AN ABSTRACT OF THE THESIS OF

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In this work sample, a student teacher implemented ESOL standards and strategies on a unit covering chemical compositions in a high school chemistry classroom. The ELD program at this high school has two types of ELD classes. ELD 1/2 classes have a grammar-based curriculum focused on the English Language, while ELD 3/4 sheltered instruction classes have a content-based curriculum that incorporates both content and language instruction. However, the ELD 3/4 classes are only available in the subjects of history and English, and so this teacher is taking the initiative to bring together content and language in a science class available to all students. Through formative and summative assessments, the teacher was able to determine that students made overall gains in both content and language. However, the overlap of content and language in assessment questions and the different lengths of the pre-assessment and post-assessment affected the overall analysis of the data. The work sample concludes with a reflection by the teacher on the strengths and weaknesses of the unit, the impact the unit had on future teaching, and specific changes needed for the unit.

Key Words: Work Sample, ESOL Standards and Strategies, English Language Learners (ELLs), English Language Development (ELD), High School Chemistry

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Implementation of ESOL Standards and Strategies in a High School Chemistry Classroom
ESOL Endorsement Work Sample - Unit: Chemical Compositions

by

Mai Duong

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I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

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Mai Duong, Author

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Contextual Aspects of Work Sample

District and School ESOL Program Models

For the district as a whole, XXX XXX XXX has set up guidelines for the ESL/ELD programs at each of their individual schools with an overarching goal to have all ELP students attain English proficiency, achieve high levels of academics overall, and meet or exceed state academic standards (ESL Department, 2013). Therefore, the type and quality of each program depends on the amount of funding provided from the district's ESL department and the staff members at the school with the ESOL endorsement. The amount of money given to the school depends on the number of ELL students enrolled, but this number is more of an estimate for the current school year, because the district makes these decisions based on the student count from the previous school year. So, the funding for the ELL program may not accurately reflect the actual number of ELL students at the school, since movement of ELL students in and out of the school boundary lines is likely to happen over the summer months. There is not much uniformity in the ESL/ELD programs among the middle schools and high schools, but the elementary schools have started to align their programs, so that there is a similar grammar-based curriculum among all of them, especially for the students that score on the lower end of ELPA composite scale. The alternative for some ELL students to have access to both content and language instruction is to join an immersion program that is available to both non-ELL and ELL students. These immersion programs are available in Russian and Spanish, and they all follow the 90/10 two-way dual language model. There are other immersion programs available in Japanese, Mandarin, and Spanish that are geared towards non-ELL students, since these programs follow the 50/50 one-way dual

language model. However, these other immersion programs are available to ELL students as well (Immersion Department, 2013).

At XXX High School, there are approximately one hundred to one hundred fifty students in the ELD program. Most of these students are immigrants from other countries outside the United States. For incoming freshman ELL students, their placement in the ELD program depends on their most recent ELPA composite score from eighth grade. ELL students that earn a composite score that determines them as either beginning or early intermediate (Level 1 or 2) ELLs attend ELD 1/2 classes, whereas ELL students that earn a composite score that determines them as either intermediate or early advanced (Level 3 or 4) ELLs attend ELD 3/4 sheltered instruction classes. And finally, ELL students that earn a composite score that determines them as advanced (Level 5) ELLs actually exit the ELD program, and then they are monitored for approximately two years. Students in the ELD program formally take the ELPA test once in a single school year. But, some of the teachers in the ELD program may choose to informally monitor students with assessments that have a similar structure to the ELPA test.

ELL students in the ELD 1/2 classes have a grammar-based curriculum focused on the English language. These classes (four total) are taught by one teacher on B-days. The teacher is not at the school on A-days, however, she does have educational assistants that help her translate the language content of the curriculum when she is in the classroom. They focus on the languages with the most ELL students, which are Vietnamese, Chinese, and Spanish. Overall, the ELD 1/2 classes contain mostly direct ELD instruction.

ELL students in the ELD 3/4 classes have a content-based curriculum that incorporates both content and language instruction. The ELD 3/4 classes either focus on social studies or English literature. As with the ELD 1/2 classes, only one teacher covers all the ELD 3/4 classes (three total), but he is at the school on both A-days and B-days, and he also has non-ELD classes. In these classes, there is also a focus on sheltered instruction. Altogether, the teacher tries to work on grammar, content, and academic skills, since many of his ELL students have success with informal English, and yet still struggle with academic English. The structure of the ELD 3/4 sheltered instruction classes is relatively new to the current school year.

School's Parent/Family and Community Outreach

At the beginning of the year, parents, families, and the community have the opportunity to attend an open house night. Additionally, parents and families have the chance to attend conferences twice a year during the middle of each semester. Throughout the year, parents, families, and the community can attend sporting, music, or drama events and participate in fundraisers put on by various student groups. Parents and families can also volunteer wherever the school might need them, and they can also be members of the parent-teacher-student association for the school. If teachers want to have guest speakers, then they have the possibility of asking parents, families, or the community to be guest speakers in their classrooms. Assemblies during the school year may also at times include parents, families, and the community. The school also has a school-based health center available to students and their families. On the other hand, the school may go out into the community when a teacher decides to take a class or a group

of students on a field trip. For instance, a science teacher may decide to take students to a science fair and/or competition, an English teacher may organize a group of students to see an author or a group of authors, and the school in general may want to give students the chance to see different colleges and businesses. Additionally, a number of student groups at the school set up service learning or volunteer opportunities for their members to gain experience and provide a helping hand to those in the community.

The parents and families of bilingual and ELL students are typically treated like the parents and families of non-bilingual and non-ELL students with the exception that written material may be translated and sent home with bilingual and ELL students in their native language. This means that teachers must request translations of written messages well in advance of the day they are expected to send such papers home with students. For the most part, parents and families hear about involvement opportunities either through their children or the high school webpage or an email subscription with a weekly newsletter. Towards the beginning of the year, the two ELD teachers also formally invite the parents and families of bilingual and ELL students to a meeting about the ELD program. Although this is an optional meeting, parents and families that attend have the opportunity to ask questions and express concerns directly to the ELD teachers about their children's education. And, for the first time, the XXX XXX XXX district has decided to hold a district-wide student leadership conference for high school students in an ESL/ELD program at their school. These ELL students will get to meet other ELL students in the district, share their experiences, and listen to speakers talk about topics that are relevant to them.

Overall parent involvement in the school is noticeable in the parent volunteers and parent-teacher-student association. There are regular parent volunteers that help out in specific classrooms and throughout the school. The parent-teacher-student association is actively involved in fundraisers for the senior all-night party, but they also have fundraisers that help students cover basic material needs that might not be available at home. However, a number of parents also attend the open house night and parent-teacher conferences along with the various athletic, music, and drama events. Distinguishing parents of ELL students from parents of non-ELL students is somewhat difficult, but the ratio between involved parents and uninvolved parents within the ELL student population is probably lower than the ratio among non-ELL students. However, parent involvement from ELL families may actually be higher than what is visible at the school, because often times students are proxies for their parents in a variety of situations. For the most part, these statements are a result of informal observations of the school throughout the day, at different school functions, and of interactions with ELL students in the classroom.

Diversity of the Classroom and the Impact on Teaching

There are learners of all types in this classroom. The talented and gifted students may need to be challenged in order to prevent boredom in the curriculum and classroom. Even though they may have the knowledge and abilities that far exceed their other peers, they still need to stimulate their minds in school, so that they continue to have the motivation to learn. Students with special needs will require an increased amount of scaffolding to stay on track with peers in regards to learning content. 504 Plans and Individualized Education Plans, along with conferences with parents and the special

needs resource specialist, will help teachers to plan instruction for these students. The ELLs speak some English. They are still trying to grasp both social and academic English fluency. ELL students are most likely to achieve social English before academic English. Additionally, these students struggle between their native cultures and the mainstream culture as they attempt to balance or integrate the two within their identities. In addition to ELLs, there are also monitored ELLs. These students are no longer in the ELD program, but they may still struggle with some aspects of academic English. For both the ELL students and the monitored ELL students, an integration of language and content instruction will be vital, so that they can stay caught up with the curriculum. Typical students have the cognitive ability to continue their education from the previous school year at an adequate pace to meet standards. At times, they will need some scaffolding, and at other times, they will need challenges to progress through the lessons of the curriculum. There are both genders (male and female) in the classroom, and there are also a wide range of races/ethnicities (in a broad sense, Caucasian, Asian, Eastern European, and Hispanic). Even though some generalizations can come from a basis in gender or race/ethnicity, characteristics of each person's learning preferences are more relevant to personality, so teachers will need to get to know students individually. However, gender and race/ethnicity are viable topics in the classroom that may maintain the interests of students through personal relevancy.

None of the students in the classroom are pulled-out for special services, and none of them have an aide or another teacher to help them during class time. To address IEP goals, the teacher will set up the classroom in a way that allows for students with IEPs to have smaller and manageable goals that will assist them in achieving their IEP goals.

Some of the students would be more successful with preferential seating. For some of them, this is because of personality, since they have a strong tendency to talk with friends no matter what is going on in the classroom, and for others, this is because of learning style. Certain students just seem to do much better with assignments and exams when they sit in a specific part of the classroom (a particular geographical location). As stated before, the classroom will need to operate with a format centered on scaffolded learning, so that students can receive a range of necessary support that will allow them to be appropriately challenged in way that still encourages learning. In addition to this strategy, other approaches, such as leveled questions and one-on-one assistance, will be important in this classroom.

There are three ELL students in this classroom, and two of them are considered to be an academic priority. Combining both ELL and non-ELL students, there are a total of eight students with the academic priority designation. One student with academic priority is also a special needs student. Students become an academic priority when they struggle to pass classes required for graduation, and as a result, they fall further behind from being able to graduate within four or five years. This designation tells teachers that they may need to provide these students with additional support on basic academic skills to help them succeed in the classroom. Three non-ELL students fall into the talented and gifted category. They all have academic reading as their area of strength, and one of the three also has the strength of being intellectually gifted. One other student has the potential to be a talented and gifted student, while another students took the ELPA test, but she was not eligible for the ELD program.

Every student in the classroom has an assigned seat, and this helps to minimize distractions and to maximize productivity for all students. During discussions, the teacher has leveled questions that range from being short, simple, and straight to the point to being long, complex, and abstract, so that all students feel some level of manageable challenge. Scaffolding in the classroom happens in multiple ways. Table groups have a mixture of students that are highly, moderately, and somewhat successful, which means that during group work time, there is always one student at each table who can provide assistance to the other students. The teacher adjusts her level of help according to the student she is helping, and so, struggling students usually have neatly defined individualized instruction, while thriving students usually have individualized instruction that has the potential to navigate in any direction. Activities in lessons also range from being straightforward to containing elements that are roundabout and sometimes unnecessary. The one student with an IEP/504 receives time extensions to complete assignments and exams, has instructions repeated more than once for clarity, and gets some help with appropriate social behavior through logical reasoning and suggestions. When possible, ELL students have visuals to accompany activities, and the teacher always provides examples before students attempt to tackle anything on their own or in small groups. Some assignments or projects have few boundaries and requirements, which means that talented and gifted students have the option to go above and beyond the bare minimum, and the teacher makes this absolutely clear, and she even tries to encourage all students to do so.

Language Levels of ELLs in this Class

Teachers seem to not have access to ELPA composite scores, but they do have access to the most recent state assessment scores. To get information on ELPA scores, teachers need to talk to the teacher in the ELD program that has the authorized access to such data. Two ELL students have an ELPA composite score of five, which means that theses students are at the advanced English proficiency level and are no longer in the ELD program, but they are still being monitored. The one other ELL student in the classroom is at the intermediate English proficiency level, since his ELPA composite score is three. Currently, he takes both ELD 1/2 and ELD 3/4 sheltered instruction classes along with non-ELD classes. These ELPA composite scores are from the 2011-2012 school year. There are a total of three ELL students in this chemistry classroom.

Language Background and Needs of Two Focal ELLs

ELL #1's native language is Lao. She has had some education in her native language, but she did come to the United States during her elementary school years. Her current ELPA level is at the advanced English proficiency level, because her composite ELPA score is a five, and she has been learning English since elementary school. Because she is a sophomore, this is her second year at the school. She is not in any other academic program. Her strengths in learning English are with listening and speaking, and her weaknesses in learning English are with reading and writing, but these weaknesses are equivalent to the level of non-ELL peers. This information came from conversations, a brief analysis of past assignments and exams, and interactions seen in class.

ELL #2's native language is Vietnamese. He has had some education in his native language, and he arrived in the United States during his middle school years. His current ELPA level is at the intermediate English proficiency level, because his composite ELPA score is a three, and he started to learn English once he came to the United States. Because he is a junior, this is his third year at the school, and at this time, he is considered an academic priority student. His strengths with learning English are with listening and reading, and his weaknesses in learning English are with speaking and writing. Even with these weaknesses, he is doing well with the chemistry material. This information came from conversations, a brief analysis of past assignments and exams, and interactions seen in class.

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Conceptual Framework

Unit Rationale Based on Content Material and SLA Theory

Understanding the concepts of atomic mass, the mole, Avogadro's number, molar mass, mass percent, empirical formulas, and molecular formulas are precursors to understanding the concepts in stoichiometry (chemical quantities in reactions). All of these concepts come together and fall under the unit of chemical compositions. Every area of chemistry utilizes chemical reactions in some way, and so all chemists need to gain the abilities to balance chemical equations, to know what information is in a chemical equation, and to utilize the information to solve problems. For example, some organic and inorganic chemists study chemical reactions to create new substances that would enhance products, some analytical chemists need chemical reactions to help them separate, identify and quantify compounds, and some nuclear chemists look at chemical reactions to learn about the potential advantages and disadvantages of radioactive elements. In order for chemists to get to this point, they must cover the same information contained in this unit at some point early in their careers. Basically, this unit will help students to eventually grasp one of the basic concepts in chemistry, which in this case is chemical quantities (Government, 1999).

At the high school level, students are ready for the increase in the complexity and sophistication of the lessons within this unit. Past science classes up to this point provided introductory lessons to matter, atoms, elements, molecules/compounds, properties, chemical reactions, and the periodic table. Now is the time when students expand on the basic and surface-level knowledge gained from those classes to incorporate a more in depth understanding of those topics, so that they can apply the information to the bigger picture of the world around them, which includes other science areas besides

chemistry. They can begin to comprehend the importance of chemistry in their everyday lives, and molecules/compounds in relation to chemical reactions give them the vehicle to undertake this task. For instance, students may start to see that the living and nonliving objects around them have specific features as a result of the molecules/compounds that make up the composition of those items. The unit at this level of difficulty will prepare students to further extend their funds of knowledge regarding these topics, other chemistry concepts, and other science categories when they take college-level science courses. (Committee, 2012).

In the curriculum, this unit takes place after the unit on chemical reactions and before the unit on chemical quantities. The main reason for selecting this order of units is fairly simple. Once students reach a certain point in the chemistry curriculum, they cannot continue to successively study specific areas of chemistry without knowledge of certain characteristics of chemical compounds. This unit would give students some foundational knowledge for the remainder of the year, and in doing so, provide students with the ability to make connections between new information and the recurring information on molecules/compounds and chemical reactions. An educator could potentially head into the more complex aspects of chemistry without introducing and explaining the concepts related to chemical compositions, however, students would probably have a more difficult time fully comprehending and learning the chemistry material. Without such context, chemistry concepts become isolated pieces of knowledge that students quickly forget, because they could not maintain their interest by linking the material to a tangible concept within chemistry and/or their lives. (de Vos, 1994).

The defining and explaining functions of language fit well with this unit, because there are some key terms that require a definition and there are a few mathematical procedures that need a clear and thorough explanation. Students are more likely to grasp academic language when language development occurs in the context of content material. This approach to language instruction also gives students the opportunity to see the role of academic language aside from novels, poems, and essays. Both English and non-English language learners benefit from language instruction, especially since many students overall have insufficient knowledge of academic language for completely independent reading, listening, speaking, and writing. Eventually, students will need a firm confidence with a majority of the skills related to academic language if they want to optimize their success in college.

Language instruction in this unit will focus on comprehensible input. The input that the teacher provides for students will be in speech patterns that they understand and in a format that somehow relates to the chemistry content of the unit. Additionally, this input will be at a level just beyond the language ability of the students. (Krashen, 1991). Giving language learners forms of the language that are comprehensible allows them to process the language until the language makes sense to them, and then the complexity of the input can gradually increase until they reach language proficiency. Having input relate to chemistry content gives language learners a context to help them gain understandings in the language that they are in the process of acquiring. This means that they can bridge different areas of knowledge in meaningful ways, and thus follow a successful path that leads to language proficiency.

Along with comprehensible input, the language instruction in the unit will also incorporate comprehensible output. Since language has a communicative purpose, the interactions that take place between people play a role in the ability of language learners to acquire a language, and receiving language (input) and language production (output) are both components of that process. Output provides language learners with the opportunity to test out their hypotheses about language, which helps them to become proficient in the new language. The use of input and output allows language learners to focus on both semantics and syntax. (Swain, 1993). The role of language is to share information and knowledge, which means that proficiency in a language requires an individual to be able to understand the language and to coherently produce the language. With input, language learners may gain comprehensions about the new language, but they would not necessarily have the ability for output in a given situation. Output without input would be impossible, because the output would not make any sense without the meanings that come from input. Eventually, the approaches of language instruction in this unit will help students to gain communicative competence, which means that they will have grammatical, sociolinguistic, and strategic competence when communicating with others (Canale, 1980). From a larger perspective, when students attain communicative competence, then essentially they have a solid grasp of the language they are trying to learn, in this case English, and thus would have adequate language proficiency when compared to peers already at that level of language comprehension.

Learning Objectives and Goals

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes? (Committee, 2012).

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components. (Oregon, 2013).

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives. EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17 Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives. (Oregon, 2013).

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner. EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms. (Oregon, 2013).

Enduring Understandings (Unit Goals): Students will understand that... 1) compounds have characteristic information that enables problems related to chemical compositions to be solved mathematically. 2) the ability to define and explain both

concrete and abstract objects and concepts is essential for effective communication with others.

Essential Unit Questions (Unit Goal Objectives): 1) What significance does mass and the mole have for compounds in chemistry? 2) What types of situations warrant the need for language that defines and explains?

Key Concepts in Lesson Objectives: 1) Average Atomic Mass 2) The Mole and Avogadro's Number 3) Molar Mass and Mass Percent 4) Empirical and Molecular Formulas

Lesson Objectives: Students will be able to... 1) define the concept of average atomic mass with adjectives and singular and plural nouns. 2) mathematically determine the number of atoms in a sample and the mass of a sample with the atomic mass. 3) explain, with regular verbs/adverbs in declarative sentences, the steps needed to figure out the number of atoms in a sample and the mass of a sample with atomic mass. 4) define the concept of molar mass and mass percent with adjectives and singular and plural nouns. 5) mathematically convert between moles and mass and to determine the mass percent of a sample. 6) explain, with regular verbs/adverbs in declarative sentences, the steps needed to convert between moles and mass and to determine mass percent of a sample 7) define the concept of empirical formula with adjectives and singular and plural nouns. 8) mathematically calculate empirical and molecular formulas for a compound. 9) explain, with regular verbs/adverbs in declarative sentences, the steps needed to calculate empirical and molecular formulas for a compound.

Language Development with Academic Content

Within this unit, there are a number of key terms that require a definition, and there are a few mathematical procedures that need a thorough explanation of the steps involved. Since students need the definitions and explanations to help them comprehend the material for this unit, the ELD standards related to defining and explaining were natural choices to incorporate into the unit with the chosen academic content of chemical compositions. Delving into the structure of sentences related to defining and explaining may help students to understand content concepts with more depth, and may even aid them in learning those concepts faster after being introduced to them. Additionally, learning about the functions and forms of defining and explaining in the context of chemistry content may help students to use and understand these language concepts in other content areas and settings outside of school. Utilizing chemistry content will assist students with comprehending language concepts in a way that does not isolate language into unrelatable or uninteresting information.

Social Justice Perspective

This unit lasts for five days over a two week period. Three of these days have lessons with new material, one day is set aside for a review, and the last day is for the unit exam. The notion of social justice in this unit will expand to include any sort of issues that relate to people and/or the environment. To incorporate a social justice perspective in such a short time frame, students have a current events assignment that is spread out during each quarter of the semester. So, for some students their current events articles are due during this unit. For this assignment, students must find three articles

related to chemistry in some way, and the articles must come from a magazine source, a newspaper source, and an internet source. Once students locate their articles, they write a summary paragraph for each one, and then they present their articles to the class on the day they are due for them. After the students share their articles, the teacher will start a discussion focused on some of the ones that were just presented to talk about the implications those articles have at a local, a national, and an international scale. This discussion brings in the language content from the unit, since students will need to define and explain the information in their articles and opinions. The chemistry content from this unit will also be connected to the discussion, and this will occur through the identification of molecular formulas, molar masses, and chemical reactions that appear in the articles presented to the class. As students complete this assignment and discussion, they should begin to see the impact that chemistry has on the world around them, and that academic language has a pivotal role when communicating with people who are not close friends or acquaintances. For this unit, the current events assignment and discussion happens during the fourth lesson.

Technology for Student Learning

Students will observe constant use of the computer, projector, and document camera as a means of communication between one person and a group of people. They will need to use the computer themselves for certain assignments in this unit, and the teacher will be able to provide some assistance in using different software and programs to achieve specific products. For instance, students need to use at least one online resource for their current events assignment, which means they need to know how to

effectively and efficiently navigate the internet. Throughout the unit, the teacher will give students website addresses to sites that contain more extensive information about the concepts and skills mentioned in class, so that they may have the option to continue learning specific pieces of knowledge if they have the interest to do so, and this will help them with their abilities to seek reliable information from online sources. These sites may also provide students with additional study material for the information covered in class.

For ELL students, as well as non-ELL students, the document camera will help them to take notes in class, because if they do not understand what the teacher is saying or the teacher is talking too fast, then they still can write the notes down to study later. After they take the time to look over their notes, then they can come to the teacher or ask another peer if they have any questions or want any sort of clarifications. The document camera, computer, and projector also provide students with visuals (images, videos, etc.) to assist them in understanding concepts and to see examples of upcoming lab work and/or assignments. Giving students the opportunity to use a computer for assignments and studying will allow them to utilize computers for an academic purpose. If necessary, the teacher can guide students with individual instructions and/or recommendations on applicable skills related to the academic use of computers.

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Unit Outline

Lesson 1 Title/Topic: Average Atomic Mass, The Mole, and Avogadro's Number

ELP for ELD Standard Function: Defining

ELP for ELD Standard Form: Nouns, Abstract Nouns, Pronouns, Adjectives

Language Objective: Students will be able to define the concept of average atomic mass with adjectives and singular and plural nouns.

Content Standard: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Content Objective: Students will be able to mathematically determine the number of atoms in a sample and the mass of a sample with the atomic mass.

Lesson Description: After reviewing the exam from the last unit, the teacher will start the notes for the current unit. The teacher will write notes on a document camera for students to write in their notebooks. This part of the lesson will be an interaction involved with questions, direct instruction, group work, and individual work. Students will also receive a new homework packet for their homework assignments. After each day of the unit, the teacher will assign students a portion of the homework packet with a due date of the following class period. A discussion on adjectives and nouns will also take place, so that students start to see an integration of language and content in lessons. Lastly, students will see a video related to the lesson and their end-of-the-year project.

Assessment: The teacher will be able to determine students' current language and content knowledge with a pre-assessment quiz. At the end of the lesson, the teacher will have students assess themselves on their ability to understand the information from this lesson with a scale that ranges from one (no comprehension) to five (complete comprehension).

Lesson 2 Title/Topic: Molar Mass and Mass Percent

ELP for ELD Standard Function: Defining and Explaining

ELP for ELD Standard Form: Nouns, Abstract Nouns, Pronouns, Adjectives; Verbs, Indicative Verbs, Declarative Sentences, Complex Sentences, Adverbs of Manner

Language Objective: Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to figure out the number of atoms in a sample and the mass of a sample with atomic mass.

Students will be able to define the concept of molar mass and mass percent with adjectives and singular and plural nouns.

Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to convert between moles and mass and to determine mass percent of a sample.

Content Standard: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Content Objective: Students will be able to mathematically convert between moles and mass and to determine the mass percent of a sample.

Lesson Description: The teacher will continue the unit with notes on the document camera after a warm-up and a review of the homework assignment from the last lesson. The purpose for the warm-up and homework review is to jog students' memory about the language and chemistry content from the last lesson. Again, the notes part of the lesson will be an interaction filled with questions, direction instruction, group work, and individual work. Students will have time to work on the new homework assignment from

the homework packet and to ask individual questions towards the end of the class period. During this time, students have the option to work alone or in groups.

Assessment: Before the end of the lesson, students will assess themselves with thumbs (up, to the side, or down) on their comfort level with the language and content material up to this point. Additionally, students will answer a couple of questions related to this lesson as an exit ticket.

Lesson 3 Title/Topic: Empirical and Molecular Formulas

ELP for ELD Standard Function: Defining and Explaining

ELP for ELD Standard Form: Nouns, Abstract Nouns, Pronouns, Adjectives; Verbs, Indicative Verbs, Declarative Sentences, Complex Sentences, Adverbs of Manner

Language Objective: Students will be able to define the concept of empirical formula with adjectives and singular and plural nouns.

Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to calculate empirical and molecular formulas for a compound.

Content Standard: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Content Objective: Students will be able to mathematically calculate empirical and molecular formulas for a compound.

Lesson Description: The teacher will continue the unit with notes on the document camera after a warm-up and a review of the homework assignment from the last lesson. The purpose for the warm-up and homework review is to jog students' memory about the language and chemistry content from the last lesson. Again, the notes part of the lesson

will be an interaction filled with questions, direction instruction, group work, and individual work. Students will have time to work on the new homework assignment from the homework packet and to ask individual questions towards the end of the class period. During this time, students have the option to work alone or in groups. Also during the work time, the teacher will have the opportunity to talk to students individually about their grades and the progress they are making overall.

Assessment: Before the end of the lesson, students will assess themselves with thumbs (up, to the side, or down) on their comfort level with the language and content material up to this point. Additionally, students will answer a couple of questions related to this lesson as an exit ticket.

Lesson 4 Title/Topic: Review Day

ELP for ELD Standard Function: Defining and Explaining

ELP for ELD Standard Form: Nouns, Abstract Nouns, Pronouns, Adjectives; Verbs, Indicative Verbs, Declarative Sentences, Complex Sentences, Adverbs of Manner

Language Objective: All six language objectives from Lessons 1-3.

Content Standard: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Content Objective: All three content objectives from Lessons 1-3.

Lesson Description: Before the teacher starts the review activity for the unit, students with current events due will have the opportunity to summarize their articles to the whole class. The current event assignment will have an informal presentation approach, so that students can share their articles from their tables. The remainder of most of the class

period will be dedicated to the review jigsaw activity that the students will complete as table groups and eventually with the whole class. Each table group will receive one question from the review packet to work on as a group. Once every group successfully works through their given problem, they will present and explain their solutions to the whole class, so that by the end of the period, each student will have a completed review packet.

Assessment: The review jigsaw activity will provide the teacher with some measure of the readiness students have for the unit exam. The teacher will also have the chance to see and hear how well students believe they will do on the unit exam when they take a self-assessment with a scale that ranges from one (not ready at all) to five (completely confident in abilities).

Lesson 5 Title/Topic: Unit Exam Day

ELP for ELD Standard Function: Defining and Explaining

ELP for ELD Standard Form: Nouns, Abstract Nouns, Pronouns, Adjectives; Verbs, Indicative Verbs, Declarative Sentences, Complex Sentences, Adverbs of Manner

Language Objective: All six language objectives from Lessons 1-3.

Content Standard: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Content Objective: All three content objectives from Lessons 1-3.

Lesson Description: Students will have about ten minutes to study for the unit exam and to ask any last-minute questions. The remainder of the class period will be available to them to complete the unit exam within an adequate amount of time. If students finish the

exam before the end of the class period, then they may work on other assignments from other classes as long as they maintain a testing environment.

Assessment: The teacher will be able to see how well student did with the language and content knowledge from this unit with the unit exam. If there is time, the teacher can seek out students' opinion about the unit exam, and perhaps have a poll where students share with the teacher how well they think they did overall.

Instructional Plans

Name: Mai Duong

Lesson Title: Lesson #1 - Average Atomic Mass, The Mole, and Avogadro's Number

Grade/Age Level: High School

Date: 8 January 2013

Time Anticipated: 90 Minutes

Materials: Document Camera, Projector, Computer, Copy of Lesson #1 Notes, Students' Notebooks, Writing Utensils, Warm-Up Questions, Unit HW Packet, Adjective and Noun Lists (Written on Whiteboard), Chapter 6 Test, Pre-Assessment, Mighty Mole Student Video

Prerequisite Skills: From past lessons, students need to know the basics of the isotope concept, and how to utilize equivalence statements and conversion factors in calculations to start with given units and end with the desired ones. Additionally, they need to know how to recognize compounds in both chemical and written form, and they should be able to count the number of atoms of each element in given compounds. From math classes, students should know the average concept for a group of numbers. Lastly, if students know that some words sometimes represent a number value, then that notion will help them with the concepts in this lesson (for example, one dozen equals twelve and one gross equals one hundred forty-four).

ELP Standards: Forms and Functions

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives.

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner.

Proficiency Levels:

Defining: EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17 Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives.

Explaining: EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms.

Oregon Content Standards:

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes?

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Lesson Objectives:

Content: Students will be able to mathematically determine the number of atoms in a sample and the mass of a sample with the atomic mass.

Language: Students will be able to define the concept of average atomic mass with adjectives and singular and plural nouns.

Anticipatory Set: As students walk into the classroom, there will be a warm-up on the document camera ready for them to work on. They have the option to work alone or with group members at their table, and the teacher will be walking around the room to provide assistance. The warm-up reviews equivalent statements and how to use them as conversion factors. (Q1: How many feet are in 532 centimeters? Q2: How many pounds are in 51 kg?) Once students have enough time to complete the warm-up, the teacher will go over the questions as a whole class, and then transition into a review of the unit exam from the last unit. Students will have their graded test in front of them as the teacher goes over the solutions and the calculations involved in some of the problems. This is an opportunity for the teacher to go over concepts that students still have misconceptions about, and students have the chance to ask questions and make clarifications. (30 minutes)

Stated Objective and Purpose: "We are starting a new unit today on chemical compositions, and so we are going to look more closely at the atomic masses listed on the periodic table, and how we can use those numbers to help us figure out the mass of a sample and the number of atoms in a sample. Additionally, we will look at forming definitions with adjectives and nouns, and in this lesson we will focus on the definition for atomic mass."

