Python Coding – Stoichiometry Length: 6 Weeks

STEM SCIENCE TECHNOLOGY ENGINEERING MATH	**Science Unit Plan**	
Teacher: Pritchard	Grade: 10th	Course: Chemistry
Unit Title: Python Coding – Stoichiometry		

LEARNING TARGETS

LT 16: I can balance a chemical equation to determine molar ratios.
LT 14: I can identify the reactants, products, and types of different chemical reactions: Composition, decomposition, double replacement, single replacement, and combustion.
LT 17: I can convert among the following quantities of a substance: mass, number of moles, number of particles, molar volume at STP.
LT 18: I can identify and solve stoichiometry problems that interconvert volume of gases at STP, moles, and mass.

UNIT OVERVIEW — **Overall summary of the unit, activities, tasks, and/or content.**

After using Codecademy.com to learn the Python coding language, students will write a program using the Python code that will solve for the molar mass of any binary or ternary ionic or covalent compound. Students seeking proficient for coding will use this program to solve molar mass calculations. Students seeking advanced for coding will write a second program that will perform stoichiometric calculations for an unknown mass, mole, or volume of a gas at STP.

MOTIVATORS — **Hooks for the unit and supplemental activities. (PBL scenarios, video clips, websites, literature)**

This unit will begin with students viewing a colorful, very exothermic, and possibly larger than life chemical reaction. Students will be asked to design a series of experiments in which they will investigate chemical reactions. Observations will initially focus on qualitative data and analysis. As the unit progresses, students will be required to complete a quantitative analysis of the reactions they have conducted. All concepts identified within the unit are necessary in order for students to complete their analysis of their own experiments.

Wk	Learning Targets	Materials & Resources	Instructional Procedures	Differentiated Instruction	Assessment
1	I can balance a chemical equation to determine molar ratios. (**SPI 3221.3.4)**	**Elephant Toothpaste** 50-100 ml of 6% hydrogen peroxide solution, saturated potassium iodide solution, liquid dishwashing detergent, and food coloring **Sugar Snake** Ingredients Sugar and Concentrated Sulfuric Acid	Essential Questions How can I describe a chemical reaction? How is energy involved in chemical reactions? What are clues that help you determine that a chemical reaction has taken place? What factors will affect the rate of chemical reactions? What chemical reactions relate to everyday life? What kind of information is represented by a chemical equation? What information is conveyed by a chemical formula? **Day 1**	Remediation RTI during PBL/RTI time. Individual/group study time. Enrichment Application opportunities in	Formative Assessments Students will have an interactive practice through CK12.org that will require students to get

		Flipped Classroom Chemistry Flexbook Textbook from ck12.org Instructor will need to choose textbook reference materials, assign students to a class, and identify relevant assignments for students. **Inquiry Activity** 36 colored paper clips (12 each of 3 different colors) Prentice Hall Chemistry	Demonstration • Create Elephant Toothpaste or Sugar Snake o Elephant Toothpaste directions can be found on the Internet. Use of hydrogen peroxide 6% will produce the same effect as using 30% but in more controlled reaction. This would also allow you to question students on the effect of increasing concentration of hydrogen peroxide to 30% or decreasing it to 3%. ▪ Take all responses as to what the students believe the products are. o Sugar Snake has special safety precautions and should not be done by the students. If you do this demonstration, use proper safety precautions. Whenever you deal with concentrated sulfuric acid, you should wear gloves, eye protection, and a lab coat. Consider the beaker a loss, since scraping burnt sugar and carbon off of it isn't an easy task. It is preferable to perform the demonstration inside of a fume hood. ▪ Take all responses as to what the students believe the products are. ▪ Advantages to this demonstration – extremely exothermic reaction allows for review of states of matter and heat notation when writing a chemical equation. Direct Instruction • Word Equation • Chemical Equation • Chemical Formula Notation Flipped Classroom • Students have registered in specified teacher group of ck12.org. Assignment for class on day 2 is to read 11.3 Balancing Equations. There are three videos that demonstrate how to balance equations if further instruction is needed. **Day 2** Inquiry Activity • Modeling Chemical Reaction • Each of the 36 paper clips represents an atom of oxygen, hydrogen, and carbon. • Students create molecules of hydrogen gas, oxygen gas, and methane. • Students "react" molecules and record each molecule reacted and formed in a balanced equation. Students are given two examples and then allowed to create their own combinations: o _____H_2 + _____O_2 → _____H_2O o _____CH_4 + _____O_2 → _____CO_2 + _____H_2O Independent/Partner Practice	the inquiry lab design for more difficult/challenging topics or combinations of elements. Learning Styles Visual Aural Verbal Physical Social Solitary	10 questions correct before moving on to next topic. Instructor can assess difficulty of questions as easy, medium, and difficult. Students will submit lab report for evaluation using Dropbox. Comments by instructor are then addressed and revised to meet safety concerns and appropriateness of activity. Students complete revisions and resubmit for final approval. Summative Assessment Inquiry-based, self-designed laboratory procedure is the summative for this week. Requirements for successful completion are outlined in Instructional Procedures.

