# Kiddom OpenStax Chemistry

## Kiddom OpenStax Chemistry Executive Summary

### Section 1. Science-Related Texas Essential Knowledge and Skills (TEKS) and English Language Proficiency Standards (ELPS) Alignment

| TEKS Student % | TEKS Teacher % | ELPS Student % | ELPS Teacher % |
|---|---|---|---|
| 72.88% | 72.88% | 100% | 100% |

### Section 2. Instructional Anchor

- The materials are somewhat designed to strategically and systematically integrate scientific and engineering practices, recurring themes and concepts, and grade-level content as outlined in the TEKS.
- The materials somewhat anchor the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

### Section 3. Knowledge Coherence

- The materials are designed to build knowledge systematically, coherently, and accurately.
- The materials provide some educative components to support teachers' content and coherence knowledge.

### Section 4. Productive Struggle

- The materials provide some opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

### Section 5. Evidence-Based Reasoning and Communicating

- The materials somewhat promote students' use of evidence to develop, communicate, and evaluate explanations and solutions.
- The materials provide some teacher guidance to support student reasoning and communication skills.

### Section 6. Progress Monitoring

- The materials include some TEKS-aligned and developmentally appropriate assessment tools.
- The materials include some guidance that explains how to analyze and respond to data from assessment tools.
- The assessments are somewhat clear and easy to understand.

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## Section 7. Supports for All Learners

- The materials provide some guidance on fostering connections between home and school.
- The materials include listening, reading, writing, and speaking supports to help Emergent Bilinguals meet grade-level science content expectations.
- The materials include a variety of research-based instructional methods that appeal to a variety of learning interests and needs.
- The materials include some guidance, scaffolds, supports, and extensions that maximize student learning potential.

## Section 8. Implementation Supports

- The materials include year-long plans with some practice and review opportunities that support instruction.
- The materials include some classroom implementation support for teachers and administrators.
- The materials provide some implementation guidance to meet variability in program design and scheduling.

## Section 9. Design Features

- The visual design of materials is clear and easy to understand.
- The materials are mostly intentionally designed to engage and support student learning with the integration of digital technology.
- The digital technology or online components are developmentally and grade-level appropriate and provide support for learning.

## Section 10. Additional Information

- The publisher submitted the technology, price, professional learning, and additional language supports.

## Indicator 2.1

Materials are designed to strategically and systematically integrate scientific and engineering practices and course-level content as outlined in the TEKS.

| | | |
|---|---|---|
| 1 | Materials provide multiple opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS. | DNM |
| 2 | Materials strategically and systematically develop students' content knowledge and skills as appropriate for the concept and grade level or course as outlined in the TEKS. | PM |
| 3 | Materials include sufficient opportunities, as outlined in the TEKS, for students to ask questions and plan and conduct classroom, laboratory, and field investigations and to engage in problem-solving to develop an understanding of science concepts. | PM |

### Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials are designed to strategically and systematically integrate some scientific and engineering practices and course-level content.

Materials do not provide opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS. Materials strategically and systematically develop some students' content knowledge and skills as appropriate for the concept and grade level or course but do not reference the TEKS. Materials include some sufficient opportunities, as outlined in the TEKS, for students to ask questions and to plan, but not to conduct classroom, laboratory, and field investigations or to engage in problem-solving to develop an understanding of science concepts.

Evidence includes but is not limited to:

Materials provide multiple opportunities for students to develop, practice, and demonstrate mastery of appropriate scientific and engineering practices as outlined in the TEKS.

- Materials do not provide opportunities for students to develop, practice, and demonstrate mastery of scientific and engineering practices (SEPs), as the material's text appears to be conceptual only. The only laboratory experiments are virtual or in video format. There are no hands-on activities found throughout the course. For example, the "Link to Learning" in Section 14.6 allows students to virtually manipulate solutions of acids and bases to see the effects on pH. This activity could be considered an investigation, but students do not experience the dimensions of scientific or engineering design.
- The materials include multiple opportunities for student engagement through reading, working through problems, answering questions, performing calculations, watching videos (as in Section 14.6: Buffers, the Acid Rain Slayer: Crash Course Chemistry #31), and manipulating simulations ("Link to Learning": pHet). But these do not include the students planning, gathering materials, building a product, testing the product, or executing a process. Furthermore, the entire material includes very few opportunities for students to practice either the interactive or communicative portions of SEPs.

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**Materials strategically and systematically develop students' content knowledge and skills as appropriate for the concept and grade level or course as outlined in the TEKS.**

- Each chapter builds on student content knowledge, and objectives are strategically and systematically developed as outlined in the chemistry course. For example, Chapter 5: Thermochemistry begins with Chapter 5.1: Energy Basics. followed by 5.2: Calorimetry. and then finally, Chapter 5.3: Enthalpy. The appropriate grade level is targeted but does not include any alignment to the TEKS. Students are given an opportunity to answer questions and check solutions within each section, but there is no opportunity to develop practical skills.
- Because TEKS are not explicitly stated within the materials, alignment is difficult. Teachers must search the TEKS on their own to ensure materials cover appropriate content at the proper depth. The materials do not make it easy for teachers to be certain that they have covered every TEKS. For example, chapter outlines within the materials do not include references to the TEKS, and the scope and sequence do not outline the progression of TEKS throughout the material.

**Materials include sufficient opportunities, as outlined in the TEKS, for students to ask questions and plan and conduct classroom, laboratory, and field investigations, and to engage in problem-solving to develop an understanding of science concepts.**

- The materials include virtual activities that allow students to practice the scientific method but do not include engineering practices such as laboratory or field investigations. For example, throughout the material, students are prompted to plan experiments, but the experiments are not actually performed.
- The materials include multiple opportunities for students to complete problem-solving coursework. For example, students make predictions and test their predictions regarding the structure of atoms in a virtual simulation in Section 2.2. In Chapter 9: Gas Laws, students identify mathematical relationships and compute values. Students are then prompted to read charts and analyze data. Finally, they are prompted to use the data and mathematical relationships to predict change.

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## Indicator 2.2

Materials anchor the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

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|---|---|---|
| 1 | Materials embed phenomena and problems across lessons to support students in constructing, building, and developing knowledge through authentic application and performance of scientific and engineering practices and course-level content as outlined in the TEKS. | PM |
| 2 | Materials intentionally leverage students' prior knowledge and experiences related to phenomena and engineering problems. | PM |
| 3 | Materials clearly outline for the teacher the scientific concepts and goals behind each phenomenon and engineering problem. | DNM |

### Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials somewhat anchor the learning in phenomena and problems as the key lever for driving learning and student mastery of disciplinary knowledge and skills.

Materials embed phenomena and problems across lessons to support students developing knowledge, but not in constructing, building, or the application and performance of scientific and engineering practices and course-level content as outlined in the TEKS. Materials intentionally leverage students' prior knowledge and experiences related to phenomena, but not to engineering problems. Materials do not outline for the teacher the scientific concepts and goals behind each phenomenon and engineering problem.

Evidence includes but is not limited to:

Materials embed phenomena and problems across lessons to support students in constructing, building, and developing knowledge through authentic application and performance of scientific and engineering practices and course-level content as outlined in the TEKS.

- The lessons in the material embed phenomena and real-world application of concepts for students. For example, students use application skills throughout each chapter of the course to conduct virtual lab investigations and make real-world connections to the chemistry content. The materials reference phenomena outside of the classroom, but students do not apply or perform experiments on their own. For example, in Chapter 2.6, "Ionic and Molecular Compounds," students view a video about mixtures of salts and compounds and how those mixtures relate to electrical conductivity. The only student action included is viewing the video, not in the experiment.
- Throughout the materials, students do not use authentic applications and performance of science and engineering practices. For example, Chapter 2.1, "Exercise," asks students to think critically and draw conclusions concerning Dalton's atomic theory using data table interpretation only. Chapter 3 includes a "Link to Learning" that takes students to a computer simulation demonstrating how variables affect the concentration of a solution. Students are building and developing knowledge but are not applying or performing scientific or engineering practices.

## Materials intentionally leverage students' prior knowledge and experiences related to phenomena and engineering problems.

- The materials leverage students' prior knowledge and experiences related to phenomena, concepts, and learned content but not related to the engineering process. The material typically begins new sections with a real-world example of the topic but does not include any corresponding investigative scientific or engineering processes for the students to participate in. For example, in Section 3.3, the materials leverage students' prior knowledge of dilution with the example of ice cubes diluting iced tea. This example is followed by a virtual lab experiment which does not include the designing or testing portion of the engineering process.
- The materials frequently do not leverage students' prior knowledge as related to phenomena and engineering problems. For example, in Section 4.3, "Stoichiometry," the lesson relies on pictures, calculations, and verbal explanations. It does not include any phenomena or engineering problems and does not leverage students' prior knowledge, such as limited ingredients when cooking. In Section 4.4, "Percent Yield," the lesson asks students to explain, derive, and calculate percent yield without referencing students' common background knowledge of the phenomena of percent yield in the kitchen.

## Materials clearly outline for the teacher the scientific concepts and goals behind each phenomenon and engineering problem.

- The materials do not contain phenomena and engineering problems to be solved by the students. There is no outline present for the teacher because the materials do not contain these scholar-based problems. In place of traditional chemistry labs, Openstax Chemistry provides digital versions of labs and exploration-based investigations instead of hands-on activities or labs.

## Indicator 3.1

Materials are designed to build knowledge systematically, coherently, and accurately.

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|---|---|---|
| 1 | Materials are designed for students to build and connect their knowledge and skills within and across units. | M |
| 2 | Materials are intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding. | M |
| 3 | Materials clearly and accurately present course-specific core concepts and science and engineering practices. | M |
| 4 | Mastery requirements of the materials are within the boundaries of the main concepts of the course. | M |

## Meets | Score 6/6

The materials meet the criteria for this indicator. Materials are designed to build knowledge systematically, coherently, and accurately.

Materials are designed for students to build and connect their knowledge and skills within and across units. Materials are intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding. Materials clearly and accurately present course-specific core concepts and science and engineering practices. Mastery requirements of the materials are within the boundaries of the main concepts of the course.

Evidence includes but is not limited to:

Materials are designed for students to build and connect their knowledge and skills within and across units.

- Materials are designed for students to build and connect their knowledge and skills within and across units. Each unit does build in both complexity and content as the course progresses. For example, in Chapter 1, Essential Ideas, students learn about measurements before the accuracy and precision of measurements. Section 3.3, Molarity, mentions that students have already looked at the composition of pure substances covered in Section 1.2, Phases and Classification of Matter. Section 6.2, The Bohr Model, references materials presented in Chapter 2, Atoms, Molecules, and Ions.
- Each chapter topic also provides students with learning objectives for student reference. For example, Topic 5.1, Energy Basics, consists of a list of learning objectives to guide students on the logical sequence of knowledge building as they proceed through each topic. For example, there are four learning objectives presented in Chapter 5: “1. Define energy, distinguish between types of energy, and describe the nature of energy changes that accompany chemical and physical changes. 2. Distinguish the related properties of heat, thermal energy, and temperature. 3. Define and distinguish specific heat and heat capacity and describe the physical implications of both. 4. Perform calculations involving heat, specific heat, and temperature change.” Also included in each topic are essential terms and equations. Each topic's summary is presented at the end of the chapter to wrap up student learning.
- For example, the material covers Lewis dot structures in Chapter 7, Chemical Bonding and Molecular Geometry, Section 7.3, Lewis Symbols and Structures. Students learn how to write

Lewis symbols and draw Lewis structures in order to understand how molecular compounds share electrons. In Section 7.6, Molecular Structures and Polarity, students learn how Lewis structures contribute to a molecule's shape and polarity.

## Materials are intentionally sequenced to scaffold learning in a way that allows for increasingly deeper conceptual understanding.

- Materials are intentionally sequenced to scaffold learning in a way to allow students a deeper understanding of each chapter and concept. The materials scaffold learning by presenting the most concrete material first and moving to increasingly complex and more conceptual content. For example, students obtain a general knowledge of what phase changes are in Section 10.3, followed by the application of phase change diagrams in Section 10.4. Another example is Section 3.1, Mole Concept. Students are introduced to the mole before using calculations with moles in Sections 3.3 and 3.4.
- For example, Chapter 12 exemplifies the progression from Explain to Use and finally to Derive. The first task in Section 12.3 asks students to “explain the form and function of a rate law.” In the next section, students must “use rate laws to calculate reaction rates.” The third section requires students to “use rate and concentration data to identify reaction orders and derive rate laws.”
- The materials contain “Links to Learning,” which provide opportunities for students to gain more profound knowledge as they proceed through the topic. For example, Section 3.1 provides a “Link to Learning” video that gives a visual perspective of the size of a mole. “Links to Learning” sections frequently contain an area called “Dig Deeper,” which provides students with additional links for research.
- The materials build upon themselves in a logical, sequential order. For example, in Section 7.3, Lewis Symbols and Structures, students learn how to write Lewis symbols. In the next section, they draw Lewis structures to understand how molecular compounds share electrons. Finally, in Section 7.6, Molecular Structures and Polarity, students learn how Lewis structures contribute to the shape and polarity of molecules.