Input: Before introducing the new material to students, the teacher will have them take a pre-assessment quiz (attached), so that she can gauge the knowledge they might already know about chemical compositions and the language abilities they might have in

relation to defining and explaining. The teacher will assure students that this pre-assessment quiz in no way impacts their grade for the class, and that the quiz is purely for informational purposes about their current level of comprehension in relation to this unit. (10 minutes)

After students are done with the pre-assessment, then have them take out their chemistry notebooks, so that they can start to take notes. The teacher will write the notes (attached) on the document camera and talk about the material at the same time, so that students can hear an explanation of the new concepts and have the time to write them down. Within the notes, they will have an opportunity to apply the concepts to example problems. First, the teacher will complete example problems by herself, and then she and the class will work on them together, and then the class will eventually do some on their own. Also during the notes, the teacher will write adjectives in one color, and nouns in another color, but she will not tell them the reason for this yet. Throughout the notes, the teacher will ask students questions that bring out their prior knowledge and that lead them to figure out some of the new material through their own thinking process. (Ex. Q1: What does the word average mean? Q2: How many eggs are in a dozen eggs? Q3: How do units cancel out in calculations with conversion factors?) At the end of the notes, the teacher will give students their homework assignment from the homework packet for this unit (HW 1, 3, 5, 7, 17, 19, 21). (25 minutes)

Next, the teacher will write the colored words from the notes into respective lists onto the whiteboard without any identifying category titles. First, students will talk among group members to try and figure out what each group of words has in common. Then, the teacher will bring the class back together to guide students into identifying the

words as adjectives and nouns. Once students get to this point, they will add more examples to those lists, so that they realize that they already know words that fall into these categories. The teacher will then bring to their attention that these words help to form defining sentences for objects and concepts, such as the sentences in the notes from earlier in the lesson. (10 minutes)

As the class period comes to an end, the teacher will show the students a video made by a group of chemistry students from last year that relates to the concepts in this lesson. The teacher will have students be on the lookout for adjectives, nouns, and defining sentences. This video also serves as an example of the types of videos that this year's chemistry students will do towards the end of the school year. After viewing the video, the whole class will discuss the language examples that they heard, and the teacher will write these on the whiteboard. Students will then have the opportunity to come up with their own sentences to define some of the concepts from the lesson. The word lists and example sentences will help some students, and others will be able to create their own unique sentences. The teacher will give support where needed. (10 minutes)

Adaptations for Students with Special Needs: To help students stay on task, the teacher will tell the entire class how much time is left to complete a task at necessary intervals. For the students who do not have enough time to write down the notes or other information important to the lesson, the teacher will have a written version that they can take with them to copy and return by next class. The teacher will also place students in groups where they are most likely to stay focused and productive.

Adaptations for ESOL or Bilinguals: The teacher will use visual/verbal scaffolding and leveled questions to approach students at different ability levels (Tong, 2008). Students

will have times when they are working alone, in small groups, or with the whole class, so they will have multiple ways to clear up any confusion they might have during the lesson (Long, 1985).

Closure: The teacher will take the remaining class period to have students assess themselves on a scale from one to five. Students will do this for each of the lesson objectives. A one represents their belief that they still cannot achieve the objective, a three represents their belief that they can sort of achieve the objective, and a five represents their belief that they can definitely achieve the objective. If students wish to share the reasons behind their number selections, then they have the option to do so at this time. (5 minutes)

Assessment: The teacher will be able to monitor students' progress by their responses to various questions during the lesson. Additionally, when the teacher walks around the room to help students with the warm-up and individual/group work, she will be able to see how well students are doing with the content and language aspects of the lessons in relation to the objectives. The pre-assessment will give the teacher valuable information about the content and language knowledge that students might already know from the unit. And, the self-assessment will provide the teacher with information related to how well students believe they are doing with the new material from the lesson.

Literacy Instruction: Students will have the opportunity to practice their note-taking skills in a science context. They will also get to work with adjectives and nouns within sentences that define objects and concepts. The pre-assessment is also written in a way

that allows students to strategically interpret the questions and problems, so that they understand how to answer them.

Technology Integration: The document camera and projector will help the teacher to communicate aspects of the lesson to students. And, the projector and computer will show students the Mighty Mole video. Altogether, students will see the benefits of technology in presenting information to a group of people, and the efficiency and effectiveness that technology can have when used properly.

Reflection and Plans for Reteaching: Students did not appear to be very receptive to the language component of the lesson. This is probably because this is the first time students have had any kind of language instruction in a science class. To remedy this, the teacher should explain to students the importance of academic language in a chemistry classroom. Additionally, the teacher can tell students that the language concepts they learn here can also be beneficial in situations outside of class and in other classes. After looking through the pre-assessments, the teacher will need to modify the short quiz in a way that allows for more information about students' language abilities to come through. For now, the teacher will set up the warm-up in lesson two as an additional piece to the pre-assessment. Overall, most students seemed to achieve both of the lesson objectives, even though only half of them felt the same way. When the teacher listened to students' responses and helped them during individual/group work time, she observed that most students knew what to do and how to process the different questions/problems. However, some of them did appear to need just a little bit more confidence, so that they would realize that they actually did understand the concepts from the lesson.

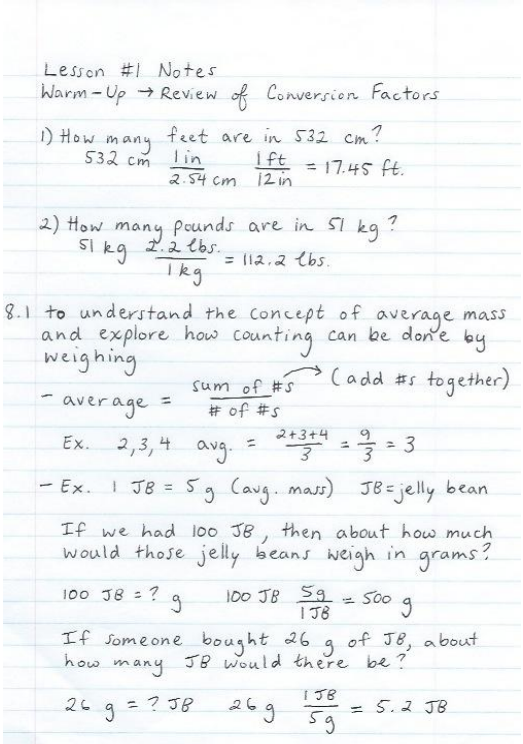
References:

Long, M.H., Porter, P.A. (1985). Group Work, Interlanguage Talk, and Second Language Acquisition. *TESOL Quarterly, 19(2),* 207-228.

Tong, F., Lara-Alecio, R., Irby, B., Mathes, P., Kwok, O. (2008). Accelerating Early Academic Oral English Development in Transitional Bilingual and Structured English Immersion Programs. *American Educational Research Journal, 45(4),* 1011-1044.

Scanned Notes and Homework Packet:

Figure 1: Lesson 1 Notes



Lesson #1 Notes
Warm-Up → Review of Conversion Factors

1) How many feet are in 532 cm?
532 cm $\frac{1\text{ in}}{2.54\text{ cm}}$ $\frac{1\text{ ft}}{12\text{ in}}$ = 17.45 ft.

2) How many pounds are in 51 kg?
51 kg $\frac{2.2\text{ lbs.}}{1\text{ kg}}$ = 112.2 lbs.

8.1 to understand the concept of average mass and explore how counting can be done by weighing

- average = $\frac{\text{sum of \#s}}{\text{\# of \#s}}$ (add #s together)

Ex. 2, 3, 4 avg. = $\frac{2+3+4}{3} = \frac{9}{3} = 3$

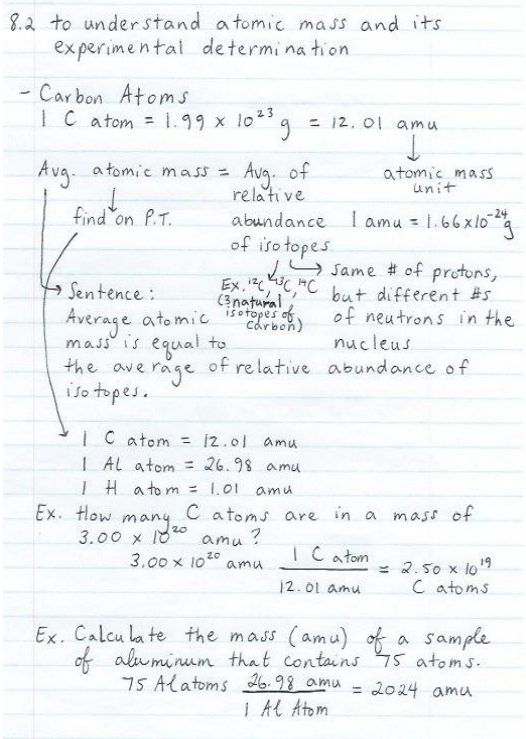
- Ex. 1 JB = 5 g (avg. mass) JB = jelly bean

If we had 100 JB, then about how much would those jelly beans weigh in grams?

100 JB = ? g 100 JB $\frac{5\text{ g}}{1\text{ JB}}$ = 500 g

If someone bought 26 g of JB, about how many JB would there be?

26 g = ? JB 26 g $\frac{1\text{ JB}}{5\text{ g}}$ = 5.2 JB



8.2 to understand atomic mass and its experimental determination

- Carbon Atoms
1 C atom = 1.99×10^{23} g = 12.01 amu (atomic mass unit)

Avg. atomic mass = Avg. of relative abundance of isotopes
(find on P.T.)

1 amu = 1.66×10^{-24} g

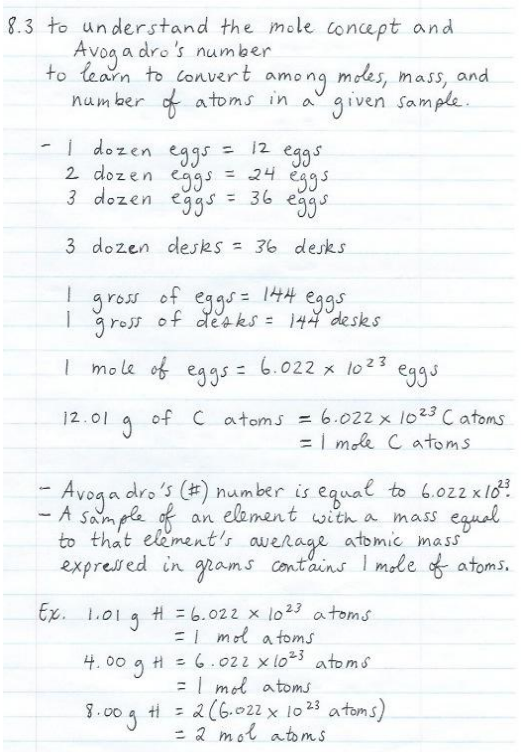
Ex. ^{12}C, ^{13}C, ^{14}C (3 natural isotopes of carbon) → same # of protons, but different #s of neutrons in the nucleus

Sentence: Average atomic mass is equal to the average of relative abundance of isotopes.

1 C atom = 12.01 amu
1 Al atom = 26.98 amu
1 H atom = 1.01 amu

Ex. How many C atoms are in a mass of 3.00×10^{20} amu?
3.00×10^{20} amu $\frac{1\text{ C atom}}{12.01\text{ amu}} = 2.50 \times 10^{19}$ C atoms

Ex. Calculate the mass (amu) of a sample of aluminum that contains 75 atoms.
75 Al atoms $\frac{26.98\text{ amu}}{1\text{ Al Atom}}$ = 2024 amu



8.3 to understand the mole concept and Avogadro's number
to learn to convert among moles, mass, and number of atoms in a given sample.

- 1 dozen eggs = 12 eggs
2 dozen eggs = 24 eggs
3 dozen eggs = 36 eggs

3 dozen desks = 36 desks

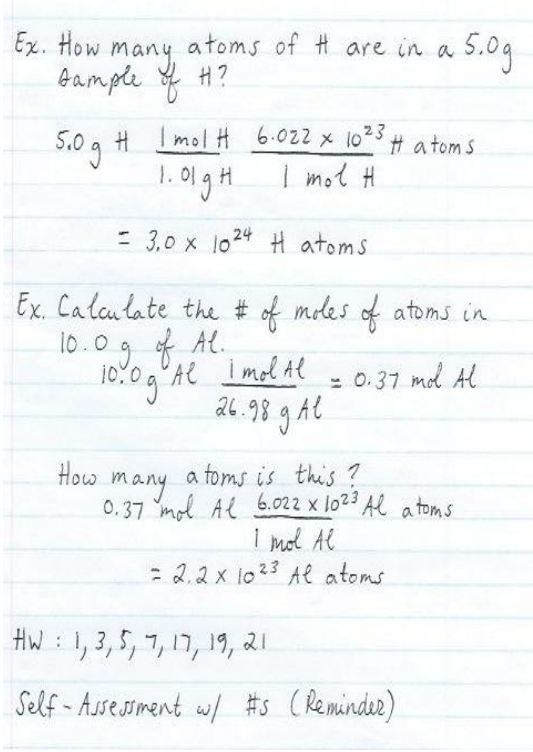
1 gross of eggs = 144 eggs
1 gross of desks = 144 desks

1 mole of eggs = 6.022×10^{23} eggs

12.01 g of C atoms = 6.022×10^{23} C atoms
= 1 mole C atoms

- Avogadro's (#) number is equal to 6.022×10^{23}.
- A sample of an element with a mass equal to that element's average atomic mass expressed in grams contains 1 mole of atoms.

Ex. 1.01 g H = 6.022×10^{23} atoms
= 1 mol atoms
4.00 g H = 6.022×10^{23} atoms
= 1 mol atoms
8.00 g H = $2(6.022 \times 10^{23}$ atoms)
= 2 mol atoms



Ex. How many atoms of H are in a 5.0 g sample of H?

5.0 g H $\frac{1\text{ mol H}}{1.01\text{ g H}}$ $\frac{6.022 \times 10^{23}\text{ H atoms}}{1\text{ mol H}}$

= 3.0×10^{24} H atoms

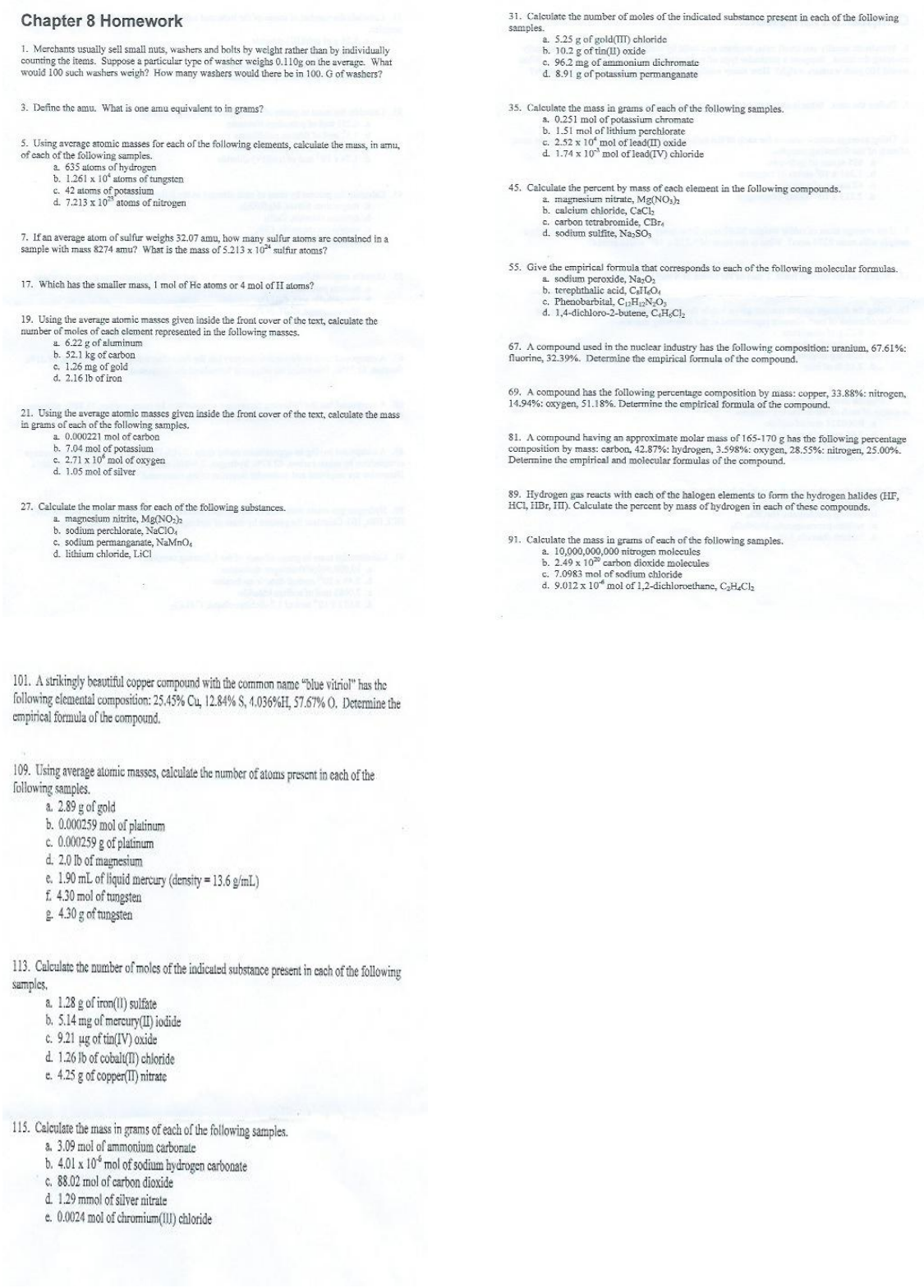
Ex. Calculate the # of moles of atoms in 10.0 g of Al.
10.0 g Al $\frac{1\text{ mol Al}}{26.98\text{ g Al}}$ = 0.37 mol Al

How many atoms is this?
0.37 mol Al $\frac{6.022 \times 10^{23}\text{ Al atoms}}{1\text{ mol Al}}$
= 2.2×10^{23} Al atoms

HW: 1, 3, 5, 7, 17, 19, 21

Self-Assessment w/ #s (Reminder)

Figure 2: Homework Packet



Chapter 8 Homework

1. Merchants usually sell small nuts, washers and bolts by weight rather than by individually counting the items. Suppose a particular type of washer weighs 0.110g on the average. What would 100 such washers weigh? How many washers would there be in 100. G of washers?

3. Define the amu. What is one amu equivalent to in grams?

5. Using average atomic masses for each of the following elements, calculate the mass, in amu, of each of the following samples.
   a. 635 atoms of hydrogen
   b. 1.261×10^4 atoms of tungsten
   c. 42 atoms of potassium
   d. 7.213×10^{23} atoms of nitrogen

7. If an average atom of sulfur weighs 32.07 amu, how many sulfur atoms are contained in a sample with mass 8274 amu? What is the mass of 5.213×10^{24} sulfur atoms?

17. Which has the smaller mass, 1 mol of He atoms or 4 mol of H atoms?

19. Using the average atomic masses given inside the front cover of the text, calculate the number of moles of each element represented in the following masses.
   a. 6.22 g of aluminum
   b. 52.1 kg of carbon
   c. 1.26 mg of gold
   d. 2.16 lb of iron

21. Using the average atomic masses given inside the front cover of the text, calculate the mass in grams of each of the following samples.
   a. 0.000221 mol of carbon
   b. 7.04 mol of potassium
   c. 2.71×10^6 mol of oxygen
   d. 1.05 mol of silver

27. Calculate the molar mass for each of the following substances.
   a. magnesium nitrite, $Mg(NO_2)_2$
   b. sodium perchlorate, $NaClO_4$
   c. sodium permanganate, $NaMnO_4$
   d. lithium chloride, LiCl

31. Calculate the number of moles of the indicated substance present in each of the following samples.
   a. 5.25 g of gold(III) chloride
   b. 10.2 g of tin(II) oxide
   c. 96.2 mg of ammonium dichromate
   d. 8.91 g of potassium permanganate

35. Calculate the mass in grams of each of the following samples.
   a. 0.251 mol of potassium chromate
   b. 1.51 mol of lithium perchlorate
   c. 2.52×10^4 mol of lead(II) oxide
   d. 1.74×10^{-3} mol of lead(IV) chloride

45. Calculate the percent by mass of each element in the following compounds.
   a. magnesium nitrate, $Mg(NO_3)_2$
   b. calcium chloride, $CaCl_2$
   c. carbon tetrabromide, CBr_4
   d. sodium sulfite, Na_2SO_3

55. Give the empirical formula that corresponds to each of the following molecular formulas.
   a. sodium peroxide, Na_2O_2
   b. terephthalic acid, $C_8H_6O_4$
   c. Phenobarbital, $C_{12}H_{12}N_2O_3$
   d. 1,4-dichloro-2-butene, $C_4H_6Cl_2$

67. A compound used in the nuclear industry has the following composition: uranium, 67.61%: fluorine, 32.39%. Determine the empirical formula of the compound.

69. A compound has the following percentage composition by mass: copper, 33.88%: nitrogen, 14.94%: oxygen, 51.18%. Determine the empirical formula of the compound.

81. A compound having an approximate molar mass of 165-170 g has the following percentage composition by mass: carbon, 42.87%: hydrogen, 3.598%: oxygen, 28.55%: nitrogen, 25.00%. Determine the empirical and molecular formulas of the compound.

89. Hydrogen gas reacts with each of the halogen elements to form the hydrogen halides (HF, HCl, HBr, HI). Calculate the percent by mass of hydrogen in each of these compounds.

91. Calculate the mass in grams of each of the following samples.
   a. 10,000,000,000 nitrogen molecules
   b. 2.49×10^{20} carbon dioxide molecules
   c. 7.0983 mol of sodium chloride
   d. 9.012×10^{-6} mol of 1,2-dichloroethane, $C_2H_4Cl_2$

101. A strikingly beautiful copper compound with the common name "blue vitriol" has the following elemental composition: 25.45% Cu, 12.84% S, 4.036%H, 57.67% O. Determine the empirical formula of the compound.

109. Using average atomic masses, calculate the number of atoms present in each of the following samples.
   a. 2.89 g of gold
   b. 0.000259 mol of platinum
   c. 0.000259 g of platinum
   d. 2.0 lb of magnesium
   e. 1.90 mL of liquid mercury (density = 13.6 g/mL)
   f. 4.30 mol of tungsten
   g. 4.30 g of tungsten

113. Calculate the number of moles of the indicated substance present in each of the following samples.
   a. 1.28 g of iron(II) sulfate
   b. 5.14 mg of mercury(II) iodide
   c. 9.21 µg of tin(IV) oxide
   d. 1.26 lb of cobalt(II) chloride
   e. 4.25 g of copper(II) nitrate

115. Calculate the mass in grams of each of the following samples.
   a. 3.09 mol of ammonium carbonate
   b. 4.01×10^{-6} mol of sodium hydrogen carbonate
   c. 88.02 mol of carbon dioxide
   d. 1.29 mmol of silver nitrate
   e. 0.0024 mol of chromium(III) chloride

Name: Mai Duong

Lesson Title: Lesson #2 - Molar Mass and Mass Percent

Grade/Age Level: High School

Date: 10 January 2013

Time Anticipated: 90 Minutes

Materials: Document Camera, Projector, Computer, Copy of Lesson #2 Notes, Students' Notebooks, Writing Utensils, Warm-Up Questions, Unit HW Packet, Words Lists Written on Whiteboard (Verbs/Adverbs, Adjectives, and Nouns), Notecards

Prerequisite Skills: From past lessons, students need to know how to utilize equivalence statements and conversion factors in calculations to start with given units and end with the desired ones. Additionally, they need to know how to recognize compounds in both chemical and written form, and they should be able to count the number of atoms of each element in given compounds. From math classes, students should know that in some instances, multiplying an answer to a division problem/fraction by a hundred will change the solution to a percent value. Lastly, students should also know the concepts from the first lesson in the unit.

ELP Standards: Forms and Functions

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives.

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner.

Proficiency Levels:

Defining: EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17 Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives.

Explaining: EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms.

Oregon Content Standards:

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes?

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Lesson Objectives:

Content: Students will be able to mathematically convert between moles and mass and to determine the mass percent of a sample.

Language: 1) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to figure out the number of atoms in a sample and the mass of a sample with atomic mass. 2) Students will be able to define the concept of molar

mass and mass percent with adjectives and singular and plural nouns. 3) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to convert between moles and mass and to determine mass percent of a sample.

Anticipatory Set: As students walk into the classroom, there will be a warm-up on the document camera ready for them to work on. They have the option to work alone or with group members at their table, and the teacher will be walking around the room to provide assistance. The warm-up reviews some of the concepts from lesson one. The teacher will also use the warm-up to get more information about students' language abilities. (Q1: Calculate the number of moles in 335 mg of barium. Q2: Explain the steps to solve the first warm-up problem. Some optional prompts are provided below.) Once students have enough time to complete the warm-up, the teacher will go over the questions as a whole class, and then transition into a review of the homework assignment from last class. Students will share their answers from each question/problem, and as a class, they will decide which ones are correct. Additionally, the teacher will have some students come up to the document camera to show the work they did to get to some of the solutions. Both the teacher and the students will help explain the calculations of the homework assignment to the whole class. (20 minutes)

Stated Objective and Purpose: "Today, we are going to continue our unit on chemical compositions. We will be focusing on being able to explain in declarative sentences with regular verbs and adverbs the steps necessary to complete calculations. Particularly, we will do this for the number of atoms in a sample, the mass of a sample, the mass percent of a sample, and to convert between moles and mass. We will also look at definitions again with adjectives and nouns, but this time with the concepts of

molar mass and mass percent. And finally, we will work on being able to mathematically determine the mass percent of a sample and convert between moles and mass."

Input: Have students take out their chemistry notebooks, so that they can start to take notes. The teacher will write the notes (attached) on the document camera and talk about the material at the same time, so that students can hear an explanation of the new concepts and have the time to write them down. Within the notes, they will have an opportunity to apply the concepts to example problems. First, the teacher will complete example problems by herself, and then she and the class will work on them together, and then the class will eventually do some on their own. Also during the notes, the teacher will write adjectives, nouns, and verbs/adverbs in different colors, and then come back to these words after the notes. Throughout the notes, the teacher will ask students questions that bring out their prior knowledge and that lead them to figure out some of the new material through their own thinking process. (Ex. Q1: What does a mole mean again? Q2: How many atoms of carbon are in this compound? Q3: Where do we get the masses from to calculate molar mass?) At the end of the notes, the teacher will give students their homework assignment from the homework packet for this unit (HW 27, 31, 35, 45). (25 minutes)

Next, the teacher will write the colored words from the notes into respective lists onto the whiteboard, and she will head each list with the appropriate category (adjectives, nouns, and verbs/adverbs). The class will review the adjectives and nouns, and then have a discussion about verbs/adverbs. Once students get to this point, they will add more examples of verbs/adverbs to the list, so that they realize that they already know words

that fall into these category. The teacher will then bring to their attention that verbs/adverbs in sentences can help explain steps in a calculation or procedure, such as the sentences in the notes from earlier in the lesson. Students will then take the time to work on coming up with their own definition and explanation sentences with the material from today's notes. The teacher will have prompts for students that may need them, and she will remind students that they can use their notes as a reference. Some students may just create their own unique sentences. The teacher will also walk around the room to provide additional support. (20 minutes)

Now, students will have some time to work by themselves or with their table group on the assigned homework. They may also continue to work on definition and explanation sentences. This is a time when students can ask the teacher for individual assistance on specific problems and/or to ask questions that will help them to understand the concepts from lesson one and two. (15 minutes)

Adaptations for Students with Special Needs: To help students stay on task, the teacher will tell the entire class how much time is left to complete a task at necessary intervals, and she will remind students that side conversations are okay as long as they are limited and the main focus stays on the lesson. For the students who do not have enough time to write down the notes or other information important to the lesson, the teacher will have a written version that they can take with them to copy and return by next class. Additionally, the teacher will remind students that they can come in before school, during lunch, after school, during first period, or during eighth period for extra help. The teacher will also place students in groups where they are most likely to stay

focused and productive. She will also place students in areas of the classroom where they are most likely to be successful (front of the room, back of the room, etc.).

Adaptations for ESOL or Bilinguals: The teacher will use visual/verbal scaffolding and leveled questions to approach students at different ability levels (Tong, 2008). Students will have times when they are working alone, in small groups, or with the whole class, so they will have multiple ways to clear up any confusion they might have during the lesson (Long, 1985). The entire lesson in a way reflects the preview/review strategy, since the warm-up relates to the new material that students will see in this lesson, and then the exit ticket reviews these concepts (Salas, 2012).

Closure: Right before the period is over, the teacher will draw the class back together to summarize the new concepts from today's lesson and how they connect to the lesson from last class. Then, students will answer a couple of questions on a notecard as an exit ticket. (Q1: What is the mass percent of boron in B_2F_6? Q2: Define molar mass in a complete sentence with adjectives and nouns.) Finally, students will assess themselves with thumbs in regards to the lesson objectives. Thumbs up for achieving the objectives, thumbs to the side for sort of achieving the objectives, and thumbs down for not achieving the objectives. If time permits, then students can share their reasons for their thumb selection. (10 minutes)

Assessment: The teacher will be able to monitor students' progress by their responses to various questions during the lesson. Additionally, when the teacher walks around the room to help students with the warm-up and individual/group work, she will be able to see how well students are doing with the content and language aspects of the lessons in relation to the objectives. The exit ticket will provide the teacher with information

about which concepts students were able to comprehend, and the ones they were not able to understand. This will help the teacher to plan the next lesson. And, the self-assessment will provide the teacher with information related to how well students believe they are doing with the new material from the lesson, which will also assist the teacher in planning the next lesson.

