Differentiated Instruction

Introduction

Across the country, states are increasingly making graduation requirements more rigid by requiring students to take additional credits of high school science. Because of this, the profile of a typical chemistry student has changed.

Chemistry classes are comprised of learners with various abilities. This guide introduces the differentiated instruction features within Savvas Chemistry © 2017. Savvas Chemistry provides support for struggling learners including math, reading, and strategies for teaching English language learners (ELLs).

Differentiated Instruction

Differentiated Instruction notes appear throughout each lesson in wraparound of the Teacher's Edition. These notes recommend strategies and reteaching ideas for various learners in each classroom. These strategies are coded with the types of activities appropriate for each type of learner.

Code Labels:

- ELL—English Language Learners
- L1—Struggling Students
- L2—Special Needs Students
- L3—Advanced Students

The example below offers three strategies for differentiated instruction.

Differentiated Instruction

ELL **ENGLISH LANGUAGE LEARNERS** Pair each student with limited English proficiency with a student who has strong mathematical skills. Encourage the English learners to ask their partners for help with any difficulty they are having understanding the terms and how to solve the problems.

L1 **STRUGGLING STUDENTS** Review the use of parentheses and the fraction bar as ways of grouping symbols to indicate the order of operations. Stress the importance of writing units for each measure in a calculation. Provide additional simple conversion problems for practice before students begin solving problems involving the mole.

L3 **ADVANCED STUDENTS** Have students create a clever way for their classmates to avoid confusing the concepts of mass and moles.

Misconception Alert

In addition to Differentiated Instruction notes, the authors have identified frequent misconceptions throughout each lesson. The Misconception Alerts inform teachers about these misconceptions and offer explanations and teaching strategies to target the concepts before students have a chance to adopt an incorrect understanding.

This example targets a misconception that students may have about calculations and the use of calculators.

> **Misconception Alert**
>
> Some students may think they are finished when the calculator displays the result of the last calculation. Explain that not all calculators automatically convert the final answer to proper scientific notation, or use the proper number of significant figures. Make sure students know how to make the correct conversion to scientific notation with their particular calculator.

Math Support

Math is an integral part of understanding chemistry concepts. Many teachers find that a number of students do not have the math skills or the ability to apply them in the context of chemistry.

The authors have taken great care in designing differentiated instruction for these students. Foundations for Math, stepped-out Sample Problems, online support for Math Tutorials and Sample Problems, and Math Tune-Ups are a few features that address struggling math students.

Foundations for Math

Foundations for Math alerts teachers to the types of math skills that students will use during the lesson. The Foundations for Math notes offer strategies for introducing the math skills and suggestions for connecting the skill to the chemistry lesson.

> **Foundations for Math**
>
> **WRITING CONVERSIONS** Work thorough some conversions that students likely encounter in their daily lives. For example: If a recipe calls for six eggs, this quantity can be considered a half-dozen eggs: 6 eggs × (1 dozen/12 eggs) = 0.5 dozen.
>
> As a class, write other familiar relationships, such as 3 feet = 1 yard, 50 cents = ½ dollar, 60 min = 1 h, 30 min = ½ h, etc. Point out that these equalities can be written in either direction, so 60 min = 1 h can also be written as 1 h = 60 min.
>
> In **Sample Problem 10.1,** the mass of a large number of apples is determined by using the mass of a smaller number of apples by means of a conversion factor created from the subset of apples. (Note that, for this example, the mass of one dozen apples is an approximation. In reality, the masses of similar-sized apples vary from one apple to the next.)