## Materials clearly and accurately present course-specific core concepts and science and engineering practices.

- The lessons within each unit include the learning objectives and the core concepts taught within the lesson. The materials clearly and accurately present course-specific core concepts and engineering practices. For example, Section 4.3, “Reaction Stoichiometry,” includes a Chemistry in Everyday Life section that describes the development of airbags and the chemistry involved. Chapter 4, Stoichiometry and Chemical Equations, contains all the core chemical equation concepts, such as writing and balancing equations, classification of reactions, stoichiometry, types of reactions, reaction yields, and quantitative chemical analysis. Students are encouraged to conduct their own experiments with a calorimeter and 5 grams of copper.
- In Section 5.2, Calorimetry, students are introduced to calorimetry and asked to “Calculate and interpret heat and related properties using typical calorimetry data.” Students are then encouraged to write a procedure and perform an experiment if equipment is available. In Section 17.5, Batteries and Fuel Cells, students learn about batteries and can learn more about the science and engineering practices used in the development of new types of batteries with the Link to Learning feature. Section 8.2 clearly and accurately covers the concepts of atomic orbital hybridizations and hybrid orbitals associated with molecular geometries. The materials

include text, diagrams, comprehension checks, and practice problems. Students analyze scientific data and use calculations.

Mastery requirements of the materials are within the boundaries of the main concepts of the course.

- Each lesson begins with objectives for students, and the end of each lesson contains summary questions that pertain to the objectives. For example, Section 2.1, Early Ideas in Atomic Theory, states that students can demonstrate the law of multiple proportions using Dalton's atomic theory. A summary question at the end of the chapter requires students to demonstrate their knowledge of the postulates by applying them to a question over the laws of definite and multiple proportions.
- The materials are designed so that students can master the main concepts of a chemistry course. For example, students would gain mastery of Chapter 9, Gases, if they worked through all the calculations and exercises provided in the materials that pertain to Chapter 9.
- For example, Section 6.4, Electronic Structure of Atoms (Electron Configurations), begins with the objective, “Students will be able to predict the ground state configuration of electrons.” At the end of the section, students draw the orbital diagram and a long-hand configuration of multiple atoms in the ground state to show mastery of the objective.

## Indicator 3.2

Materials provide educative components to support teachers' content and knowledge coherence.

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|---|---|---|
| 1 | Materials support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices. | DNM |
| 2 | Materials contain explanations and examples of science concepts, including course-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS. | PM |
| 3 | Materials explain the intent and purpose of the instructional design of the program. | M |

## Partial Meets | Score 3/6

The materials partially meet the criteria for this indicator. Materials provide some educative components to support teachers' content and knowledge coherence.

Materials do not support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices. Materials contain multiple explanations and examples of science concepts but do not include grade-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS. Materials explain the intent and purpose of the instructional design of the program.

Evidence includes but is not limited to:

Materials support teachers in understanding the vertical alignment of course-appropriate prior knowledge and skills guiding the development of course-level content and scientific and engineering practices.

- Materials do not support teachers in understanding the vertical alignment of prior knowledge and skills, as no guidance is provided on background knowledge needed for each topic. For example, in Section 9.2, Ideal Gas Laws, students use algebraic equations to solve for an unknown variable. Students need prior knowledge of algebraic concepts to be able to solve a PV=nRT equation, but the materials do not provide teacher support for this prior knowledge requirement. Prior knowledge and skills are not explicitly stated throughout the materials to guide teachers. For example, Chapter 2, Atoms, Molecules, and Ions, includes an introduction, multiple sections, key terms, key equations, a summary, and exercises. However, the instructor resources do not include any vertical alignment, such as Middle School TEKS, or prior knowledge that students would need to build upon for this lesson.

Materials contain explanations and examples of science concepts, including course-level misconceptions to support the teacher's subject knowledge and recognition of barriers to student conceptual development as outlined in the TEKS.

- The materials contain multiple explanations of science concepts in each lesson. For example, Chapter 2, Atoms, Molecules, and Ions, includes charts and diagrams illustrating molecular mass to help students visualize the calculations. Chapter 8, Orbital Models, also uses text, diagrams, and pictorial representations to explain orbital models.

- However, the materials do not contain explanations of student misconceptions. For example, Section 7.1, Dipole Attractions, explains that ionic compounds do not form molecules and that "the formula does not represent the physical arrangement of its ions." While the materials do correctly instruct students, there is no warning to teachers of this common student misconception.
- In Section 4.1, Writing and Balancing Chemical Equations, students are instructed to complete the task. The materials correctly give all the steps needed to students, but they do not support teachers in addressing a common misconception, such as when to multiply or add. Section 4.2, Classifying Chemical Reactions, contains multiple explanations and examples of the different types of chemical reactions, including everyday examples of each type. However, this section is missing teacher support for some common student misconceptions, such as confusing single-replacement reactions with combustion reactions because of their similar structure. Similarly, Section 3.1, Formula Mass and the Mole Concept includes several exercises back to back without further explanation beyond the solution.
- In Section 21.6, Biological Effects of Radiation, the materials describe the short-term and long-term effects of radiation on the human body and describe the different types of radiation. But it does not address misconceptions that students may have about nuclear radiation

## Materials explain the intent and purpose of the instructional design of the program.

- The materials contain an introduction explaining the intent and purpose of the program's instructional design. Within the introduction, the "Coverage, Scope and Sequence, and Pacing Guide" highlights the main uses and intentionality of the course and orders topics from basic to more advanced content. A summary provides the reasoning of the scope and sequence and the purpose of content knowledge. The Introduction also describes how "Chemistry in Everyday Life," "How Science Interconnects," and "Portrait of a Chemist" sections are embedded throughout each lesson to give students a connection to learning in other areas of science, history, and their daily lives.
- A teacher's guide is found on the first page of the text, providing teachers with the course's coverage, scope, and pacing guide. The materials state, "Topics are introduced within the context of familiar experiences whenever possible, treated with an appropriate rigor to satisfy the learner's intellect, and reinforced in subsequent discussions of related content."

## Indicator 4.1

Materials provide opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

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|---|---|---|
| 1 | Materials consistently support students' meaningful sensemaking through reading, writing, thinking, and acting as scientists and engineers. | PM |
| 2 | Materials provide multiple opportunities for students to engage with course-level appropriate scientific texts to gather evidence and develop an understanding of concepts. | PM |
| 3 | Materials provide multiple opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts. | PM |
| 4 | Materials support students to act as scientists and engineers who can learn from engaging in phenomena and engineering design processes, make sense of concepts, and productively struggle. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials provide some opportunities for students to engage in productive struggle through sensemaking that involves reading, writing, thinking, and acting as scientists and engineers.

Materials support students' meaningful sensemaking through reading, writing, thinking, and acting as scientists but not as engineers. Materials provide multiple opportunities for students to engage with course-level appropriate scientific texts and develop an understanding of concepts but not to gather evidence. Materials provide some opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts. Materials support students to act as scientists who can learn from engaging in phenomena and make sense of concepts, but not as engineers or the engineering design process or productive struggle.

Evidence includes but is not limited to:

Materials consistently support students' meaningful sensemaking through reading, writing, thinking, and acting as scientists and engineers.

- The materials provide many opportunities for students to act like scientists, but few, if any, opportunities to act like engineers, which includes planning, asking further questions, revising, and presenting results. For example, Chapter 9.1, Gas Pressure, helps students make sense of what they are learning by connecting gas pressure to measuring blood pressure. But students do not perform any blood pressure measurements themselves, and they do not plan or revise an engineering design. In Section 2.1, Early Ideas in Atomic Theory, students think like scientists to answer questions presented in text, illustrations, charts, videos, and graphs throughout the chapter. Students also think like scientists when interacting with the PhET simulation "To Build an Atom." In another example, students read about chemical equilibria in Section 13.1, then use their knowledge to write reaction quotient expressions in Section 13.2.

- Although students are encouraged to perform experiments on their own, the materials do not list equipment needed or procedures, and there is no opportunity for students to hypothesize, design, revise, and present their conclusions using data. For example, in Chapter 14, students are introduced to the concept of acid-base titration. They read, think about, and perform calculations on the process, but students do not perform an actual titration or collect data. In Section 5.2, Heat Transfer, students are told, “If you have access to a calorimeter, write a procedure to perform a similar experiment using a 5 g piece of copper and calculate the final temperature. How many calorimeters are we going to build?” Students are not provided with sufficient support, such as safety information or equipment descriptions, to complete the experiment on their own.
- “Links to Learning” are embedded throughout the material but generally only provide students with more factual information and do not prompt them to plan, ask further questions, or revise their solutions.

Materials provide multiple opportunities for students to engage with course-level appropriate scientific texts to gather evidence and develop an understanding of concepts.

- Materials provide multiple opportunities for students to engage with grade-level appropriate texts to develop an understanding of concepts. However, they do not provide opportunities to gather evidence to develop an understanding of concepts. For example, when students are classifying types of reactions and predicting solubility in Chapter 4, they are not performing experiments or gathering data. In Chapter 5, students are able to read and think about calorimetry as well as answer questions and perform calculations as scientists would do. However, there is no opportunity to gather evidence on calorimetry by performing the experiment.
- The material encourages students to record their questions throughout the lessons and also includes side activities to engage them. For example, Chapter 14, Acid-Base Equilibria, primarily contains factual reading and example calculations for the students, along with some videos. The materials connect the reading to Environmental Science and provide links to additional information, but the materials do not prompt students to gather evidence to develop an understanding.
- The material gives students multiple examples of science concepts that extend to other branches of science besides chemistry. For example, Chapter 15.1, Precipitation and Dissociation, gives a great example of the dissociation of barium sulfate used in a medical screening test called “barium swallow” in the How Sciences Interconnect section. While informative, the example does not require the students to gather their own evidence.
- The materials provide minimal support to students to gather evidence. For example, in Chapter 10.6, Lattice Structures in Crystalline Solids, Link to Learning, students are introduced to Bragg's Law and why it is essential. The parameters on the simulator can be adjusted to get different results, and students are instructed to “Decide on a scenario you’d like to explore using the simulator, and walk through the variables to investigate that scenario.” Likewise, Chapter 9.5, Kinetic-Molecular Theory, Link to Learning, takes students to an external source that covers the effect of temperature on molecular speed. Students can adjust parameters and record outcomes, but there is no guidance for students to gather evidence and no 'check for understanding' questions or prompts to develop students’ understanding of the concept.

**Materials provide multiple opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts.**

- Materials do not provide multiple opportunities for students to engage in various written and graphic modes of communication to support students in developing and displaying an understanding of scientific concepts. For example, in Section 11.1, The Dissolution Process, students run a virtual lab that generates a graph as parameters are changed. There is no opportunity for students to generate their own graphs or to share and compare their responses.
- In Chapter 3, students learn about the composition of substances and how to calculate formula masses. Various charts are presented in the text to guide student understanding, but students do not create their own tables for practice or use their results in two-way communication. In a similar example, students do not generate their own graphs from data and or share or communicate their results in Chapter 9, Gas Laws. The "Exercises" section of Chapter 7, Chemical Bonding and Molecular Geometry, provides students with text boxes to type in their own responses to the questions, but these answers are not communicated.
- Throughout the materials, students are given multiple opportunities to write explanations, predictions, and comparisons, but there is very little opportunity for students to share or compare their thinking. For example, in Chapter 2, students explain why the symbol for the element oxygen differs from the formula for a molecule of oxygen but do not engage in any two-way communication. In Section 2.4, students are required to draw molecular structures, and in Section 13.3, Exercises, students must make written predictions of "what will happen if" concerning shifts in equilibria. But in neither of these sections are students sharing or comparing their thinking.

**Materials support students to act as scientists and engineers who can learn from engaging in phenomena and engineering design processes, make sense of concepts, and productively struggle.**

- Virtual labs, as presented in these materials, allow students to make sense of concepts but lack productive struggles, such as problems to solve or goals to reach. For example, the virtual lab in Section 11.3, Solubility, provides students with good visuals of saturated, unsaturated, and supersaturated solutions, and students can practice making different types of saturated salt solutions. However, it does not include any scientific or engineering processes for the students to work through. In another example, the materials include an excellent explanation of the harmful effects of radiation on biological systems at the end of Chapter 21, Nuclear Chemistry, including tying into phenomena that were taught in previous sections. But it is missing prompts or questions that would allow the students to struggle with their understanding of the vast concept productively.
- You can find many online simulations throughout the materials that allow students to control variables, change outcomes, and think like scientists. However, the materials do not include opportunities for students to plan, create, or revise like engineers. For example, Chapter 13, Link to Learning, includes a video demonstration of the effects of volume on gas pressure. In this online activity, students engage with phenomena, making sense of concepts, thinking critically, making observations, drawing conclusions to answer questions, and making predictions, just like scientists. But they are not planning, carrying out, revising, or presenting their results like engineers.
- In Chapter 5, Calorimetry, Link To Learning, students watch a video about bomb calorimeters and how to construct one, but students are not given an opportunity to design or build their

own calorimeters. In Chapter 11.5, Colloids, Chemistry in Everyday Life, students learn about the Deepwater Horizon Oil Spill disaster and some of the engineering solutions that were used, such as booms, skimmers, controlled burns, and chemical solubility. But students do not have an opportunity to engage in their own engineering design process to struggle and learn about solubility productively.