Literacy Instruction: Students will have the opportunity to practice their note-taking skills in a science context. They will also get to work with adjectives and nouns within sentences that define objects and concepts. Additionally, they will work with verbs/adverbs with sentences that explain calculations. And then, they will have the chance to practice writing sentences that define and explain with the information from the lesson. Students will also be able to discern the functions and forms of these type of sentences in their notes.

Technology Integration: The document camera and projector will help the teacher to communicate aspects of the lesson to students. Some students will also get to use the document camera to show their thought process on some of the homework problems. Altogether, students will see the benefits of technology in presenting information to a group of people, and the efficiency and effectiveness that technology can have when used properly.

Reflection and Plans for Reteaching: Students appeared to do well with the objectives from this lesson, especially since most students were able to successfully answer the questions for the exit ticket. Exit tickets provide a quick snapshot of the amount of information students were able to retain from the current lesson, and so the approach serves as a reasonable assessment to help the teacher reflect on ways to assist students

in the next lesson. So, the teacher will continue to use exit tickets in the remainder of this unit. Some students still seem annoyed with the extra work they have to do with the language component of the lesson, especially since they know that the other chemistry classes do not have to do anything with language. For some reason, they do not see the place language has in a content classroom outside of English, even though the teacher has explained the relevance that language has in the science community. This is also not the norm for them, and so they might just be responding to the change in the routine of the classroom that they have had since September. However, some students are okay with the integration of language and content, since they complete the activities without any side grumbles or complaints. Next time, the teacher may want to cut down on some of the new material in the lesson, because she barely had enough time to adequately cover all the information she wanted to have students go over in the activities.

References:

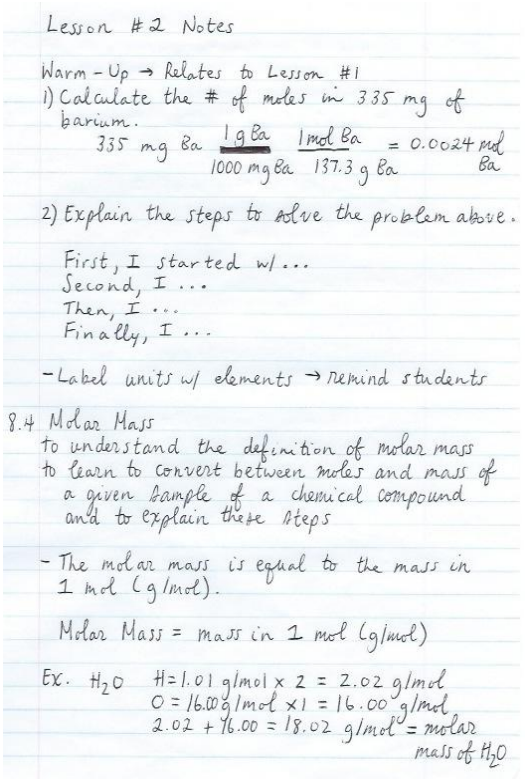
Long, M.H., Porter, P.A. (1985). Group Work, Interlanguage Talk, and Second Language Acquisition. *TESOL Quarterly*, *19(2)*, 207-228.

Salas, Monica. (2012). *Vocabulary Development for Academic Success in Kindergarten English Language Learners*. Retrieved from Texas State University Digital Library Database at https://digital.library.txstate.edu/handle/10877/4187.

Tong, F., Lara-Alecio, R., Irby, B., Mathes, P., Kwok, O. (2008). Accelerating Early Academic Oral English Development in Transitional Bilingual and Structured English Immersion Programs. *American Educational Research Journal*, *45(4)*, 1011-1044.

Scanned Notes:

Figure 3: Lesson 2 Notes



Lesson #2 Notes

Warm-Up → Relates to Lesson #1

1) Calculate the # of moles in 335 mg of barium.

$335\ mg\ Ba \times \frac{1\ g\ Ba}{1000\ mg\ Ba} \times \frac{1\ mol\ Ba}{137.3\ g\ Ba} = 0.0024\ mol\ Ba$

2) Explain the steps to solve the problem above.

First, I started w/ ...
Second, I ...
Then, I ...
Finally, I ...

- Label units w/ elements → remind students

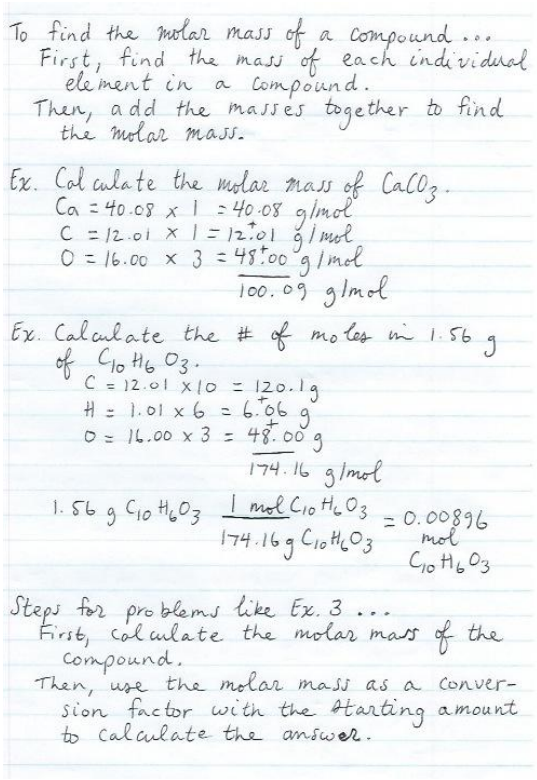
8.4 Molar Mass

to understand the definition of molar mass
to learn to convert between moles and mass of a given sample of a chemical compound and to explain these steps

- The molar mass is equal to the mass in 1 mol (g/mol).

Molar Mass = mass in 1 mol (g/mol)

Ex. H_2O H = 1.01 g/mol x 2 = 2.02 g/mol
O = 16.00 g/mol x 1 = 16.00 g/mol
2.02 + 16.00 = 18.02 g/mol = molar mass of H_2O



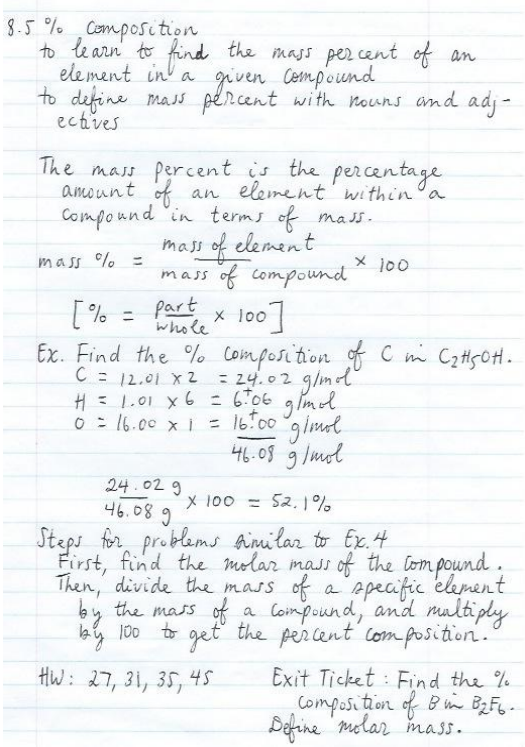
To find the molar mass of a compound ...
First, find the mass of each individual element in a compound.
Then, add the masses together to find the molar mass.

Ex. Calculate the molar mass of $CaCO_3$.
Ca = 40.08 x 1 = 40.08 g/mol
C = 12.01 x 1 = 12.01 g/mol
O = 16.00 x 3 = 48.00 g/mol
100.09 g/mol

Ex. Calculate the # of moles in 1.56 g of $C_{10}H_6O_3$.
C = 12.01 x 10 = 120.1 g
H = 1.01 x 6 = 6.06 g
O = 16.00 x 3 = 48.00 g
174.16 g/mol

$1.56\ g\ C_{10}H_6O_3 \times \frac{1\ mol\ C_{10}H_6O_3}{174.16\ g\ C_{10}H_6O_3} = 0.00896\ mol\ C_{10}H_6O_3$

Steps for problems like Ex. 3 ...
First, calculate the molar mass of the compound.
Then, use the molar mass as a conversion factor with the starting amount to calculate the answer.



8.5 % Composition

to learn to find the mass percent of an element in a given compound
to define mass percent with nouns and adjectives

The mass percent is the percentage amount of an element within a compound in terms of mass.

$\text{mass \%} = \frac{\text{mass of element}}{\text{mass of compound}} \times 100$

$\left[\% = \frac{\text{part}}{\text{whole}} \times 100\right]$

Ex. Find the % composition of C in C_2H_5OH.
C = 12.01 x 2 = 24.02 g/mol
H = 1.01 x 6 = 6.06 g/mol
O = 16.00 x 1 = 16.00 g/mol
46.08 g/mol

$\frac{24.02\ g}{46.08\ g} \times 100 = 52.1\%$

Steps for problems similar to Ex. 4
First, find the molar mass of the compound.
Then, divide the mass of a specific element by the mass of a compound, and multiply by 100 to get the percent composition.

HW: 27, 31, 35, 45

Exit Ticket: Find the % composition of B in B_2F_6.
Define molar mass.

Name: Mai Duong

Lesson Title: Lesson #3 - Empirical and Molecular Formulas

Grade/Age Level: High School

Date: 14 January 2013

Time Anticipated: 90 Minutes

Materials: Document Camera, Projector, Computer, Copy of Lesson #3 Notes, Students' Notebooks, Writing Utensils, Warm-Up Questions, Unit HW Packet, Words Lists Written on Whiteboard (Verbs/Adverbs, Adjectives, and Nouns), Notecards

Prerequisite Skills: From past lessons, students need to know how to utilize equivalence statements and conversion factors in calculations to start with given units and end with the desired ones. Additionally, they need to know how to recognize compounds in both chemical and written form, and they should be able to count the number of atoms of each element in given compounds. From math classes, students should be familiar with the operations of multiplication and division, the notion of rounding, and the concept of number size. Lastly, students should also know the concepts from the first and second lessons in the unit.

ELP Standards: Forms and Functions

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives.

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner.

Proficiency Levels:

Defining: EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17 Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives.

Explaining: EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms.

Oregon Content Standards:

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes?

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Lesson Objectives:

Content: Students will be able to mathematically calculate empirical and molecular formulas for a compound.

Language: 1) Students will be able to define the concept of empirical formula with adjectives and singular and plural nouns. 2) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to calculate empirical and molecular formulas for a compound.

Anticipatory Set: As students walk into the classroom, there will be a warm-up on the document camera ready for them to work on. They have the option to work alone or with

group members at their table, and the teacher will be walking around the room to provide assistance. The warm-up reviews some of the concepts from lesson two. (Q1: Calculate the molar mass of $C_6H_{12}O_6$. Q2: Explain the steps to solve the first warm-up problem. Some optional prompts are provided below. Q3: Calculate the mass percent of hydrogen in $C_6H_{12}O_6$.) Once students have enough time to complete the warm-up, the teacher will go over the questions as a whole class, and then transition into a review of the homework assignment from last class. Students will share their answers from each question/problem, and as a class, they will decide which ones are correct. Additionally, the teacher will have some students come up to the document camera to show the work they did to get to some of the solutions. Both the teacher and the students will help explain the calculations of the homework assignment to the whole class. (20 minutes)

Stated Objective and Purpose: "Today, we are going to continue our unit on chemical compositions. We will be focusing on being able to explain in declarative sentences with regular verbs and adverbs the steps necessary to complete calculations. Particularly, we will do this for the empirical and molecular formulas of compounds. We will also look at definitions again with adjectives and nouns, but this time with the concept of empirical formula. And finally, we will work on being able to mathematically determine the empirical and molecular formulas of compounds."

Input: Have students take out their chemistry notebooks, so that they can start to take notes. The teacher will write the notes (attached) on the document camera and talk about the material at the same time, so that students can hear an explanation of the new concepts and have the time to write them down. Within the notes, they will have an opportunity to apply the concepts to example problems. First, the teacher will complete example problems by herself, and then she and the class will work on them together, and then the class will

eventually do some on their own. Also during the notes, the teacher will write adjectives, nouns, and verbs/adverbs in different colors, and then come back to these words after the notes. Throughout the notes, the teacher will ask students questions that bring out their prior knowledge and that lead them to figure out some of the new material through their own thinking process. (Ex. Q1: What would the empirical formula be for this molecular formula? Q2: If we assume we have a one hundred gram sample, then what does the given percent composition mean? Why? Q3: How do we convert from grams to moles?) At the end of the notes, the teacher will give students their homework assignment from the homework packet for this unit (HW 55, 67, 69, 81). (25 minutes)

Next, the teacher will have students pull out the defining and explaining sentences from their notes. Once students locate them, they will choose which lists each of the colored words should go (verbs/adverbs, adjectives, or nouns). Students will first do this in table groups, and during this time, the teacher will walk around the room to check-in with each group a couple of times. Then, the whole class will come back together to discuss this as a class. The teacher will write the lists that the students come up with on the whiteboard. She will also have students label the sentences they pick out as a definition or explanation. (15 minutes)

Now, students will have some time to work by themselves or with their table group on the assigned homework. This is a time when students can ask the teacher for individual assistance on specific problems and/or to ask questions that will help them to understand the concepts from any of the lessons in this unit. Before students start working, the teacher will show students a website (http://www.khanacademy.org) that they can use to help them study and/or clarify any confusion they might have about any of the chemistry concepts.

The teacher will show a small clip from one of the videos relevant to this lesson, so that students can see the type of videos that are available on the website. (20 minutes)

Adaptations for Students with Special Needs: To help students stay on task, the teacher will tell the entire class how much time is left to complete a task at necessary intervals, and she will remind students that side conversations are okay as long as they are limited and the main focus stays on the lesson. The teacher will also keep the length of the various activities in the lesson in mind, so that she makes sure that they do not run too long past students' attention span. For the students who do not have enough time to write down the notes or other information important to the lesson, the teacher will have a written version that they can take with them to copy and return by next class. Additionally, the teacher will remind students that they can come in before school, during lunch, after school, during first period, or during eighth period for extra help. The teacher will also place students in groups where they are most likely to stay focused and productive. She will also place students in areas of the classroom where they are most likely to be successful (front of the room, back of the room, etc.).

Adaptations for ESOL or Bilinguals: The teacher will use visual/verbal scaffolding and leveled questions to approach students at different ability levels (Tong, 2008). Students will have times when they are working alone, in small groups, or with the whole class, so they will have multiple ways to clear up any confusion they might have during the lesson (Long, 1985). The entire lesson in a way reflects the preview/review strategy, since part of the warm-up relates to the new material that students will see in this lesson, and then the exit ticket reviews these concepts (Salas, 2012). A version of the word sort activity is also part of this lesson with the verbs/adverbs, adjectives, and nouns (Whisler, 1990).

Closure: Right before the period is over, the teacher will draw the class back together to summarize the new concepts from today's lesson and how they connect to the lessons from the last two class. Then, students will answer a couple of questions on a notecard as an exit ticket. (Q1: What is the molecular formula for vitamin C if the empirical formula is $C_3H_4O_3$ and the molar mass of vitamin C is one hundred eighty g/mol? Q2: Write some sentences to explain the steps for the calculations in Q1. Optional prompts are provided below.) Finally, students will assess themselves with thumbs in regards to the lesson objectives. Thumbs up for achieving the objectives, thumbs to the side for sort of achieving the objectives, and thumbs down for not achieving the objectives. If time permits, then students can share their reasons for their thumb selection. (10 minutes)

Assessment: The warm-up and review of the homework will give some indication of how well students did with the new information from last class. The teacher will be able to monitor students' progress with the material from today's lesson by their responses to various questions during the lesson. Additionally, when the teacher walks around the room to help students with the warm-up and individual/group work, she will be able to see how well students are doing with the content and language aspects of the lessons in relation to the objectives. The exit ticket will provide the teacher with information about which concepts students were able to comprehend, and the ones they were not able to understand. This will help the teacher to plan the next lesson. And, the self-assessment will provide the teacher with information related to how well students believe they are doing with the new material from the lesson, which will also assist the teacher in planning the next lesson.

Literacy Instruction: Students will have the opportunity to practice their note-taking skills in a science context. Students will also be able to discern the functions and forms of

sentences that define and explain in their notes. Then, they will take the verbs/adverbs, adjectives, and nouns and sort them into the appropriate lists of words.

Technology Integration: The document camera and projector will help the teacher to communicate aspects of the lesson to students. Some students will also get to use the document camera to show their thought process on some of the homework problems. Altogether, students will see the benefits of technology in presenting information to a group of people, and the efficiency and effectiveness that technology can have when used properly. Additionally, the teacher will make use of the internet as an additional resource for students to help them with the content from this unit.

Reflection and Plans for Reteaching: Nothing extraordinary, negative or positive, occurred after the lesson. Most students appear to be successful with the lesson objectives in class, and so they just need to take the time outside of class to study and practice the concepts. Overall, the mixture of attitude about language in a chemistry classroom remains the same. A set routine seems to be in place now for these lessons with new information, which would seem like a good thing, but the unit is almost at an end and the remaining two lessons do not have any new material. Once the lessons for this work sample are over, the class will go back to the cooperating teacher's curriculum with the exception that the student teacher will still be able to incorporate some level of language into the content material. So, students will still have a similar structure to the lessons, since the unit was based on the cooperating teacher's unit, but there will just not be as much language and content integration. For next time, this unit and the students would benefit from a word wall in the classroom. This word wall could stay up for an entire school year, and both the teacher and the students would continually add words to the lists. Students could then use

the word wall as a word bank to help with forming sentences and understanding concepts, especially if visual images are put up with the words.

References:

Long, M.H., Porter, P.A. (1985). Group Work, Interlanguage Talk, and Second Language Acquisition. *TESOL Quarterly*, *19(2)*, 207-228.

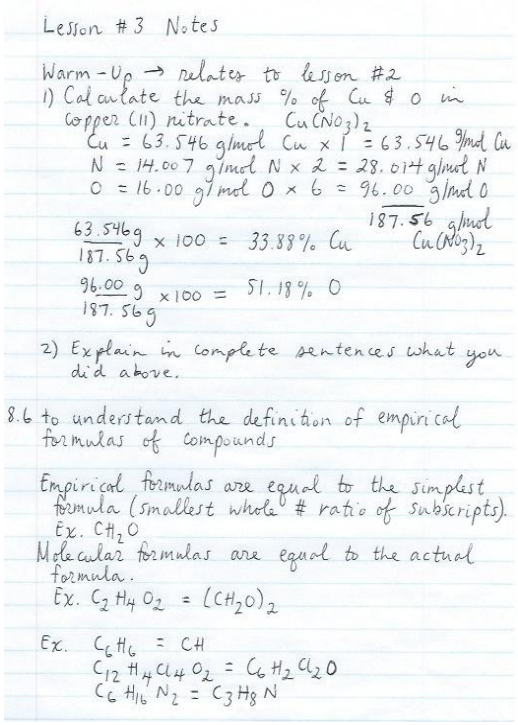
Salas, Monica. (2012). *Vocabulary Development for Academic Success in Kindergarten English Language Learners*. Retrieved from Texas State University Digital Library Database at https://digital.library.txstate.edu/handle/10877/4187.

Tong, F., Lara-Alecio, R., Irby, B., Mathes, P., Kwok, O. (2008). Accelerating Early Academic Oral English Development in Transitional Bilingual and Structured English Immersion Programs. *American Educational Research Journal*, *45(4)*, 1011-1044.

Whisler, N., Williams, J. (1990). *Literature and Cooperative Learning: Pathway to Literacy*. Sacramento, CA: Literature Co-op.

Scanned Notes:

Figure 4: Lesson 3 Notes



Lesson #3 Notes

Warm-Up → relates to lesson #2
1) Calculate the mass % of Cu & O in copper (II) nitrate. $Cu(NO_3)_2$
Cu = 63.546 g/mol Cu × 1 = 63.546 g/mol Cu
N = 14.007 g/mol N × 2 = 28.014 g/mol N
O = 16.00 g/mol O × 6 = 96.00 g/mol O
187.56 g/mol $Cu(NO_3)_2$

$\frac{63.546\text{g}}{187.56\text{g}} \times 100 = 33.88\%$ Cu

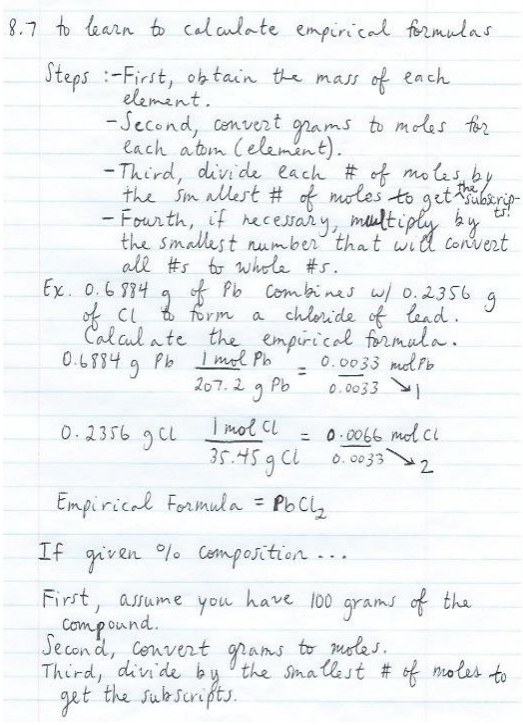
$\frac{96.00\text{g}}{187.56\text{g}} \times 100 = 51.18\%$ O

2) Explain in complete sentences what you did above.

8.6 to understand the definition of empirical formulas of compounds

Empirical formulas are equal to the simplest formula (smallest whole # ratio of subscripts).
Ex. CH_2O
Molecular formulas are equal to the actual formula.
Ex. $C_2H_4O_2 = (CH_2O)_2$

Ex. $C_6H_6 = CH$
$C_{12}H_4Cl_4O_2 = C_6H_2Cl_2O$
$C_6H_{16}N_2 = C_3H_8N$



8.7 to learn to calculate empirical formulas

Steps :-First, obtain the mass of each element.
-Second, convert grams to moles for each atom (element).
-Third, divide each # of moles by the smallest # of moles to get the subscripts!
-Fourth, if necessary, multiply by the smallest number that will convert all #s to whole #s.

Ex. 0.6884 g of Pb combines w/ 0.2356 g of Cl to form a chloride of lead. Calculate the empirical formula.

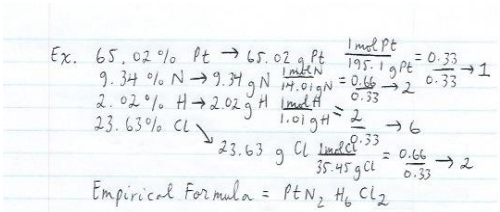
0.6884 g Pb $\frac{1\text{ mol Pb}}{207.2\text{ g Pb}} = \frac{0.0033\text{ mol Pb}}{0.0033} \rightarrow 1$

0.2356 g Cl $\frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = \frac{0.0066\text{ mol Cl}}{0.0033} \rightarrow 2$

Empirical Formula = $PbCl_2$

If given % composition ...

First, assume you have 100 grams of the compound.
Second, convert grams to moles.
Third, divide by the smallest # of moles to get the subscripts.



Ex. 65.02% Pt → 65.02 g Pt $\frac{1\text{ mol Pt}}{195.1\text{ g Pt}} = \frac{0.33}{0.33} \rightarrow 1$
9.34% N → 9.34 g N $\frac{1\text{ mol N}}{14.01\text{ g N}} = \frac{0.66}{0.33} \rightarrow 2$
2.02% H → 2.02 g H $\frac{1\text{ mol H}}{1.01\text{ g H}} = \frac{2}{} \rightarrow 6$
23.63% Cl → 23.63 g Cl $\frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = \frac{0.66}{0.33} \rightarrow 2$
Empirical Formula = $PtN_2H_6Cl_2$

8.8 to learn to calculate the molecular formula of a compound when given the empirical formula and molar mass

to be able to explain these calculations in complete sentences w/ verbs/adverbs

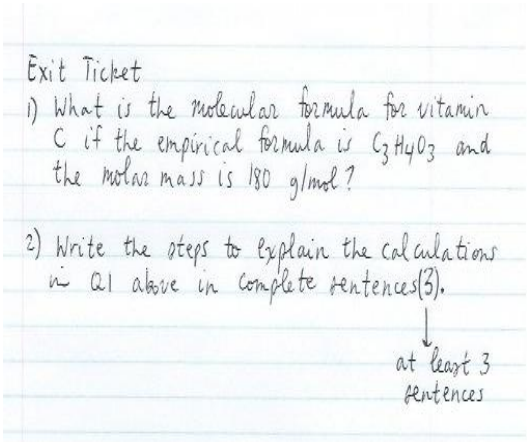
Steps: First, calculate the mass of the empirical formula.
Second, divide the molar mass of the molecular formula by the molar mass of the empirical formula.
Third, multiply the subscripts in the empirical formula by the ans. calculated in the second step.

HW: 55, 67, 69, 81

Ex. Molar mass of compound = 98.96 g/mol
71.65% Cl → 71.65 g Cl $\frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = \frac{2.02}{2.02} \rightarrow 1$

24.27% C → 24.27 g C $\frac{1\text{ mol C}}{12.01\text{ g C}} = \frac{2.02}{2.02} \rightarrow 1$

4.07% H → 4.07 g H $\frac{1\text{ mol H}}{1.01\text{ g H}} = \frac{4.04}{2.02} \rightarrow 2$
Empirical Formula = CH_2Cl = 49.48 g/mol
98.96 ÷ 49.48 = 2 → Molecular Formula = $(CH_2Cl)_2 = C_2H_4Cl_2$



Exit Ticket
1) What is the molecular formula for vitamin C if the empirical formula is $C_3H_4O_3$ and the molar mass is 180 g/mol?

2) Write the steps to explain the calculations in Q1 above in complete sentences(3).
↓
at least 3 sentences

Name: Mai Duong

Lesson Title: Lesson #4 - Review Day

Grade/Age Level: High School

Date: 16 January 2013

Time Anticipated: 90 Minutes

Materials: Document Camera, Projector, Computer, Students' Notebooks, Writing Utensils, Notecards, Warm-Up Questions, Review Activity Packet, Unit HW Packet, Sentence Prompts/Frames (Written on Whiteboard), Current Events Assignment

Prerequisite Skills: From past lessons, students need to know how to utilize equivalence statements and conversion factors in calculations to start with given units and end with the desired ones. Additionally, they need to know how to recognize compounds in both chemical and written form, and they should be able to count the number of atoms of each element in given compounds. Lastly, students should also know the concepts from the first, second, and third lessons in the unit.

ELP Standards: Forms and Functions

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives.

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner.

Proficiency Levels:

Defining: EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17

Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives.

Explaining: EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms.

Oregon Content Standards:

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes?

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Lesson Objectives:

Content: 1) Students will be able to mathematically determine the number of atoms in a sample and the mass of a sample with the atomic mass. 2) Students will be able to mathematically convert between moles and mass and to determine the mass percent of a sample. 3) Students will be able to mathematically calculate empirical and molecular formulas for a compound.

Language: 1) Students will be able to define the concept of average atomic mass with adjectives and singular and plural nouns. 2) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to figure out the

number of atoms in a sample and the mass of a sample with atomic mass. 3) Students will be able to define the concept of molar mass and mass percent with adjectives and singular and plural nouns. 4) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to convert between moles and mass and to determine mass percent of a sample. 5) Students will be able to define the concept of empirical formula with adjectives and singular and plural nouns. 6) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to calculate empirical and molecular formulas for a compound.

Anticipatory Set: As students walk into the classroom, there will be a warm-up on the document camera ready for them to work on. They have the option to work alone or with group members at their table, and the teacher will be walking around the room to provide assistance. The warm-up reviews some of the concepts from lesson three. (Q1: Determine the empirical formula when given the molecular formula.) Once students have enough time to complete the warm-up, the teacher will go over the question as a whole class, and then transition into a review of the homework assignment from last class. Students will share their answers from each question/problem, and as a class, they will decide which ones are correct. Additionally, the teacher will have some students come up to the document camera to show the work they did to get to some of the solutions. Both the teacher and the students will help explain the calculations of the homework assignment to the whole class. (15 minutes)

Stated Objective and Purpose: "Today, we are going to review all the lesson objectives from the past three lessons in preparation for the unit exam next class. We will do this with a jigsaw review activity, which will be explained a little bit later."

Input: Before getting to the review activity, students with current events due today will go ahead and present them. They may stay seated in their seats when they are sharing their articles. If students share an article with both positive and negative implications, then the teacher will draw out a discussion where students examine the impact of the issue and/or science on a local, national, and international scale. This will guide students to critically think about the role science can have on a wide range of issues that affect people, animals, and the environment. (20 minutes)

Next, the teacher will introduce the review activity (attached). Students at each table will work together as a group to figure out the problem given to them from the review packet. The teacher will walk around the classroom and provide assistance when possible or necessary. She will also make sure students know what they are supposed to do at this time. Once everyone understands their assigned problem, each table group will present their work to the class. Students will need to clearly define and/or explain their solution(s) verbally in complete sentences. Provided sentence prompts/frames may help them with this, but they are not required to use them. By the time all the presentations are done, everyone should have a completed review packet. Make sure that students have the opportunity to ask questions, so that they can clear up any confusion they might have with the task and/or concepts. (45 minutes)

Towards the end of the class period, the teacher will assign the remainder of the homework packet as additional review for the unit exam (HW 89, 91, 101, 109, 113, 115). This will be due next time on the day of the test. The teacher will remind students that if they need additional help before the next class period, then they can

come to see her and/or they can use the website she had given them last class as a study aid.

Adaptations for Students with Special Needs: To help students stay on task, the teacher will tell the entire class how much time is left to complete a task at necessary intervals, and she will remind students that side conversations are okay as long as they are limited and the main focus stays on the lesson. The teacher will also keep the length of the various activities in the lesson in mind, so that she makes sure that they do not run too long past students' attention span. For the students who do not have enough time to write down the solutions for the review packet, the teacher will have a written version that they can take with them to copy and return by next class. Additionally, the teacher will remind students that they can come in before school, during lunch, after school, during first period, or during eighth period for extra help. The teacher will also place students in groups where they are most likely to stay focused and productive. She will also place students in areas of the classroom where they are most likely to be successful (front of the room, back of the room, etc.). If necessary, the teacher can make modifications to the current events assignment to meet the needs of the students.