In this example, the lesson deals with conversion factors. The note recommends connecting conversion to everyday conversions before applying them to a chemistry problem. For instance, look at the following problem:

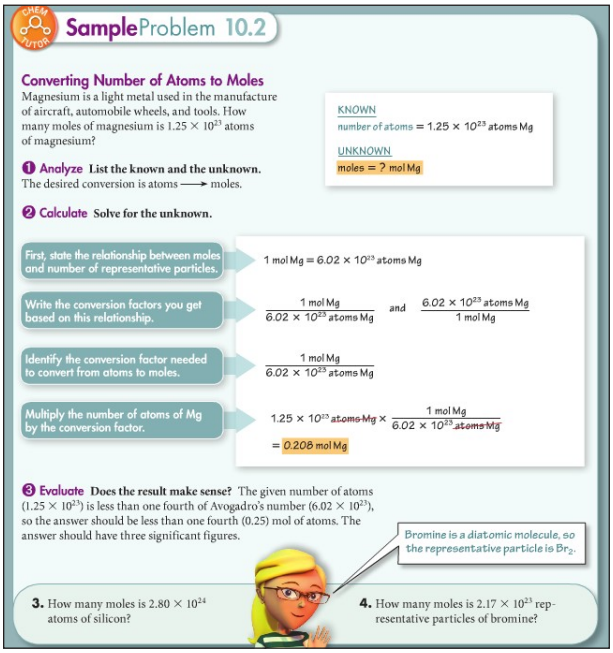
6 eggs × (1 dozen/12 eggs) = 0.5 dozen

Stepped-Out Sample Problems

Sample Problems are introduced a few times during a lesson. These problems relate to various chemistry concepts that apply math. Each Sample Problem is broken down into three distinct steps. In Step 1, Analyze, students read the problem and determine the known and unknown variables of the problem. They also identify exactly what they are trying to determine to be able to solve the problem.

In Step 2, Calculate, students walk through the methods for solving the problem. This step highlights the operations and algorithms involved in the calculations.

Many times, students feel that they are finished after doing the calculations. The Sample Problems encourage students to take problem solving further. In Step 3, Evaluate, students determine if the calculations and final answer make sense.



Sample Problem 10.2

Converting Number of Atoms to Moles

Magnesium is a light metal used in the manufacture of aircraft, automobile wheels, and tools. How many moles of magnesium is 1.25×10^{23} atoms of magnesium?

KNOWN
number of atoms = 1.25×10^{23} atoms Mg

UNKNOWN
moles = ? mol Mg

1 Analyze **List the known and the unknown.**
The desired conversion is atoms ⟶ moles.

2 Calculate **Solve for the unknown.**

First, state the relationship between moles and number of representative particles.
$1 \text{ mol Mg} = 6.02 \times 10^{23} \text{ atoms Mg}$

Write the conversion factors you get based on this relationship.
$\frac{1 \text{ mol Mg}}{6.02 \times 10^{23} \text{ atoms Mg}}$ and $\frac{6.02 \times 10^{23} \text{ atoms Mg}}{1 \text{ mol Mg}}$

Identify the conversion factor needed to convert from atoms to moles.
$\frac{1 \text{ mol Mg}}{6.02 \times 10^{23} \text{ atoms Mg}}$

Multiply the number of atoms of Mg by the conversion factor.
$1.25 \times 10^{23} \text{ atoms Mg} \times \frac{1 \text{ mol Mg}}{6.02 \times 10^{23} \text{ atoms Mg}}$
$= 0.208 \text{ mol Mg}$

3 Evaluate **Does the result make sense?** The given number of atoms (1.25×10^{23}) is less than one fourth of Avogadro's number (6.02×10^{23}), so the answer should be less than one fourth (0.25) mol of atoms. The answer should have three significant figures.

Bromine is a diatomic molecule, so the representative particle is Br_2.

3. How many moles is 2.80×10^{24} atoms of silicon?

4. How many moles is 2.17×10^{23} representative particles of bromine?

Online Chemistry Tutorials

Many of the Sample Problems are available online at SavvasChem.com. Students can access the Chem Tutor feature through the Chemistry Tutorials that are located at the lesson level.

These Sample Problems are animated and walk students step by step through the three steps of problem solving. Avatars explain the process and offer students tips on organizing the data. After the tutorial, students complete a related problem and submit it for grading. Struggling readers and ELLs—who need simplified directions—may also access the Foundation version of the tutorial.