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## Indicator 5.1

Materials promote students' use of evidence to develop, communicate, and evaluate explanations and solutions.

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| 1 | Materials prompt students to use evidence to support their hypotheses and claims. | PM |
| 2 | Materials include embedded opportunities to develop and utilize scientific vocabulary in context. | M |
| 3 | Materials integrate argumentation and discourse throughout to support students' development of content knowledge and skills as appropriate for the concept and course. | PM |
| 4 | Materials provide opportunities for students to construct and present developmentally appropriate written and verbal arguments that justify explanations to phenomena and/or solutions to problems using evidence acquired from learning experiences. | PM |

### Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials sometimes promote students' use of evidence to develop, communicate, and evaluate explanations and solutions.

Materials sometimes prompt students to use evidence to support their hypotheses and claims. Materials include embedded opportunities to develop and utilize scientific vocabulary in context. Materials integrate discourse but not argumentation throughout to support students' development of content knowledge and skills as appropriate for the concept and course. Materials provide opportunities for students to construct and present developmentally appropriate written but not verbal arguments that justify explanations of phenomena and/or solutions to problems using evidence acquired from learning experiences.

Evidence includes but is not limited to:

**Materials prompt students to use evidence to support their hypotheses and claims.**

- Materials prompt students to use some evidence to support their hypotheses and claims. For example, in Section 2.1, Early Ideas of Atomic Theory, Exercises, students are asked a critical thinking question about Dalton's postulates. They use evidence read from the text to make their claim. Another instance where students create a hypothesis and support it with evidence is in Section 12.2, Question 2: "Explain why an egg cooks more slowly in boiling water in Denver than in New York City."
- For example, in Chapter 1, Exercises, questions include calculations and definition-related questions only. They provide minimal opportunities for students to gather evidence or formulate hypotheses. Most end-of-chapter practice exercises consist of questions without any example data for students to use as evidence. Finally, in Section 13.1, Question 5 does require students to use evidence to answer the question but does not allow them to create a hypothesis or claim.

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## Materials include embedded opportunities to develop and utilize scientific vocabulary in context.

- The materials contain multiple embedded opportunities for students to develop and use scientific vocabulary. Content vocabulary words are in bold print throughout the materials, and students are frequently asked to define scientific terms and compare and contrast them. For example, in Section 5.1, Exercises, the material asks students to identify the difference between using a match and a bonfire to stay warm, prompting students to use scientific vocabulary such as “heat capacity” to answer the question. In Chapter 3, Elements of Chemistry, students must use key terms repeatedly as they work through the problems.
- Further examples include Section 6.1, Electromagnetic Energy, in which the words “electromagnetic spectrum” and “wave” appear in bold print to draw attention. Students must understand and use these vocabulary words to answer questions later in the section. Chapter 10.1, Intermolecular Forces, practice exercise provides another example of embedded opportunities. Students are prompted to define and provide examples of key terms such as “dispersion force,” “dipole-dipole attraction,” and “hydrogen bond.” Similarly, Chapter 6.2, The Bohr Model, prompts students to explain how energy levels can be quantized.
- The materials contain opportunities for students to use scientific vocabulary in a written response. For example, in the exercises of 5.1, Energy Basics, the material asks students to identify the difference between using a match and a bonfire to stay warm at the same temperature. This prompts students to describe the scenario using scientific vocabulary, such as heat capacity.

## Materials integrate argumentation and discourse throughout to support students’ development of content knowledge and skills as appropriate for the concept and course.

- Materials have limited opportunities to integrate argumentation discourse to support students' development of content, knowledge, and skills. For example, in Chapter 14, students work through various types of acid-base problems and use discourse but not argumentation. Integration of argumentation and discourse is only found within Emergent Bilingual (EB) sections within the materials.
- The materials frequently prompt students to discuss concepts with each other. For example, students are encouraged to work in pairs or groups to discuss diagrams in Section 9.2, The Ideal Gas Law. In Chapter 4.3, Reaction Stoichiometry, EB students are asked to participate in a gallery walk to present their work to their peers. Another broad example of discourse occurs in the EB guidance given for all the End of Chapter Exercises. Teachers are guided to “assign partners, and ask partners to take turns reading the questions aloud and discuss the answer to the question. Partners should then take turns writing the agreed upon response.” These examples illustrate how the materials support the discourse portion of the guidance bullet.
- However, the materials do not require students to take an argumentative stance and discuss with a peer of opposing opinion. For example, in Section 7.2, Covalent Bonding, the material asks students to explain why NaCl is not a molecule. The question already gives students the outcome and simply asks them to differentiate between solids, liquids, and gasses. Another example occurs in Chapter 14, where students work through various acid-base problems and are asked to write equations to support their decision as to whether NH3 is a conjugate acid, a conjugate base, or both. In Section 1.3, Physical and Chemical Properties, EB students are prompted to discuss their findings in the chapter with one another. While they have the opportunity for discourse, they are not arguing a stance on a scientific concept.

**Materials provide opportunities for students to construct and present developmentally appropriate written and verbal arguments that justify explanations to phenomena and/or solutions to problems using evidence acquired from learning experiences.**

- The materials contain few opportunities for students to verbalize arguments. For example, students work on multiple problems in Chapter 4, Stoichiometry, and provide written explanations in Chapter 3, Composition, but do not have an opportunity to verbalize arguments in either chapter. It should be noted that there was evidence for this guidance bullet regarding EB (formerly ELL) students. For example, Chapter 13.1, Chemical Equilibria Exercises, prompts EB students to engage in argumentation with a partner, but this direction does not include non-EB students.
- Students are given the opportunity to construct responses using evidence but few opportunities to present them. For example, Section 10.5, The Solid State of Matter, asks students to explain differences in melting points using evidence partially, but it does not prompt students to present their arguments. Also, Section 4.2, Exercises, ask students to identify physical vs. chemical changes using evidence provided in the material. However, students are not required to put their evidence in their answers, and there is no opportunity to present their results. In Section 13.1, Chemical Equilibria, students must construct and present an argument to justify their explanation of what it means for a reaction to be reversible. However, the materials do not contain opportunities for students to argue their points.

# Indicator 5.2

Materials provide teacher guidance to support student reasoning and communication skills.

| | | |
|---|---|---|
| 1 | Materials provide teacher guidance on anticipating student responses and the use of questioning to deepen student thinking. | PM |
| 2 | Materials include teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context. | PM |
| 3 | Materials provide teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims. | PM |
| 4 | Materials support and guide teachers in facilitating the sharing of students' thinking and finding solutions. | PM |

## Partial Meets | Score 2/4

The materials partially meet the criteria for this indicator. Materials provide some teacher guidance to support student reasoning and communication skills.

Materials provide some teacher guidance on anticipating student responses and the use of questioning to deepen student thinking. Materials include some teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context. Materials provide some teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims. Materials provide some support and guidance to teachers in facilitating the sharing of students' thinking and finding solutions.

Evidence includes but is not limited to:

Materials provide teacher guidance on anticipating student responses and the use of questioning to deepen student thinking.

- All the lessons in the materials include prompts encouraging students to answer questions. Questions are embedded within each chapter and posted with answers at the end of each chapter for review. Most sections also include a check for understanding. One example is Chapter 2.6, Ionic and Molecular Compounds, which includes example exercises, sample problems with solutions, and a check for understanding.
- However, the material does not provide teacher guidance for anticipated student responses. For example, Chapter 10.4, Phase Diagrams, provides exemplars for teachers but no guidance on anticipating different student responses. In another example, Section 7.6, Molecular Structure and Polarity, provides teachers with multiple questions to implement in the lesson but provides no teacher guidance on anticipating common student misconceptions.
- The materials include teacher guidance for the use of questioning to deepen thinking for Emergent Bilingual (EB) students, but not for all students. For example, Section 1.5 begins with "ELL recommendations" that include open-ended questioning, restating questions, allowing students processing time, and opportunities to self-correct. But the section is missing teacher guidance on how the previously mentioned strategies to deepen student thinking could be incorporated into the lesson for all students. In another example of the materials using questioning to deepen thinking for EB students only, Section 2.3 suggests that teachers rephrase and/or model responses when EB students respond to lesson questions with "brief or one-word

responses." But there is no guidance for anticipating incorrect responses from misconceptions or how to use questions to deepen understanding with non-EB students who answer questions with very brief answers.

## Materials include teacher guidance on how to scaffold and support students' development and use of scientific vocabulary in context.

- Materials sometimes include teacher guidance on scaffolding and supporting students' development and use of scientific vocabulary. The teacher guidance is included for the EB students but not the remainder of the students. For example, chapter review questions are provided with answers, but the materials do not provide teacher guidance on how to use them to support vocabulary development. Additionally, questions embedded within the chapters do not include guidance on how to use them to scaffold or support students as they develop the use of scientific vocabulary. Finally, while Section 7.6, Molecular Structure and Polarity, includes a small text between two practice sessions to prepare students for an increase in rigor, it provides little support for developing or using scientific vocabulary.
- The materials meet this Guidance Bullet for EB students. For example, Section 1.1 includes directions for EB students to create and use flashcards to learn new vocabulary. For example, in Section 1.2, the materials suggest that teachers allow EB students to interact with other students to help them use and develop their scientific vocabulary. Other examples include Section 1.3, which includes the statement, "After introducing new concepts that include complex academic vocabulary, allow language learners an opportunity to seek clarification," and Section 3.3, Molarity, which provides guidance for EB students to learn common roots of scientific words to assist with decoding new vocabulary. Last, in Chapter 10, Key Terms, the materials provide guidance for EB students to participate in small-group role-playing for beginner, intermediate, or advanced levels.

## Materials provide teacher guidance on preparing for student discourse and supporting students in using evidence to construct written and verbal claims.

- The materials include only a few instances of teacher guidance for "supporting students in using evidence to construct written and verbal claims." That limited support is mainly for EB students only. For example, Chapter 1, Essential Ideas, prompts EBs to construct a KWL chart to track their learning and all students to construct a list of questions and thoughts as they proceed through the chapter. But, the materials do not provide teacher guidance for using evidence to support claims. In another example that partially meets this guidance bullet, Section 4.2 prompts EB students to use evidence to relate something they have learned in class to their day-to-day life or a personal experience and then present it to a small audience.
- The materials provide teacher guidance to prepare EB students for discourse but do not provide lesson-specific guidance for non-EB students. For example, teachers are advised to let EB students use a graphic aid to assist them with discourse at the beginning of Section 1.3, Physical and Chemical Properties. It says, "After listening to a lecture or discussion about a section of the text, ELL students work in small groups to retell each other one thing that each has learned. Students may select a photograph or picture to facilitate their retelling." The materials guide EB students to get into discussion groups in Chapter 8.1, Valence Bond Theory, and prompt teachers to use guiding questions and work with EBs one-on-one in Section 9.3, Stoichiometry. At the beginning of Section 21.4, Transmutation and Nuclear Energy, teachers are advised to "provide ELL students with sentence stems to help them communicate their thoughts, opinions,

and ideas." But the material lacks guidance for the teacher on how to prepare native speakers in the classroom for discourse.

## Materials support and guide teachers in facilitating the sharing of students' thinking and finding solutions.

- The beginning of Section 1.2 provides guidance for teachers to facilitate sharing student thinking for EB students by creating small groups that mix language learners and native speakers. Also, in Section 1.2, Phases and Classification of Matter, the material encourages EB students to listen and speak during a Chemistry in Everyday Life discussion. EB student support is also included in Section 9.2, The Ideal Gas Law, which includes a teacher prompt to help EB students communicate their ideas using graphic aids. Unfortunately, similar resources for all students could not be found in the sections.
- The materials provide many worked-out example problems, but students are not encouraged to share their solutions with the class, and little teacher guidance is provided to facilitate students' finding solutions. The EB support section states, "When students get to the End-of-Chapter Exercises, point out that there is a structure to each type of question (multiple choice vs. open-ended) and that the answer to the first type will be found in the text. Have them read the questions carefully, underlining keywords. Then, they should search for those words in the text, using section headings, bolded vocabulary, and graphics to guide their search." But resources for all students could not be found in the materials.