		Attention Grabber Use link below to Amazing Chemical Reactions at beginning of Day 4/5 to spark students' interest in chemical reactions. Many of the reactions are not safe for high school so it allows students to see some of the unusual reactions. Amazing Chemical Reactions https://www.youtube.com/watch?v=FofPjj7v414	• Students will convert word equations to chemical equations and then balance the equations. **Day 3** Self-directed study • Students not needing additional teacher directed instruction are free to progress through the practice activity on CK12.org. Students requiring additional assistance will sit in predetermined area for ease of monitoring and assistance. Modeling Chemical Reaction activity and independent practice done on day 2will identify those needing additional intervention from instructor. **Day 4/5** Hey Check This Out!! • Attention Grabber - Use link to Amazing Chemical Reactions at https://www.youtube.com/watch?v=FofPjj7v414 beginning of class to spark students' interest in chemical reactions. Many of the reactions are not safe for high school so it allows students to see some of the unusual reactions. Inquiry Lab Design • Students will receive their Inquiry Lab Design topic. This lab requires student to design and conduct a laboratory exercise that will identify the five types of chemical reactions and answer the following questions. o How does one distinguish between a ▪ Single displacement/replacement ▪ Double, displacement/replacement ▪ Synthesis/composition ▪ Decomposition ▪ Combustion reaction o What are possible indicators that a chemical reaction has occurred? o How does one predict the products of each type of reaction? o How would one write a balanced chemical equation for each reaction that occurred in the laboratory exercise? o What are the disposal methods required for each product? • Students will conduct independent research, design and submit their lab proposal in word format. Instructor will evaluate student design, request revisions, and approve or disapprove laboratory exercise. Students are required to make any needed solutions, check inventory for chemicals, request purchase of needed items, supply items that can be purchased locally, and design data tables. All set-up and cleanup of laboratory exercise is the student's responsibility. Flipped Classroom • Students will need to read sections 11.4 to 11.9 for background		

			information on types of chemical reactions. This reading will take place at home and class time will be used for small group or one-on-one instruction.		
2	I can identify the reactants, products, and types of different chemical reactions: Composition, decomposition, double replacement, single replacement, and combustion. **SPI 3221.3.2**	Single-replacement reaction Mossy Zinc and Hydrochloric Acid Double-replacement reaction Potassium Chromate and Silver Nitrate Lead (II) Nitrate and Potassium Iodide Video resource https://www.youtube.com/watch?v=7hVKb4ROjZw#t=379 Synthesis Reaction Magnesium Ribbon https://www.youtube.com/watch?v=nsEkKIiOz7Q Decomposition Reaction Hydrogen Peroxide 3% and active yeast (catalyst) VERY STRANGE video link but will leave a lasting impression on students. https://www.youtube.com/watch?v=ritaljhhk7s Combustion Reaction Bunsen burner and fuel source Review of all five types of reactions https://www.youtube.com/watch?v=nsEkKIiOz7Q	**Day 6** Small group discussion • Students will read information related to the five types of chemical reactions located in ck12.org. before coming to class on day 6. Each day the students will have the opportunity, during class, to receive small group instruction on the five types of reactions. Demonstrations will identify the type of reaction focus for that day. Students are to complete the practice problems in ck12.org for single replacement and double replacement reactions. Demonstration • Single-replacement reaction – Drop a small piece of mossy zinc into a test tube containing10mL of 6M hydrochloric acid. Immediately place an inverted test tube and collect the hydrogen gas being given off. Place a lit match at the base of the inverted test tube and listen for the "bark" sound that is the hydrogen gas exploding. Do not bring lit match close to hydrochloric acid. • Double-replacement reaction – Add silver nitrate drop by drop to approximately 50 mL of potassium chromate OR add potassium iodide drop by drop by drop to lead (II) nitrate. Research • Students will continue research using online resources, and/or laboratory manuals provided by instructor. Students should identify a laboratory investigation they would like to complete for single replacement and double replacement reactions. Once students have identified their activities, they will complete the Lab Report template created by the science department. This Lab Report must be submitted via Dropbox and approved before students are allowed to proceed. **Day 7** Demonstration • Synthesis reaction - Take a 5cm strip of magnesium ribbon and burn it in oxygen. • Decomposition reaction – Add some active yeast to a Ziploc baggie to serve as your catalyst. Experiment with appropriate amounts. Add hydrogen peroxide to the bag and zip it closed. You may need to shake the bag to initiate reaction. Bag will expand as the decomposition of the hydrogen peroxide occurs. You may need to open the bag some to allow the oxygen gas to escape. Small group discussion • Students will read information related to the five types of chemical reactions located in ck12.org. before coming to class on day 6. Each day the students will have the opportunity, during class, to	Remediation RTI during PBL/RTI time. Flipped Classroom will allow for individual or group study time. Small group intervention with instructor will also be available. Enrichment Application opportunities to more difficult/challenging topics or combinations of elements. Inquiry based laboratory design will allow students to choose more challenging explorations. Ck12.org modifies practice questions based on success rate at various levels. Practice questions will be automatically adjusted to challenge students with more difficult questions when appropriate. Learning Styles	Formative Assessments Students will have an interactive practice through CK12.org that will require students to get 10 questions correct before moving on to next topic. Instructor can assess difficulty of questions as easy, medium, and difficult. Molar Mass, Mass to Moles, Particles, to Moles, Volume to Moles evaluations will be given before moving onto the next item. Students will submit lab report for summative evaluation using Edmodo. This is only done after the students have