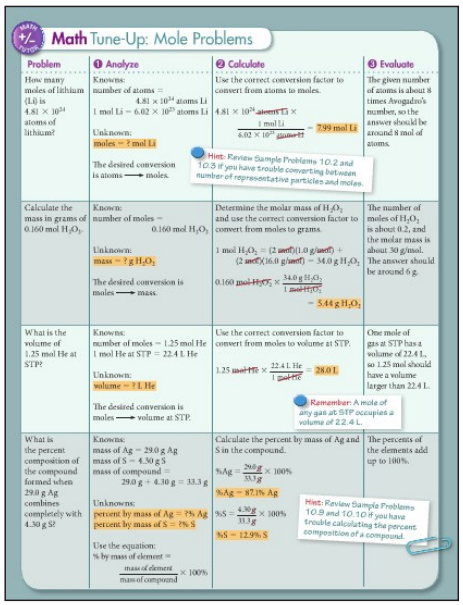
Online Math Tutorials

Students that continue to struggle with the chapter math concepts have access to Math Help via the Math Tutorials online. These tutorials are located in the Chapter-Level Activities section. Similar to the Chemistry Tutorials, avatars walk students through math concepts.

After the tutorial, students have the opportunity to demonstrate their understanding by completing a related math problem.

Math Tune-Up

Each chapter may address up to four or five math concepts. The authors have supplied students with an overview of each one at the end of each chapter on the Math Tune-Up page. Students may use this page to review for end-of-chapter assessments or use it as a reference during the chapter.



Math Tune-Up: Mole Problems

Problem	❶ Analyze	❷ Calculate	❸ Evaluate
How many moles of lithium (Li) is 4.81×10^{24} atoms of lithium?	Knowns: number of atoms = 4.81×10^{24} atoms Li 1 mol Li = 6.02×10^{23} atoms Li Unknown: moles = ? mol Li The desired conversion is atoms ⟶ moles.	Use the correct conversion factor to convert from atoms to moles. $4.81 \times 10^{24}\ \text{atoms Li} \times \frac{1\ \text{mol Li}}{6.02 \times 10^{23}\ \text{atoms Li}} = 7.99\ \text{mol Li}$ Hint: Review Sample Problems 10.2 and 10.3 if you have trouble converting between number of representative particles and moles.	The given number of atoms is about 8 times Avogadro's number, so the answer should be around 8 mol of atoms.
Calculate the mass in grams of 0.160 mol H_2O_2.	Known: number of moles = 0.160 mol H_2O_2 Unknown: mass = ? g H_2O_2 The desired conversion is moles ⟶ mass.	Determine the molar mass of H_2O_2 and use the correct conversion factor to convert from moles to grams. 1 mol H_2O_2 = (2 mol O)(1.0 g/mol) + (2 mol O)(16.0 g/mol) = 34.0 g H_2O_2 $0.160\ \text{mol } H_2O_2 \times \frac{34.0\ \text{g } H_2O_2}{1\ \text{mol } H_2O_2} = 5.44\ \text{g } H_2O_2$	The number of moles of H_2O_2 is about 0.2, and the molar mass is about 30 g/mol. The answer should be around 6 g.
What is the volume of 1.25 mol He at STP?	Knowns: number of moles = 1.25 mol He 1 mol He at STP = 22.4 L He Unknown: volume = ? L He The desired conversion is moles ⟶ volume at STP.	Use the correct conversion factor to convert from moles to volume at STP. $1.25\ \text{mol He} \times \frac{22.4\ \text{L He}}{1\ \text{mol He}} = 28.0\ \text{L}$ Remember: A mole of any gas at STP occupies a volume of 22.4 L.	One mole of gas at STP has a volume of 22.4 L, so 1.25 mol should have a volume larger than 22.4 L.
What is the percent composition of the compound formed when 29.0 g Ag combines completely with 4.30 g S?	Knowns: mass of Ag = 29.0 g Ag mass of S = 4.30 g S mass of compound = 29.0 g + 4.30 g = 33.3 g Unknowns: percent by mass of Ag = ?% Ag percent by mass of S = ?% S Use the equation: % by mass of element = $\frac{\text{mass of element}}{\text{mass of compound}} \times 100\%$	Calculate the percent by mass of Ag and S in the compound. $\%\text{Ag} = \frac{29.0\ \text{g}}{33.3\ \text{g}} \times 100\%$ %Ag = 87.1% Ag $\%\text{S} = \frac{4.30\ \text{g}}{33.3\ \text{g}} \times 100\%$ %S = 12.9% S Hint: Review Sample Problems 10.9 and 10.10 if you have trouble calculating the percent composition of a compound.	The percents of the elements add up to 100%.