# Kiddom OpenStax Chemistry

## Indicator 6.1

Materials include a variety of TEKS-aligned and developmentally appropriate assessment tools.

| | | |
|---|---|---|
| 1 | Materials include a range of diagnostic, formative, and summative assessments to assess student learning in a variety of formats. | M |
| 2 | Materials assess all student expectations over the breadth of the course and indicate which student expectations are being assessed in each assessment. | PM |
| 3 | Materials include assessments that integrate scientific concepts and science and engineering practices. | PM |
| 4 | Materials include assessments that require students to apply knowledge and skills to novel contexts. | M |

### Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some developmentally appropriate assessment tools that are not TEKS-aligned.

Materials include a range of diagnostic, formative, and summative assessments to assess student learning in various formats. Materials assess all student expectations over the breadth of the course and do not indicate which student expectations (TEKS) are being assessed in each assessment. Materials include assessments that integrate scientific concepts and science practices but not engineering practices. Materials include assessments that require students to apply knowledge and skills to novel contexts.

Evidence includes but is not limited to:

Materials include a range of diagnostic, formative, and summative assessments to assess student learning in a variety of formats.

- Materials include diagnostic assessments for providing teachers with information to monitor progress and identify learning gains in a variety of formats.
- The Exercises at the end of each chapter provide a formal assessment. Each chapter contains embedded exercises of various formats that the teacher may use as a formative or summative assessment. For example, the second chapter contains a variety of questions, including short answers, written responses, fill-in-the-blank, and multiple choice.
- Teachers can use the Check Your Learning sections of each chapter either formally or informally as a diagnostic tool. For example, Chapter 12.4, Integrated Rate Laws, includes the following "Check Your Learning" question: "Iodine-131 is a radioactive isotope that is used to diagnose and treat some forms of thyroid cancer. Iodine-131 decays to xenon-131 according to the equation: I-131⟶Xe-131+electron. The decay is first-order with a rate constant of 0.138 d−1. How many days will it take for 90% of the iodine−131 in a 0.500 M solution of this substance to decay to Xe-131?"
- Materials include formative assessments in a variety of formats to measure student learning and determine the next steps for instruction. Examples include:
    - In Chapter 10.1, Intermolecular Forces, students read about bonding and boiling points. Then Example 10.1 asks students to order compounds from highest to lowest boiling

point, followed by Example 10.2, which asks students to predict which compound will have a higher boiling point.
    - Each chapter includes "Exercises" sections that contain questions in many formats, such as compare and contrast, explain, interact with a simulation, or evaluate.
    - Chapter 1.6, Mathematical Treatment of Measurement Results, includes five example problems to assess student learning formally. Each example problem is fully worked out and is followed by a similar problem for the student to work independently.
    - In Chapter 1.1, Chemistry in Context, seven end-of-chapter exercises provide students with a formative assessment of their learning.
- Materials include opportunities for teachers to collect information about what students are learning from the materials and use it to plan future lessons. For example, Section 5.2, Calorimetry, contains five different "Check Your Learning" questions for students to demonstrate mastery. The questions range from conceptual explanations to calculations.
- Materials include summative assessments in a variety of formats. For example, the Exercises section of Section 10.3, Phase Transitions, contains 24 summative questions for teachers to choose from. The questions include written conceptual, multiple choice, and math calculation problems.
- Materials include a variety of informal assessments that give teachers feedback on student learning at the moment so that they can modify instructional approaches. Chapters include "Examples" that walk students through problems by posing a question, demonstrating all the steps of the solution, and then asking students to practice the skill with a "Check Your Learning" component. Not only is this useful for teacher feedback, but this also allows students to monitor their own learning throughout the chapter.
- The "Exercises" questions at the end of each section can be used as exit tickets for the lesson. For example, Chapter 2.1, Early Ideas in Atomic History, includes the questions, "Identify the postulate of Dalton's theory that is violated by the following observations: 59.95% of one sample of titanium dioxide is titanium; 60.10% of a different sample of titanium dioxide is titanium" and "In the following drawing, the green spheres represent atoms of a certain element. The purple spheres represent atoms of another element. If the spheres of different elements touch, they are part of a single unit of a compound. The following chemical change represented by these spheres may violate one of the ideas of Dalton's atomic theory. Which one?"

### Materials assess all student expectations over the breadth of the course and indicate which student expectations are being assessed in each assessment.

- The materials partially meet the criteria for this guidance bullet. The materials contain a scope and sequence by topic, not aligned to the TEKS, outlining what will be taught in the course. The materials are organized and aligned by topic but not with the TEKS. The materials include lesson plans that outline how the materials can be used to teach specific concepts and skills and address specific students' expectations and guidance on how to assess student learning.
    - The materials outline student objectives for each chapter and include formative assessment tools embedded in the chapters pertaining to the objectives. For example, Section 3.4, Other Units for Solution Concentrations, states that students will be able to "Perform computations relating a solution's concentration and its components' volumes and/or masses using these units." The section contains several different types of solution calculation problems for students to demonstrate their mastery of this objective.

  - The Introduction to each chapter provides an outline, and each section starts with clearly stated objectives. For example, in Section 2.1, Atomic Theory, the Learning Objectives are: “State the postulates of Dalton’s atomic theory” and “Use postulates of Dalton’s atomic theory to explain the laws of definite and multiple proportions.” Exercises 2.1, located at the end of the chapter, contains questions to assess those specific student expectations.
- The materials include assessments that are designed to measure student understanding and mastery of the concepts and skills taught for each topic individually. However, the assessments are not TEKS-aligned, and the materials do not include a list of the TEKS that are assessed.
  - The Exercises at the end of Chapter 2 contain questions that assess student expectations (not TEKS-aligned). The materials include teacher notes that guide teachers in evaluating student responses to assess whether expectations were met.
  - Section 7.3, Lewis Symbols and Structures, contains the objective that students will be able to “Draw Lewis structures depicting the bonding in simple molecules.” In the “Exercises” of this section, the material gives students multiple opportunities to draw covalent Lewis structures.
- The materials indicate which student expectations are assessed by topic, not by TEKS.
- The assessments are given individually for each chapter section by topic. Each topic begins with two to three learning objectives that match the assessment questions at the end of the topic. These learning objectives are not aligned with the TEKS. The assessments are clearly delineated by topic, but the topics do not match the TEKS.
- For example, Chapter 7, Chemical Bonding and Molecular Geometry, includes the topics: 7.1 Ionic Bonding, 7.2 Covalent Bonding, 7.3 Lewis Symbols and Structures, 7.4 Formal Charges and Resonance, 7.5 Strengths of Ionic and Covalent Bonds, and 7.6 Molecular Structure and Polarity. These topics roughly correlate to TEKS 7D: “analyze the properties of ionic, covalent, and metallic substances in terms of intramolecular and intermolecular forces,” 6E: “construct models to express the arrangement of electrons in atoms of representative elements using electron configurations and Lewis dot structures,” 11A: “describe the unique role of water in solutions in terms of polarity,” and 5C: “analyze and interpret elemental data, including atomic radius, atomic mass, electronegativity, ionization energy, and reactivity to identify periodic trends” (just electronegativity is addressed here).
- However, the following Learning Objectives from Chapter 7 are not included in the TEKS at all: 7.4: “Compute formal charges for atoms in any Lewis structure,” “Use formal charges to identify the most reasonable Lewis structure for a given molecule,” “Explain the concept of resonance and draw Lewis structures representing resonance forms for a given molecule” and 7.5, “Describe the energetics of covalent and ionic bond formation and breakage,” “Use the Born-Haber cycle to compute lattice energies for ionic compounds,” and “Use average covalent bond energies to estimate enthalpies of reaction.”
- The materials provide the answer keys for every assessment but do not include an assessment table that lists all assessments for the unit and the specific student expectations assessed by each.

## Materials include assessments that integrate scientific concepts and science and engineering practices.

- The materials include assessments requiring students to integrate scientific knowledge and science practices, but not engineering practices, appropriate to the student's assessment expectation. For example, in the “Using Displacement of Water to Determine Density” activity found in Section 1.4, Measurements, students use a simulation to observe water displacement and calculate density. This formative assessment gives students a great visual and example for calculating density. The materials include instructions for students to “Write a procedure to measure the volume of a piece of wood and a piece of iron via the displacement of water. Be sure to include your general prediction. Use the simulator to determine the densities of each. You may need to alter your sizes to meet the requirements of the simulator.” The directions for this simulation are limited to a basic science experiment and do not provide opportunities for students to apply engineering practices.

- SIn Chapter 5.2, Calorimetry, the end-of-chapter exercises #3–4 require students to complete the exercises by referring to a hot/cold pack example. This practice is appropriate as an assessment of scientific practices but not engineering. Students would be assessed on their own engineering designs of a hot/cold pack to meet these criteria.
- In Chapter 10.1, Intermolecular Forces, end-of-chapter exercises, students complete a PhET States of Matter simulation and answer questions based on their observations during the simulation. This practice is appropriate as an assessment of scientific practices but not engineering. While students are directed to the Internet to research Newtonian fluids, engineering practices such as designing a solution, testing the design, revision, and presenting results are not included in the exercise.
- Section 11.4, Colligative Properties, contains multiple formative assessment questions for students to demonstrate their ability to calculate molarity, freezing point depression, boiling point elevation, and other properties of solutions. While these questions cover the objectives of the lesson, the lesson does not contain any activities or questions to integrate science and engineering practices for students.
- Exercise 17.5, Batteries and Fuel Cells, integrates scientific concepts in answering the questions. Part A asks students to compare a copper electrode to a lead electrode, and Part C requires knowledge of contextual information. However, there is no opportunity for students to design or construct a model or experiment or to clarify, collaborate, or revise.

## Materials include assessments that require students to apply knowledge and skills to novel contexts.

- The materials include assessments that require students to apply knowledge and skills to a new phenomenon or problem. For example, the “Links to Learning” in Section 2.4, Chemical Formulas, provides an online simulation called “Molecule Building.” In this simulation, students build a collection of molecules using buckets of atoms as resources. Atoms are shown to scale. This activity allows students to visualize the difference between coefficients and subscripts in molecular formulas.
- The material presents assessment questions as a part of a relatable or exciting scenario for the students. For example, the Exercises questions for Section 6.1, Electromagnetic Energy, relate to topics such as reptiles, radio stations, and lasers.
- Section 9.2, The Ideal Gas Law, includes a virtual simulation to assess students’ understanding of the relationships between pressure, volume, temperature, and amount of gas. Students can see representations of individual gas molecules bumping into each other and can manipulate the temperature and size of the container.
- In Section 15.1, Precipitation and Dissolution, students complete a sample exercise involving blood plasma, and Exercise 17.6, Corrosion, asks, “Which of these metals could be used as a sacrificial anode in the cathodic protection of an underground steel storage tank?”
- Section 19.2, Coordination Chemistry of Transition Metals, requires students to apply knowledge and skills in the novel situation of using chelation therapy in alternative medicine.

## Indicator 6.2

Materials include guidance that explains how to analyze and respond to data from assessment tools.

| | | |
|---|---|---|
| 1 | Materials include information and/or resources that provide guidance for evaluating student responses. | M |
| 2 | Materials support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science, based on measures of student progress appropriate for the developmental level. | DNM |
| 3 | Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension. | M |
| 4 | Materials provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data. | DNM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some guidance explaining how to analyze and respond to data from assessment tools.

Materials include information and/or resources that provide guidance for evaluating student responses. Materials do not support teachers' analysis of assessment data. No guidance and direction are provided to respond to individual student's needs, in all areas of science, based on measures of student progress appropriate for the developmental level. Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension. Materials do not provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data.

Evidence includes but is not limited to:

**Materials include information and/or resources that provide guidance for evaluating student responses.**

- Materials include information and/or resources that provide guidance for evaluating student responses. "Check Your Learning" exercises that provide answers and explanations are included in every section of every chapter.
- Additionally, the materials contain an answer key with each exercise so teachers can evaluate student responses. For example, in Section 1.6, Mathematical Treatment of Measurement Results, Exercises, teachers are provided with written-out answers to view when grading student responses.
- Section 2.2, Atomic Theory, contains problems with solutions for the Laws of Definite and Multiple Proportions. Both Section 3.1, Formula Mass and the Mole Concept, and Chapter 5, Thermochemistry, end-of-chapter exercises contain end-of-chapter exercises that include exemplars for teachers to use to aid in grading.
- Section 7.2 provides a detailed explanation of "Electronegativity and Pond Polarity exercises." These explanations provide guidance to teachers as students work through the sections.
- "Notes for Evaluating Responses" are included after each question in the Exercises sections. For example, in Section 12.1, Question 1 asks, "Why are elementary reactions involving three or more reactants very uncommon?" The following text box provides an evaluation note stating, "Although some intermolecular reactions are known, it is very rare for three or more molecules

to come together at exactly the same instant and with the proper orientation required for a reaction to occur."