Adaptations for ESOL or Bilinguals: The teacher will use visual/verbal scaffolding and leveled questions to approach students at different ability levels (Tong, 2008). Students will have times when they are working alone, in small groups, or with the whole class, so they will have multiple ways to clear up any confusion they might have during the lesson (Long, 1985). The review activity revolves around the jigsaw strategy, which allows students to work with others without the burden of having to complete the entire

assignment, so that they focus more on the process of a particular problem (King, 1993).

Closure: Right before the period is over, the teacher will draw the class back together to summarize the lesson objectives that students will need to know for the unit exam. She will offer suggestions on how to study in order to minimize anxiety and maximize success. Lastly, while students are thinking about the unit exam, they will rate their level of comfort with the material from the unit on a notecard where a one (1) is not comfortable, a three (3) is somewhat comfortable, and a five (5) is very comfortable. Additionally, they will write at least one reason why they feel this way. If they are comfortable sharing the self-assessment as a whole class, then the teacher will give them the option to do so. (10 minutes)

Assessment: The warm-up and review of the homework will give some indication of how well students did with the new information from last class. When the teacher walks around the room to help students with the warm-up and individual/group work, she will be able to monitor how well students are doing with the content and language concepts in relation to the objectives. The review activity, particularly when students share their work, also offers the teacher with insight about students' progress. And, the self-assessment will provide the teacher with valuable information related to how well students believe they are doing with the material for the unit exam, which will assist the teacher in seeing their successes and struggles and with planning the next unit.

Literacy Instruction: Students with current events will have the opportunity to summarize their science articles to the whole class. Everyone will have the chance to use complete sentences with nouns and adjectives to define specific concepts. They

will also be able to practice explaining the steps to various problems with verbs/adverbs in declarative sentences.

Technology Integration: During this lesson, the document camera and projector will communicate information to both the teacher and students. Everyone will use the technology equipment to informally present language and content material. Students will be able to see that this type of technology has the capability to share information with a large number of people in a visual way.

Reflection and Plans for Reteaching: The jigsaw activity went over well, but the teacher will need to make sure that she manages her time for this lesson a little better, so that there is time to complete the entire activity. Additionally, she should assign the review homework earlier, so that students who finish their part of the jigsaw review will have something else to work on while they wait for everyone else to finish. Some students were a little reluctant when they had to present their solutions to the whole class, but not one group refused to share their work. This might just be a result from the fact that they normally do not have to share this type of information in front of everyone in such a setting. However, the jigsaw activity did go well enough with students that the teacher may try to insert this strategy within a lesson that introduces new information to students in an upcoming unit. Most students seemed prepared for the test next class, but that will not be confirmed until next time the class meets and the exams are graded.

References:

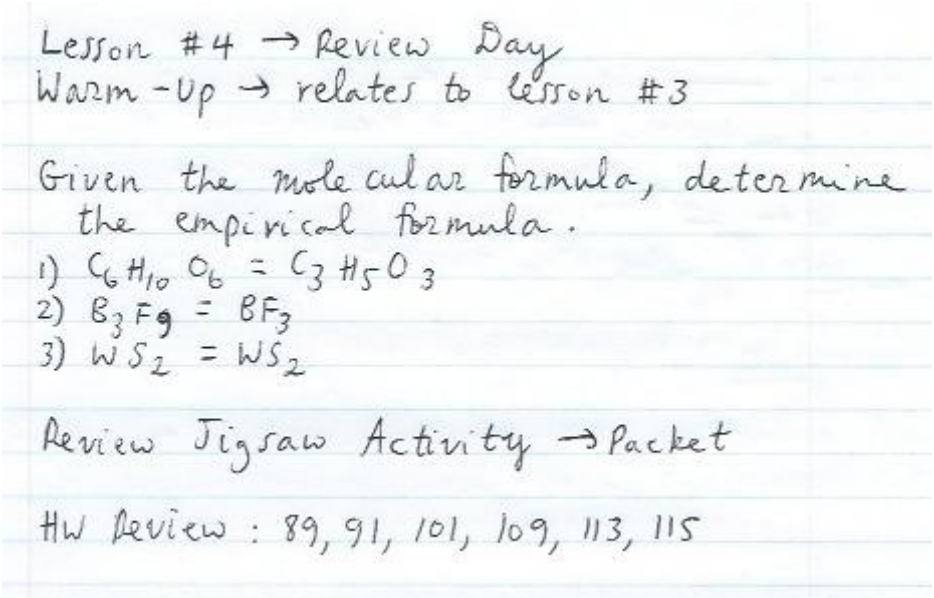
King, A. (1993). From Sage on the Stage to Guide on the Side. *College Teaching, 41(1),* 30-35.

Long, M.H., Porter, P.A. (1985). Group Work, Interlanguage Talk, and Second Language Acquisition. *TESOL Quarterly, 19(2)*, 207-228.

Tong, F., Lara-Alecio, R., Irby, B., Mathes, P., Kwok, O. (2008). Accelerating Early Academic Oral English Development in Transitional Bilingual and Structured English Immersion Programs. *American Educational Research Journal, 45(4)*, 1011-1044.

Scanned Notes and Review Jigsaw Activity:

Figure 5: Lesson 4 Notes



Lesson #4 → Review Day
Warm-Up → relates to Lesson #3

Given the molecular formula, determine the empirical formula.

1) $C_6H_{10}O_6 = C_3H_5O_3$
2) $B_3F_9 = BF_3$
3) $WS_2 = WS_2$

Review Jigsaw Activity → Packet

HW Review: 89, 91, 101, 109, 113, 115

Figure 6: Review Jigsaw Activity

Name:_____ Date:_____

Review Packet

Task: The problem your table group will figure out and present to the class corresponds to the number on the sticky note at your table. For example, Table 1 will complete Problem 1. When your table group shares the solution(s) with the whole class, make sure definitions and explanations are clear with complete sentences. The sentence prompts/frames on the whiteboard may help your table group with this. When other table groups are presenting, you should write down the solution(s) in your own review packet.

1) A. Define average atomic mass in a complete sentence.

   B. How many Hafnium (Hf) atoms are in a sample with a mass of 5.00×10^{15} amu?

   C. What is the mass in amu of a sample of Hafnium (Hf) with 550 atoms?

2) A. In a complete sentence, define a mole in terms of Avogadro's number.

B. How many moles of atoms are in a 34.0 g sample of Palladium (Pd)?

C. How many atoms are in a sample of Palladium (Pd) with a mass of 62.0 mg?

3) A. Define molar mass in a complete sentence.

B. What is the molar mass of CH_3NH_2?

C. How many moles of CH_3NH_2 are in a 47.85 g sample of CH_3NH_2?

4) A. Define percent (%) composition (mass percent (%)) in a complete sentence.

B. Mathematically define percent (%) composition (mass percent (%)).

C. What is the percent (%) composition (mass percent (%)) of each element in CH_3COOH?

5) A. Define empirical formula in a complete sentence.

B. Define molecular formula in a complete sentence.

C. What are the empirical formulas for the following molecular formulas:

$C_2H_4O_2$

$C_8H_{10}N_4O_2$

$C_2H_5NO_2$

6) A. 57.14 g of carbon (C), 9.52 g of nitrogen (N), 27.18 g of oxygen (O), and 6.16 g of hydrogen (H) combine together to form a compound. What is the empirical formula of this compound?

7) A. What is the empirical formula for a compound with 36.48% sodium (Na), 25.44% sulphur (S), and 38.08% oxygen (O)?

8) A. What is the empirical and molecular formula for a compound with 60.63% carbon (C), 7.07% hydrogen (H), and 32.31% oxygen (O)? The molar mass of this compound is 198 g/mol.

Name: Mai Duong

Lesson Title: Lesson #5 - Unit Exam

Grade/Age Level: High School

Date: 18 January 2013

Time Anticipated: 90 Minutes

Materials: Document Camera, Projector, Computer, Students' Notebooks, Writing Utensils, Unit Exam, Extra Calculators, Notebook Grade Sheet for Unit

Prerequisite Skills: From past lessons, students need to know how to utilize equivalence statements and conversion factors in calculations to start with given units and end with the desired ones. Additionally, they need to know how to recognize compounds in both chemical and written form, and they should be able to count the number of atoms of each element in given compounds. Lastly, students should also know the concepts from the first, second, and third lessons in the unit.

ELP Standards: Forms and Functions

Defining: Nouns, Pronouns, Adjectives - Students learn to define concrete and abstract objects/concepts with correct nouns, pronouns, and adjectives.

Explaining: Verb Forms, Declarative/Complex Sentences, Adverbs of Manner - Students learn to develop and use explanations using appropriate verb forms, declarative and complex sentences, and adverbs of manner.

Proficiency Levels:

Defining: EP.IN.17 Intermediate: Connected text including irregular nouns, personal, possessive pronouns and adjectives with some irregular past tense verbs. EP.EA.17

Early Advanced: Concrete and abstract topics using irregular nouns, singular and plural, personal and possessive pronouns and adjectives.

Explaining: EP.IN.18 Intermediate - Explain simple, straightforward information of immediate relevance, using regular verbs and adverbs of manner in declarative sentences and compound sentences. EP.EA.18 Early Advanced - Get across important points using declarative, compound and complex sentences, regular and irregular verb forms.

Oregon Content Standards:

National Standards (NRC Next Generation Science Standards): PS1.A: Structure and Properties of Matter: How do particles combine to form the variety of matter one observes?

State Standards (Oregon Department of Education): H.1: Structure and Function: A system's characteristics, form, and function are attributed to the quantity, type, and nature of its components.

Lesson Objectives:

Content: 1) Students will be able to mathematically determine the number of atoms in a sample and the mass of a sample with the atomic mass. 2) Students will be able to mathematically convert between moles and mass and to determine the mass percent of a sample. 3) Students will be able to mathematically calculate empirical and molecular formulas for a compound.

Language: 1) Students will be able to define the concept of average atomic mass with adjectives and singular and plural nouns. 2) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to figure out the

number of atoms in a sample and the mass of a sample with atomic mass. 3) Students will be able to define the concept of molar mass and mass percent with adjectives and singular and plural nouns. 4) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to convert between moles and mass and to determine mass percent of a sample. 5) Students will be able to define the concept of empirical formula with adjectives and singular and plural nouns. 6) Students will be able to explain, with regular verbs/adverbs in declarative sentences, the steps needed to calculate empirical and molecular formulas for a compound.

Anticipatory Set: As students walk into the classroom, there will be instructions on the document camera that tell them that they have about fifteen minutes for some last-minute studying before they must turn in their chemistry notebooks and start the unit exam. (15 minutes)

Stated Objective and Purpose: "Today, we have our unit exam. You have about fifteen minutes to study before I pass out the test. You will also be turning in your notebooks, so that they can be graded and returned before the end of the class period."

Input: The teacher will hand out the unit exam and collect students' notebooks. Students will have almost the rest of the class period to complete the test. Before students begin, the teacher will talk to students about the expectations of a testing environment, and explain the consequences for anyone who is caught cheating. While students are taking the test, the teacher will be grading their notebooks on the completeness of their notes and homework assignments with a premade grade sheet. The teacher will also constantly monitor students, so that the unit exam will end up as the most accurate summative assessment possible. (70 minutes)

Adaptations for Students with Special Needs: To help students stay on task with the unit exam, the teacher will tell the entire class how much time is left to complete the test at various intervals. She will also place students in areas of the classroom where they are most likely to be successful (front of the room, back of the room, etc.). The teacher will extend the time for the unit exam when there are conditions that warrant the time extension, and if necessary, she can also make changes to the exam to make the test shorter and yet still have a usable summative assessment.

Adaptations for ESOL or Bilinguals: There are some sentence prompts in the unit exam, and these serve as way to scaffold the language, since students that may need a small clue to head in the right direction can use the sentence starters in their answer (Tong, 2008). There is also a small level of visual scaffolding in the instructions and questions to sort of help students understand what the problems were asking them (Tong, 2008).

Closure: After the teacher collects all the tests, she will have students take a self-assessment on how they believe they did on the unit exam. They will use their fingers and a rating scale from one to five. A one represents the belief that they did not do well, a three represents their belief that they did sort of well, and a five represents their belief that they did very well. The teacher may have students share their reasons for their number selection among table group members, and then give them the option to share their reasons with the whole class. (5 minutes)

Assessment: The unit exam will serve as a summative assessment for the unit. This test examines students' ability to accomplish the lesson objectives from the first three lessons of the unit. Results from the test will give the teacher an indication of the

concepts that she may need to somewhat cover again in conjunction with the next unit. And, the self-assessment will tell the teacher what thoughts students had about the unit exam, which will help her to determine if she needs to make modifications to the test before she utilizes that assessment again. Students' attitude toward the unit exam may also prompt the teacher to find alternative summative assessments for upcoming units.

Literacy Instruction: The unit exam gives students the opportunity to identify the appropriate defining sentences when answering a number of problems. Additionally, students will have the chance to write explaining sentences for some of the calculations they work out. Students will also put their reading and decoding skills to use when they read each problem, so that they can figure out what the question is asking them to do or find.

Technology Integration: When students walk in the door, the document camera and projector will communicate information to the students. They will see that such technology has the capability of handing out instructions, so that the teacher can attend to other matters before class actually starts.

Reflection and Plans for Reteaching: This day was very uneventful, but after seeing the results from the test, the teacher may want to format the questions again, so that there are more than two ways (multiple choice and short answers) for students to show their knowledge and application abilities. Additionally, the teacher may want to somehow find a way to add more visual images, so that students can use them as clues to help them figure out what they need to do to solve for the solutions. She may have hesitated with doing this in the first place, because she was unsure if the chosen pictures would either confuse her students even more or actually assist them in completing the unit

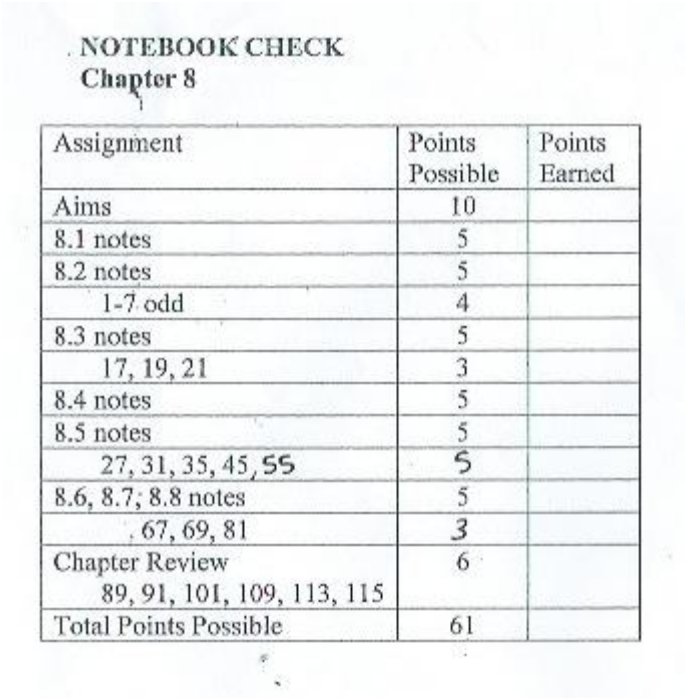
exam. The self-assessment gave the teacher an indication that students had mixed reactions to the test. Some students felt confident that they did well, while others felt that they only did somewhat well or not well at all. This seems like a typical response to any kind of test in any class, however, the teacher would have liked to see more students be prepared, so that they would feel more comfortable with the content and language information and their ability to apply that knowledge. The teacher may try to find an alternative summative assessment next time, so that students do not have to feel the pressures of having to take an exam when they demonstrate their knowledge and abilities. An assessment that takes away anxiety is more likely to accurately reflect what students know at the time of the assessment. Though, students do need to be able to study for tests and to take them without having stress be a factor in the results.

References:

Tong, F., Lara-Alecio, R., Irby, B., Mathes, P., Kwok, O. (2008). Accelerating Early Academic Oral English Development in Transitional Bilingual and Structured English Immersion Programs. *American Educational Research Journal*, *45(4)*, 1011-1044.

Scanned Notebook Check Sheet:

Figure 7: Notebook Check Sheet



NOTEBOOK CHECK
Chapter 8

Assignment	Points Possible	Points Earned
Aims	10	
8.1 notes	5	
8.2 notes	5	
1-7 odd	4	
8.3 notes	5	
17, 19, 21	3	
8.4 notes	5	
8.5 notes	5	
27, 31, 35, 45, 55	5	
8.6, 8.7; 8.8 notes	5	
67, 69, 81	3	
Chapter Review 89, 91, 101, 109, 113, 115	6	
Total Points Possible	61	

Assessment Strategies and Analysis of Learning

Pre-Assessment and Post-Assessment Instruments

The pre-assessment was a short five-question test, and students had approximately twenty minutes to answer the questions. To relieve the stress of taking a quiz, the teacher told students that the pre-assessment was not graded and simply provided her with information about their prior knowledge on content and language material related to the unit. The short length of the test and the question formats also reduced anxiety, so that students actually focused on the knowledge they already knew.

The post-assessment was a unit exam with multiple choice and short answer questions that took approximately one class period to complete. Each student worked individually on the post-assessment, and the only materials that were available to them were the unit exam, a periodic table, a list of polyatomic ions, a writing utensil, and a calculator. Once they started the unit exam, students could not leave the room until they handed in their unit exam to the teacher. Students were not allowed to use each other as a resource, and so the post-assessment reflected on each student's ability to understand and apply the concepts covered in the unit. This post-assessment was very similar to the summative assessment that the cooperating teacher had for all her general chemistry classes, and so this class received the same end-of-the-unit assessment in order to maintain a level of consistency. However, adjustments were made to the unit exam assessment by the student teacher, so that the assessment met the requirements of the work sample and lined up with her approach to assessment. Additionally, the unit exam needed to examine both content and language objectives/standards instead of just content objectives/standards. This post-assessment hopefully maximized the possibility that students tapped into their prior and current knowledge to the fullest depths in a way that

accurately reflected the snapshot of their current comprehension of the science and language material.

Figure 8: Pre-Assessment

Name:_____ Date:_____

Pre-Assessment - Chemical Composition Unit

1) Short Answer: In the space provided below, define atomic mass with complete sentences. The two words in the word bank should be a part of the definition.

Word Bank:	average	isotopes

_____

_____

_____

_____

_____

2) Multiple Choice: Circle the letter (A, B, C, or D) to show the chosen answer to the following question. Which numerical value is the same as Avogadro's number?

A. 6.022 atoms
B. 6.022 x 10 atoms
C. 6.022 x 1023 atoms
D. 6.022 x 102300 atoms

The pre-assessment continues on the next page. ⟶

3) Show Work: In the space provided below, calculate the empirical formula for the compound from the given percent (%) composition.

Element (Symbol)	Percent (%) Composition
Platinum (Pt)	65.02%
Chlorine (Cl)	23.63%
Nitrogen (N)	9.34%
Hydrogen (H)	2.02%

Show Work Here:

The pre-assessment continues on the next page. ⟶

4) Write Out Steps: In the table below, write out the steps in complete sentences that led to the empirical formula on the previous page in Problem #3. The given word bank has words that may or may not help. An example of a written step is shown in the table.

Word Bank: first second third fourth fifth next then added subtracted multiplied divided changed converted assumed one hundred (100) total mass grams moles molar mass percent composition smallest biggest whole numbers

Step Number (#)	Description of Step
1 (Example Step)	First, I figured out the elements that were in the compound. (Example Step)

5) True or False: Determine if the following statement is true or false, and then circle one of the answer choices below. A person can figure out the molecular formula of a compound if he/she knows the empirical formula and the molar mass of the compound.

Answer Choice #1: True

Answer Choice #2: False

This is the end of the pre-assessment.

Figure 9: Post-Assessment

Name:_____ Date:_____

Chemical Composition Unit Exam

Multiple Choice - Write the letter of the selected answer on the blank line (_____) to the left of the question (?) or problem (.).

_____ 1. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?

A) 0.8452 moles
B) 1.183 moles
C) 6.022 x 1023 moles
D) 8.648 x 1023 moles
E) 3.134 x 1025 moles

_____ 2. What is the definition of average atomic mass in a complete sentence?

A) The average atomic mass is equal to the average relative abundance of the isotopes for an element.
B) average relative abundance of an element
C) The average atomic mass is equal to an average of random numbers related to the weight of an element.
D) average mass of every single atom of an element in existence
E) The average atomic mass is equal to the average mass of every single atom of an element in existence.

_____ 3. A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the compound is 60.05 amu. Calculate the molecular formula of this compound.

A) C2H4O2
B) CH2O
C) C2H3O4
D) C2H2O4
E) CHO2

_____ 4. A compound contains 38.7% K, 13.9% N, and 47.4% O by mass. What is the empirical formula of the compound?

A) KNO3
B) K2N2O3
C) KNO2
D) K2NO3
E) K4NO5

_____ 5. Calculate the molar mass of potassium dichromate (K2Cr2O7)?

A) 107.07 g/mol
B) 255.08 g/mol
C) 242.18 g/mol
D) 294.18 g/mol
E) 333.08 g/mol

_____ 6. What is the definition of Avogadro's number in a complete sentence?

A) 144, a gross
B) Avogadro's number is the same as 144, which is the same as 1 gross.
C) 6.022 x 1023, a mole
D) Avogadro's number is the same as 6.022 x 1023, which is the same as 1 mole.
E) 13, a baker's dozen

_____ 7. Calculate the mass percent (%) of Al in aluminum sulfate (Al2(SO4)3).

A) 7.886% Al
B) 15.77% Al
C) 21.93% Al
D) 45.70% Al
E) 35.94% Al

_____ 8. What is the definition of molar mass in a complete sentence with an adjective?

A) Avogadro's number is the molar mass.

B) The molar mass is the percent (%) composition by mass.

C) Combustion analysis determines the molar mass of a compound.

D) The molar mass is equivalent to the sum of the masses of each atom in its chemical formula.

E) Weight of a sample of substance.

_____ 9. Calculate the molar mass of calcium nitrate (Ca(NO3)2) to one decimal place.

A) 102.1 g/mol

B) 164.0 g/mol

C) 204.2 g/mol

D) 150.1 g/mol

E) 116.1 g/mol

_____ 10. What is the definition of mass percent (%) in a complete sentence with a noun and an adjective?

A) Mass percent (%) divided (÷) masses then multiplied (x) by a hundred (100).

B) Mass percent (%) multiplied (x) by a hundred (100) then divided (÷) the masses.

C) The mass percent (%) is equal to the mass of an element divided (÷) by the mass of the compound multiplied (x) by a hundred (100).

D) The mass percent (%) is mass of element multiplied (x) by mass of compound divided (÷) by a hundred (100).

E) The mass percent (%) is equal to the element multiplied (x) by the compound divided (÷) by a hundred (100).

_____ 11. Which compound contains the largest number of atoms in one mole?

A) S8
B) C10H8
C) Al2(SO4)3
D) Na3PO4
E) H2

_____ 12. How many molecules of CH4 are in 48.2 g of this compound?

A) 5.00 x 1024 molecules CH4
B) 3.00 molecules CH4
C) 2.90 x 1025 molecules of CH4
D) 1.81 x 1024 molecules CH4
E) 4.00 molecules CH4

_____ 13. How many oxygen atoms are contained in 2.74 g of Al2(SO4)3?

A) 12 oxygen atoms
B) 6.02 x 1023 oxygen atoms
C) 7.22 x 1024 oxygen atoms
D) 5.79 x 1022 oxygen atoms
E) 8.01 x 10-3 oxygen atoms

_____ 14. The molecular formula of aspartame, the generic name of NutraSweet®, is C14H18N2O5. What is the molar mass of aspartame rounded to the nearest integer?

A) 24 g/mol
B) 156 g/mol
C) 294 g/mol
D) 43 g/mol
E) 39 g/mol

_____ 15. In a <u>complete sentence</u> with a <u>verb</u>, what is the final step when figuring out the molecular formula of a compound?

A) Last, divide the mass of the molecular formula by the mass of the empirical formula.
B) Last, mass of molecular formula and mass of empirical formula.
C) Last, multiply the subscripts in the empirical formula with the number that came from the previous step.
D) Last, subscripts of empirical formula with the number from the previous step.
E) Last, calculate the mass of the empirical formula.

Calculations - Answer the following questions or problems in the provided space. Make sure to show all the work that led to the answer(s) in order to receive full credit.

16. How many grams of pyridine (C5H5N) are contained in 0.0396 mol of pyridine? In complete sentences with verbs, explain the steps that led to the final answer. Use the following sentence prompt to start the explanation: First, I calculated the...

17. How many sulfur dioxide molecules are there in 18.00 g of sulfur dioxide?

18. Calculate the mass percent of nitrogen, lead, and oxygen in Pb(NO3)2.

19) A compound was found to contain 90.6% lead (Pb) and 9.4% oxygen (O). What is the empirical formula for this compound. In complete sentences with verbs, explain the steps that led to the final answer.

20. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What are the empirical and molecular formulas for this compound?

ESOL Assessment Strategies

Formal assessments in this unit included observations (Torrance, 2001), self-assessments (Leahy, 2005), and exit tickets (Honigsfeld, 2010). Observations happened continually throughout every lesson when students responded to questions, when the teacher walked around the room as students worked alone or in groups to provide assistance when necessary, and when the teacher saw the work students did on the warm-ups, homework assignments, and review activity. This type of formal assessment allowed the teacher to make adjustments within lessons and for future lessons, because she was able to see how students processed the information. She knew what she needed to reiterate and what misconceptions to address to help students understand the material, and she learned which teaching approaches did or did not work well during the unit. Self-assessments also happened with every lesson, but students did these toward the end of the class period. Students were able to share with the teacher their attitude towards the language and content aspects of the unit, and their opinion about how well they were doing with comprehending and applying the concepts in the lesson. The teacher was able to use this information to alter activities and questions in a way that maintained students' focus and attention, and she found ways to individualize instruction on a small scale for some students. Exit tickets happened with the lessons of the unit that had new material being introduced to students. This formal assessment gave the teacher a snapshot of the strengths and struggles students had with those lessons. Such feedback ensured that the teacher would incorporate appropriate short reviews of previous lessons in upcoming ones.

Student Learning Gains and Losses

Chart 1: Students' Reading and Math Oregon Assessment of Knowledge and Skills Scores

Student (#)	Reading (Grade Taken; Score; Status)	Math (Grade Taken; Score; Status)
1	8; 233; Meets	8; 235; Meets
2	8; 241; Exceeds	HS; 239; Meets
3	8; 235; Meets	HS; 246; Meets
4	HS; 240; Meets	HS; 242; Meets
5	8; 234; Meets	HS; 244; Meets
6	8; 241; Exceeds	8; 238; Meets
7	7; 231; Meets	HS; 238; Meets
8	8; 246; Exceeds	HS; 241; Meets
9	8; 231; Meets	HS; 230; Does Not Meet
10	HS; 260; Exceeds	HS; 239; Meets
11	8; 234; Meets	HS; 241; Meets
12	HS; 226; Does Not Meet	HS; 231; Does Not Meet
13	8; 233; Meets	HS; 241; Meets
14	8; 231; Meets	8; 237; Meets
15	6; 210; Does Not Meet	8; 213; Does Not Meet
16	8; 273; Exceeds	HS; 258; Exceeds
17	8; 237; Meets	HS; 244; Meets
18	6; 223; Meets	HS; 237; Meets
19	8; 234; Meets	HS; 234; Does Not Meet
20	HS; 246; Meets	HS; 221; Does Not Meet
21	8; 246; Exceeds	HS; 265; Exceeds
22	HS; 239; Meets	HS; 238; Meets
23	8; 230; Does Not Meet	HS; 235; Does Not Meet
24	8; 235; Meets	8; 241; Meets
25	8; 231; Meets	8; 231; Does Not Meet
26	8; 242; Exceeds	HS; 248; Meets
27	8; 244; Exceeds	8; 245; Exceeds

Chart 1 has the most recent state assessment scores for each student in the areas of reading and math. The teacher kept this information in mind when she planned her lessons for this unit. However, the influence of this data was minimal after the teacher

took the time to consider the advantages and disadvantages of these types of tests, especially since most of the reading scores were from eighth grade.