			receive small group instruction on the five types of reactions. Students are to complete the practice problems in ck12.org for synthesis and decomposition reactions. Research • Students will continue research using online resources, and/or laboratory manuals provided by instructor. Students should identify a laboratory investigation they would like to complete for synthesis and decomposition reactions. Once students have identified their activities, they will complete the Lab Report template created by the science department. This Lab Report must be submitted via Dropbox and approved before students are allowed to proceed. **Day 8** Demonstration • Combustion reaction – This demonstration involves discussion of the Bunsen burner and fuel that is used in the science lab. No other materials are needed other than the burner, lighter, and fuel. Small group discussion • Students will read information related to the five types of chemical reactions located in ck12.org. before coming to class on day 6. Each day the students will have the opportunity, during class, to receive small group instruction on the five types of reactions. Students are to complete the practice problems in ck12.org for combustion reactions. Research • Students will continue research using online resources, and/or laboratory manuals provided by instructor. Students should identify a laboratory investigation they would like to complete for a combustion reaction. Students will be limited on choices with this reaction type but should still research the reaction type. Once students have identified their activity, they will complete the Lab Report template created by the science department. This Lab Report must be submitted via Dropbox and approved before students are allowed to proceed. **Day 9/10** Summarizing Strategy • Students will complete the self-designed laboratory exercise addressing all five of the types of chemical reactions, correctly identify the reactants and products, and balance each equation identifying the correct mole ratios. Use of standard chemical equation notation, such as identifying solids, liquids, gases, and heat transfer, are required.	Visual Aural Verbal Physical Social Solitary	had a peer review and addressed those comments made in the peer evaluation.
3	I can convert among the following	**Engagement Activity** Silly song but popular choice "A Mole is a Unit" https://www.youtube.com/watch?	**Day 11** Peer Review and Final Edits for laboratory exercise addressing all five of the types of chemical reactions. • Students will complete their lab report from their laboratory	Remediation RTI during PBL/RTI time.	Formative Assessments Students will submit lab