- The materials guide teachers on how students should respond to questions, provide specific examples of the expected responses, and the amount of credit students should receive per question. For example, for Question 1 in the "Exercises" section of Section 20.1, Hydrocarbons, the materials inform teachers that the question is a written response worth up to four points and provide teachers "a note for evaluating responses."

Materials support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science, based on measures of student progress appropriate for the developmental level.

- The materials do not support teachers' analysis of assessment data with guidance and direction to respond to individual students' needs, in all areas of science based on measures of student progress appropriate for the developmental level. There is guidance for students individually as they work through the material, but not for teachers. There is no guidance provided to help teachers track student learning as they progress through the material.
- While the material does include answer keys to help collect student data, it does not suggest where to go after collecting data. For example, Section 1.5, Measurement Uncertainty, Accuracy, and Precision, includes answer keys to check students' answers to the practice questions. Still, it does not include any suggested extension activities or practices for teachers to implement if students are struggling with that question or topic.
- Guidance for assessments is limited to an initial assessment and does not indicate what direction to take based on student data. For example, Section 3.3, Molarity, contains a formative assessment question for each section to check student understanding of the calculations. Teachers are instructed to form small groups that include both struggling students and more advanced students "so that they may work together to solve them" and "discuss their answers and their approach within their groups to help all students." The materials do not contain additional guidance or questions for teachers to use to respond to students who may struggle with those calculations.

Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension.

- Assessment tools yield relevant information for teachers to use when planning instruction, intervention, and extension. For example, the virtual water displacement activity in Section 1.4, Measurements, provides teachers with useful information on students' current understanding of water displacement and density. Teachers can use students' responses to plan for upcoming lessons involving measurements.
- Teachers can check student performance on various formative assessments provided throughout the units, which would help plan student needs. For example, the teacher can check student performance on concentration calculations and monitor students' needs on formula manipulation, math, or calculator skills in Section 3.3, Molarity.
- There are five activities in Chapter 4, Stoichiometry of Chemical Reactions, that can provide the teacher with information on student progress for this topic.
- Chapter 11, Solutions and Colloids, includes formative assessments within each section, followed by a formative assessment in an Exercise section for each topic covered. This provides the teacher with helpful information for planning instruction, intervention, and extension.

- The materials provide assessment tools to help the teacher determine when students may be struggling with the math of a topic. For example, Section 17.7, Electrolysis, contains multiple stoichiometric calculation questions with a “check your learning” box for students to input answers and for teachers to collect data.

## Materials provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data.

- The materials do not provide a variety of resources and teacher guidance on how to leverage different activities to respond to student data. The materials include many activities but do not provide teacher guidance on how to use the activities. Students are provided answers and explanations as they work, but those explanations are not to guide teachers. Materials do not provide a comprehensive section that provides teachers with student data as students progress through each unit. Examples include:
    - In Section 3.1, the materials ask students to perform calculations to find the mass of a compound or the mass of an element within a compound. The materials do not guide teachers on what to do with students who need more assistance or perform poorly on the assessment.
    - Section 5.3, Exercises, asks students to calculate enthalpy. The materials do not provide the teacher with additional directions or extension activities for students who struggle with the calculations.

## Indicator 6.3

Assessments are clear and easy to understand.

| | | |
|---|---|---|
| 1 | Assessments contain items that are scientifically accurate, avoid bias, and are free from errors. | M |
| 2 | Assessment tools use clear pictures and graphics that are developmentally appropriate. | M |
| 3 | Materials provide guidance to ensure consistent and accurate administration of assessment tools. | PM |
| 4 | Materials include guidance to offer accommodations for assessment tools that allow students to demonstrate mastery of knowledge and skills aligned to learning goals. | PM |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Assessments are clear and easy to understand, and some teacher guidance is provided.

Assessments contain items that are scientifically accurate, avoid bias, and are free from errors. Assessment tools use clear pictures and graphics that are developmentally appropriate. Materials provide some guidance to ensure consistent and accurate administration of assessment tools. Materials include some guidance to offer accommodations for assessment tools for some student groups that allow students to demonstrate mastery of knowledge and skills aligned with learning goals.

Evidence includes but is not limited to:

Assessments contain items that are scientifically accurate, avoid bias, and are free from errors.

- Assessments contain items that are scientifically accurate, unbiased, and free from errors. For example, Section 1.3, Physical and Chemical Changes, asks students to classify six properties as physical or chemical. The questions are unbiased, and the answers are correct and scientifically accurate. Question 7 in the same section asks students to classify properties as intensive or extensive. Students drag and drop items, and both questions and answers are scientifically accurate, unbiased, and correct.
- Additionally, Section 3.1, Formula Mass and the Mole Concept Exercises, contains multiple formula mass problems. Each problem includes a worked-out solution. The solutions are accurate and use the correct molecular weight in atomic mass units for each element.
- The Section 5.1 Energy Basics discussion activity has no bias towards any one solar energy plant. The Solana Generating Station in Arizona's Sonora Desert and the Ivanpah Solar Generating System in California's Mojave Desert were both used as examples of large solar thermal power plants.
- The Section 9.3 discussion activity, "How Sciences Interconnect: Greenhouse Gases and Climate Change," had no bias present. The greenhouse effect was introduced, major greenhouse gasses were listed, and the human effects of $CO_2$ production were discussed. The "Link to Learning" provided more information via a video link, and the "Portrait of a Chemist" introduced Susan Soloman with her credentials. A second video provided more information about her research. All of this information presented scientific discoveries and ongoing research on climate change without bias.

- Section 21.4, Transmutation and Nuclear Energy Exercises, contains multiple questions regarding nuclear energy. The materials remain unbiased and do not take a stance on whether nuclear energy is good or bad.

## Assessment tools use clear pictures and graphics that are developmentally appropriate.

- The materials meet the criteria for this guidance bullet. For example, in Section 2.1, Early Ideas in Atomic Theory, students are asked to view a drawing that includes starting materials and products and then compare the drawing to Dalton's Atomic Theory. The picture is clear and developmentally appropriate.
- In Section 7.2, Covalent Bonding, Example 7.3, students are asked to use electronegativity values to arrange covalent bonds in order of increasing polarity. Students use embedded charts that are clear and appropriate to arrange the bonds.
- Section 11.2, Electrolytes, includes a graphic representation of a strong, weak, and non-electrolyte solution. The graphic is well-organized and appropriate to assist students in understanding the differences between the three types of solutions.
- In Section 11.4, Colligative Properties, example exercises include flowchart images with step-by-step guidelines to help students through the calculation process.
- In Section 12.4, Integrated Rate Laws, example exercises contain example graphs to aid students through a graphing prompt. The graphs are clear and appropriate.
- Section 20.1, Hydrocarbons, contains “Check Your Learning” formative assessment questions. The questions contain clear and easy-to-depict graphics of each molecule’s skeletal structure.

## Materials provide guidance to ensure consistent and accurate administration of assessment tools.

- Materials do not provide clear guidance for teachers to consistently and accurately administer assessment tools.
    - Each chapter of the materials includes three to five sections that provide an assessment for each section. The materials do not provide end-of-chapter or end-of-unit assessments. The assessments for each section are called “Exercises” and can be assigned to students as summative assessments for that section of the chapter. Each question in the Exercises section includes a suggested point value, the correct answer, and a complete explanation of the answer.
    - The only guidance provided for these assessments was found in the Introduction: “This [the exercises at the end of each chapter] allows teachers to monitor student progress within each section of the chapter.” Teachers are not given guidance on how to ensure that the administration of an assessment is consistent and standardized across examiners.
    - Materials lack clear guidance for teachers to efficiently administer the assessment, such as reminders or tips that give suggestions for the time allotted to complete the assessment or recommendations for breaking parts of an extended assessment across days or class periods.
    - The materials do not include a Teacher Guide that lists the types of informal assessment tools included in the curriculum and how to use them effectively.
- The materials include some detailed information that supports the teacher’s understanding of assessment tools and their scoring procedures.
    - For example, Question 1 in Section 7.1, Exercises, asks, “Does a cation gain protons to form a positive charge, or does it lose electrons?” The note for evaluating responses

provides clear teacher guidance: "The protons in the nucleus do not change during normal chemical reactions. Only the outer electrons move. Positive charges form when electrons are lost."
  - Question 5 in Section 11.2, "Exercises," asks, "What is the expected electrical conductivity of the following solution?" The materials designate a four-point value for this question and include the following teacher guidance in the form of a note to the teacher: "High conductivity (solute is an ionic compound that will dissociate when dissolved)."
  - Section 16.1, Spontaneity, contains multiple "Check Your Learning" questions for students. These questions contain an answer key and explanation for the teacher to implement the material accurately.
  - Each assessment question provides a suggested point value, as seen in Section 18.1, Periodicity, which contains score points for the teacher to see how much each question is worth.

## Materials include guidance to offer accommodations for assessment tools that allow students to demonstrate mastery of knowledge and skills aligned to learning goals.

- The materials include some guidance and accommodations for Emergent Bilingual (EBs) students (called English Language Learners in the materials) but do not provide guidance for accommodations for Special Education students or other students with individual education plans (IEPs). Examples include:
  - Section 1.2 offers support for EB students. The section states, "Create small groups that mix language learners and native speakers. Have them work together to discuss the Chemistry in Everyday Life sections. Beginning language learners may choose to listen if they do not feel confident contributing to discussion. Invite language learners to ask peers and/or teacher for clarification if they are unsure about a word, phrase, or concept in a question or oral response." This guidance would not apply to an ADHD student with accommodations, for example.
  - Section 4.2, Classifying Chemical Reactions, suggests, "Periodically assign simple extended speaking assignments to language learners, asking them to relate something they have learned to their day-to-day life or a personal experience. Give students a list of topics to choose from based on the current chapter being studied. Have language learners present to a small audience consisting of either their fellow ELL classmates or a group of classmates that includes native speakers." This guidance does not apply to other student populations with accommodations, such as Autism Spectrum Disorder or low IQ students.Section 12.7, Catalysis, contains an ELL Support section at the top of the page. The section outlines the accommodations for teachers to implement for EB students throughout the lesson. However, the lesson does not contain accommodations for teachers to implement for other student populations that may need accommodations, other than suggesting, "Online resources can provide suggestions of accommodations for other student populations."
- The materials include a Classroom Planner and Reports feature that teachers can use to determine assignment status, grade averages, grade distribution, and student completion data. The feature also identifies students who exceed, approach, or master the content for specific assignments. The teacher can use this data to identify struggling students and those who have mastered the material. However, assessments do not accommodate students with various types of IEPs.

# Kiddom OpenStax Chemistry

## Indicator 7.1

Materials include guidance, scaffolds, supports, and extensions that maximize student learning potential.

| | | |
|---|---|---|
| 1 | Materials provide recommended targeted instruction and activities to scaffold learning for students who have not yet achieved mastery. | PM |
| 2 | Materials provide enrichment activities for all levels of learners. | M |
| 3 | Materials provide scaffolds and guidance for just-in-time learning acceleration for all students. | M |

### Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include guidance, scaffolds, supports, and extensions that maximize student learning potential but do not include targeted instruction for students who have not yet achieved mastery.

Materials scaffold learning for all students but do not provide targeted instruction and activities to students who have not yet achieved mastery. Materials provide enrichment activities for all levels of learners. Materials provide scaffolds and guidance for just-in-time learning acceleration for all students.

Evidence includes but is not limited to:

Materials provide recommended targeted instruction and activities to scaffold learning for students who have not yet achieved mastery.

- The materials are well scaffolded, but students who have not yet achieved mastery have very little support for targeted instruction or activities.
  - For example, students cover energy basics in Section 5.1 before applying what they learned in Section 5.2, Calorimetry, and Section 5.3, Enthalpy. The Calorimetry and Enthalpy sections do not include any recommended or targeted activities for students who did not master Energy Basics other than instructions to "go back and review the previous Section."
  - Section 1.4, Measurements, include worked-out example problems and a density simulation for students that includes questions on how to calculate density. The review questions at the end of the section, however, are designed for students who have already mastered the material.
  - Chapter 9, Gas Laws, includes 17 practice questions that a teacher could use as targeted practice, and the end of every chapter includes a summary section that students could read and study as needed. But there are no sections that are targeted at students who have not achieved mastery.
- The materials are scaffolded from a learning perspective, but targeted instructions and activities are only available in Emergent Bilingual (formerly ELL) support sections. For example, Section 2.2, ELL Support, says to, "Ask students to give short oral summaries about what they have learned from their reading. Provide assistance to students who speak mostly in present tense but are ready to learn proper verb tenses. To convert present-tense sentences to appropriate tense, students may benefit from a simple past/present/future graphic organizer where they

record proper tense for irregular verbs." However, no activities or resources are listed for other students who may not have achieved mastery.

- For example, Chapter 3, Composition of Substances and Solutions, includes practice questions within the lessons to scaffold learning and also includes simulations. However, these simulations do not include targeted instructional goals for assisting students in achieving mastery. Chapter 7.6, Molecular Structure and Polarity, supports a scaffolded lesson in which lessons increase in complexity as students progress. Materials do not support students who have not yet achieved mastery.