Chart 2: Pre-Assessment and Post-Assessment Scores with Learning Gains/Losses

Student (#)	Pre-Assessment Scores (Language %; Content %)	Post-Assessment Scores (Language %; Content %)	Learning Gains/Losses (Language % Change; Content % Change)	Met Unit Goals (Language Y/A/N; Content Y/A/N)* *Y=Yes; S=Somewhat; N=No
1	N/A	93; 57	N/A	Y; S
2	67; 67	100; 77	+33; +10	Y; Y
3	67; 50	71; 60	+4; +10	Y; S
4	67; 33	N/A	N/A	N/A
5	50; 17	100; 83	+50; +66	Y; Y
6	N/A	71; 43	N/A	Y; N
7	33; 33	64; 33	+31; 0	S; N
8	N/A	79; 33	N/A	Y; N
9	50; 50	71; 57	+21; +7	Y; S
10	N/A	93; 73	N/A	Y; Y
11	33; 33	100; 77	+67; +44	Y; Y
12	17; 50	71; 57	+54; +7	Y; S
13	N/A	71; 30	N/A	Y; N
14	50; 67	71; 73	+21; +6	Y; Y
15	50; 33	86; 50	+36; +17	Y; S
16	100; 67	100; 87	0; +20	Y; Y
17	67; 33	100; 90	+33; +57	Y; Y
18	N/A	36; 37	N/A	N; N
19	N/A	64; 50	N/A	S; S
20	N/A	57; 53	N/A	S; S
21	67; 67	100; 97	+33; +30	Y; Y
22	17; 67	93; 57	+76; -10	Y; S
23	N/A	86; 60	N/A	Y; S
24	33; 33	71; 43	+38; +10	Y; N
25	50; 50	86; 33	+36; -17	Y; N
26	67; 33	93; 93	+26; +60	Y; Y
27	67; 0	86; 83	+19; +83	Y; Y
Avg.	53; 44	81; 61	+34; +23	N/A

Figure 10: Graph of Learning Gains and Losses

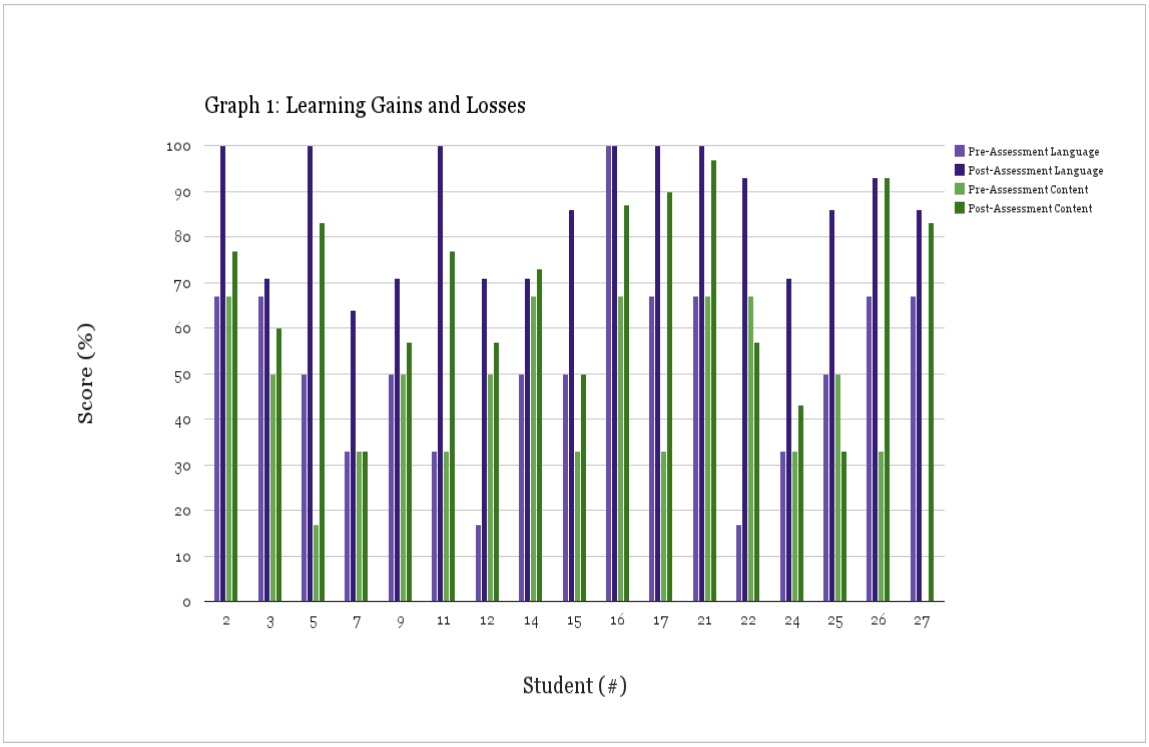


Chart 3: Grade Sheet for Unit

Student (#)	Pre-Assessment Scores (12 (T), 6 (L), 6 (C))*	Notes & HW (71)	Exit Tickets (checked)	Unit Exam Scores (80 (G), 44 (T), 14 (L), 30 (C))*
1	N/A	58	X	49, 30, 13, 17
2	8, 4, 4	71	X	70, 37, 14, 23
3	7, 4, 3	N/A	X	53, 28, 10, 18
4	6, 4, 2	71	X	N/A
5	4, 3, 1	71	X	68, 39, 14, 25
6	N/A	71	-	24, 23, 10, 13
7	4, 2, 2	69	X	39, 19, 9, 10
8	N/A	51.5	-	29, 21, 11, 10
9	6, 3, 3	71	X	34, 27, 10, 17
10	N/A	71	X	62, 35, 13, 22
11	4, 2, 2	67.5	X	65, 37, 14, 23
12	4, 1, 3	70	X	55, 27, 10, 17
13	N/A	0	-	21, 19, 10, 9
14	7, 3, 4	71	X	65, 32, 10, 22
15	5, 3, 2	71	X	47, 27, 12, 15

16	10, 6, 4	69	X	69, 40, 14, 26
17	6, 4, 2	71	X	75, 41, 14, 27
18	N/A	53	-	20, 16, 5, 11
19	N/A	51.5	X	35, 24, 9, 15
20	N/A	35.5	-	26, 24, 8, 16
21	8, 4, 4	71	X	79, 43, 14, 29
22	5, 1, 4	59.5	X	43, 30, 13, 17
23	N/A	69	X	56, 30, 12, 18
24	4, 2, 2	50.5	X	32, 23, 10, 13
25	6, 3, 3	71	X	39, 22, 12, 10
26	6, 4, 2	71	X	78, 41, 13, 28
27	4, 4, 0	71	X	69, 37, 12, 25

*G = Official Grade; T = Work Sample Total Score; L = Work Sample Language Score; C = Work Sample Content Score

The language and content scores were determined through a process that applied to both the pre-assessment and post-assessment. This scoring system was only for the work sample, and thus in no way affected students' actual grades in class. However, Chart 3 does have both actual and work sample scores for the entire unit. When reviewing students' responses to questions, they either reached the objective (two points), somewhat reached the objective (one point), or did not reach the objective (zero points). Language questions and content questions were examined separately, which led to separate scores (one for language and another for content). Each question on the pre-assessment and post-assessment was either a language or content question. This point system permitted a direct comparison between the pre-assessment and post-assessment in order to determine learning gains or losses over the unit.

To determine if students did meet, somewhat met, or did not meet the content and language unit goals, percent ranges were chosen for each option, and then students' scores were compared to this scale. Percentage scores that were greater than or equal to seventy percent ($\geq 70\%$) meant that students did meet unit goals, percentage scores that

were greater than or equal to fifty percent and less than seventy percent ($50\% \leq x < 70\%$) meant that students somewhat met unit goals, and percentage scores that were below fifty percent ($\leq 50\%$) meant that students did not meet unit goals. Graph 1 summarized the language and content percentage scores from Chart 2 in a visual format, which made the comparison between the pre-assessment and post-assessment easier to interpret.

In terms of the language unit goal, students overall made gains, because there was an average overall learning gain of thirty-four percent, and every single student actually made some amount of forward progress. Approximately eighty-five percent of the class met this unit goal (twenty-two students), approximately twelve percent of the class somewhat met this goal (three students), and approximately four percent of the class did not meet this unit goal (one student). The pre-assessment may not have accurately reflected students' language skills and abilities before the unit, because one language question was dependent on work done for one of the content questions. If students did not do the content question, then they were unable to put down an answer for the language question. To help remedy this, an answer to a language question from either the warm-up or exit ticket in lesson two was also included in the pre-assessment score for language for each student. The setup of the post-assessment was more likely to accurately reflect students' language abilities at the end of the unit, because students had to identify and write sentences that answered the language questions. However, every assessment does have some margin of error, and so a perfect pre-assessment or post-assessment is virtually impossible.

In terms of the content unit goal, students overall made gains, because there was an average overall learning gain of twenty-three percent. Approximately thirty-eight

percent of the class met this unit goal (ten students), approximately thirty-four percent of the class somewhat met this unit goal (nine students), and approximately twenty-seven percent of the class did not meet this unit goal (seven students). After comparing these percentages with the percentages for the language unit goal in the previous paragraph, most students apparently had a harder time with the content information than the language material in the unit. They might not have had enough time to process, understand, and apply the content concepts during the span of five lessons (about eleven days). Additionally, students would only be the most successful with this unit if they were able to comprehend and utilize the concepts from past lessons and units, and so, if students were still struggling with the information from earlier in the school year, then they were probably not going to do well with this unit. The following paragraphs explain further the possible reasons that might have led to a low number of students actually achieving the content unit goal, as well as the language unit goal for the few students that did not meet that goal.

The challenge for students in this unit came from the need to apply concepts and skills from previous lessons and units to comprehend and complete the post-assessment. So, if students were unable to fully grasp the content material before the end of the unit, they were more likely to struggle with the post-assessment, and thus waste time during the unit exam trying to figure out what to do. On the other hand, students that were prepared for the post-assessment had no problem, or only minor struggles, when taking the unit exam. Overall, students were challenged to learn the material in the unit, so that they could show their progress towards or their achievement of the unit goals. Additionally, there was motivation from the fact that they would need to know the

concepts and skills from this unit in order to have the capability to understand the information in upcoming units.

From the data, a majority of student were unable to come close to or achieve one hundred percent proficiency (the range of ninety to one hundred percent) on the language or content components of the post-assessment. The wording or format of some of the questions may have caused this result. Before giving out any post-assessment, the teacher should have other individuals (not the students) look over the directions and questions to ensure they are clear and straightforward for both ELL and non-ELL students. This would minimize the possibility that the post-assessment inaccurately measures students' current proficiency with the unit goals. The teacher did not do this for this work sample, but if she went through the questions for both the pre-assessment and post-assessment for any unit, and determined that some of them might incorrectly report learning gains or losses when she analyzed the data, then she might want to throw those questions out before the scores were calculated.

Next time, the teacher should extend the time assigned for each concept and skill in the unit. This allows students to have more practice with the specific chemistry material in class. Also, there is the opportunity to incorporate more activities related to these topics, so that students receive the same information in different ways. If one approach does not work well for some of them to learn new knowledge, then they will have other formats available that may suit their style of learning better. The activities may also serve as a method to increase student engagement, which would increase the likelihood that they at least attempt to grasp the new content material. Giving students more time with the concepts and skills will help them to fully understand the information,

and then they can apply that knowledge in other situations, such as the post-assessment and upcoming units.

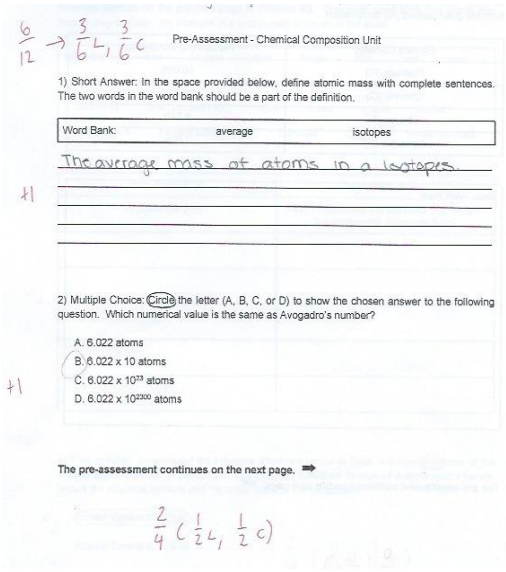
Scored Work and Analyzed Data for Two Focal ELLs

ELL #1 (Student 25) had a score of fifty percent for both language and content on the pre-assessment. On the post-assessment, she had a score of eighty-six percent on language and thirty-three percent on content. This indicated that she had a thirty-six percent gain on language and a seventeen percent loss on content between the pre-assessment and the post-assessment. From her percentage scores on the post-assessment, she met the unit goal for language, but she did not meet the content unit goal. For the most part, she was able to grasp defining and explaining sentences, but she may need just a bit more practice with adjectives. In terms of content, she did well with determining the empirical formulas, while she did not do well with calculating molar masses (specifically with counting the number of atoms for each element in compounds). Because of her struggles with the concept of molar mass, she had a difficult time with determining molecular formulas and mass percents, and with converting between grams and moles, since these other concepts utilize the molar masses of compounds to get to the desired end point. Parts of her formative assessments (observations of warm-ups, homework assignments, and exit tickets) showed she was having trouble with the material related to these concepts. There were also similar misconceptions in her thought process in both the formative assessments and the post-assessment. Next time, the teacher should go over common misconceptions with the whole class, which would help all students review information within the unit. The teacher could also come up with ways to give students,

such as ELL #1, the option for more practice with specific skills geared toward the content concepts, and even the language concepts. If possible, the teacher should also take some time to work with small groups where students are struggling in the same area, so that they receive more individualized assistance. ELL #1 would definitely have benefited from these changes.

Scanned Work for ELL #1:

Figure 11: ELL #1's Pre-Assessment



6/12 → 3/6 L, 3/6 C

Pre-Assessment - Chemical Composition Unit

1) Short Answer: In the space provided below, define atomic mass with complete sentences. The two words in the word bank should be a part of the definition.

Word Bank:	average	isotopes

The average mass of atoms in a isotopes.

+1

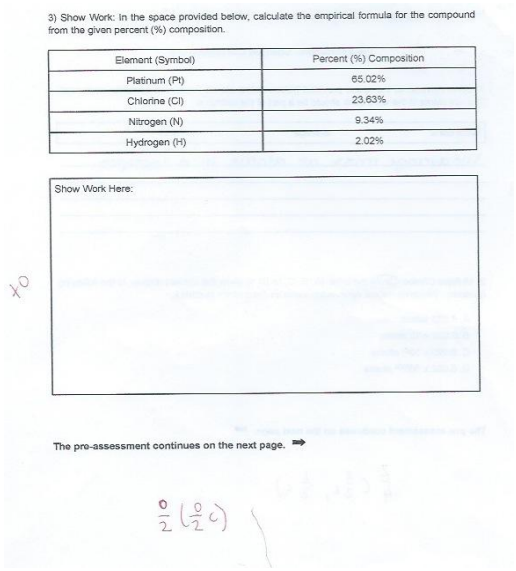
2) Multiple Choice: Circle the letter (A, B, C, or D) to show the chosen answer to the following question. Which numerical value is the same as Avogadro's number?

A. 6.022 atoms
B. 6.022 x 10 atoms
C. 6.022×10^{23} atoms
D. 6.022×10^{2300} atoms

+1

The pre-assessment continues on the next page. ➡

2/4 (1/2 L, 1/2 C)



3) Show Work: In the space provided below, calculate the empirical formula for the compound from the given percent (%) composition.

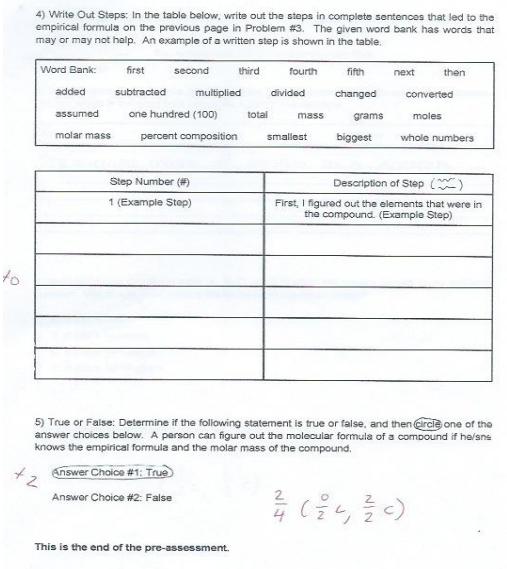
Element (Symbol)	Percent (%) Composition
Platinum (Pt)	65.02%
Chlorine (Cl)	23.63%
Nitrogen (N)	9.34%
Hydrogen (H)	2.02%

Show Work Here:

+0

The pre-assessment continues on the next page. ➡

0/2 (0/2 C)



4) Write Out Steps: In the table below, write out the steps in complete sentences that led to the empirical formula on the previous page in Problem #3. The given word bank has words that may or may not help. An example of a written step is shown in the table.

Word Bank:	first	second	third	fourth	fifth	next	then
added	subtracted	multiplied	divided	changed	converted		
assumed	one hundred (100)	total	mass	grams	moles		
molar mass	percent composition	smallest	biggest	whole numbers			

Step Number (#)	Description of Step (~)
1 (Example Step)	First, I figured out the elements that were in the compound. (Example Step)

+0

5) True or False: Determine if the following statement is true or false, and then circle one of the answer choices below. A person can figure out the molecular formula of a compound if he/she knows the empirical formula and the molar mass of the compound.

+2

Answer Choice #1: True

Answer Choice #2: False

2/4 (0/2 L, 2/2 C)

This is the end of the pre-assessment.

Figure 12: ELL #1's Additional Pre-Assessment Question from Warm-Up

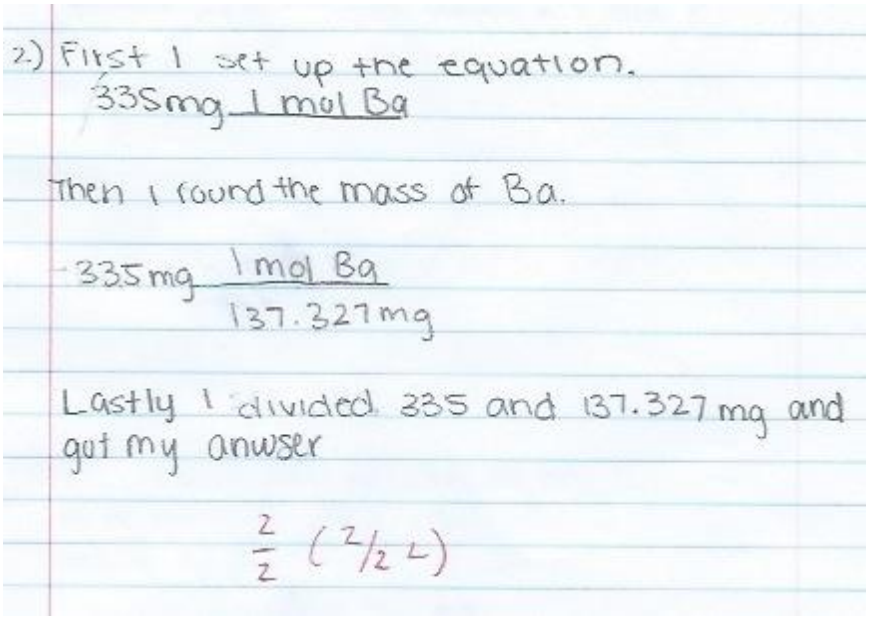
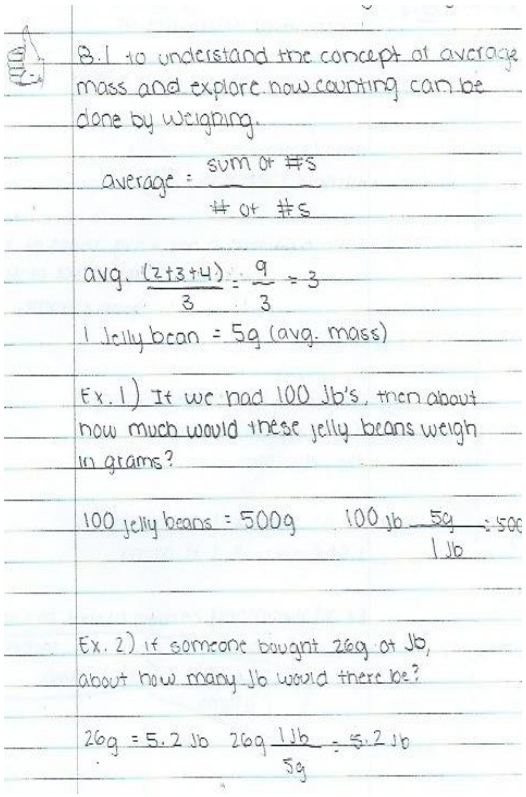
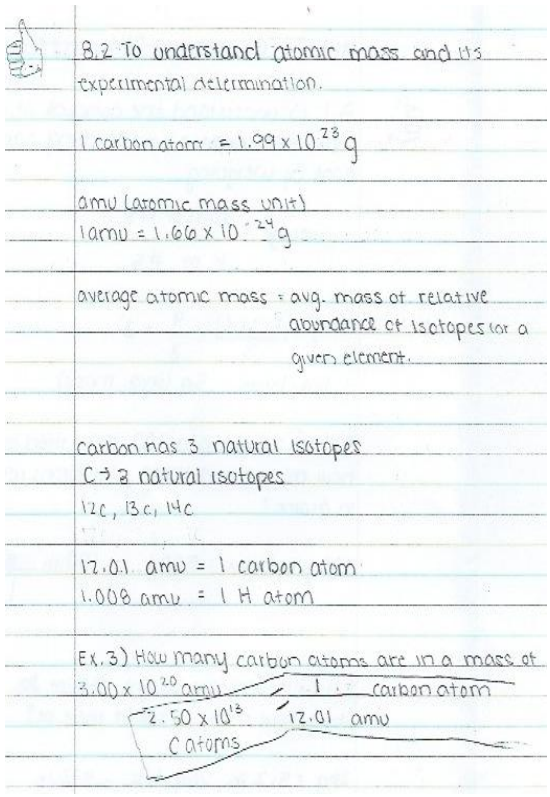


Figure 13: ELL #1's Notebook (Warm-Ups, Notes, Homework)





Ne atom = 20.2 amu

20.2g Ne = 1 mol Ne = 6.022×10^{23} Ne atoms

a sample of an element w/ a mass equal to that element's atomic mass expressed in grams contains 1 mole of atoms.

* 6.022×10^{23} = Avagadro's #

8.00 g He = 2 mole He = 2(6.022×10^{23} He atoms)

1 He atom = 4.00 amu
4.00g He = 1 mole He

Ex. 5) How many atoms of Hydrogen are in 5.0g sample of Hydrogen?

$5.0\text{g H} \times \frac{1\text{ mol H}}{1.01\text{g H}} \times \frac{6.022 \times 10^{23}\text{ H atoms}}{1\text{ mol \#}} = 3.00 \times 10^{24}$ Hydrogen atoms

Ex. 6) calculate the number of moles in 10g Al

$10\text{g Al} \times \frac{1\text{ mol Al}}{26.98\text{ g Al}} = 0.37\text{ mol Al}$

Ex. 7) How many is this? (Look at Ex. 6)

$0.37\text{ mol Al} \times \frac{6.022 \times 10^{23}\text{ Al atoms}}{1\text{ mol Al}} = 2.2 \times 10^{23}$ atoms.

Homework 1-21

1) 1 washer weighs = 0.110g avg.
100 washer weighs = 11g avg
100 washer weighs $\frac{0.110\text{g}}{1\text{ washer weighs}} = 11\text{g}$
100.6 / 0.110g = 909 washers.
There would 909 washers if it weighed 100g.

3) amu = atomic mass atom
1 amu = 1.66×10^{-24} g.

5) a) 635 atoms of Hydrogen
$635\text{ H atoms} \times \frac{1.008\text{ amu}}{1\text{ H atoms}} = 629.96\text{amu}$

b) 1.261×10^4 atoms of tungsten
$2.318 \times 10^6 = \frac{1}{183.8}$ tungsten atom amu

c) 42 atoms of potassium
$42\text{ K atoms} \times \frac{39\text{ amu}}{1\text{ K atoms}} = 1.07\text{ amu}$

Ex. 4) calculate the mass (amu) of a sample of Al that contains 75 atoms.

$75\text{ Al atoms} \times \frac{26.98\text{ amu}}{1\text{ Al atoms}} = 2,024\text{ amu}$

8.3 to understand the mole concept and Avogradros #.

To learn to convert among moles, mass, and # of atoms in a given sample.

1 dozen eggs = 12 eggs

3 dozen eggs = 36 eggs

1 gross of eggs = 144 eggs
1 gross of jelly beans = 144 jelly beans.

1 mole eggs = 6.022 x 10.23 eggs

12.01g of C = 1 mole of carbon
= 6.022×10^{23} carbon atoms.

d) 7.213×10^{23} atoms of nitrogen
$1.010 \times 10^{25} = \frac{1}{14}$ nitrogen atom amu

~~7.213×10^{23} (10 atoms x 1 amu)~~

7) 1 sulfur atom = 32.07 amu
$8274\text{ amu} = \frac{1\text{ atom}}{32.07\text{ amu}} = 257.99$

$5.213 \times 10^{24}(1\text{ mol} / 6.022 \times 10^{23}) = 86.57$

$86.57\text{ mols} \times \frac{32\text{ g}}{1\text{ mol}} = 2770\text{g}$

17) 1 mole of Helium 4.0026 g/mol
4 moles of Hydrogen is 4.0316 g/mol.
Hydrogen weighs more.

19) a) $6.22\text{g Al} \times \frac{1\text{ mol Al}}{26.98\text{g Al}} = 0.23\text{ mol Al}$

b) $52.1\text{ kg C} \times \frac{1\text{ mol C}}{12.011\text{ kg C}} = 4.33\text{ mol C}$

c) $1.26\text{mg Au} \times \frac{1\text{ mol Au}}{196.96\text{ mg Au}} = 0.006\text{ mol Au}$

d) $2.16\ lb\ Fe \times \frac{1\ mol}{55.84\ lb\ Fe} = 0.038$

21) a) $0.000221\ C \times \frac{1\ mol}{12.011\ C} = 0.0000184\ mol\ C$

b) $7.04\ K \times \frac{1\ mol}{39.09\ K} = 0.18\ K$

c) $2.71 \times 10^6 = 8.13 \times 10^6$
$2.71 \times 10^6 / 6.022 \times 10^{23} = 0.45\ mole$
$0.45\ mol \times 44.01\ g/mol = 1.99\ g$

d) $1.05\ Ag \times \frac{1\ mol}{107.86\ Ag} = 0.0097$

8.4 Molar Mass

- To understand the definition of Molar Mass.
- To learn to convert between moles and mass of a given sample of a chemical compound.

The molar mass is equal to the mass in 1 mol kg(mol).
Molar mass = g/mol (mass in one mole)

Ex 1) H_2O
$H = 1.01\ g/mol \times 2 = 2.02\ g/mol\ H$

$O = 16\ g/mol \times 1 = 16\ g/mol$

$2.02\ g/mol + 16\ g/mol = 18.02\ g/mol\ H_2O$
H O

To find molar mass of a compound...
First, find the mass of each individual element in a compound.

Then, add the masses together.

Ex 2) Calculate the molar mass of $CaCO_3$
$Ca = 40.08\ g/mol \times 1 = 40.08\ g/mol\ Ca$
$C = 12.01\ g/mol \times 1 = 12.01\ g/mol\ C$
$O = 16\ g/mol \times 3 = 48\ g/mol\ O$
$100.09\ g/mol\ CaCO_3$

Ex 3) Calculate the number of moles in 1.56g of $C_{10}H_6O_3$

$C = 12.01\ g/mol \times 10 = 120.1$
$H = 1.01\ g/mol \times 6 = 6.06$
$O = 16\ g/mol \times 3 = 48.00\ g/mol$
$174.16\ g/mol$

$1.56\ g\ C_{10}H_6O_3 \times \frac{1\ mol}{174.16\ g/mol} = .00896\ mol$

Steps for prob. similar to Ex. 3

① First you calculate molar mass of the compound

② Then, use molar mass as a conversion factor with the starting amt. in the prob.

8.5 % composition

- to learn to find the mass % of an element in a given compound.
- define mass percent.

The mass percentage amount of an element within a compound in terms of mass

Ex. 4) Find the percent composition of C in C_2H_5OH.

$C = 12.01\ g/mol \times 2 = 24.02\ g/mol\ C$
$H = 1.01\ g/mol \times 5 = 6.06\ g/mol\ H$
$O = 16.00\ g/mol \times 1 = 16.00\ g/mol\ O$
$46.08\ g/mol$

$\frac{24.02\ g/mol\ C}{46.08\ g/mol} = .521 \quad .521 \times 100 = 52.1\ \%$

Steps for prob: like ex 4.
First, find the molar mass of the compound.
Then, divide mass of a specific element by the mass of a compound.
Last, multiply by 100.

$\text{mass } \% = \frac{\text{mass element}}{\text{mass compound}} \times 100$

Homework 27, 31, 35, 345

27) a) Magnesium nitrate $Mg(NO_2)_2$
$Mg = 24.30\ g/mol \times 1 = 24.30\ g/mol\ Mg$
$N = 14.00\ g/mol \times 2 = 28.00\ g/mol\ N$
$O = 16.00\ g/mol \times 4 = 64\ g/mol\ O$
$116.30\ g/mol$
$Mg(NO_2)_2$

b) $NaClO_4$
$Na = 22.98\ g/mol \times 1 = 22.98\ g/mol\ Na$
$Cl = 34.45\ g/mol \times 1 = 34.45\ g/mol\ Cl$
$O = 16.00\ g/mol \times 4 = 64.00\ g/mol\ O$
$121.43\ g/mol$
$NaClO_4$

c) Sodium permanganate $NaMnO_4$
Na = 22.990 g/mol x 1 = 22.990 g/mol
Mn = 54.938 g/mol x 1 = 54.938 g/mol
O = 15.999 g/mol x 4 = 63.996 g/mol
141.924 g/mol $NaMnO_4$

d) Lithium chloride LiCl
Li = 6.94 g/mol x 1 = 6.94 g/mol
Cl = 35.45 g/mol x 1 = 35.45 g/mol
42.39 g/mol LiCl

31) a) 5.25 g of gold (III) chloride
$5.25\,g \times \frac{1\ mol}{303.325\,g} = 0.017\ mol$

b) 10.2 g of tin (II) oxide
$10.2\,g \times \frac{1\ mol}{134.71\,g} = 0.075\ g/mol$

c) 96.2 mg of ammonium dichromate
$96.2\,mg \times \frac{1\ mol}{252.070\,mg} = 0.381\ mol$

d) 8.91 g of potassium permanganate
$8.91\,g \times \frac{1\ mol}{158.034\,g} = 0.056\ mol$

35) a) 0.251 mol of potassium chromate
194.18 x 0.251 mol = 49.74 g

b) 1.51 mol of lithium perchlorate
106.39 x 1.51 mol = 160.64 g

c) 2.52×10^4 mol of lead (II) oxide
$PbO \times \frac{223.2\,g}{1\ mol} = 5.62 \times 10^6\,g\ PbO$

d) 1.74×10^{-3} mol of lead (IV) chloride
$278.1 \times \frac{223.2\,g}{1\ mol} = 62,071.92 \times 10^4\,g$

38) a) Magnesium nitrate $Mg(NO_3)_2$
Mg = 24.3050 g/mol x 1 = 24.3050 g/mol
N = 14.0067 g/mol x 1 = 14.0067 g/mol x 2 = 28.0134
O = 15.9994 g/mol x 3 = 47.9982 g/mol x 2 = 95.9964
148.3148
24.3050 / 148.3148 = 0.163 x 100 = 16.38 %

b) calcium chloride $CaCl_2$
Ca = 40.078 g/mol x 1 = 40.078 g/mol
Cl = 35.45 g/mol x 2 = 70.9 g/mol
110.978 g/mol
40.078 / 110.978 = 0.361 x 100 = 36.1 %

c) Carbon tetrabromide CBr_4
C = 12.0107 g/mol x 1 = 12.0107 g/mol
Br = 79.904 g/mol x 4 = 319.616 g/mol
331.6267 g/mol
331.6267 / 12.0107 = 27.6109 x 100 = 2,761 %

d) Sodium sulfite Na_2SO_3
Na = 22.989 g/mol x 2 = 45.978 g/mol
S = 32.065 g/mol x 1 = 32.065 g/mol
O = 15.999 g/mol x 3 = 47.997 g/mol
126.04 g/mol
126.04 / 45.978 = 2.741 x 100 = 274.13 %

1/14/13 warm up
1) calculate the mass % of Cu and O in Copper (II) nitrate.
Cu = 63.546 g/mol x 1 = 63.546 g/mol
N = 14.007 g/mol x 2 = 28.014 g/mol
O = 15.999 g/mol x 6 = 95.994 g/mol
187.554 g/mol
187.554 / 63.546 = 2.951 (Cu) x 100 = 295.1 %

2) what I did was find the mass of each element and multiply Cu by 1, N by 2, and O by 6. Add up the answers. what ever that answer was, I divided by each answer I got on the elements. Then I times it by 100. & that's now I got my answer.