Reading Support

Struggling readers will benefit from the Foundations for Reading strategies that are available throughout a lesson in the wraparound of the Teacher's Edition. This feature offers teachers support for helping students build vocabulary and teach reading strategies.

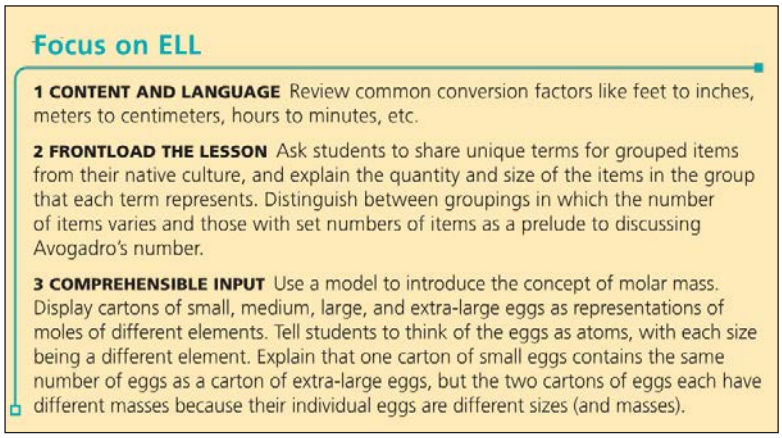
Foundations for Reading

BUILD VOCABULARY Have students write two or three sentences, each of which relates a mole to at least one other vocabulary term, such as: a mole contains Avogadro's number of particles; the mass of one mole of a substance is its molar mass, which is found by determining the mass in grams of its representative particles.

READING STRATEGY Students may more easily grasp the meaning of the mole by developing their own mental picture. For instance, suggest visualizing a giant egg carton with 6.02×10^{23} depressions for particles, or a giant sack bulging with Avogadro's number of particles.

ELL Support

The Focus on ELL notes that are available in the wraparound of the Teacher's Edition offer teachers strategies for providing students with content and language objectives, frontloading a lesson, providing comprehensible input, and providing opportunities for language production. Many of these notes offer suggestions for beginning, intermediate, and advanced English speakers.



Focus on ELL

1 CONTENT AND LANGUAGE Review common conversion factors like feet to inches, meters to centimeters, hours to minutes, etc.

2 FRONTLOAD THE LESSON Ask students to share unique terms for grouped items from their native culture, and explain the quantity and size of the items in the group that each term represents. Distinguish between groupings in which the number of items varies and those with set numbers of items as a prelude to discussing Avogadro's number.

3 COMPREHENSIBLE INPUT Use a model to introduce the concept of molar mass. Display cartons of small, medium, large, and extra-large eggs as representations of moles of different elements. Tell students to think of the eggs as atoms, with each size being a different element. Explain that one carton of small eggs contains the same number of eggs as a carton of extra-large eggs, but the two cartons of eggs each have different masses because their individual eggs are different sizes (and masses).

Savvas Chemistry © 2017 Foundation Edition

The Foundation Edition of Savvas Chemistry targets struggling students in your chemistry classroom. Written at a lower readability, the Foundation Edition makes chemistry accessible to all of your students by offering enhanced math support and proven reading strategies.

Review

This guide explored the features of differentiated instruction for Savvas Chemistry © 2017. It examined features for struggling math and reading students, as well as ELLs. Additionally, it introduced the Foundation Edition of the Savvas Chemistry program.