Applying the Understanding by Design® Framework

Introduction

This guide introduces the Understanding by Design® framework (the UbD® framework) and discusses how it is integrated into the presentation and development of Savvas Chemistry © 2017. It specifically examines how the UbD® framework is used in practice through program strategies that move students from content recall to understanding.

What is the UbD™ framework?

The UbD® framework is a researched-based way of thinking about the design of curriculum, instruction, and assessment. The UbD® framework is described in detail in the book *Understanding by Design* by Grant Wiggins and Jay McTighe. Grant Wiggins worked with Pearson to incorporate his unique instructional philosophy across all academic disciplines. The framework provides a deep understanding of the important ideas that are taught. It provides a way to move from simply covering the curriculum to ensuring understanding. This is done through a process of learning that provides students with opportunities to investigate, explore, test, and verify important concepts. It really boils down to helping students learn how to transfer knowledge.

Big Ideas and Essential Questions

With the UbD® framework, the curriculum is not just a series of discrete facts and skills. Big Ideas give context and meaning to the content.

A Big Idea is a working concept, theme, or issue that a student uses to make sense of otherwise confusing and seemingly unconnected facts.

Essential Questions are designed to challenge theories and force students to stretch their thinking by using course content to support and inform answers. In doing so, students find meaning and value and are able to make connections to what may have previously felt like rote memorization of "boring" content.

The UbD® framework does not just help students know something. It helps them understand why it matters and how they can apply what they have learned.

Backward Design

The UbD® framework emphasizes the use of the backward design process to develop instruction. This process involves identifying the desired results first and working backward to figure out how to get there.

Backward design involves three stages:

- Stage 1: Identify the desired results of instruction.
- Stage 2: Determine the acceptable evidence of understanding.
- Stage 3: Plan the instruction.

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The example below shows how one teacher used backward design for planning instruction:

Stage 1 Identify the desired results of instruction.	**Stage 2** Determine the acceptable evidence of understanding.	**Stage 3** Plan the instruction.
Big Idea: The mole Essential Question: Why is the mole an important measurement in chemistry? Key Concept Questions: • How can you convert among the count, mass, and volume of something? • How do chemists count the number of atoms, molecules, or formula units in a substance? • How do you determine the molar mass of an element and of a compound?	• Students must correctly define the following terms: mole, Avogadro's number, representative particle, and molar mass • Students must accurately find mass from a count. • Students must accurately convert the number of atoms to the number of moles and vice versa. • Students must accurately calculate the molar mass of a compound.	• Reading assignment, pages 306–315 • Reading and Study Workbook Lesson 10.1 • Finding Mass from a Count, page 307 • Converting Number of Atoms to Moles, page 309 • Converting Moles to Number of Atoms, page 311 • Use Models: Molar Mass, page 312 • Teacher Demo, page 313: Moles and Mass • Finding the Molar Mass of a Compound, page 315 • Class Activity, page 314: Calculating Molar Mass • Lesson Check 315 • Small Scale Lab 13: Measuring Mass: A Means of Counting

The UbD® Framework and Savvas Chemistry © 2017

Savvas Chemistry © 2017 leverages the UbD® framework to provide a way to move from simply covering the curriculum to ensuring students' understanding. According to the UbD® framework, understanding is not achieved through covering content alone. It is achieved through carefully designed instruction derived from specific goals. The process of learning provides students with the opportunity to investigate, test, and verify key concepts to make sense of important science content.

Savvas Chemistry © 2017 emphasizes the use of a backward design process to develop instruction. So, rather than beginning the planning process with activities, materials, or textbook content, the backward design in Savvas Chemistry © 2017 begins with identifying the desired long-term results. These desired results serve as the focal point for the planning of all curriculum, instruction, and assessment. This helps avoid superficial coverage of content.

The UbD® Framework in Practice

The authors integrated many concepts from the UbD® framework into the program features. Familiarity with these features gives teachers a starting point for using the UbD® framework in their instruction.

Chapter Launch

The Big Ideas and Essential Questions are introduced to students through the Chapter Openers. Turn to Chapter 11 (pages 344–346) in the Teacher's Edition to see an example.

The Big Idea is located on the right side of the page. The Big Idea for this chapter is Reactions. This Big Idea forms the backbone of this chapter and is the essential understanding for the content and instruction presented.

Each chapter's Big Ideas are accompanied by Essential Questions. The chapter lessons are framed around finding answers to these questions. This framework encourages students to think like scientists as they engage in activities, uncover the answer, and transfer their knowledge throughout the lesson and onto the next.