187.554 / 28.014 = 6.695 (N) x 100 = 669.5
187.554 / 95.994 = 1.953 (O) x 100 = 195.3

8.6 To understand meaning of empirical formula of compounds.

Empirical formulas is equal to the simplest formula (smallest whole # ratio of the subscripts

Ex. CH_2O

Molecular formulas is equal to the actual formula.

Ex. $C_2H_4O_2 = (CH_2O)_2$

Ex: $C_6H_6 = CH$

Ex: $C_{12}H_4Cl_4O_2 = C_6H_2Cl_2O$

Ex: $C_6H_6N_2 = C_3H_8N$

8.7 to learn to calculate empirical formulas

steps:
First, obtain the mass of each element (g).

Second, convert g → mol for each atom.

Third, you are gonna divide each # of moles by the smallest # of moles.

Last, multiply by the smallest # that will convert all # to whole #'s.

Ex: .6884 g of Pb combines w/ .2356 g of Cl to form a chloride of lead. Calculate the empirical formula.

$.6884\text{ g Pb} \times \frac{1\text{ mol Pb}}{207.2\text{ g Pb}} = .0033\text{ mol Pb}$; $\frac{.0033}{.0033} = 1$

$.2356\text{ g Cl} \times \frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = .0066\text{ mol Cl}$; $\frac{.0066}{.0033} = 2$

If given % composition...
First, assume 100 g of compound.

second, convert grams to mols

Last, divide by smallest # of moles.

Ex: ① $65.02\%\text{ Pt} = 65.02\text{ g} \times \frac{1\text{ mol Pt}}{195.1\text{ g Pt}} = \frac{.33}{.33} = 1$

② $9.34\%\text{ N} = 9.34\text{ g} \times \frac{1\text{ mol N}}{14.01\text{ g N}} = \frac{.66}{.33} = 2$

③ $2.02\%\text{ H} = 2.02\text{ g} \times \frac{1\text{ mol H}}{1.01\text{ g H}} = \frac{2}{.33} = 6$

④ $23.63\%\text{ Cl} = 23.63\text{ g} \times \frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = \frac{.66}{.33} = 2$

$PtN_2H_6Cl_2$

8.8 to learn to calculate the molecular formula of a compound when given the empirical formula and molar mass.

steps:
First, calculate the mass of the empirical formula

Second, divide the molar mass or molecular formula by the molar mass of the empirical formula.

Last multiply subscripts in empirical formula by the answer in step 2

Ex 71.65% Cl
24.27% C MM = 98.96 g
4.07% H

$71.65\text{ g Cl} \times \frac{1\text{ mol Cl}}{35.45\text{ g Cl}} = \frac{2.021\text{ mol Cl}}{2.02} = 1$

$24.27\text{ g C} \times \frac{1\text{ mol C}}{12.01\text{ g C}} = \frac{2.02\text{ mol C}}{2.02} = 1$

$4.07\text{ g H} \times \frac{1\text{ mol H}}{1.01\text{ g H}} = \frac{4.02\text{ mol H}}{2.02} = 2$

$\frac{98.96\text{ g/mol}}{49.48\text{ g/mol}} = 2$; $2(CH_2Cl) = C_2H_4Cl_2$

★ Homework 55, 67, 69, 81 (7 Problems)

55) a) sodium Peroxide Na_2O_2
NaO

b) Terephthalic acid $C_8H_6O_4$
$C_4H_3O_2$

c) Phenobarbital, $C_{12}H_{12}N_2O_3$
$C_2H_2NO_3$

d) 1,4-dichloro-2-butene, $C_4H_6Cl_2$
$C_2H_2Cl_1$

67) copper: 33.88% Nitrogen: 14.94%
Oxygen: 51.18%

$33.88\%\text{ Cu} = 33.88\text{ g} \times \frac{1\text{ mol Cu}}{63.546\text{ g Cu}} = \frac{0.533}{0.533} = 1$

$14.94\%\text{ N} = 14.94\text{ g} \times \frac{1\text{ mol N}}{14.007\text{ N}} = \frac{1.066}{0.533} = 2$

$51.18\%\text{ O} = 51.18\text{ g} \times \frac{1\text{ mol O}}{15.99\text{ g O}} = \frac{3.200}{0.533} = 6.00$

CuN_2O_6

69) Uranium: 67.61% Fluorine: 32.39%
$67.61\% = 67.61\text{ g} \times \frac{1\text{ mol U}}{239.02\text{ g}} = \frac{0.28}{0.28} = 1$
$32.39\% = 32.39\text{ g} \times \frac{1\text{ mol F}}{18.99\text{ g}} = \frac{1.70}{0.28} = 6.07$

UF_6

81) C = 42.87% H = 3.598%
O = 28.55% N = 25.00%

42.87% = 42.87g C × 1 mol C / 12.011g C = 3.56692 / 1.7844 = 2

3.598% = 3.598g H × 1 mol H / 1.008g H = 3.5694 / 1.7844 = 2

28.55% = 28.55g O × 1 mol O / 15.999g O = 1.78444 / 1.7844 = 1

25.00% = 25.00g N × 1 mol N / 14.007g N = 1.7848 / 1.7844 = 1

C_2H_2ON

MM = 100.02

100.02 / 43.025 = 2.324 → $2(C_2H_2ON)$

Warm up:

1) $C_6H_{10}O_6 \longrightarrow C_3H_5O_3$

2) $B_3F_9 \longrightarrow BF_3$

3) $WS_2 \longrightarrow WS_2$

Rest of Homework!

89) MM: 165 - 170g

C = 42.87% H = 3.598 O = 28.55 N = 25.00

42.87% C × 1 mol C / 12.011g C = 3.56923 mol C / 1.7844 = 2

3.598% H × 1 mol H / 1.008g H = 3.56944 mol H / 1.7844 = 2

28.55% O × 1 mol O / 15.999g O = 1.7844 / 1.7844 = 1

25.00% N × 1 mol N / 14.007g N = 1.7848 / 1.7844 = 1

165 / 29.018 = 6 → $6(CHON) = C_6H_6O_6N_6$

91) a) 10,000,000,000 mol N × 14.007g / mol N = 140,070,000,000 g

b) 2.49 × 10^{20} × 1 mol CO / 6.023 × 10^{23} = 4.13×10^{-4} = 0.413 mol

c) 7.0983 mol NaCl × 58.44g NaCl = 414.824 mol

d) 9.012 × 10^{-6} × 1 mol / 6.023 × 10^{23} = 1.497×10^{23}

101) 25.45% Cu 12.84% S 4.036% H
57.67% O

25.45% Cu × 1 mol Cu / 63.546g Cu = 0.40049728 = 1

12.84% S × 1 mol S / 32.06g S = 0.400499 / 0.40049 = 1

4.036% H × 1 mol H / 1.088g H = 4.003996825 = 10

57.67% O × 1 mol O / 15.999g O = 3.604460029 / 0.40049 = 9

$CuSH_{10}O_9$

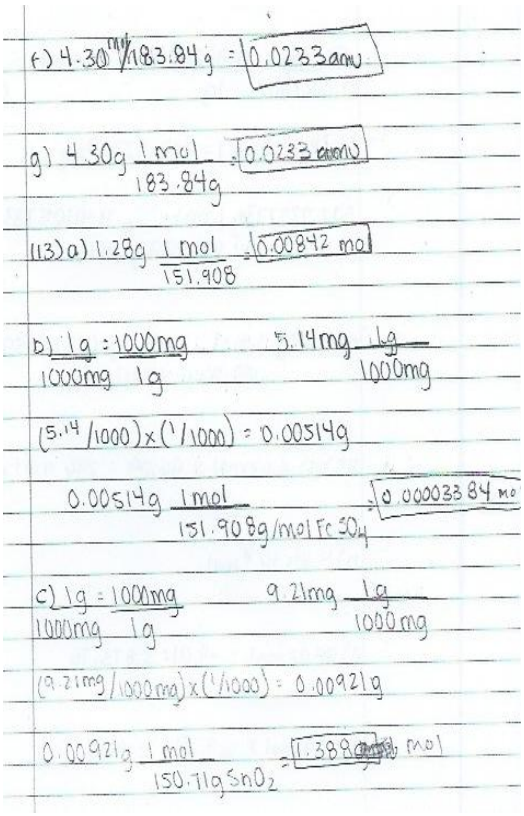
109) a) 2.89g Au × 196.96amu / 1 Au atoms = 0.014amu

b) 0.000259 Pt × 195.084amu = 0.0000133amu / 1 Pt atoms

c) 0.000259 Pt × 195.084amu = 0.0000133amu / 1 Pt atoms

d) 2.016 Mg × 24.3050amu = 0.08269903amu / 1 Mg atoms

e) 1.90mL × 13.6 g/mL = 25.84Hg
25.84g × 1 mol / 201g = 0.128amu



f) $4.30\text{ g} / 183.84\text{ g} = 0.0233\text{ amu}$

g) $4.30\text{ g} \times \frac{1\text{ mol}}{183.84\text{ g}} = 0.0233\text{ amu}$

113) a) $1.28\text{ g} \times \frac{1\text{ mol}}{151.908} = 0.00842\text{ mol}$

b) $\frac{1\text{ g}}{1000\text{ mg}} = \frac{1000\text{ mg}}{1\text{ g}}$ $\quad 5.14\text{ mg} \times \frac{1\text{ g}}{1000\text{ mg}}$

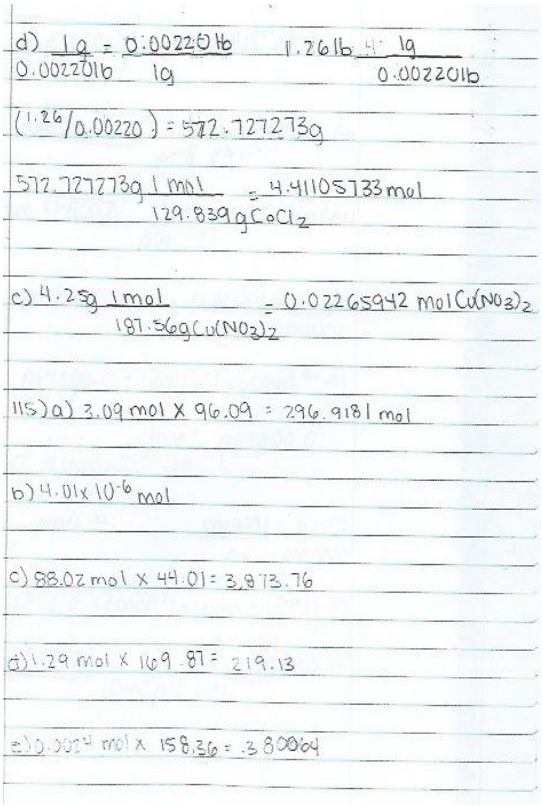
$(5.14/1000) \times (1/1000) = 0.00514\text{ g}$

$0.00514\text{ g} \times \frac{1\text{ mol}}{151.908\text{ g/mol FeSO}_4} = 0.00003384\text{ mol}$

c) $\frac{1\text{ g}}{1000\text{ mg}} = \frac{1000\text{ mg}}{1\text{ g}}$ $\quad 9.21\text{ mg} \times \frac{1\text{ g}}{1000\text{ mg}}$

$(9.21\text{ mg}/1000\text{ mg}) \times (1/1000) = 0.00921\text{ g}$

$0.00921\text{ g} \times \frac{1\text{ mol}}{150.71\text{ g SnO}_2} = 1.389 \times 10^{-5}\text{ mol}$



d) $\frac{1\text{ g}}{0.0022016\text{ lb}} = \frac{0.0022016\text{ lb}}{1\text{ g}}$ $\quad 1.26\text{ lb} \times \frac{1\text{ g}}{0.0022016\text{ lb}}$

$(1.26/0.00220) = 572.727273\text{ g}$

$572.727273\text{ g} \times \frac{1\text{ mol}}{129.839\text{ g CoCl}_2} = 4.41105733\text{ mol}$

c) $4.25\text{ g} \times \frac{1\text{ mol}}{187.56\text{ g Cu(NO}_3)_2} = 0.02265942\text{ mol Cu(NO}_3)_2$

115) a) $3.09\text{ mol} \times 96.09 = 296.9181\text{ mol}$

b) $4.01 \times 10^{-6}\text{ mol}$

c) $88.02\text{ mol} \times 44.01 = 3,873.76$

d) $1.29\text{ mol} \times 169.87 = 219.13$

e) $0.002\text{ mol} \times 158.36 = .380064$

NOTEBOOK CHECK
Chapter 8

Assignment	Points Possible	Points Earned
Aims	10	
8.1 notes	5	
8.2 notes	5	
8.3 notes	5	
1-7 odd, 17, 19, 21	7	
8.4 notes	5	
8.5 notes	5	
27, 31, 35, 45	4	
8.6, 8.7, 8.8 notes	15	
55, 67, 69, 81	4	
Chapter Review 89, 91, 101, 109, 113, 115	6	
Total Points Possible	71	71

Figure 14: One of ELL #1's Exit Ticket

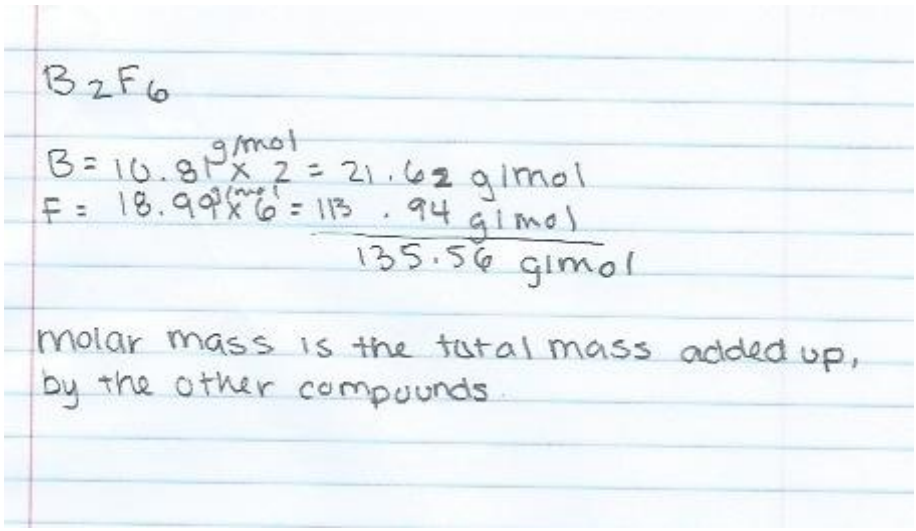
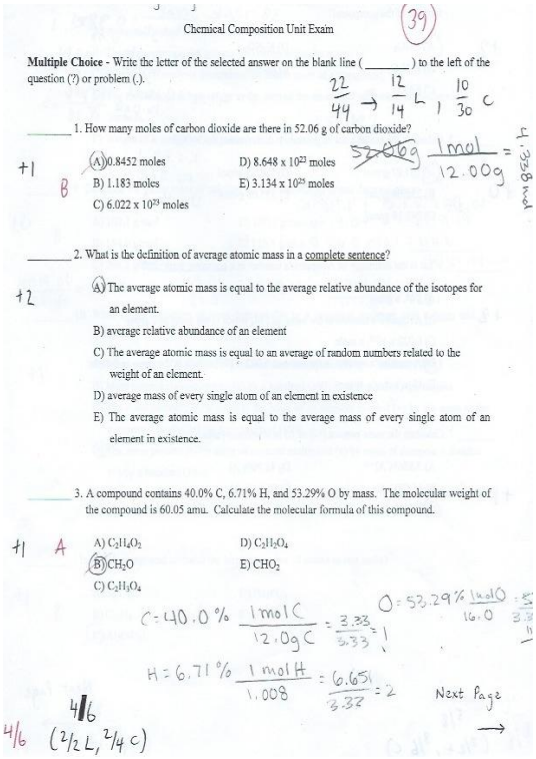


Figure 15: ELL's #1 Post-Assessment


Chemical Composition Unit Exam (39)

Multiple Choice - Write the letter of the selected answer on the blank line (_____) to the left of the question (?) or problem (.).

_____1. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?

+1 B (A) 0.8452 moles B) 1.183 moles C) 6.022 x 10^{23} moles D) 8.648 x 10^{23} moles E) 3.134 x 10^{25} moles

_____2. What is the definition of average atomic mass in a complete sentence?

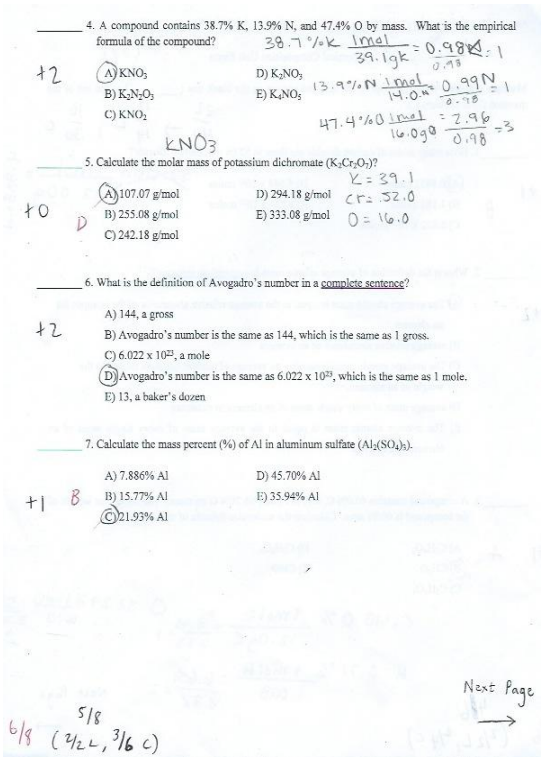
+2 (A) The average atomic mass is equal to the average relative abundance of the isotopes for an element. B) average relative abundance of an element C) The average atomic mass is equal to an average of random numbers related to the weight of an element. D) average mass of every single atom of an element in existence E) The average atomic mass is equal to the average mass of every single atom of an element in existence.

_____3. A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the compound is 60.05 amu. Calculate the molecular formula of this compound.

+1 A (A) $C_2H_4O_2$ (B) CH_2O C) $C_2H_3O_4$ D) $C_2H_2O_4$ E) CHO_2

Next Page →

4/6 (2/2 L, 2/4 C)


_____4. A compound contains 38.7% K, 13.9% N, and 47.4% O by mass. What is the empirical formula of the compound?

+2 (A) KNO_3 B) $K_2N_2O_2$ C) KNO_3 D) K_2NO_3 E) K_4NO_3

_____5. Calculate the molar mass of potassium dichromate ($K_2Cr_2O_7$)?

+0 D (A) 107.07 g/mol B) 255.08 g/mol C) 242.18 g/mol D) 294.18 g/mol E) 333.08 g/mol

_____6. What is the definition of Avogadro's number in a complete sentence?

+2 A) 144, a gross B) Avogadro's number is the same as 144, which is the same as 1 gross. C) 6.022 x 10^{23}, a mole (D) Avogadro's number is the same as 6.022 x 10^{23}, which is the same as 1 mole. E) 13, a baker's dozen

_____7. Calculate the mass percent (%) of Al in aluminum sulfate ($Al_2(SO_4)_3$).

+1 B A) 7.886% Al B) 15.77% Al (C) 21.93% Al D) 45.70% Al E) 35.94% Al

Next Page →

6/8 5/8 (2/2 L, 3/6 C)

_____ 8. What is the definition of molar mass in a complete sentence with an adjective?

A) Avogadro's number is the molar mass.
B) The molar mass is the percent (%) composition by mass.
C) Combustion analysis determines the molar mass of a compound.
(D) The molar mass is equivalent to the sum of the masses of each atom in its chemical formula.
E) Weight of a sample of substance.

+2

_____ 9. Calculate the molar mass of calcium nitrate ($Ca(NO_3)_2$) to one decimal place.

A) 102.1 g/mol
B) 164.0 g/mol
C) 204.2 g/mol
D) 150.1 g/mol
(E) 116.1 g/mol

Ca = 40.1 × 70.1 = 2811.01
N = 14.0 × 70.1 = 981.4
O = 16.0 × 70.1 = 1121.6
14914.01 mm

+0 B

$\frac{4914.01}{981.4} = 5.007$ $\frac{4914.01}{2811.0} = 1.748\,Ca$ $\frac{4914.01}{1121.6} = 4.381$

_____ 10. What is the definition of mass percent (%) in a complete sentence with a noun and an adjective?

A) Mass percent (%) divided (÷) masses then multiplied (x) by a hundred (100).
B) Mass percent (%) multiplied (x) by a hundred (100) then divided (÷) the masses.
C) The mass percent (%) is equal to the mass of an element divided (÷) by the mass of the compound multiplied (x) by a hundred (100).
(D) The mass percent (%) is mass of element multiplied (x) by mass of compound divided (÷) by a hundred (100).
E) The mass percent (%) is equal to the element multiplied (x) by the compound divided (÷) by a hundred (100).

+1 C

_____ 11. Which compound contains the largest number of atoms in one mole?

A) S_8
B) $C_{10}H_8$
(C) $Al_2(SO_4)_3$
D) Na_3PO_4
E) H_2

+1 B

4/8
5/8 (3/4 L, 1/4 C)

Next Page →

_____ 12. How many molecules of CH_4 are in 48.2 g of this compound?

A) 5.00 x 10^{21} molecules CH_4
B) 3.00 molecules CH_4
C) 2.90 x 10^{25} molecules CH_4
D) 1.81 x 10^{24} molecules CH_4
(E) 4.00 molecules CH_4

C = 48.2g $\frac{1\,mol}{12.0gC}$ = 60.2 mol
H = 48.2 $\frac{1\,mol}{1.008}$ = 47.8 mol
108

$\frac{108}{60.2} = 1.79$ $\frac{108}{47.8} = 2.25$

+0 D

_____ 13. How many oxygen atoms are contained in 2.74 g of $Al_2(SO_4)_3$?

(A) 2 oxygen atoms
B) 6.02 x 10^{23} oxygen atoms
C) 7.22 x 10^{24} oxygen atoms
D) 5.79 x 10^{22} oxygen atoms
E) 8.01 x 10^{-3} oxygen atoms

+0 D

_____ 14. The molecular formula of aspartame, the generic name of NutraSweet®, is $C_{14}H_{18}N_2O_5$. What is the molar mass of aspartame rounded to the nearest integer?

A) 24 g/mol
B) 156 g/mol
C) 294 g/mol
(D) 43 g/mol
E) 39 g/mol

C_7H_3NO

N = 43.008g $\frac{1\,mol}{14.0}$ = 3.072
O = 43.008 $\frac{1\,mol}{16.0}$ = 2.688
C = 43.008g $\frac{1\,mol}{12.01g}$ = 3.5
H = 43.008 $\frac{1\,mol}{1.008}$ = 42.6

+0 C

_____ 15. In a complete sentence with a verb, what is the final step when figuring out the molecular formula of a compound?

A) Last, divide the mass of the molecular formula by the mass of the empirical formula.
B) Last, mass of molecular formula and mass of empirical formula.
C) Last, multiply the subscripts in the empirical formula with the number that came from the previous step.
D) Last, subscripts of empirical formula with the number from the previous step.
(E) Last, calculate the mass of the empirical formula.

+1 C

1/8
4/8 (1/2 L, 0/6 C)

Next Page →

Calculations - Answer the following questions or problems in the provided space. Make sure to show all the work that led to the answer(s) in order to receive full credit.

16. How many grams of pyridine (C_5H_5N) are contained in 0.0396 mol of pyridine? In complete sentences with verbs, explain the steps that led to the final answer. Use the following sentence prompt to start the explanation: First, I calculated the...

First, I converted the mol to grams. 1g $\frac{1\,mol}{1g}$
Secondly, I canceled out the grams.
Lastly, I multiped it.

+2 L,
+1 C

+1

17. How many sulfur dioxide molecules are there in 18.00 g of sulfur dioxide?

18.00g $\frac{1\,mol}{32.1g}$ = 0.562 mol/g

?

molecules SO_2 +1

+3

4/6
+4 (2/2 L, 2/4 C)

Next Page →

18. Calculate the mass percent of nitrogen, lead, and oxygen in $Pb(NO_3)_2$.

N = 237.2%N $\frac{1\,mol}{14.0gN}$ = 16.9

Pb = 237.2%Pb $\frac{1\,mol}{207.2gPb}$ = 1.14

O = 237.2%O $\frac{1\,mol}{16.0gO}$ = 14.82

32.86g/mol $Pb(NO_3)_2$

$\frac{32.86}{16.9} = 1.94$ $\frac{32.86}{1.14} = 28.82$ $\frac{32.86}{14.82} = 2.217$

+2
+0

19) A compound was found to contain 90.6% lead (Pb) and 9.4% oxygen (O). What is the empirical formula for this compound. In complete sentences with verbs, explain the steps that led to the final answer.

90.6%Pb $\frac{1\,mol}{207.2gPb}$ = $\frac{0.437}{0.437}$ = 1x3 = 3 PbO

9.4%O $\frac{1\,mol}{16.0gO}$ = $\frac{0.587}{0.437}$ = 1.3x3 = 4

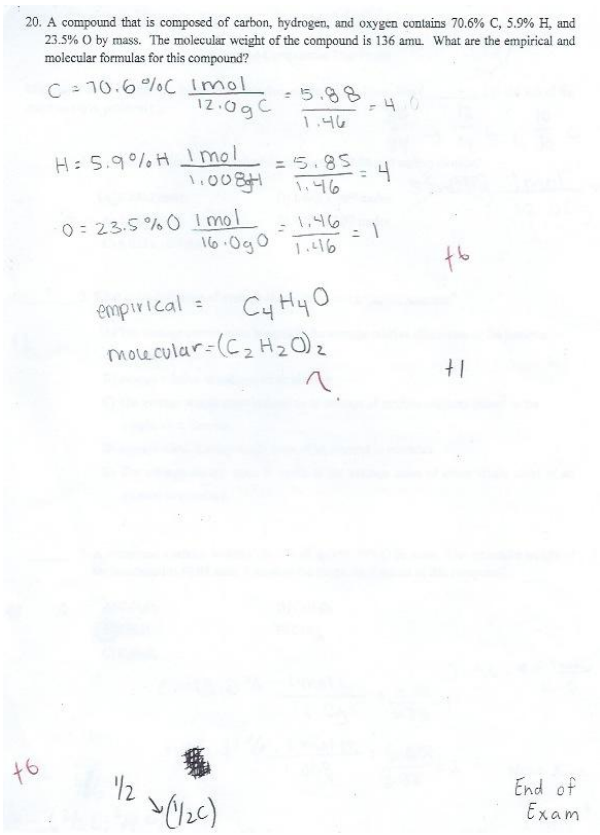
First I multiplied the percent to the mass.
Second I divided the answer (%/mass) to the lowest number

+8

+2 L,
+1 C

3/6
+10 (2/2 L, 1/4 C)

Next Page →



20. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What are the empirical and molecular formulas for this compound?

C = 70.6%C $\frac{1\,mol}{12.0\,gC} = \frac{5.88}{1.46} = 4.0$

H = 5.9%H $\frac{1\,mol}{1.008\,H} = \frac{5.85}{1.46} = 4$

O = 23.5%O $\frac{1\,mol}{16.0\,gO} = \frac{1.46}{1.46} = 1$

+6

empirical = C_4H_4O

molecular = $(C_2H_2O)_2$

+1

+6

1/2 $(1/2C)$

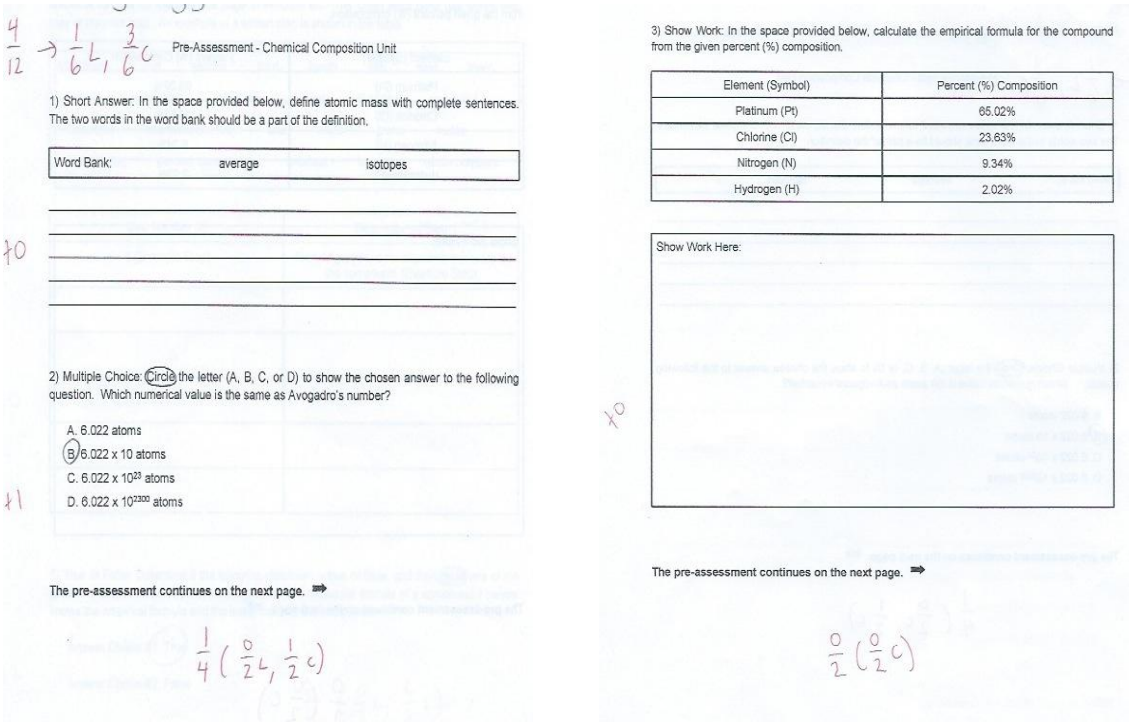
End of Exam

ELL #2 (Student 12) had a score of seventeen percent for language and fifty percent for content on the pre-assessment. On the post-assessment, he had a score of seventy-one percent on language and fifty-seven percent on content. This resulted in a fifty-four percent gain on language and a seven percent gain on content between his pre-assessment and his post-assessment. From his percentage scores on the post-assessment, he met the language unit goal and somewhat met the content unit goal. For the most part, he did well with understanding sentences with the purpose of defining and explaining, but he may need some practice with writing such sentences. However, some of the trouble he was having with content may have contributed to the language score he got on the post-assessment. Parts of his formative assessments (observations of warm-ups, homework assignments, and exit tickets) indicated that he progressed through the unit

well in terms of content concepts. At first he struggled with certain processes, and then with practice, he seemed to be able to understand the concepts and to apply the skills to problems. On the post-assessment, he demonstrated that he knew the gist of the concepts from the unit, but he would miss a step here and there when solving the problems for solutions. This led to the score he got on the post-assessment for content. Next time, the teacher should come up with activities that give students, such as ELL #2, practice with the language and content concepts and skills in problems that appear to drastically differ from each other, but the questions essentially go through the same process to get to the answers. Therefore, students would get practice with a variety of problems that related to the unit.

