additional detail.

National Core Arts Standards

VA:Cr2.3.8a: Select, organize, and design images and words to make visually clear and compelling presentations.
VA:Cr1.2.8a: Collaboratively shape an artistic investigation of an aspect of present day life using a contemporary practice of art and design.
MA:Cr1.1.8: Generate ideas, goals, and solutions for original media artworks through application of focused creative process, such as, divergent thinking and experimenting.
MA:Re8.1.8: Analyze the intent and meaning of a variety of media artworks, focusing on intentions, forms, and various context.
Ma:Cn10.1.8b: Explain and demonstrate how media artworks expand meaning and knowledge, and create cultural experiences, such as local and global events.

Resources:

Common Core Standards Initiative. (2019). Eighth Grade Science Standards. http://www.corestandards.org/

National Coalition for Core Arts Standards. (2012). "The Arts and the Common Core: A Review of Connections Between the Common Core State Standards and the National Core Arts Standards Conceptual Framework". http://www.nationalartsstandards.org/sites/default/files/College%20Board%20Research%20-%20Arts%20and%20Common%20Core%20-%20final%20report1.pdf

National Core Arts Standards. (2016). Eighth Grade Art Standards. https://www.nationalartsstandards.org/