	quantities of a substance: mass, number of moles, number of particles, molar volume at STP. (**SPI 3221.3.5)**	v=PvT51M0ek5c Lyrics to "A Mole is a Unit" http://www.exploratorium.edu More serious video intro "How big is a mole?" https://www.youtube.com/watch?v=TEl4jeETVmg TEDEd lesson link http://ed.ted.com/lessons/daniel-dulek-how-big-is-a-mole-not-the-animal-the-other-one **Flipped Classroom** Chemistry Flexbook Textbook from ck12.org Instructor will need to choose textbook reference materials, assign students to a class, and identify relevant assignments for students. Lab Report Rubric for students to peer review lab reports before final submission.	exercises last week and seek one student to peer review the report. Revisions based on reviews will be addressed and lab report is to be submitted to Edmodo for final teacher evaluation. **Day 12** Engage • Song "A Mole is A Unit" by Michael Offutt • Students are challenged to check the information given in the song. o Examples ▪ A mole of paper would go to the moon and back eighty billion times ▪ Mole of marshmallows would weigh five million trillion tons Flipped Classroom • Option A o Students are to read about Avogadro and molar mass in flexbook. o Additional reading: http://www.scientificamerican.com/article.cfm?id=how-was-avogadros-number o Practice with content information via ck12.org • Option B o Complete TEDEd lesson at the following link o http://ed.ted.com/lessons/daniel-dulek-how-big-is-a-mole-not-the-animal-the-other-one Small Group Instruction • Students needing assistance on assigned material or not ready for Molar Mass formative assessment will meet with instructor in small groups. Once students have demonstrated understanding of molar mass, they may complete the Molar Mass Evaluation and then move forward to conversions. Independent Study • Students that encountered no problems in reading or practice assessment will take the Molar Mass Evaluation before moving on to conversions. Python Coding • Students will write Python code to determine the molar mass of any compound given its formula and atomic mass. Work this week will focus on manipulating various binary and ternary compounds and determining molar mass for each. Students can use the Molar Mass Evaluation examples to assess if their Python code is correct for calculating molar mass of compounds. **Day 13** Flipped Classroom • Conversions between Moles and Mass – ck12.org Small Group Instruction/Independent Study	Flipped Classroom will allow for individual or group study time. Small group intervention with instructor will also be utilized. Enrichment Application opportunities to more difficult/challenging topics or combinations of elements. Inquiry based laboratory design will allow students to choose more challenging explorations. Ck12.org modifies practice questions based on success rate at various levels. Practice questions will be automatically adjusted to challenge students with more difficult questions if appropriate. Learning Styles Visual Aural Verbal Physical Social Solitary	report for teacher evaluation using Dropbox. Comments by instructor are then addressed and revised to meet safety concerns and appropriateness of activity. Students complete revisions and resubmit for final approval. Students will have an interactive practice through CK12.org that will require students to get 10 questions correct before moving on to next topic. Instructor can assess difficulty of questions as easy, medium, and difficult.

			• Students choose which level of instruction is needed. There will be a short 10 to 15 minute class discussion on topic before moving to appropriate areas of the room. Students may use this time to work on Python coding and to check each other's progress or seek assistance from the coding experts on Python. **Day 14/15** Science Snapshot of the Day • Three question assessment to get students thinking about molar mass and conversions to and from the mole. o Sample questions – How many moles of water are in 25.0 grams of water? How many grams of sodium chloride are in 100.0 grams of sodium chloride? • After students have had time to answer questions independently, volunteers will airplay on Promethean Board their solutions for class discussion on problem solving technique and accuracy. Flipped Classroom • Students will spend 10 to 15 minutes discussing the reading from previous night. o Summary questions are supplied at end of reading and will serve as discussion guides. • What are the similarities between conversions of mole and mass and moles to volume or particles? • What are the differences? Guided/Independent Practice • Students will practice mass to volume and mass to particle problems in class. This will allow instructor to assist in the use of equivalence statements and problem solving technique. What is not finished in class must be completed by next class session.		
4	I can convert among the following quantities of a substance: mass, number of moles, number of particles, molar volume at STP. (**SPI 3221.3.5)**	Teacher created group study questions in question/answer format. There is some prep time needed for this but both students are responsible for different parts of the practice. *Example:* *What mass of carbon dioxide is produced when 44.1 g of propane reacts with sufficient oxygen?* Q: What are the reactants? A: Q: What is the formula for propane? A: Q: What is the formula for oxygen? (Hint: Diatomic	**Day 16** Independent Practice • Students will complete a group tutoring practice assessment that requires them to give each other a problem to solve. One person, person B has the question and hints to solve the problem while the other person, person A has to solve. The hints given can be used to help guide students. When person A has completed the problem, person B verifies the answer. Attention to details such as correct number of significant digits, unit of measurement, and identification of substance will be assessed. Person A then gives a different problem to person B and helps them solve the problem using identified hints. It is the responsibility of the partners to coach each other on finding the solution. • See Materials and Resources for a sample of question/hint format. **Day 17** Summative Assessment • Students will complete a teacher written summative requiring students to balance chemical equations, classify reactions, and	<u>Remediation</u> RTI during PBL/RTI time. Flipped Classroom will allow for individual or group study time. Small group intervention with instructor will also be utilized. <u>Enrichment</u> Application opportunities to more	<u>Formative Assessments</u> Students will have an interactive practice through CK12.org that will require students to get 10 questions correct before moving on to next topic. Instructor can assess difficulty of questions as