Scanned Work for ELL#1:

Figure 16: ELL #2's Pre-Assessment



Pre-Assessment - Chemical Composition Unit

1) Short Answer: In the space provided below, define atomic mass with complete sentences. The two words in the word bank should be a part of the definition.

Word Bank:	average	isotopes

2) Multiple Choice: Circle the letter (A, B, C, or D) to show the chosen answer to the following question. Which numerical value is the same as Avogadro's number?

A. 6.022 atoms
B. 6.022 x 10 atoms
C. 6.022×10^{23} atoms
D. 6.022×10^{2300} atoms

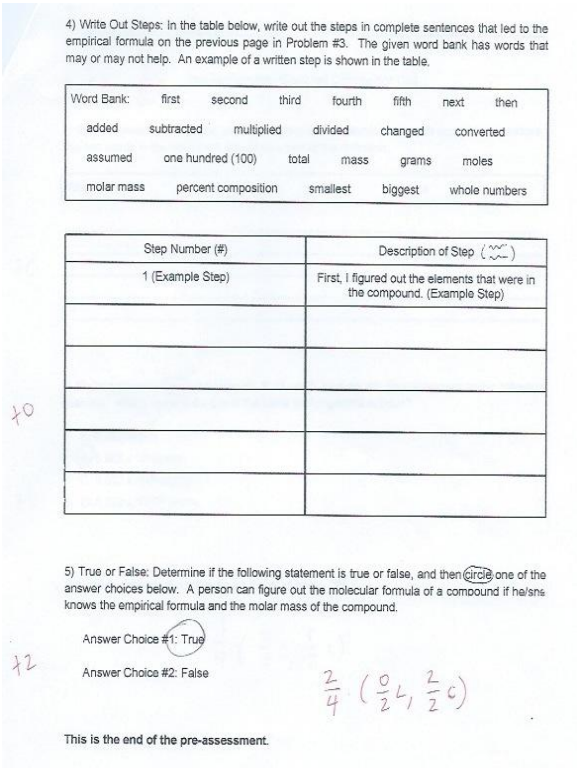
The pre-assessment continues on the next page. ➡

3) Show Work: In the space provided below, calculate the empirical formula for the compound from the given percent (%) composition.

Element (Symbol)	Percent (%) Composition
Platinum (Pt)	65.02%
Chlorine (Cl)	23.63%
Nitrogen (N)	9.34%
Hydrogen (H)	2.02%

Show Work Here:

The pre-assessment continues on the next page. ➡



4) Write Out Steps: In the table below, write out the steps in complete sentences that led to the empirical formula on the previous page in Problem #3. The given word bank has words that may or may not help. An example of a written step is shown in the table.

Word Bank:	first	second	third	fourth	fifth	next	then
added	subtracted	multiplied	divided	changed	converted		
assumed	one hundred (100)	total	mass	grams	moles		
molar mass	percent composition	smallest	biggest	whole numbers			

Step Number (#)	Description of Step (~)
1 (Example Step)	First, I figured out the elements that were in the compound. (Example Step)

+0

5) True or False: Determine if the following statement is true or false, and then circle one of the answer choices below. A person can figure out the molecular formula of a compound if he/she knows the empirical formula and the molar mass of the compound.

Answer Choice #1: True

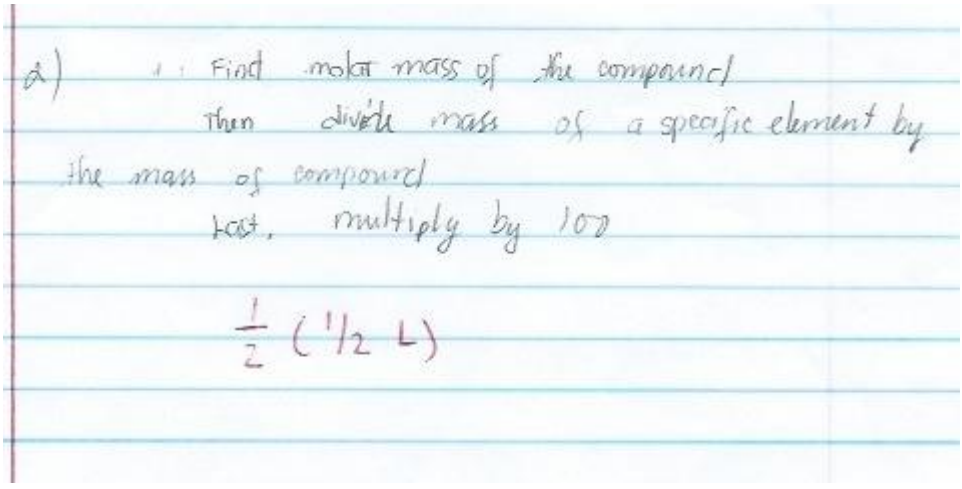
+2

Answer Choice #2: False

$\frac{2}{4}$ ($\frac{0}{2}$ L, $\frac{2}{2}$ C)

This is the end of the pre-assessment.

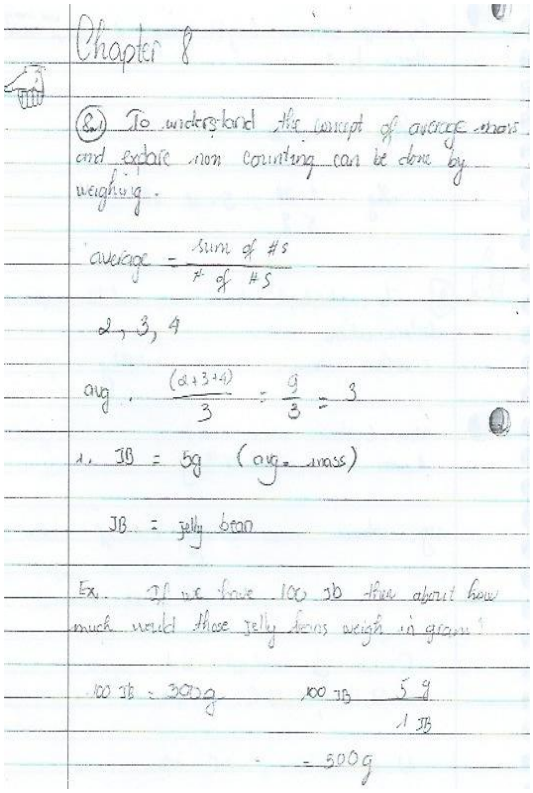
Figure 17: ELL #2's Additional Pre-Assessment Question from Exit Ticket



2) 1. Find molar mass of the compound
Then divide mass of a specific element by the mass of compound
Last, multiply by 100

$\frac{1}{2}$ ('/2 L)

Figure 18: ELL #2's Notebook (Warm-Ups, Notes, Homework)



Chapter 8

(8.1) To understand the concept of average mass and explore mass counting can be done by weighing.

average = sum of #s / # of #s

2, 3, 4

avg. $\frac{(2+3+4)}{3} = \frac{9}{3} = 3$

1 JB = 5g (avg. mass)

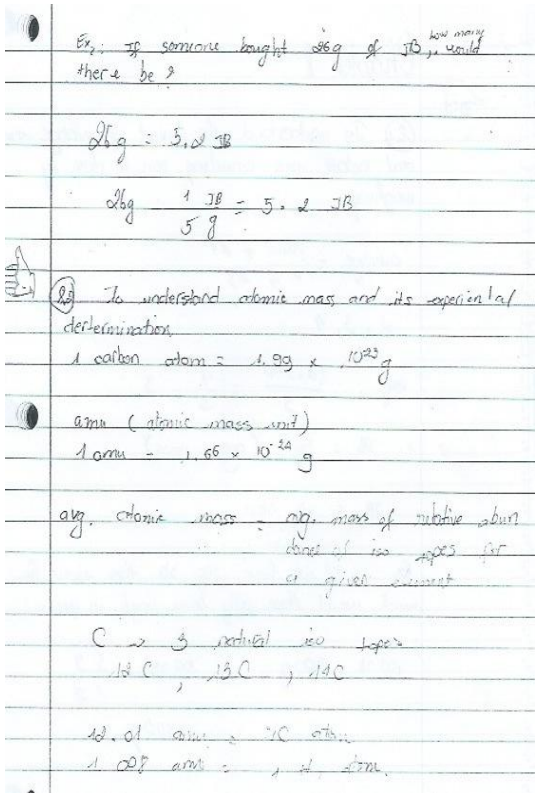
JB = jelly bean

Ex. If we have 100 JB then about how much would those jelly beans weigh in grams?

100 JB = 300g

$\frac{100 \text{ JB}}{1 \text{ JB}} \quad \frac{5 \text{ g}}{}$

= 500g



Ex: If someone bought 26g of JB, how many would there be?

26 g = 5.2 JB

$\frac{26 \text{ g}}{5 \text{ g}} \quad \frac{1 \text{ JB}}{} = 5.2 \text{ JB}$

(8.2) To understand atomic mass and its experimental determination

1 carbon atom = 1.99 x 10^{-23} g

amu (atomic mass unit)

1 amu = 1.66 x 10^{-24} g

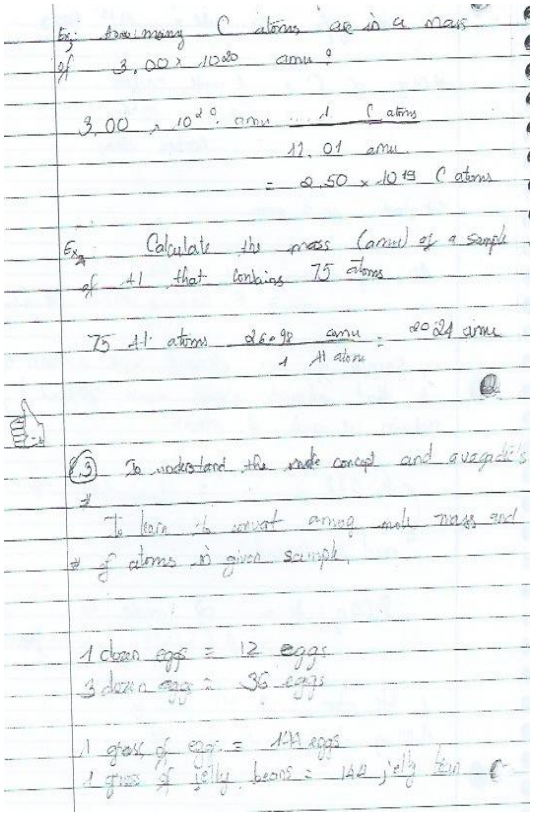
avg. atomic mass = avg. mass of relative abundance of isotopes for a given element

C → 3 natural isotopes

^{12}C, ^{13}C, ^{14}C

12.01 amu → 1C atom

1 amu → 1 atom



Ex: How many C atoms are in a mass of 3.00 x 10^{20} amu?

3.00 x 10^{20} amu $\frac{1 \text{ C atoms}}{12.01 \text{ amu}}$

= 2.50 x 10^{19} C atoms

Ex: Calculate the mass (amu) of a sample of Al that contains 75 atoms

75 Al atoms $\frac{26.98 \text{ amu}}{1 \text{ Al atom}}$ = 2024 amu

(8.3) To understand the mole concept and avogadro's #

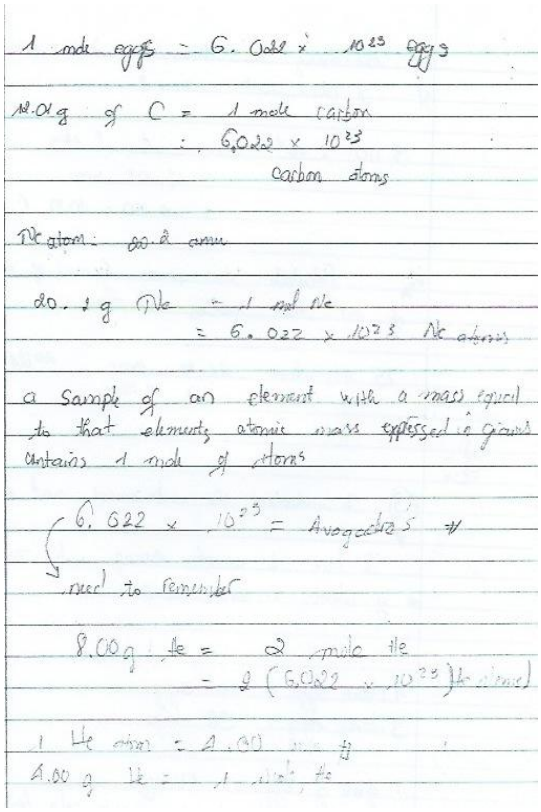
To learn the convert among mole, mass and # of atoms in given sample

1 dozen eggs = 12 eggs

3 dozen eggs = 36 eggs

1 gross of eggs = 144 eggs

1 gross of jelly beans = 144 jelly beans



1 mole eggs = 6.022 x 10^{23} eggs

12.01 g of C = 1 mole carbon

= 6.022 x 10^{23} carbon atoms

1 Ne atom = 20.2 amu

20.1 g Ne = 1 mol Ne

= 6.022 x 10^{23} Ne atoms

a sample of an element with a mass equal to that element's atomic mass expressed in grams contains 1 mole of atoms

6.022 x 10^{23} = Avogadro's #

need to remember

8.00 g He = 2 mole He

= 2 (6.022 x 10^{23}) He atoms

1 He atom = 4.00 g

4.00 g He = 1 mole He

Ex 5: How many atoms of H are in 50g sample of H_2?

$5.69\ H \times \frac{1\ mol\ H}{1.01\ g\ H} \times \frac{6.022 \times 10^{23}\ H\ atoms}{1\ mol\ H} = 3.0 \times 10^{24}\ H\ atoms$

Ex 6: Calculate the # of moles in 10g Al

$10g\ Al \times \frac{1}{26.98} \frac{mol\ Al}{g\ Al} = 0.37\ mol\ Al$

Ex 7: How many atoms is this?

$0.37\ mol\ Al \times \frac{6.022 \times 10^{23}\ Al\ atoms}{1\ mol\ Al} = 2.2 \times 10^{23}\ atoms$

Homework

1) $\frac{20g}{1} \cdot \frac{1}{2.110g} = 900 = 9.10^2$

3) Atomic mass unit

5) a) 635 atoms of H

$\frac{635\ atoms\ H}{1} \times \frac{1.008\ amu}{1\ H} = \frac{368}{13.68 \times 10^2\ amu}$

b) 1.261×10^4 atoms of

$\frac{1.261 \times 10^4\ atom}{1} \times \frac{183.84\ amu}{1\ atom} = \frac{2.318\ 822.4}{} = 2.32 \times 10^4$

7) $\frac{8274\ amu}{1} \times \frac{1\ atom}{32.07\ amu} = 258.0\ atom$

$\frac{5.013 \times 10^{24}\ atom}{1} \times \frac{32.07\ amu}{1\ atom} = 167.2 \times 10^2 = 1672 \times 10^{26}\ g$

11) 1 mole of He > than 4 mol of 4 atom

10) a) $\frac{6.22g\ of\ Al}{1} \times \frac{1\ mol}{26.98g\ of\ Al} = .231\ mol$

$\frac{.231\ mol}{1} \times \frac{6.022 \times 10^{23}\ atom}{1\ mol} = 1.39 \times 10^{23}\ Al$

b) $52.1g = 5210g$

$\frac{5200g\ of\ C}{1} \times \frac{1\ mol}{12.01g\ of\ C} = 433.05 = 4340\ mol$

$\frac{4340\ mol}{1} \times \frac{6.022 \times 10^{23}\ atom}{1\ mol} = 26135.48 \times 10^{23} = 2.61 \times 10^{24}\ C$

c) $1.26\ mg \rightarrow .00126g$

$\frac{.00126\ g}{1} \times \frac{1\ mol}{196.97g} = 6.40 \times 10^{-6}\ mol$

21) a) 0.000 021 mol of carbon

$= .00\ 026\ 5g$

b) 7.04 mol of K

$= 275g$

c) 2.71×10^{-5} mol of O

$= 43.4g$

d) 1.65 mol of Ag

$= 178g$

2.4) + to understand the def. of molar mass
+ to learn to convert between moles and mass of a given sample of a chemical compound

The molar mass is equal to the mass in 1 mol (g/mol)

Molar mass = $\frac{g}{mol}$ (mass in one mole)

Ex: H_2O

H = 1.01 g/mol x 2 = 2.02 g/mol H
O = 16g/mol x 1 = 16 g/mol O

2.02 g/mol + 16 g/mol = 18.02 g/mol H_2O

* To find molar mass of a compound...
First, find the mass of each individual element in a compound
Then add the masses together

Ex. Calculate the molar of $CaCO_3$

Ca = 40.08 g/mol x 1 = 40.08 g/mol Ca
C = 12.01 g/mol x 1 = 12.01 g/mol C
O_3 = 16 g/mol x 3 = 48 g/mol O
100.09 g/mol $CaCO_3$

Ex 3: Calculate the # of moles in 1.56g of $C_{10}H_8O_3$

C = 12.01 g/mol x 10 = 120.1 g/mol C
H = 1.01 g/mol x 6 = 6.06 g/mol H
O = 16 g/mol x 3 = 48 g/mol O
174.16 g/mol $C_{10}H_8O_3$

1.56g $C_{10}H_8O_3$ $\frac{1\ mol}{174.16\ g\ C_{10}H_8O_3}$

= .00896 mol $C_{10}H_8O_3$

Steps for problem similar to Ex 3:
First use calculate molar mass of the compound
Then use molar mass as a conversion factor w/ the missing amt. in the problem.

8.5 • To learn to find the mass of an element in given an compound
• Define mass percent

The mass percent is the percentage amount of an element within a compound in terms of mass

Ex 4: Find the % composition of C in $C_2H_6O_4$

C = 12.01 g/mol x 2 = 24.02 g/mol C
H = 1.01 g/mol x 6 = 6.06 g/mol H
O = 16 g/mol x 4 = 64 g/mol O
46.08 g/mol $C_2H_6O_4$

24.02 g/mol C / 46.08 g/mol $C_2H_6O_4$ = .521 x 100 = 52.1 % C

Steps for prob. like Ex 4
First find molar mass of the compound
Then divide mass of a specific element by the mass of a compound
Last, multiply by 100

Mass % = $\frac{\text{mass element}}{\text{mass of compound}} \times 100$

= Homework

(2) a) $Mg(NO_2)_2$

Mg: 24.31 g/mol x 1 = 24.31 g/mol Mg
N: 14.01 g/mol x 2 = 28.02 g/mol N
O: 16 g/mol x 4 = 64 g/mol O
116.33 g/mol $Mg(NO_2)_2$

b) $NaClO_4$

Na: 22.99 g/mol x 1 = 22.99 g/mol Na
Cl: 35.45 g/mol x 1 = 35.45 g/mol Cl
O: 16 x 4 g/mol x = 64 g/mol O
122.44 g/mol $NaClO_4$

c) $NaMnO_4$

Na: 14.01 g/mol x 1 = 14.01 g/mol Na
Mn: 54.94 g/mol x 1 = 54.94 g/mol Mn
O: 16 g/mol x 4 = 64 g/mol O
132.95 g/mol $NaMnO_4$

d) LiCl

Li: 6.94 g/mol x 1 = 6.94 g/mol Li
Cl: 35.45 g/mol x 1 = 35.43 g/mol Cl
42.39 g/mol LiCl

(3) a) Au_2Cl

Au: 196.97 g/mol x 3 = 590.91 g/mol Au
Cl: 35.45 g/mol x 1 = 35.45 g/mol Cl
626.36 g/mol Au_2Cl

5.25g Au_2Cl $\frac{1\ mol}{626.36\ g/mol\ Au_2Cl}$ = 0.00838176 mol Au_2Cl

b) SnO

Sn: 118.71 g/mol x 1 = 118.71 g/mol Sn
O: 16 g/mol x 1 = 16 g/mol O
134.71 g/mol SnO

10.2g SnO $\frac{1\ mol}{134.71\ g/mol\ SnO}$ = .07572 mol SnO

c) $(NH_4)_2Cr_2O_7$

N: 14.007 g/mol x 2 = 28.014 g/mol N
H: 1.008 g/mol x 8 = 8.064 g/mol H
Cr: 51.996 g/mol x 2 = 103.992 g/mol Cr
O: 16 g/mol x 7 = 112 g/mol O
252.054 g/mol $(NH_4)_2Cr_2O_7$

d) 8.91g of potassium permanganate ($KMnO_4$)
K = 39.09
Mn = 55.0
O = 16.00 x 4 = 64.00
158.09 g

8.91 g / 158.09 g/mol $KMnO_4$ = .056 mol

(35) a) 0.851 mol of K_2CrO_4
K_2CrO_4 = (39.1 x 2) + 52.0 + (16.00 x 4) = 194.2 g
N = 0.85 x 194.2 = 48.505 g

b) 1.51 mol $LiClO_4$
$LiClO_4$ = 6.94 + 35.45 + (16.00 x 4) = 106.39 g/mol

c) 2.52×10^4 mol of PbO
PbO = 207.02 + 16.00 = 223.02 g/
N: $2.52 \times 10^4 \times 223.02$

d) 1.74×10^{-3} mol of $PbCl_2$
$PbCl_2$ = 207.02 + (35.45 x 4) = 347.22 g/mol
N: $1.74 \times 10^{-3} \times 347.22$

(45) a) $Mg(NO_3)_2$
Mg = 24.03
N = 14.00 x 2 = 42
O = 16.00 x 6 = 96
182.03 g/mol

$\frac{48}{126.03} \times 100 = 38.08\%$

Warm - up

① $Cu(NO_3)_2$

Cu: $63.546 \times 1 = 63.55$ g/mol Cu

O: $16 \times 6 = 96$

N: $14.01 \times 2 = 28.02$

187.57

$Cu = \frac{63.55}{187.57} \times 100 = 33.88\%$ Cu

$O = \frac{96}{187.57} \times 100 = 51.18\%$ O

② - Find molar mass of the compound
- Divide mass of a specific element by the mass of a compound
- Multiply by 100

$\frac{24.03}{162.07} \times 100 = 14.83\%$

$\frac{42}{162.07} \times 100 = 25.92\%$

$\frac{96}{162.03} \times 1000 = 59.24\%$

b) $CaCl_2$

Ca: $40.01 \times 1 = 40.01 = 110.11$ g/mol

Cl: $35.05 \times 2 = 71.01$

$\frac{40.01}{110.01} \times 100 = 36.33\%$ Ca $\quad \frac{70.1}{110.11} \times 100 = 63.66\%$ Cl

c) CBr

C: $12.01 \times 1 = 12.01$

Br: $79.04 \times 4 = 316.36$ $\Rightarrow 328.37$ g/mol

$\frac{12.01}{328.37} \times 100 = 3.65\%$ $\quad \frac{316.36}{328.37} \times 100 = 96.3\%$

d) Na_2SO_3

Na: $22.01 \times 2 = 46.02$

S: $32.01 \times 1 = 32.01$

O: $16.00 \times 3 = 48$ g/mol

126.03

$\frac{46.02}{126.03} \times 100 = 176.79\%$

$\frac{32.01}{126.03} \times 100 = 176.79\%$

8.6 To understand the meaning of empirical formulas of compounds

Empirical formulas = equal to the simplest formula (smallest whole # ratio of the subscripts)

Ex. CH_2O

Molecular formulas is equal to the actual formula

Ex. $C_2H_4O_2$

$(CH_2O)_2 = C_2H_4O_2$

Ex. $C_6H_6 = CH$

Ex. $C_3H_6O_2 = C_6H_2Cl_2O$

Ex. $C_6H_{16}N_2 = C_3H_8N$

ST To learn to calculate empirical formulas

Steps
- First, obtain the mass each element (g)
- Second, convert g (E) $\Rightarrow$ mol for each atom
- Third, divide each of moles by the smallest # of moles
- last, multiply by the smallest # that will convert all # to whole #s

Ex. .6884 g of Pb combined w/ .2356 g Cl to form a chloride of lead. Calculate the empirical formula

.6884 g of Pb $\frac{1 \text{ mol Pb}}{207.2 \text{ g Pb}} = \frac{.0033}{.0033}$ mol Pb

.2356 of Cl $\frac{1 \text{ mol Cl}}{35.45 \text{ g Cl}} = \frac{.0066}{.0033}$ mol Cl

$PbCl_2$

If given percent composition
- First, assume 100g of compound
- Second, convert g to moles
- last, divide by smallest # of moles

Ex. 65.04 % Pb = 65.04 g

9.34 % N = 9.34 g

2.02 % H = 2.02 g

23.63 % Cl = 23.63 g

65.04 g Pb $\frac{1 \text{ mol Pb}}{195.1 \text{ g Pb}} = \frac{.33}{.33} = 1$

9.34 g N $\frac{1 \text{ mol N}}{14.01 \text{ g N}} = \frac{.66}{.33} = 2$

2.02 g H $\frac{1\ mol\ H}{1.01\ g\ H} = \frac{2}{.33} = 6$

23.63 g Cl $\frac{1\ mol\ H}{35.45\ g\ Cl} = \frac{.66}{.33} = 2$

$C_2H_6Cl_2$

9.8 Goo learn to calculate the molecular formula of a compound when given the empirical formula and molar mass

Steps

+ First, Calculate the mass of the empirical formula
+ Second, divide the molar mass of molecular formula by the molar mass of the empirical formula
+ Last, multiply subscripts in empirical formula by the answer in step 2

71.65% Cl MM = 98.96 g
24.27% C
4.07% H

CH_2Cl = 49.48 g / mol

C = 12.01 g/mol
H = 1.01 x 2 = 2.02 g/mol
Cl 35.45 g / mol

71.65 g Cl $\frac{1\ mol\ Cl}{35.45\ g\ Cl} = \frac{2.02}{2.02}$ mol Cl = 1

24.27 g C $\frac{1\ mol\ C}{12.01\ gC} = \frac{2.02}{2.02}$ mol C = 1

4.07 g H $\frac{1\ mol\ H}{1.01\ gH} = \frac{4.03\ mol}{2.02}$ H = 2

$\frac{98.96\ g/mol}{49.48\ g/mol} = 2$

$2(CH_2Cl) = (CH_2Cl)_2 = C_2H_4Cl_2$

Homework

55) a) Na_2O c) $C_{12}H_{22}N_2O_3$
b) $C_4H_3D_3$ d) C_2H_3Cl

67) 67.61% = 67.61g
32.39% = 32.39g

67.61 g U $\frac{1\ mol\ U}{238.03\ g\ U} = \frac{.28}{.28} = 1$

32.39 g F $\frac{1\ mol\ F}{19\ g\ F} = 1.71 = 6$

UF_6

69) 33.88% Cu = 33.88 g Cu
14.94% N = 14.94 g N
51.18% O = 51.18 g O

14.94 g N $\frac{1\ mol\ N}{14.01\ g\ N} = \frac{1.07}{.53} = 2$

51.18 g O $\frac{1\ mol\ O}{16\ g\ O} = \frac{3.2}{.53} = 6$

33.88 g Cu $\frac{1\ mol}{63.55\ g\ Cu} = \frac{.53}{.53} = 1$

$Cu(NO_3)_2$

81) 42.87% C = 42.87 g C
3.598% H = 3.598 g H
28.55% O = 28.55 g O
25.00% N = 25.00 g N
MM = 167 - 170 g

42.87 g C $\frac{1\ mol}{12.01\ gC} = \frac{3.56}{1.78} = 2$

3.598 g H $\frac{1\ mol}{1.01\ gH} = \frac{3.598}{1.78} = 2$

28.55 g O $\frac{1\ mol}{16\ gO} = \frac{1.78}{1.78} = 1$

25.00 g N $\frac{1\ mol}{14.01\ gN} = \frac{1.78}{1.78} = 1$

C_2H_2ON empirical formula
C: 12.01 x 2 = 24.02 O: 16 x 1 = 16 56.03 g
H: 1.01 x 2 = 2.02 N: 14.01 x 1 = 14.01