The Essential Questions for Chapter 11 (pages 344–346) are the following:

1. How do chemical reactions obey the law of conservation of mass?
2. How can you predict the products of a chemical reaction?

Within the UbD® framework, real-world connections, activities, and inquiries should make the material relevant and meaningful. Each Chapter Opener starts off with an engaging picture that acts as a conversation starter that introduces students to the Big Idea. The engaging picture for Chapter 11 on pages 344–346 in the Teacher's Edition helps students connect the Big Idea to a picture of a familiar scenario. This chapter introduces chemical reactions by discussing the image of the aquarium.

Key Questions

Throughout each lesson, students unlock the Essential Questions by answering Key Questions. In the process, they build a meaningful understanding of the content and how it relates to the Essential Questions and Big Idea.

For Lesson 11.1 (page 346), the main concept is Describing Chemical Reactions. During the lesson, students focus on the following Key Questions:

1. How do you write a skeleton equation?
2. What are the steps for writing and balancing a chemical equation?

Check for Understanding

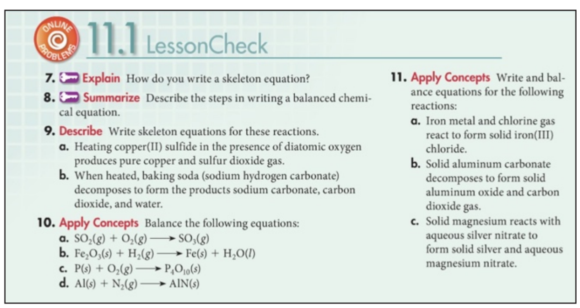
At least once per lesson, note the feature called Check for Understanding. For Lesson 11.1 (page 351), remind students of one of the Essential Questions, “How do chemical reactions obey the law of conservation of mass?” Students use what they have learned to answer this Essential Question. If students have trouble answering the Essential Question, use the Adjust Instruction note to clarify or reteach the concept.

Assessment Options

The UbD® framework calls for a variety of assessment options throughout the lessons and chapters. These options help teachers measure each student’s degree of understanding. The assessments include authentic assessments that gauge understanding through real-world applications.

Lesson Check

Each lesson concludes with the Lesson Check. In addition to addressing the Key Questions of the lesson, students must answer items that require them to apply the lesson concepts.


ONLINE PROBLEMS

11.1 LessonCheck

7. Explain How do you write a skeleton equation?

8. Summarize Describe the steps in writing a balanced chemical equation.

9. Describe Write skeleton equations for these reactions.
   a. Heating copper(II) sulfide in the presence of diatomic oxygen produces pure copper and sulfur dioxide gas.
   b. When heated, baking soda (sodium hydrogen carbonate) decomposes to form the products sodium carbonate, carbon dioxide, and water.

10. Apply Concepts Balance the following equations:
   a. $SO_2(g) + O_2(g) \longrightarrow SO_3(g)$
   b. $Fe_2O_3(s) + H_2(g) \longrightarrow Fe(s) + H_2O(l)$
   c. $P(s) + O_2(g) \longrightarrow P_4O_{10}(s)$
   d. $Al(s) + N_2(g) \longrightarrow AlN(s)$

11. Apply Concepts Write and balance equations for the following reactions:
   a. Iron metal and chlorine gas react to form solid iron(III) chloride.
   b. Solid aluminum carbonate decomposes to form solid aluminum oxide and carbon dioxide gas.
   c. Solid magnesium reacts with aqueous silver nitrate to form solid silver and aqueous magnesium nitrate.

Chapter Assessments

To locate chapter-level assessments, consult the Planning Guide at the beginning of the chapter. The last row of the guide, Assessing the Big Idea, lists the Essential Questions and the assessment resources. Options include Study Guide, Skills Tune-Up, Standardized Test Prep, and workbook resources.

Assessing the BIGIDEA: REACTIONS		
	Essential Questions 1. How do chemical reactions obey the law of conservation of mass? 2. How can you predict the products of a chemical reaction?	Study Guide p 375 Skills Tune-Up p 376 STP p 381 Reading and Study Workbook Self-Check and Vocabulary Review Chapter 11

Review

This guide examined the UbD® framework and discussed how it is integrated into the presentation and development of Savvas Chemistry © 2017. It also examined how the UbD® framework is used in practice through program strategies that move students from content recall to understanding.