		molecule) A: Q: What is the product? What is formed? (Hint: This is a combustion reaction.) A: Q: What is the formula for carbon dioxide? What is the formula for water? A: Q: What is the equation for this reaction? A: Q: What is the balanced equation for the reaction? A: Q: What are you given? A: Q: What is the unknown? A: Q: What are your equivalency statement(s)? A: Q: What is the mole ratio? A: Q: How do you set up the problem? A: Q: What is the answer? A:	convert from mass to number of moles, number of particles, and/or molar volume. **Day 18** Remediation • Students will work in pairs to correct items from summative assessment given on day 17. Mastery of the three concepts assessed is critical for understanding of stoichiometry, the next item of study. **Day 19/20** Inquiry Lab Design • In order to prepare for the stoichiometric laboratory summative assessment students will revise their laboratory exercises to predict the amounts of reactants produced in each experiment. This revision will require their use of stoichiometry. The new laboratory exercise will change the focus from a qualitative evaluation to a quantitative evaluation. In addition, students will record their percent error and account for possible errors in their techniques used in the experiment. o Students will analyze data from their laboratory exercises on types of chemical reactions. One part of the lab report conclusion requires students to "Discuss possible errors that could have occurred in the collection of the data (experimental errors)." Students are to address the possible errors in the next lab. o Students will select one of the five experiments and revise the laboratory procedures for one of the five to be used in a stoichiometric analysis of the reaction. Students will need to implement revisions in procedure that were identified as areas of possible errors. o This laboratory exercise will require students to identify a given amount of reactant and predict the amount of product produced at the end of the experiment. Students will complete this laboratory exercise by using this amount of reactant and determining their percent error after completing the lab.	difficult/challenging topics or combinations of elements. Inquiry based laboratory design will allow students to choose more challenging explorations. Ck12.org modifies practice questions based on success rate at various levels. Practice questions will be automatically adjusted to challenge students with more difficult questions if appropriate. <u>Learning Styles</u> Visual Aural Verbal Physical Social Solitary	easy, medium, and difficult. Students will submit lab report for evaluation using Dropbox. Comments by instructor are then addressed and revised to meet safety concerns and appropriateness of activity. Students complete revisions and resubmit for final approval.
5	I can identify and solve stoichiometry problems that interconvert volume of gases at STP, moles, and	**<u>Engagement Activity</u>** Use of food or recipes to discuss everyday examples of stoichiometric calculations. Also, will be an excellent example for extension to limiting reactants. **<u>Flipped Classroom</u>** Chemistry Flexbook Textbook from <u>ck12.org</u> Instructor will need to choose	**Day 21** Stoichiometry introduction with a food example. • S'mores – 10 graham crackers, 10 squares chocolate, and 4 marshmallows • Sandwich example in <u>ck12.org</u> "Everyday Stoichiometry" • If real food is not desirable, play food or recipe manipulation to serve for unusual number of servings could be given. Whole class discussion • Mass-Mass Stoichiometry • Mole Ration • Students need to complete the Mass-Mass Stoichiometry Practice	<u>Remediation</u> RTI during PBL/RTI time. Flipped Classroom will allow for individual or group study time. Small group intervention with	<u>Formative Assessments</u> Students will have an interactive practice through CK12.org that will require students to get 10 questions