Exam - up
Empirical formular
1) $C_3H_6O_3$

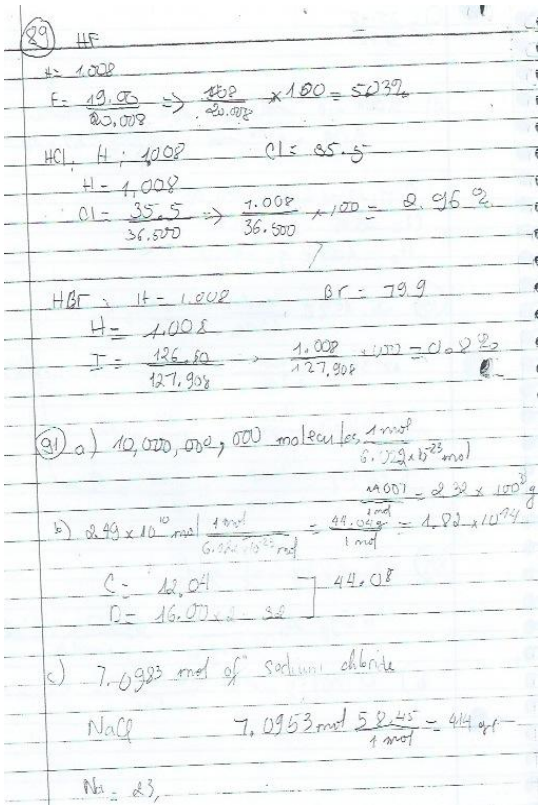
$\frac{165\ g}{56.05\ g} = 3$

$(C_2H_2ON)_3 = C_6H_6O_3N_3$

molecular formula

2) B F_3

3) W S_2



89) HF
H = 1.008
F = 19.00 / 20.008 ⇒ 1.008 / 20.008 × 100 = 5.039%

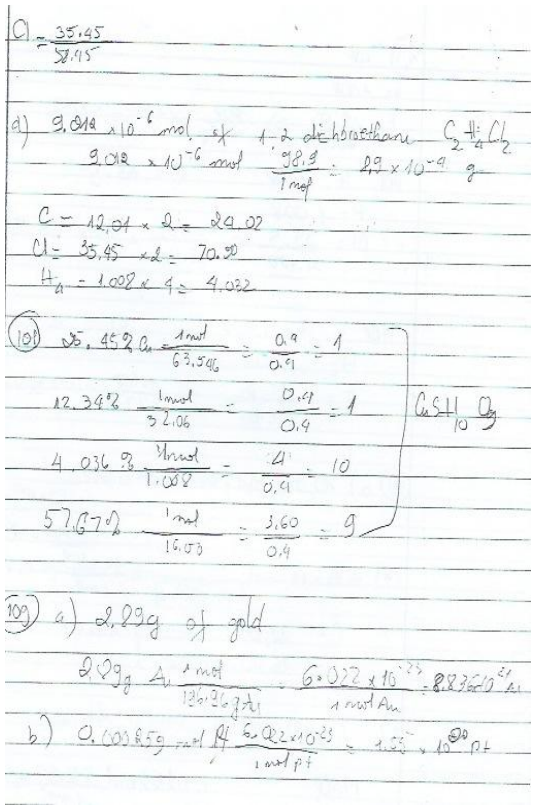
HCl, H: 1.008 Cl: 35.5
H = 1.008
Cl = 35.5 / 36.508 ⇒ 1.008 / 36.508 × 100 = 2.76%

HBr, H = 1.008 Br = 79.9
H = 1.008
I = 126.90 / 127.908 ⇒ 1.008 / 127.908 × 100 = 0.788%

91) a) 10,000,000,000 molecules × 1 mol / 6.022 × 10^23 mol

b) 2.99 × 10^10 mol × 1 mol / 6.022 × 10^23 mol = 49.67 / 1 mol = 4.82 × 10^-24 g
C = 12.01
O = 16.00 × 2 = 32
44.01 g

c) 7.0923 mol of sodium chloride
NaCl 7.0953 mol × 58.45 / 1 mol = 414 g
Na = 23,

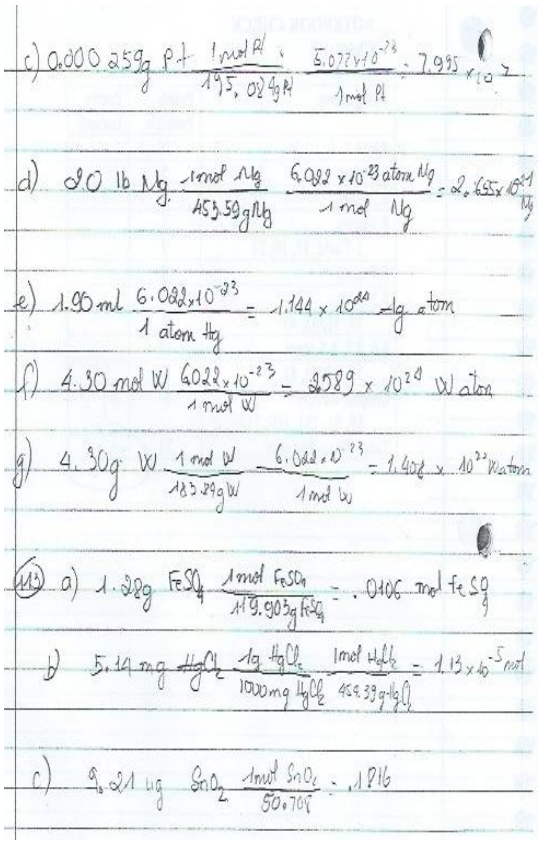


Cl = 35.45 / 58.45

d) 9.018 × 10^-6 mol of 1,2 dichloroethane $C_2H_4Cl_2$
9.018 × 10^-6 mol × 98.9 / 1 mol = 89 × 10^-9 g
C = 12.01 × 2 = 24.02
Cl = 35.45 × 2 = 70.90
H_4 = 1.008 × 4 = 4.032

101) 35.45 g Cl × 1 mol / 63.546 = 0.9 / 0.9 = 1
12.34 g × 1 mol / 52.06 = 0.9 / 0.9 = 1
4.036 g H × 1 mol / 1.008 = 4 / 0.9 = 10
57.67 g × 1 mol / 16.03 = 3.60 / 0.9 = 9
$CuSH_{10}O_9$

109) a) 2.89 g of gold
2.89 g Au × 1 mol / 196.96 g Au = 6.022 × 10^23 / 1 mol Au = 8.835 × 10^21 Au
b) 0.00385 mol Pt × 6.022 × 10^23 / 1 mol Pt = 1.55 × 10^20 Pt



c) 0.000259 g Pt × 1 mol Pt / 195.08 g Pt × 6.022 × 10^23 / 1 mol Pt = 7.995 × 10^17

d) 90 lb Mg × 1 mol Mg / 453.59 g Mg × 6.022 × 10^23 atom Mg / 1 mol Mg = 2.655 × 10^26 Mg

e) 1.90 ml × 6.022 × 10^23 / 1 atom Hg = 1.144 × 10^24 Hg atom

f) 4.90 mol W × 6.022 × 10^23 / 1 mol W = 2589 × 10^24 W atom

g) 4.30 g W × 1 mol W / 183.84 g W × 6.022 × 10^23 / 1 mol W = 1.408 × 10^22 W atom

113) a) 1.28 g $FeSO_4$ × 1 mol $FeSO_4$ / 119.903 g $FeSO_4$ = .0106 mol $FeSO_4$

b) 5.14 mg $HgCl_2$ × 1 g $HgCl_2$ / 1000 mg $HgCl_2$ × 1 mol $HgCl_2$ / 459.39 g $HgCl_2$ = 1.13 × 10^-5 mol

c) 9.21 ug SnO_2 × 1 mol SnO_2 / 150.708 = .1816

NOTEBOOK CHECK
Chapter 8

Assignment	Points Possible	Points Earned
Aims	10	
8.1 notes	5	
8.2 notes	5	
8.3 notes	5	
1-7 odd, 17, 19, 21	7	
8.4 notes	5	
8.5 notes	5	
27, 31, 35, 45	4	
8.6, 8.7, 8.8 notes	15	
55, 67, 69, 81	4	
Chapter Review 89, 91, 101, 109, 113, 115	6	-1
Total Points Possible	71	70

Figure 19: One of ELL #2's Exit Ticket

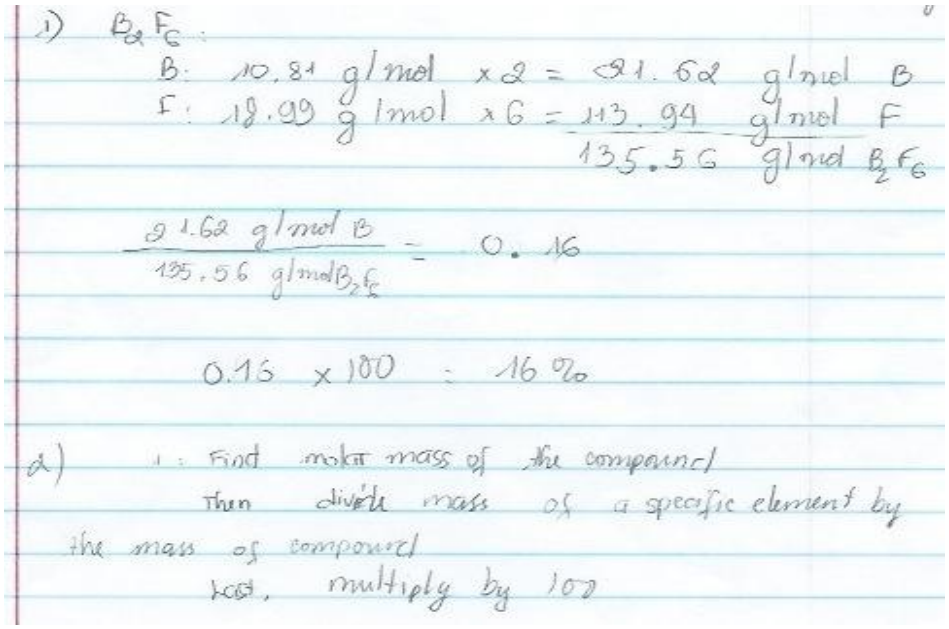
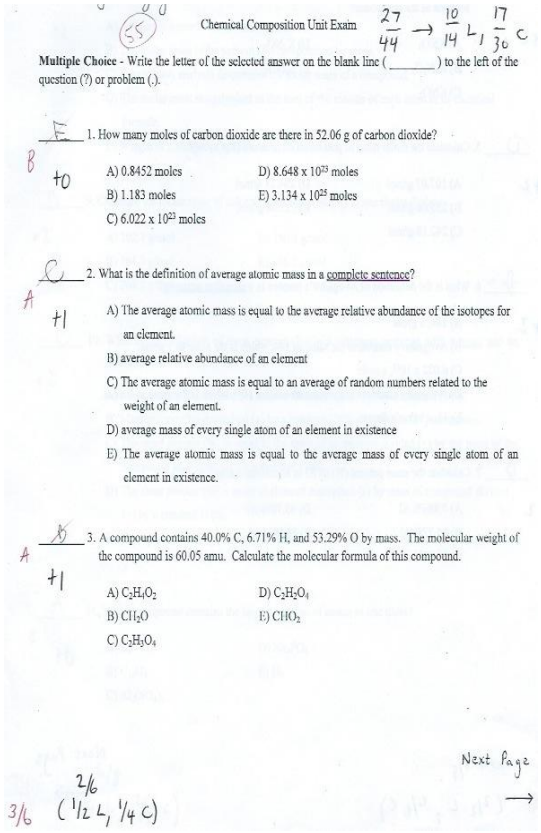


Figure 20: ELL #2's Post-Assessment



Chemical Composition Unit Exam

Multiple Choice - Write the letter of the selected answer on the blank line (_____) to the left of the question (?) or problem (.).

E 1. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?

A) 0.8452 moles
B) 1.183 moles
C) 6.022×10^{23} moles
D) 8.648×10^{23} moles
E) 3.134×10^{25} moles

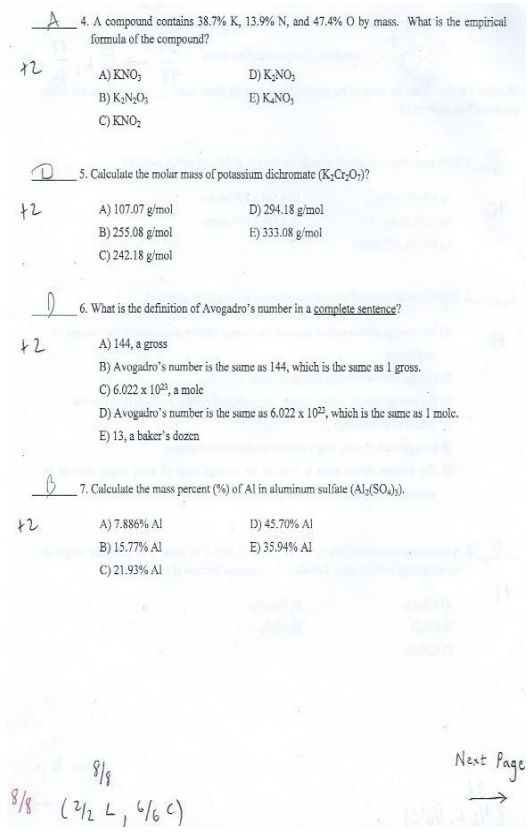
C 2. What is the definition of average atomic mass in a complete sentence?

A) The average atomic mass is equal to the average relative abundance of the isotopes for an element.
B) average relative abundance of an element
C) The average atomic mass is equal to an average of random numbers related to the weight of an element.
D) average mass of every single atom of an element in existence
E) The average atomic mass is equal to the average mass of every single atom of an element in existence.

A 3. A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the compound is 60.05 amu. Calculate the molecular formula of this compound.

A) $C_2H_4O_2$
B) CH_2O
C) $C_2H_3O_4$
D) $C_2H_2O_4$
E) CHO_2

Next Page →



A 4. A compound contains 38.7% K, 13.9% N, and 47.4% O by mass. What is the empirical formula of the compound?

A) KNO_3
B) $K_2N_2O_3$
C) KNO_2
D) K_2NO_3
E) K_4NO_3

D 5. Calculate the molar mass of potassium dichromate ($K_2Cr_2O_7$)?

A) 107.07 g/mol
B) 255.08 g/mol
C) 242.18 g/mol
D) 294.18 g/mol
E) 333.08 g/mol

D 6. What is the definition of Avogadro's number in a complete sentence?

A) 144, a gross
B) Avogadro's number is the same as 144, which is the same as 1 gross.
C) 6.022×10^{23}, a mole
D) Avogadro's number is the same as 6.022×10^{23}, which is the same as 1 mole.
E) 13, a baker's dozen

B 7. Calculate the mass percent (%) of Al in aluminum sulfate ($Al_2(SO_4)_3$).

A) 7.886% Al
B) 15.77% Al
C) 21.93% Al
D) 45.70% Al
E) 35.94% Al

Next Page →

D 8. What is the definition of molar mass in a complete sentence with an adjective?

+2

A) Avogadro's number is the molar mass.
B) The molar mass is the percent (%) composition by mass.
C) Combustion analysis determines the molar mass of a compound.
D) The molar mass is equivalent to the sum of the masses of each atom in its chemical formula.
E) Weight of a sample of substance.

B 9. Calculate the molar mass of calcium nitrate ($Ca(NO_2)_2$) to one decimal place.

+2

A) 102.1 g/mol
B) 164.0 g/mol
C) 204.2 g/mol
D) 150.1 g/mol
E) 116.1 g/mol

C 10. What is the definition of mass percent (%) in a complete sentence with a noun and an adjective?

+2

A) Mass percent (%) divided (÷) masses then multiplied (x) by a hundred (100).
B) Mass percent (%) multiplied (x) by a hundred (100) then divided (÷) the masses.
C) The mass percent (%) is equal to the mass of an element divided (÷) by the mass of the compound multiplied (x) by a hundred (100).
D) The mass percent (%) is mass of element multiplied (x) by mass of compound divided (÷) by a hundred (100).
E) The mass percent (%) is equal to the element multiplied (x) by the compound divided (÷) by a hundred (100).

A 11. Which compound contains the largest number of atoms in one mole?

B +0

A) S_8
B) $C_{10}H_8$
C) $Al_2(SO_4)_3$
D) Na_3PO_4
E) H_2

7/8 6/8 (4/4 L, 2/4 C)

Next Page →

C 12. How many molecules of CH_4 are in 48.2 g of this compound?

D +1

A) 5.00×10^{24} molecules CH_4
B) 3.00 molecules CH_4
C) 2.90×10^{25} molecules of CH_4
D) 1.81×10^{24} molecules CH_4
E) 4.00 molecules CH_4

C 13. How many oxygen atoms are contained in 2.74 g of $Al_2(SO_4)_3$?

D +1

A) 12 oxygen atoms
B) 6.02×10^{23} oxygen atoms
C) 7.22×10^{24} oxygen atoms
D) 5.79×10^{22} oxygen atoms
E) 8.01×10^{-3} oxygen atoms

B 14. The molecular formula of aspartame, the generic name of NutraSweet®, is $C_{14}H_{18}N_2O_5$. What is the molar mass of aspartame rounded to the nearest integer?

C +1

A) 24 g/mol
B) 156 g/mol
C) 294 g/mol
D) 43 g/mol
E) 39 g/mol

C 15. In a complete sentence with a verb, what is the final step when figuring out the molecular formula of a compound?

C +1

A) Last, divide the mass of the molecular formula by the mass of the empirical formula.
B) Last, mass of molecular formula and mass of empirical formula.
C) Last, multiply the subscripts in the empirical formula with the number that came from the previous step.
D) Last, subscripts of empirical formula with the number from the previous step.
E) Last, calculate the mass of the empirical formula.

4/8 4/8 (1/2 L, 3/6 C)

Next Page →

Pg. 5

Calculations - Answer the following questions or problems in the provided space. Make sure to show all the work that led to the answer(s) in order to receive full credit.

16. How many grams of pyridine (C_5H_5N) are contained in 0.0396 mol of pyridine? In complete sentences with verbs, explain the steps that led to the final answer. Use the following sentence prompt to start the explanation: First, I calculated the...

C = 12 x 5 = 60gC
H = 1.01 x 5 = 5.05gH
N = 14 x 1 = 14gN
79.05 g C_5H_5N

+7 +0 L, +1 C

79.05 g C_5H_5N / 0.0396 mol = 1996.021 g C_5H_5N

17. How many sulfur dioxide molecules are there in 18.00 g of sulfur dioxide?

+0 10

1/6 (0/2 L, 1/4 C)

Next Page →

J

18. Calculate the mass percent of nitrogen, lead, and oxygen in $Pb(NO_3)_2$.

Pb = 207.2 x 1 = 207.2
N = 14.0 x 2 = 28
O = 16 x 6 = 96
331.2

%Pb = 207.2 / 331.2 x 100 = 62.5 %Pb
%N = 28 / 331.2 x 100 = 8.4 %N
%O = 96 / 331.2 x 100 = 29 %O

+10 +2

19) A compound was found to contain 90.6% lead (Pb) and 9.4% oxygen (O). What is the empirical formula for this compound. In complete sentences with verbs, explain the steps that led to the final answer.

90.6% Pb = 90.6g Pb
9.4% O = 9.4g O

PbO

90.6g Pb 1 mol / 207.2 g Pb = .44 / .44 = 1 x 3 = 3
9.4g O 1 mol / 16 g O = .59 / .44 = 1.3 x 3 = 4

+8

First: I change percent of each element to grams
Then: find the mol of each element

+2 L, +1 C

5/6 (2/2 L, 3/4 C)

+18

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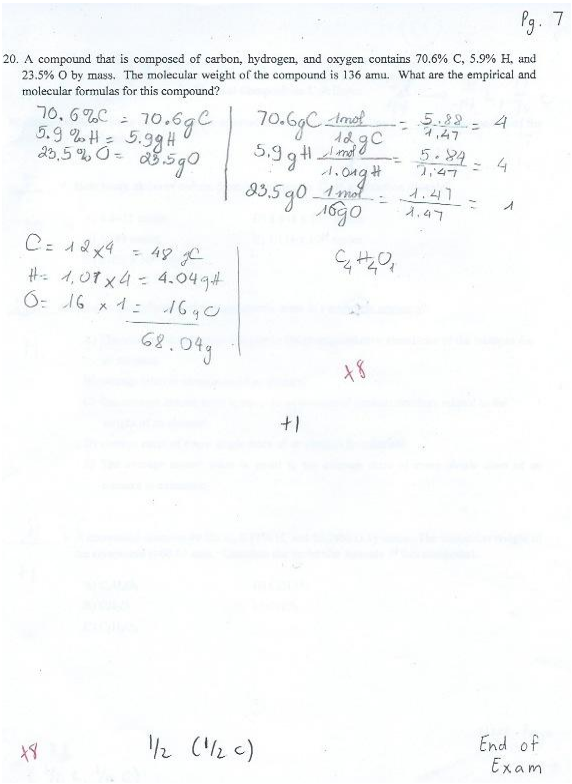

Pg. 7

20. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What are the empirical and molecular formulas for this compound?

70.6%C = 70.6gC
5.9%H = 5.9gH
23.5%O = 23.5gO

70.6gC 1mol/12gC = 5.88/1.47 = 4
5.9gH 1mol/1.01gH = 5.84/1.47 = 4
23.5gO 1mol/16gO = 1.47/1.47 = 1

C = 12x4 = 48gC
H = 1.01x4 = 4.04gH
O = 16x1 = 16gO
68.04g

$C_4H_4O_1$

x8

+1

x8 1/2 (1/2 c) End of Exam

Communicate Student Learning and Progress to ELLs/Parents

Communication about the classroom, grades, and progress with students and parents happened through multiple ways that included an online gradebook, the cooperating teacher's website, conferences, and emails. Emails focused on communication with parents, while one-on-one conferences geared communication towards students, and the online gradebook and cooperating teacher's website were available to both parents and students. Emails, one-on-one conferences, the online gradebook, and the cooperating teacher's website showed students' continual progress throughout the unit, because these forms of communication happened regularly or received regular updates. In general, this communication was one way, which meant that the teacher would share information with students and parents, but the students and

parents did not necessarily respond in return. There were some students that brought their concerns about the class to the teacher's attention, and in these instances, she was able to talk to students and help them on an individual basis with specific issues.

This did not entirely happen with this work sample, because there was only one unit, but the teacher could communicate student learning and progress in a continual way by showing data that represent time spans with multiple units. After explaining how the unit goals relate to state and national standards, the teacher could show the principal, parents, and students whether or not students are making adequate progress in terms of standards by recording students' growth of comprehension between the beginning and the end of each unit with a table that relates unit goal objectives with the result of assessment practices (see Chart 2). Therefore, the teacher has the ability to illustrate students' progress towards standards throughout the entire year, and at various points in the curriculum, she can compile all the tables with an added column for standards, so that the documentation is all together in one place and is transferable from one year to the next.

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Unit Reflection

Strengths and Weaknesses

From a big picture perspective, the teacher did well with establishing a routine in the classroom with her students. Even though the unit was only five lessons long, these standard processes and procedures were transferable to the lessons of previous and upcoming units, and thus applicable to an entire curriculum for a whole school year. Routines were beneficial to both ELL and non-ELL students, because they knew what to expect while in class in terms of learning approaches and strategies. As a result, the teacher had the ability to spend more time on meaningful instruction, students had the opportunity to learn effectively and efficiently for long-term understanding and application, and some of the classroom management was taken care of beforehand. With routines, the teacher also had the option to throw in a twist every now and then to help students stay focused and interested.

In this unit, the teacher also did well with incorporating both informal and formal formative assessments. The snapshots of students' progress throughout the unit assisted the teacher in planning future lessons. She was able to determine which concepts and skills students were struggling with on assignments, and then found the time to cover specific material again either with the whole class or a group of students. Information from these formative assessments also gave the teacher some insight into the thought processes of her students. From their different logic patterns, she could see where misconceptions arose and was able to address them in order to guide students toward success with the unit as a whole. Students' opinions from self-assessments were also beneficial to the teacher, since she used this information to gauge how well students were

responding to certain teaching approaches and would make changes to them when necessary.

The surface coverage of concepts along with the limited types of activities were some of the weaknesses in this unit. With the structure of the class in general, there was an emphasis on making sure that students received an introduction to a wide range of concepts. However, this approach led to limited comprehension in some students for both the content and language concepts, which ultimately resulted in minimal learning gains and even some learning losses. Going into depth with some of the concepts would probably have given most students a better understanding of the material in this unit, and then this fuller comprehension would have had the potential to help students in upcoming units, especially since some concepts cut across multiple units. The small learning gains and the learning losses probably also came from the occasional lack of engagement from some students during the lessons. Varying activities from the traditional teaching approaches would have raised the level of engagement for all students, and this increase in attention would have benefited them in learning the language and content material.

Measuring students' knowledge through the pre-assessment and post-assessment definitely needed improvement in terms of accuracy. First off, the different lengths between the two assessments impacted the final analysis, because students had a higher probability of achieving a passing score on the language and content components in the longer post-assessment than in the shorter pre-assessment. Secondly, there were questions in both assessments that involved both content and language at some level. Initially, the teacher wrote each question with the intent to measure only language or content, but after looking through students' scores there was evidence that some of the

answers to the problems depended on both areas. If a question was supposed to examine language ability, but students did not know the content associated with the question, then they would not be able to show their level of language proficiency. Similarly, if a question was supposed to look into content knowledge, but students did not understand the language written in the question, then they would not be able to show their level of content proficiency. The outcome from either situation would lead to the same problem. This meant that there was some discrepancy between what the assessments measured and what students actually knew about the language and content specific to this unit. These issues with the pre-assessment and post-assessment made the comparison between the two difficult and statistically unrealistic.

Impact on Future Teaching

With the movement toward common core standards, the teacher should transition into a curriculum that concentrates more on depth of understanding and meaningful application of language and content material. The teacher also needs to stay in tuned with students' level of engagement, and to adjust the activities within the lessons of a unit to maximize the interest from students. Most importantly, the teacher needs to work on creating assessments that accurately gauge students' knowledge and abilities with content and language. Questions focused on content should have enough visuals and/or contextual clues, so that students can answer those questions without having language impeding their ability to do so. While questions focused on language should not heavily depend on students' knowledge of the content material, but should still somehow relate to the subject of the class, which in this case is chemistry. Additionally, if there are

questions that end up with significant overlap between language and content, then the teacher could double grade those questions with criteria for each area.

On another note, the teacher will probably begin to teach language functions and forms with explicitly stated sentence frames. In this unit, she taught toward the ELP standards through parts of speech, and this led implicitly to sentence frames related to the language standards. She initially decided to go with this route, because the connection between language and content material seemed easier this way, especially since this was going to be the first time students in this chemistry class were going to have lessons that contained both aspects. Her overall thought was to start students with pieces of language knowledge they were more likely to already know, and she believed that they would know parts of speech from English classes and not necessarily know how to specifically structure sentences for particular functions. However, after a suggestion from the coordinator of the ESOL program, the teacher realized that having a solid foundation in parts of speech was not enough to progress ELL and non-ELL students to a point where they could proficiently use English. Students would need examples of sentences in the form of sentence frames to see how the structure of sentences contributed to their function in communication. This broader comprehension of the functions and forms of sentences would gradually get students to a proficiency level that would be more sustainable in the long run.

After seeing the end result of this unit, the teacher wants to plan a curriculum that incorporates language instruction throughout the whole year. She would probably make language instruction a permanent accompaniment to lab write-ups that students would do twice every month, but she would also still have language be a part of content instruction.

There would also be opportunities for the teacher to assign short writing pieces, such as an abstract or review of a science article, where she would bring in language instruction. And, at the same time, she would be helping students with science literacy. Since the increase in language instruction is not typical in a science curriculum, the teacher would choose to make some language instruction explicit, and in other instances, she would bring students' attention to language forms and functions without stating outright that a language lesson was taking place.

After reviewing the social justice portion of the work sample, the teacher determined that the activity she had students complete did not meet the criteria for addressing social justice issues in the classroom. In a large sense, social justice involves the recognition that the setup of structures in society is in a position to give advantages to specific groups of people and disadvantages to other groups of people at the same time. Those with the advantages are more likely to thrive and succeed in ways that are based on the values in society (for example, financially, educationally, and socially), while those with the disadvantages must struggle to attain the same endpoint. With this recognition, striving for social justice must also indicate that there is a possibility for groups of people to enact changes to these structures in society, so that the treatment of all individuals by such structures is more equitable. In a chemistry classroom, social justice can happen in the context of the science community. From a broader perspective, the professional science community in the United States has a high number of Caucasian or European male scientists, especially in fields such as chemistry, physics, and engineering, even though a majority of the population goes through some form of science education through their formal years. Because of the structures in society, the transition from being a

student to a researcher happens more commonly for this specific group of people than any other group of people when the time comes to make decisions about possible careers. So, as a class, the teacher and students can examine why this social justice issues occurs and what actions could be taken at different levels of society (classroom, school, local, state, national, etc.). Eventually, both the students and the teacher would implement some of these changes, probably at the classroom and school levels, and maybe even the local level, and then continue to look at different aspects of the issue and the potential changes that could take place.

Summary of Changes Specific to this Unit

The first change the teacher would make to this unit would be the amount of time actually spent on the unit. Nine lesson objectives were covered in three lessons with an additional class period set aside for a review day. If students had more time in class with the teacher to practice applying the language and content concepts in a variety of conditions, then more of them might have made significant learning gains on the post-assessment. With the additional time, the teacher could have interactive activities that utilize both the language and content concepts from the unit. So instead of just notes, the students would be able to see the new information in action, and this interaction with the material they are learning could be the tipping point that guides them to complete comprehension that would be applicable to other situations.

Another change the teacher would undertake with this unit would be the summative assessment. Instead of a unit exam, the teacher would try to develop a lab that incorporated the concepts from this unit into an authentic assessment. Students

would still need to complete the lab and accompanying questions individually without any resources, but they might perform better on an assessment that deviated from the standard end-of-the-unit test, especially since an alternative assessment would bring along less stress and anxiety.

The final main change the teacher would attempt with this unit would be the amount of time set aside for the closure part of the lessons. Often times, the teacher had to rush through the closure activity right before the bell rang to signal the end of class. So, next time, the teacher would ensure that there was enough time at the end of each lesson to form connections between the lesson and unit objectives with a thorough, but brief, discussion.

Resource and References

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