### Materials provide enrichment activities for all levels of learners.

- The materials include enrichment activities for all levels of learners. For example, Section 2.2, Link to Learning, includes a PhET simulation showing Rutherford's gold foil experiment. Students interact by manipulating variables and observing the resulting changes at the level of simplicity or complexity they desire. The Exercises section of each chapter contains review questions of varied complexity, as illustrated by the simple, moderate, and complex review questions included in the Exercises section of Chapter 9, Gases. Chapter 5, Thermochemistry, also contains key terms, equations, and exercises of varying complexity for students to complete.
- The materials include additional links for students to read more information and also links for students to view concepts with a simulator. For example, Section 3.1, Links to Learning, contains a video that students can watch on the mole concept. Students can dig deeper, complete questions, and explore the size of the mole. Section 5.2, Calorimetry, contains worked-out example problems, Check for Understanding questions, and additional links for students to view actual chemical reactions.
- The material's Links to Learning in other chapters also include videos, simulations, and interactives. Section 2.7, Chemical Nomenclature, includes a Link to Learning that allows students to practice naming compounds at the level and topic of their choosing. Chapter 3.3, Molarity, includes a Link to Learning that allows students to explore the relationship between solutes, volumes, and concentrations. Students can learn qualitative and quantitative relationships between the parameters according to their level of understanding.

### Materials provide scaffolds and guidance for just-in-time learning acceleration for all students.

- The material consistently spirals back to previously learned information and also provides just-in-time learning strategies for teachers and students.
    - For example, Section 7.1, Ionic Bonding, includes practice questions embedded within the lesson that check for student understanding as they progress.
    - Section 2.3, Atomic Structure, provides "just-in-time" learning by describing a scenario where the absence of iodine in a person's diet causes an enlargement of the thyroid gland. A solution is provided, and then students are asked to apply their prior knowledge of the periodic table to determine the number of protons, neutrons, and charge of a platinum atom.
- The material also includes worked-out problems and examples to scaffold student learning.
    - For example, the first section in Chapter 9 has various gas law problem examples worked out, as well as practices for students to try. Emergent Bilingual support is also provided in this section.
    - Section 12.3, Rate Laws, includes three worked-out example problems and then includes a similar problem for the students to solve on their own.

- Most chapters also include key terms, exercises, and summaries. For example, Chapter 15, Equilibria of Other Reaction Classes, includes an outline, chapter summary, key terms, and key equations for students to refer to when they struggle with these components of the lesson. Additionally, the introduction guides students to jot down questions as they proceed through the chapter to go back and review with their teacher.

## Indicator 7.2

Materials include a variety of research-based instructional methods that appeal to a variety of learning interests and needs.

| | | |
|---|---|---|
| 1 | Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content. | M |
| 2 | Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one). | M |
| 3 | Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation. | M |
| 4 | Materials represent a diversity of communities in the images and information about people and places. | M |

## Meets | Score 2/2

The materials meet the criteria for this indicator. Materials include a variety of research-based instructional methods that appeal to a variety of learning interests and needs.

Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content. Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one). Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation. Materials represent a diversity of communities in the images and information about people and places.

Evidence includes but is not limited to:

Materials include a variety of developmentally appropriate instructional approaches to engage students in the mastery of the content.

- Each chapter includes a chapter outline, pictures, connections to the real world, diagrams, illustrations, examples, videos, Links to Learning, and a section for students to keep a running list of questions. Each chapter concludes with a list of key terms, key equations, and a summary for students to wrap up their learning. For example, in Section 10.1, Intermolecular Forces, students interact with a virtual simulator to understand phase changes. They can also view a video link that covers van der Walls forces. The Exercises sections within each chapter include both multiple-choice and written free-response questions to engage students.
- Chapter lessons include features that can draw students into scientific inquiry and discussions through examples from everyday life, how the different sciences interconnect, and through portraits of real-life scientists. For example, Chapter 1.4, Measurements, has a Link to Learning that is interactive for students to explore the density of different materials.
- Additionally, Section 2.2 provides a link that takes students to a page where they can listen to Thompson tell them his theories about the size of an atom. The section also includes two links to learning that show Rutherford's gold foil experiment and then allow students to investigate the differences between Rutherford's model and the plum pudding model.

## Materials consistently support flexible grouping (e.g., whole group, small group, partners, one-on-one).

- The materials support flexible grouping..
  - For example, the Introduction to Chapter 1 suggests students create a KWL chart to support their learning. The materials support flexible grouping by suggesting students complete the activity alone, with a partner, or in a group.
  - In Section 4.2, teachers are instructed to "Give students a list of topics to choose from based on the current chapter being studied. Have language learners present to a small audience consisting of either their fellow ELL classmates or a group of classmates that includes native speakers."
  - For example, Section 2.3: Chemical Formulas, contains guidance for emergent bilingual (EB) students to work with a partner on vocabulary words. The EB support section for Section 9.2, The Ideal Gas Law, encourages the teacher to place EB students into small groups and have them take turns presenting to the class.
  - 
- The materials include multiple EB language support sections that are also applied to non-EB students.
  - For example, EB guidance in Section 4.2, Classifying Chemical Reactions, suggests dividing the EB students so they can practice presenting a concept to a small subset of other EB students or to a group of students that includes native speakers.
  - Section 4.3, Reaction Stoichiometry, contains a description of a Gallery Walk that instructseach student group to present their poster or drawing, followed by a "walk and talk."

## Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent) and provide guidance and structures to achieve effective implementation.

- Materials consistently support multiple types of practices (e.g., modeled, guided, collaborative, independent). For example, Chapter 2, Atoms, Molecules, and Ions, Section 2.7 provides both collaborative and independent practice for students in naming compounds and writing formulas. Content and concepts are modeled in various ways, including data tables and everyday life examples.
- Since they are meant for independent practice, guided problems often include answer keys to ensure students understand how to follow the steps. For example, students are presented with a titration analysis question in Example 4.4: Quantitative Chemical Analysis that walks students through the example problem step by step. The materials include a place for students to write down questions they may have as they proceed through the chapters, and the chapters include guided exercises and practice questions throughout the lessons.

## Materials represent a diversity of communities in the images and information about people and places.

- The materials represent a diversity of communities in the images and information about people and places. For example, Chapter 1 makes reference to a female scientist and her contributions to science as a researcher for the Food and Drug Administration. Chapter 9 includes an image of a female scuba diver. In Section 2.4, Portrait of a Chemist, the African American scientist Paula Hammon is represented, as well as Erin Brockovich (American) in Chapter 2.7.
- The materials are designed so that no one people group is pictured as the overwhelming majority. For example, Chapter 21 contains pictures of three Caucasian men at Three-Mile

Island, a Japanese woman at Fukushima, a black man with a white man, a Hispanic man, and a diagram with a multicultural woman.

- Materials include historical scientists as well as more recent scientists such as African American scientist Alma Levant Hayden who is described in Chapter 1. The materials also include diverse nonscientists who have contributed, such as Naotake Murayama's pictures of scientist Don Hutcheson in Chapter 18.

## Indicator 7.3

Materials include listening, speaking, reading, and writing supports to assist emergent bilingual students in meeting course-level science content expectations.

| | | |
|---|---|---|
| 1 | Materials include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS. | M |
| 2 | Materials encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English. | M |

## Meets | Score 2/2

The materials meet the criteria for this indicator. Materials include listening, speaking, reading, and writing supports to assist emergent bilingual students in meeting course-level science content expectations.

Materials include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS. Materials encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English.

Evidence includes but is not limited to:

Materials include guidance for linguistic accommodations (communicated, sequenced, and scaffolded) commensurate with various levels of English language proficiency as defined by the ELPS.

- Throughout the materials, Emergent Bilingual (EB) students are given multiple opportunities to practice, acquire, and use new English vocabulary as they progress through the course. Many chapters provide guidance for (formerly called) English Language Learners. For example, Chapter 1, Introduction, guides the teacher to have students read chapter outlines, goals, and objectives. Teachers are also guided to have students complete a K-W-L Chart. The material frequently prompts the teacher to place emergent bilinguals into small groups based on their ability for discussion. For example, teachers are guided to: "Create small groups that mix language learners and native speakers. Have them work together to discuss the information. Beginning language learners may choose to listen if they do not feel confident contributing to discussion," in Section 1.2.
- The linguistic accommodations within the materials are sequenced. For example, by the time they reach Chapter 9, the "teacher guidance" suggests that students keep notes, write legibly, and avoid abbreviations. The linguistic accommodations are also scaffolded. For example, in Section 11.4, Colligative Properties, the materials include multiple guidance statements for EB students, including prompts on bringing in students' background knowledge for the section.
- The materials include many suggested extension activities for EB students. For example, Section 1.1 includes a Flash Card extension activity. EB students create the cards themselves and then work with a partner, taking turns quizzing each other. Section 8.1, Valence Bond Theory, prompts teachers to have students discuss the new concepts they have learned to support them

in speaking confidently. Throughout the materials, EB students are given multiple opportunities to practice, acquire, and use new English vocabulary as they progress through the course.

Materials encourage strategic use of students' first language as a means to linguistic, affective, cognitive, and academic development in English.

- In Chapter 2, the material prompts the teacher to provide linguistic accommodations for students who cannot read the text by checking online for accommodated content areas and then setting up a time to discuss comprehension. Other chapters include guidance for introducing a new topic, such as using simple language and rephrasing for student comprehension. Teachers are also guided to use "Link to Learning" videos with EB students. Teachers are advised to pause the video strategically to help students integrate what they have seen and heard or even replay key parts.
- The materials are structured to allow teachers to use a student's current level of English to continue to develop their understanding. For example, the end of Section 3.1 contains a suggestion paragraph for teachers to use when working with English learners. It also gives different sets of tips depending on the student's level (beginner versus advanced).
- The materials also include methods for teachers to leverage EB students' current vocabulary as a means to increase their English proficiency. For example, in Section 2.3, the material suggests the types of responses that emergent bilingual students may have to questions from the teacher in a lesson. Using these responses, teachers are guided to model what correct responses would look like, which helps students improve their responses to further questions and builds student vocabulary.

# Kiddom OpenStax Chemistry

## Indicator 7.4

Materials provide guidance on fostering connections between home and school.

| | | |
|---|---|---|
| 1 | Materials provide information to be shared with students and caregivers about the design of the program. | DNM |
| 2 | Materials provide information to be shared with caregivers for how they can help reinforce student learning and development. | DNM |
| 3 | Materials include information to guide teacher communications with caregivers. | PM |

### Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials provide some guidance on fostering connections between home and school.

Materials do not provide information to be shared with students and caregivers about the design of the program. Materials do not provide information to be shared with caregivers for how they can help reinforce student learning and development. Materials include some information to guide teacher communications with caregivers.

Evidence includes but is not limited to:

Materials provide information to be shared with students and caregivers about the design of the program.

- The materials do not provide information to be shared with students and caregivers about the program's design. Every chapter within the materials includes a teacher guide with a scope and sequence and an outline of the chapter. However, the materials do not provide information to be shared with students or caregivers about the program's design within the teacher guide or the chapters.
  - For example, in the Introduction section, the materials state that “chapter summaries can be used for students to start conversations about the material with their families.” Still, the program's design is not mentioned anywhere in the materials.
  - For example, in the Introduction section, it is stated that “Family materials can be assigned through the ‘Summary’ section. Students can utilize the summaries as discussion starters as they share their knowledge of chemistry with their families and caregivers.” However, once passing through the materials, there is no indication of the program's design.

Materials provide information to be shared with caregivers for how they can help reinforce student learning and development.

- The materials do not include information to be shared with caregivers other than general advice. For example, the materials say, “Families and caregivers should be encouraged to ask their students about their studies in the course and feel free to reach out to the instructor with any questions throughout the term,” without providing any content or information for caregivers to ask about. The materials also provide the generic statement, “Families and caregivers should encourage students to use online resources and reach out to their instructors with questions or concerns." This general advice does not assist caregivers in reinforcing their student's learning in the Chemistry course. The materials include chapter summaries that may be shared with caregivers, however, materials do not give this suggestion. There is no indication of how caregivers could reinforce students' learning or developing concepts.

## Materials include information to guide teacher communications with caregivers.

- The materials provide some teacher guidance for communication with caregivers. For example, the Introduction includes resources for parents and caregivers for some of the digital technology used in this program. Instructors may preview the design of the program with caregivers via email, a letter, or at open house events.
- Materials do not include information to guide teacher communications with caregivers.

## Indicator 8.1

Materials include year-long plans with practice and review opportunities that support instruction.

| | | |
|---|---|---|
| 1 | Materials are accompanied by a TEKS-aligned scope and sequence outlining the order in which knowledge and skills are taught and built in the course materials. | PM |
| 2 | Materials provide clear teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices. | DNM |
| 3 | Materials provide review and practice of knowledge and skills spiraled throughout the year to support mastery and retention. | M |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some year-long plans with some practice and review opportunities that support instruction.