	mass. (**SPI 3221.3.6)**	textbook reference materials, assign students to a class, and identify relevant assignments for students.	in ck12.org before next class. • Announced formative assessment on day 22. Use quiz that is supplied to teacher in ck12.org or use one designed by teacher. **Day 22** Small Group Instruction • Mass-Volume Stoichiometry • Students will work on mass-volume stoichiometry problems in small groups. Teacher will move from group to group offering assistance where needed. Flipped Classroom • Students will need to read sections Volume-Volume Stoichiometry. This reading will take place at home and class time will be used for small group or one-on-one instruction. **Day 23** Small Group Instruction • Volume-Volume Stoichiometry • Students will work on volume-volume stoichiometry problems in small groups. Teacher will move from group to group offering assistance where needed. Inquiry Lab Design • Preparation day for stoichiometric lab. o Students that have completed mass-mass, mass-volume, and volume-volume stoichiometric practice will prepare for their laboratory exercise. Student not ready for lab will complete the three stoichiometric categories before proceeding to the lab. **Day 24/25** Stoichiometric Summative Assessment • Laboratory based. Students will complete the self-designed laboratory exercise addressing stoichiometric calculations of product produced in a chemical reaction. Percent error will also be used to evaluate effectiveness of student laboratory techniques.	instructor will also be utilized. Enrichment Application opportunities to more difficult/challenging topics or combinations of elements. Inquiry based laboratory design will allow students to choose more challenging explorations. Ck12.org modifies practice questions based on success rate at various levels. Practice questions will be automatically adjusted to challenge students with more difficult questions if appropriate. Learning Styles Visual Aural Verbal Physical Social Solitary	correct before moving on to next topic. Instructor can assess difficulty of questions as easy, medium, and difficult. Summative Assessment on stoichiometry will be laboratory based. Students will revise laboratory exercise from previous week to incorporate a quantitative analysis. This revision will also address any issues encountered on first attempt. Percent error will also be used to evaluate effectiveness of student laboratory techniques.
6	I can identify and solve stoichiometry problems that interconvert volume of	Limiting Reactant and Percent Yield video https://www.youtube.com/watch?v=LicEaaXhlEY#t=270 ADVANCED SUMMATIVE	*This week of instruction is two fold. Students that have mastered the concept of mass-mass, mass-volume, and volume-volume will continue on an advanced pathway of instruction going beyond the standards identified. Students still requiring assistance on key concepts will continue small group or individual instruction. Activities will be identified as ADVANCED or PROFICIENT. Variation in laboratory exercise will occur on day 29/30. Students will need to use classroom time or arrange for a time during the school day to get materials together for the lab on day*	Remediation RTI during PBL/RTI time. Flipped Classroom will allow for individual or	Formative Assessments Students will have an interactive practice through CK12.org that

	gases at STP, moles, and mass. (**SPI 3221.3.6)**	LABORATORY ASSESSMENT Flinn Scientific—Teaching Chemistry™ eLearning Video Series A video of the *Target Mole Lab* activity, presented by Bob Becker, is available in *Mole Relationships and the Balanced Equation* and in *Bob Becker Target Labs,* part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.	*29/30.* **Day 26** PROFICIENT – Small group or individual instruction • Individualized instruction on identified areas of need. • Practice exercises in ck12.org reveals missed concepts for each student and will allow for focus, individualized remediation. ADVANCED – Small group or individual instruction • Limiting Reactant and Percent Yield • https://www.youtube.com/watch?v=LicEaaXhlEY#t=270 • Students will watch this video and along with their reading and support materials in ck12.org complete the Limiting Reactant and Percent Yield Practice problems **Day 27** PROFICIENT – Day 26 and Day 27 are the same. Small group or individual instruction • Individualized instruction on identified areas of need. • Practice exercises in ck12.org reveals missed concepts for each student and will allow for focus, individualized remediation. ADVANCED – Day 26 and Day 27 are the same. Small group or individual instruction • Limiting Reactant and Percent Yield • https://www.youtube.com/watch?v=LicEaaXhlEY#t=270 • Students will watch this video and along with their reading and support materials in ck12.org complete the Limiting Reactant and Percent Yield Practice problems • Written Summative Assessment on conversions involving mass-mass, mass-volume, and volume-volume stoichiometric calculations on Day 28. Advanced grade will require demonstration of limiting reactants and percent yield mastery. **Day 28** Summative Assessment • Teacher created written assessment of identification and solving of stoichiometry problems that interconvert volume of gases at STP, moles, and mass. **Day 29/30** Stoichiometry PROFICIENT Summative Laboratory Assessment • Laboratory based. Students will complete the self-designed laboratory exercise addressing stoichiometric calculations of product produced in a chemical reaction. Percent error will also be used to evaluate effectiveness of student laboratory techniques. Stoichiometry ADVANCED Summative Laboratory Assessment • Target Mole Lab Mole Relationships and the Balanced Equation from Flinn Scientific Publication No. 91660.	group study time. Small group intervention with instructor will also be utilized. Enrichment Application opportunities to more difficult/challenging topics or combinations of elements. Inquiry based laboratory design will allow students to choose more challenging explorations. Ck12.org modifies practice questions based on success rate at various levels. Practice questions will be automatically adjusted to challenge students with more difficult questions if appropriate. Learning Styles Visual Aural Verbal Physical Social Solitary	will require students to get 10 questions correct before moving on to next topic. Instructor can assess difficulty of questions as easy, medium, and difficult.