Materials contain a scope and sequence that is not TEKS-aligned. Materials provide some teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices. Materials provide review and practice of knowledge and skills spiraled throughout the year to support mastery and retention.

Evidence includes but is not limited to:

**Materials are accompanied by a TEKS-aligned scope and sequence outlining the order in which knowledge and skills are taught and built in the course materials.**

- All 21 chapters are outlined in the scope and sequence with a pacing guide, but these chapters are not TEKS-aligned. For example, Chapter 21, "Nuclear Chemistry," contains lessons that outline the areas of Nuclear Chemistry that are covered but does not include the TEKS associated with the lesson. Learning objectives are given in each chapter, such as Chapter 3 at the top of the chapter. However, they are not TEKS aligned. For example, Chapter 4, "Stoichiometry of Chemical Reactions," does not include TEKS.
- The chapter outline in the introduction shows the order and sequence of the materials. Subsections address each topic and organize content. The beginning of each chapter includes an ordered outline. For example, Chapter 3 begins with Topic 3.1, "Formula Mass and the Mole Concept," followed by Topic 3.2, "Determining Empirical and Molecular Formulas," followed by Topic 3.3, "Molarity," and finally Topic 3.4, "Other Units for Solution Concentration." Although the order of topics is presented, they are not aligned with TEKS for each section.

**Materials provide clear teacher guidance for facilitating student-made connections across core concepts and scientific and engineering practices.**

- In Chapter 1, Lesson 1.3, "Physical and Chemical Properties," there is no guidance for teachers to help students make connections. The only time the teacher's role is mentioned is when support is included for emergent bilingual students. . In Lesson 4.4, "Reaction Yields," the lesson describes the connection of percent yield between Green Chemistry and Atom Economy. While the materials provide a description of the connection, there is no reference to how the teacher can implement this connection in the classroom. There is no guided activity that allows the teacher to implement this connection in an investigative manner for the students.

- Emergent Bilingual (EB, formerly called ELL) support sections are found throughout the text. For example, in an activity in Section 9.2, students practice speaking and internalize new academic language by constructing a graphic to explain a key idea within the chapter. " Each chapter also asks the student to fill out a data table as a scientist. This data table helps students formulate questions as they read but does not allow them to experiment or explore. There are no scientific or engineering activities included in these areas. There is one activity at the end of the resource about STEM Career Research.
- Learning Objectives within chapters are not specific to SEPs (Science and Engineering Process Standards) or TEKS. For example, Chapter 4.2 includes learning objectives at the top of the chapter but does not provide teacher guidance for student connections to SEPs.
- The introduction to Unit 3 prompts students to "think, ask questions, and define problems like a scientist." Each unit section prompts the student to recall core concepts from previous units and make connections to the concepts. Activity 3.1 provides a note to teachers stating that "students will have a text box to enter their response." The materials provide opportunities for the students to think critically and solve problems. They reference and connect core concepts throughout the unit. For example, the introduction to Section 6.3 poses questions raised due to Bohr's model before introducing quantum theory.

## Materials provide review and practice of knowledge and skills spiraled throughout the year to support mastery and retention.

- The content in each unit spirals back to previously learned concepts when explaining new material, drawing on students' knowledge of fundamental concepts through examples and problems. For example, Section 7.1 reviews basic atom concepts before describing ionic bonding.
- Each lesson contains a summary for students to review the information they learned, and key ideas are highlighted. Key terms and equations are provided at the end of each chapter. Within the lesson, each section is followed by student practice, such as Example 6.12 and end-of-Chapter 6 exercises. There are examples and solutions as well as "Check Your Learning" exercises. The end of each section lists key terms, key equations, and a summary. For example, Chapter 9, "Gas Laws," contains practice exercises using all the gas law formulas. At the end of the chapter, formulas are presented on one concise page.
- Additionally, each lesson within each chapter contains practice questions embedded throughout the content. A final exercise is provided for each lesson to allow students to demonstrate their knowledge of the material. Each subsequent lesson contains information that builds on the last lesson. For example, in the exercise from Chapter 21.2, "Nuclear Equations," there are review questions about atomic structure that was covered in Chapter 2.

# Kiddom OpenStax Chemistry

## Indicator 8.2

Materials include classroom implementation support for teachers and administrators.

| | | |
|---|---|---|
| 1 | Materials provide teacher guidance and recommendations for use of all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and scaffolds to support and enhance student learning. | PM |
| 2 | Materials include standards correlations, including cross-content standards, that explain the standards within the context of the course. | DNM |
| 3 | Materials include a comprehensive list of all equipment and supplies needed to support instructional activities. | DNM |
| 4 | Materials include guidance for safety practices, including the course-appropriate use of safety equipment during investigations. | DNM |

### Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials include some classroom implementation support for teachers and administrators.

The materials provide some teacher guidance and recommendations for using all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and some scaffolds to support and enhance student learning. Materials do not include standards correlations, including cross-content standards, that explain the standards within the context of the course. Due to there being no hands-on activities in the materials, they do not include a comprehensive list of all equipment and supplies needed to support instructional activities, and also do not include guidance for safety practices, including the grade-appropriate use of safety equipment during investigations.

Evidence includes but is not limited to:

Materials provide teacher guidance and recommendations for use of all materials, including text, embedded technology, enrichment activities, research-based instructional strategies, and scaffolds to support and enhance student learning.

- The introduction provides some guidance for teachers, such as a scope and sequence, pacing guide, lesson implementation, and progress monitoring. However, the Teacher Guide contains only scaffolds for Emergent Bilingual (EB) students. Lesson introductions provide lesson overviews, and each section provides learning objectives but does not provide any teacher guidance on scaffolding, implementation, or teaching techniques. Exercises do contain some teacher support and answers to practice problems.
- Lessons contain some embedded technology and enrichment activities with answer keys but no explicit guidance for teachers on the activities. For example, in Chapter 1, “Measurements,” the material provides a link to an interactive simulator for density but does not mention how the teacher should utilize the material. It does not include any instruction strategies or even guiding questions for the teacher to ask students. In Chapter 2, “Molecular and Empirical Formulas,” a link gives students practice building and manipulating molecules, but the material lacks recommendations or instructions for how the teacher can utilize the simulation in a lesson or activity.

# Kiddom OpenStax Chemistry

## Materials include standards correlations, including cross-content standards, that explain the standards within the context of the course.

- Each lesson within a chapter contains an outline of the objectives covered but does not mention the standards. The objectives contain specific tasks that students should be able to do by the end of the lesson. For example, by the end of Lesson 2.1, students should be able to state the postulates of Dalton's atomic theory. But the objectives are not aligned with specific standards that go across content or standards within the scope of general chemistry.
- Curriculum content is organized by a logical progression of appropriate topics and rigor presented at the beginning. However, no standard correlations, cross-content standards, or explanations of the standards could be found throughout the materials. Each chapter introduction includes a list of topics covered, but they do not align with standards. The introduction also does not contain cross-content standards. Sections within chapters include Learning Objectives stating the content covered, but the material contains no designation of specific standards.
- Students use standards from other disciplines to complete assignments, but no specific mention of these cross-curricular standards exists within the material itself. For example, Chapter 2.1 includes cross-content material such as history ("Early Ideas of Atomic History") and English (reading for comprehension and writing to answer open-ended questions), but neither an explanation nor a designation exists for these standards.

## Materials include a comprehensive list of all equipment and supplies needed to support instructional activities.

- The materials do not meet this standard because in place of traditional chemistry labs, Openstax Chemistry provides digital versions of labs and exploration-based investigations. Due to the lack of investigative activities, no comprehensive list of equipment and supplies is provided.
- For example, in OpenStax Chemistry 2e: Powered by Kiddom, the 4.3 Reaction Stoichiometry lesson states the general approach to using stoichiometric relationships is similar in concept to the way people go about many common activities. Food preparation, for example, offers an appropriate comparison. A recipe for making eight pancakes calls for 1 cup pancake mix, 34 cup milk, and one egg. The "equation" representing the preparation of pancakes per this recipe is 1 cup mix + 34 cup milk + 1 egg ⟶ 8 pancakes. If two dozen pancakes are needed for a big family breakfast, the ingredient amounts must be increased proportionally according to the amounts given in the recipe. This lesson does not include a comprehensive list of all equipment and supplies needed to support instructional activities.

## Materials include guidance for safety practices, including the course-appropriate use of safety equipment during investigations.

- Safety practices and the use of equipment are not included in the text because they are not part of the curriculum. The materials do not contain investigations; therefore, it does not mention best safety practices.
- The materials include interactives that engage. For example, "Chemistry 2e incorporates links to relevant, interactive exercises and animations that help bring topics to life through our Link to

Learn feature." Some examples of these features include PhET simulations, IUPAC data and interactives, and TED Talks.

- In Lesson 1.2, Phases and Classification of Matter, the Link for Learning explains, "In a tiny cell in a plasma television, the plasma emits ultraviolet light, which in turn causes the display at that location to appear a specific color. The composite of these tiny dots of color makes up the image that you see. Watch this video to learn more about plasma and the places you encounter it." The materials do not include investigations.
- Materials include virtual lab investigations that provide digital versions of equipment and supplies needed during the instructional activity. For example, in Chapter 10 Exercises, Section 10.1, students are provided a link to a virtual simulation that shows digital investigations that do not require safety precautions like traditional labs. While no additional safety equipment is needed for virtual online labs, students do not participate in hands-on investigations with standard safety equipment expectations.

# Kiddom OpenStax Chemistry

## Indicator 8.3

Materials provide implementation guidance to meet variability in program design and scheduling.

| | | |
|---|---|---|
| 1 | Materials support scheduling considerations and include guidance and recommendations on required time for lessons and activities. | PM |
| 2 | Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression. | M |
| 3 | Materials designated for the course are flexible and can be completed in one school year. | M |

## Partial Meets | Score 1/2

The materials partially meet the criteria for this indicator. Materials provide some implementation guidance to meet variability in program design and scheduling.

Materials support some scheduling considerations and include some guidance and recommendations on required time for lessons and activities. Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression. Materials designated for the course are flexible and can be completed in one school year.

Evidence includes but is not limited to:

Materials support scheduling considerations and include guidance and recommendations on required time for lessons and activities.

- The time allotment requires strict adherence to 120 days and does not allow for flexibility within the year. The scope and sequence includes the suggested number of days for each chapter, but lessons do not have pacing or flexibility options.
- For example, Chapter 1, “Essential Ideas,” has six days allocated, and Chapter 2, “Atoms, Molecules, and Ions,” has eight days allocated. The materials do not include time or days required per section or activity.
- For example, Chapter 3, “Empirical and Molecular Formulas,” contains instruction, practice questions, and videos, but does not include timing suggestions for each component.
- The introduction includes a coverage, scope, and pacing guide for teachers that “adheres to the scope and sequence of most general chemistry courses nationwide.” It also contains an outline of the chapters and the recommended number of days to spend on an assignment. For example, the outline suggests three days for Thermochemistry.

Materials guide strategic implementation without disrupting the sequence of content that must be taught in a specific order following a developmental progression.

- The materials break content into chapters and subsections that follow a sequential order for developmental progress. Introductions precede content, and reference guides (including key terms and equations) follow content. Summaries and exercises wrap up each chapter. The arrangement of chapters follows a sequential order conducive to students learning content in a developmental progression. Chapters covering fundamental concepts occur before chapters with more advanced concepts.

- The materials contain a scope and sequence with lessons in order of increasing rigor and knowledge. For example, the sequence and order of Chapter 3, “Composition of Substances and Solutions,” begins with 3.1, “Formula Mass and the Mole Concept,” which must be taught before 3.2, “Determining Empirical and Molecular Formulas.” The next topic, Topic 3.3, “Molarity,” follows the logical progression, and finally, the chapter ends with other solution concentration calculations.
- Lessons within a chapter contain a logical flow of information. For example, Chapter 10 discusses the properties of liquids and solids before the discussion of solutions in Chapter 11. Chapter 14 introduces the concept of pH in Lesson 14.2 before discussing how to calculate pH using titration in Lesson 14.7.

### Materials designated for the course are flexible and can be completed in one school year.

- The pacing guide suggests 120 days for implementation of the entire set of materials. Since a school year is more than 120 days, this pacing allows teachers the ability to schedule around state testing days or other school functions that interrupt instruction and still complete the materials within a school year.
- The Introduction includes a section called “Interactives that Engage.” This section includes interactive links such as PhET simulations, IUPAC data, and TED Talks to help bring topics to life through the Link to Learning feature. These additional resources could provide flexibility and extend learning. The material contains self-paced guides for students, and students can skip simulations and practices if they do not need them.

# Kiddom OpenStax Chemistry

## Indicator 9.1

The visual design of materials is clear and easy to understand.

| | | |
|---|---|---|
| 1 | Materials include an appropriate amount of white space and a design that supports and does not distract from student learning. | Yes |
| 2 | Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting. | Yes |
| 3 | Materials include digital components that are free of technical errors. | Yes |

### Not Scored

The visual design of materials is clear and easy to understand.

Materials include an appropriate amount of white space and a design that supports and does not distract from student learning. Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting. Materials include digital components that are free of technical errors.

Evidence includes but is not limited to:

Materials include an appropriate amount of white space and a design that supports and does not distract from student learning.

- Materials include an appropriate amount of white space and a design that supports and does not distract from student learning. For example, the introduction is well-organized for students. The chapter outline is in black and white, followed by each section, including the possible points that can be earned. The materials include charts, graphs, and tables that are presented appropriately. Important vocabulary words are bolded in the materials.
- The curriculum content is shown on the left margin in black and white. Students view each chapter, beginning with an introduction and ending with a summary that will open up to a full page as they begin to read.
- The materials do not overwhelm students with large amounts of images and information on the screen at one time. For example, Section 2.7, Chemical Nomenclature, has the information boxed into sections. This structure compartmentalizes the material and makes it easier for students to focus on one section at a time.
- Section 3.1 contains materials with adequate white space so as not to distract student learning. The materials display textual information, examples, illustrations, and data tables in an organized manner.
- Chapter 4.1, Writing and Balancing Chemical Equations, contains white space on both sides of the material that minimizes distractions during lessons.
- Section 8.4, Molecular Orbital Theory, does not contain any images or text on the outer margins of the screen. This format focuses the student's eye more on the text and images being presented.
- Section 9.3, Stoichiometry, has adequate spacing and margins for informational text, problems, solutions, and illustrations. The clean and clear organization does not distract from student learning.

## Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting.

- Materials embed age-appropriate pictures and graphics that support student learning and engagement without being visually distracting. For example, Figure 1.3 in Chapter 1 provides a flow chart on the topic of chemistry. The word is bolded and is a darker blue as compared to the branches of chemistry that are not bolded and a light gray. Chapter 1 also includes Figure 1.18, which provides everyday examples of physical changes. The pictures are age appropriate and interesting.
- Section 3.1 includes numerous pictures and illustrations: molecular models, a photo of one mole of several elements, a photo of a drop of water, and a photo of a spool of copper. Each picture and graphic is visually appealing, increasing engagement. Each graphic is age appropriate for a high school chemistry student. The graphics help students understand the concept of a mole and make the content more relevant by including familiar objects.
- Section 3.4 includes a photo of a bleach bottle with its chemical formula and concentration, a photo of some commonly encountered medical tools, and a photo of water and pickles. Each picture is age-appropriate. The photos are appealing and familiar to increase student engagement and make learning relevant without being distracting.
- Section 15.2, Lewis Acids and Bases, includes several images showing the formation of Lewis acids and bases through the transfer of electrons. These images give students a grade-level-appropriate depiction of the formation of acids and bases.
- Section 21.4, Transmutation and Nuclear Energy, includes multiple engaging images of nuclear reactors and reactions. The material includes a description of the images and how they relate to the chapter.

## Materials include digital components that are free of technical errors.

- Materials include digital components that are free of technical errors. For example, all answer keys are provided to students as they work digitally. Work is graded by the system and is free of errors. The digital point system provided for each section is also free of errors.
- The materials include links to virtual simulations that do not have technical errors. For example, Section 3.3, Molarity, contains a link to a simulator. The simulator loads quickly and can be used correctly without any issues.
- Section 6.4, Electronic Structure of Atoms, contains information about deriving predicted ground-state electron configurations, identifying and explaining exceptions to predicted electron configurations, and relating electron configurations to element classifications in the periodic table. This section contains no technical errors.
- The materials include links to videos that do not have technical errors. For example, Section 11.3, Solubility, contains a link to a video showing the precipitation of sodium acetate. No issues were loading and playing the video.
- Section 17.1, Review of Redox Chemistry, provides information about redox chemistry, including oxidation and reduction, agents, half-reactions, and practice problems. This section contains no technical errors.

# Kiddom OpenStax Chemistry

## Indicator 9.2

Materials are intentionally designed to engage and support student learning with the integration of digital technology.

| | | |
|---|---|---|
| 1 | Materials integrate digital technology and tools that support student learning and engagement. | Yes |
| 2 | Materials integrate digital technology in ways that support student engagement with the science and engineering practices and course-specific content. | No |
| 3 | Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate. | Yes |
| 4 | Materials integrate digital technology that is compatible with a variety of learning management systems. | Yes |

## Not Scored

Materials are somewhat intentionally designed to engage and support student learning with the integration of digital technology, except for engineering practices.

Materials integrate digital technology and tools that support student learning and engagement. Materials incorporate digital technology in ways that support student engagement with the science and course-specific content but not with engineering practices. Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate. Materials integrate digital technology that is compatible with a variety of learning management systems.

Evidence includes but is not limited to:

**Materials integrate digital technology and tools that support student learning and engagement.**

- Materials integrate digital technology and tools that support student learning and engagement. The materials include PhET simulations, IUPAC data, interactives, and video TED Talks that lead to student engagement. For example, in Section 3.2, Determining Empirical and Molecular Formulas, the Link to Learning includes a video link that provides additional worked examples illustrating the derivation of empirical formulas.
- Section 3.3, Molarity, links to a simulation that helps students confirm the dilution equation. Students virtually manipulate solute and solution volume amounts and watch the changes in concentration and visual coloration.
- Section 4.4, Reaction Yields, includes an interactive simulation illustrating the concepts of limiting and excess reactants.
- In Section 5.2, Calorimetry, the materials engage students and connect bomb calorimeters to the calorimetric equations taught in the lesson through a link to a video and website showing the preparation and uses of bomb calorimeters.

**Materials integrate digital technology in ways that support student engagement with the science and engineering practices and course-specific content.**

- The materials include virtual simulations that engage students in course content but do not engage students in scientific or engineering practices, such as devising experiments, refining hypotheses, collaborating in the design, or participating in other engineering practices. For example, Section 2.3, Atomic Structure and Symbolism, includes a link to the PhET simulation "Build a Molecule." This engaging resource presents students with buckets of elements (atoms shown to scale) that can only be connected using chemical principles. After two learning sessions, the simulation proceeds to a "playground" mode for students. The materials instruct students to "make a prediction as to what you think the atom will look like and whether or not you think the atom will have isotopes. Write down your prediction and then check to see if you are correct." However, students are not refining or collaborating in the activity as scientists or engineers would.

- Section 5.1, Energy Basics, contains a Link to Learning interactive simulation that takes students through the various phase changes of substances such as neon, argon, oxygen, and water. Students are engaged in the virtual state changes by manipulating the heat energy input and output of a closed system. Students can also manage the amounts of moles and pressure on the system to observe molecular and graphical state changes. The materials instruct students to "Choose your variable and make a hypothesis as to what will happen during the phase change. Run the simulation and reflect on what you saw. Change your procedure as needed to address your hypothesis." These instructions help students to think like scientists but do not engage students in engineering practices.Section 5.3, Enthalpy, contains an engaging video that presents the process of using algae for biofuel. While the video describes an engineering process resulting from scientific research, the students are not researching or experimenting with biofuel.

## Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate.

- Materials integrate digital technology that provides opportunities for teachers and/or students to collaborate. For example, the Periodic Exploration activity in Chapter 2 could be structured as a collaborative guided practice.
- PhET simulations can be done collaboratively. For example, student collaboration could be used in the "Balancing Chemical Equations" simulation in Section 4.1, Writing and Balancing Chemical Equations.
- In Section 5.2, Calorimetry, the Link to Learning is a video that shows the precipitation reaction that occurs when a disk in a chemical hand warmer is flexed. Teachers and students could engage in discussions as the video plays.
- In Section 6.3, Development of Quantum Theory, the Link to Learning provides a cartoon view of the Double Slit Experiment that helps students understand wave/particle duality and the associated experiments. Students and teachers can pause the video to discuss this very complex topic.
- In Section 9.2, The Ideal Gas Law, the ELL support section encourages the teacher to place ELL students into small groups to complete the simulation. This suggestion could also be used for all students.

## Materials integrate digital technology that is compatible with a variety of learning management systems.

- Digital materials are accessible and compatible with multiple operating systems and devices. For example, the materials include PhET simulations for virtual labs. PhET simulations are compatible with most operating systems.

- The materials contain other websites that are compatible with many operating systems. For example, Section 2.3, Atomic Structure and Symbolism, includes a link to a YouTube video about spectrometry. YouTube is compatible with nearly all operating systems.
- Section 5.2, Calorimetry, provides Links to Learning that show a reaction, a different link that shows a tool in action, and another link that shows calculations. Each of these resources can be accessed by PC and also by MacBook.
- In Section 6.3, Development of Quantum Theory, the Link to Learning links a YouTube video that can be viewed on any learning management system.
- The materials in Section 8.2 can be accessed on a PC and a MacBook. The Link to Learning takes students to the University of Wisconsin-Oshkosh website to learn about visualizing hybrid orbitals in three dimensions. The website is accurately displayed on both PC and Mac.
- While the materials are accessible from PCs and Macs, they do not list which operating systems or devices are compatible, such as Chromebooks, Android, or Apple Smartphones.

# Kiddom OpenStax Chemistry

## Indicator 9.3

Digital technology and online components are developmentally and course-appropriate and provide support for learning.

| | | |
|---|---|---|
| 1 | Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression. | Yes |
| 2 | Materials provide teacher guidance for the use of embedded technology to support and enhance student learning. | Yes |
| 3 | Materials are available to parents and caregivers to support student engagement with digital technology and online components. | Yes |

## Not Scored

Digital technology and online components are developmentally and course-appropriate and provide support for learning.

Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression. Materials provide teacher guidance for the use of embedded technology to support and enhance student learning. Materials are available to parents and caregivers to support student engagement with digital technology and online components.

Evidence includes but is not limited to:

Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression.

- Digital technology and online components are developmentally appropriate for the course and align with the scope and approach to science knowledge and skills progression. For instance, Section 1.4, Measurements, Link to Learning, takes students to a website that reviews the basics of scientific notation, which is an area of the content that students typically struggle with the most.
- Section 2.5, Periodic Table, Link to Learning, provides students with two links to interactive periodic tables, which students can use to explore the properties of the elements. The websites include podcasts and videos of each element.
- The Link to Learning in Section 3.3 requires students to "Use the simulation to explore the relations between solute amount, solution volume, and concentration and to confirm the dilution equation." This PhET simulation is developmentally appropriate and aligns with the scope and sequence.
- Section 10.1, Intermolecular Forces, covers van der Waals forces. The section includes an engaging link to a video about the applications of van der Waals forces.
- Section 11.1, The Dissolution Process, includes a virtual lab that allows students to observe and manipulate the dissolution of different solutes. This lab aligns with the lesson.

# Kiddom OpenStax Chemistry

## Materials provide teacher guidance for the use of embedded technology to support and enhance student learning.

- Materials provide teacher guidance for the use of embedded technology to support and enhance student learning. The Introduction includes sections for teachers that discuss utilizing the engaging interactives provided in the text. Examples include:
    - Section 2.7, Chemical Nomenclature Extend Your Knowledge, provides a Link to Learning “Bases - Naming and Formulas” to aid students further with extra lessons and practices. Teachers can use this extra support to help with lesson delivery, as they can assign binary, polyatomic, and variable charge ionic compounds to students.
    - Section 11.3, Solubility, Link to Learning, takes students to a PhET simulation called “Salts and Solubility.” Students begin with dissolving table salt, then slightly soluble salts, and finally, can design their own salt in this simulation. Teachers guide the simulation to support and enhance the learning of solubility.
    - Section 17.5, Batteries and Fuel Cells, provides students and teachers with several links to more information and examples of various types of batteries to deepen knowledge and assist in lesson delivery.

## Materials are available to parents and caregivers to support student engagement with digital technology and online components.

- The materials provide the following instructions in the Introduction, “Instructors may preview with caregivers the program design and expectations via email, a letter, or at open house events. Families and caregivers should be encouraged to ask their students about their studies in the course and feel free to reach out to the instructor with any questions throughout the term. Families and caregivers should encourage students to use online resources and reach out to their instructors with questions or concerns.”
- The Family Materials section of Chapter 1, Introduction, provides information on how the summary section of each chapter can serve as a sentence starter for students as they share their accumulated knowledge of chemistry with parents and caregivers. But no suggestions or guidance is provided to assist caregivers in supporting their student’s engagement with the digital and online components.
- Parents can use the student’s credentials to log in to the curriculum, but caregivers have no “Parent View” or guidance.
- Section 11.3, Solubility, provides a link to an interactive simulation that allows students to prepare saturated solutions. The materials include a link to a “Tips for using PhET” website.