Day-to-Day Teaching Support

A Natural Approach to Chemistry has a well-developed "toolbox" for teaching the course, with many student and teacher resources. These include comprehensive print and online materials, and a robust suite of digital resources, including video podcasts for most Student Book sections, Lab Prep videos for teachers, Student Skill Sheets at basic, on grade, and advanced levels, and additional web support for various topics. The lab investigations feature an alphanumeric title than matches the chapter and an A - E element which roughly aligns with a depth of knowledge (DOC) designation. Many of the A labs can actually be used without any chapter content prerequisite if teachers are partial to an "activity before content" approach.

This section provides support for lesson planning and the daily teaching of the program, with the following topic areas:

- Learning Sequences represent the authors' suggestions for sequencing and integrating content from the Student Book and Lab Investigations Manual
- Using the Driving Question Board (DQB) is used early on in each chapter for using an investigative phenomena and for working with student questions in a systematic way
- Getting Started provides ideas and suggestions keyed to the opening two-page spread for each chapter and using the DQB as a way to engage students
- Assessment describes the various formative and summative strategies and resources available to teachers
- Diverse Learners reminds us that different students approach learning differently, and gives options for working with the diverse learners you teach

We hope you find this section helpful and appreciate your interest in our programs.

Learning Sequences

A Learning Sequence (LS) represents a sequence of student learning opportunities, including labs, readings, digital content (video podcast, student sheets, web links, etc.) recommended for most students working at grade level, with options for remediation and enrichment. Steps in the LS increase in cognitive demand and application of previous material, from simple to complex and as mentioned, include opportunities for hands-on interaction, for extracting information from text, and for working with digital or web content. This also supports the 5E model (see the 5E section in this Teacher Edition for more information on how the 5E model was used to develop this course).

Suggested Learning Sequence for Chapter 2

Working towards:

PS1-1: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-3: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

- DCI: PS1.A, Structure and Properties of Matter; PS1.B: Chemical Reactions; PS2.B, Types of Interactions
- SEP: Developing and and Using Models, Planning and carrying out investigations
- CCC: Patterns
- CC ELA/Math: WHST.9-12.9, RST.9-10.7, HSN-Q.A.1, HSN-QA.3, SL.11-12.5

DAYS	SB/LIM	TITLE	DESCRIPTION
1	SB	Getting Started	*A Slimy Chemical Reaction* provides the initial phenomena engagement; students brainstorm questions they have about the diversity of matter and how new substances are formed.
2	LIM	2A: Mixtures	Students mix quantitative proportions of sugar, sand, and salt with water and investigate basic physical properties of the mixtures. Percent concentration is calculated for each mixture.
3	SB	2.1: Matter and the Elements	Matter has physical and chemical properties. The macroscopic properties of matter can be explained by microscopic structures. The periodic table organizes the elements.
4	SB	2.2: Molecules and Compounds	Most matter is formed of elements in specific ratios given by the chemical formula. Compounds can be ionic, molecular or both.
5	LIM	2B: The Chemical Formula	Students use molecular models to build molecules and learn how to write chemical formulas and structural diagrams. They also use atomic masses to calculate formula mass for the first time.
6	SB	2.3: Mixtures and Solutions	A solution is a homogeneous mixture of at least one solute dissolved in a solvent. Concentration can be used to describe the solution strength. Solutions can be gasses as well as liquids.
7	LIM	2D: Density as a Diagnostic Tool	Students use the displacement method with a graduated cylinder to find the density of pennies and nickels. The data are used to show that pennies are mostly zinc, not copper.
8	SB	Chemical Connections	Review learning content for chapter and explore cross cutting concepts.
9-10	LIM	2C: One in a Million	Students use the spectrophotometer to observe that the color of a solution changes with concentration. They perform a serial dilution on food color solutions and use absorption data to create a graph that allows them to find the concentration of a mystery solution.

Using the Driving Question Board

Each chapter begins with a Getting Started section that uses an investigative phenomenon, typically a description of a hands-on activity that could also be done in real time with students to elicit student questions. Teachers are encouraged to incorporate students' own authentic questions in teaching the unit by using a Driving Question Board (Weizman, et. al, 2008)[4]. This engages students and creates a shared sense of purpose.

Begin setting up a Driving Question Board (DQB) for the chapter to collect student questions about matter and atoms for later discussion. You will revisit the DQB throughout the chapter. There are several questions listed at the beginning of each Getting Started chapter section that you can use to help start the process, but it is vital that students suggest their own questions. Other prompts include the use of the cover image for the chapter to help students focus and come up with questions. The following examples are from Chapter 2, Matter and Atoms.

Ask *"What questions about matter and atoms are suggested by this photo?"*

Or ask *"What is matter made of?"*

"How do you think there are so many different kinds of matter?"

"Why are substances solids, liquids, or gasses?"

Students should work in small groups to come up with initial questions and then narrow down their questions to come up with 2-3 questions per group that they present to the class and ideally post in the classroom. Students can collect these questions on sticky notes, chart paper, index cards, or electronically, using a Google Jamboard (or the like) provided by the teacher.

Expect students to be reluctant or tentative at first, perhaps hesitant to suggest questions as this type of open sharing with peers is not exactly the norm in public school classrooms these days. Do what you can to make this a safe, noncritical space for peer-to-peer interaction where comments are valued by the group and not judged. If a student's comments are mocked or derided, then you can understandably expect that student to be hesitant to share in future.

The questions can be used to focus class discussion at the end of each chapter section. Ask, "What have you learned that would help you answer these questions?" "How has your thinking changed?"

Students may want to take a great deal of time to polish and refine their questions and may even start to try to answer peer questions as they are posted. Remind them that this activity qualifies as initial brainstorming and that they will have many opportunities to engage with these questions while working on this chapter and later in the course.

Sample DQB questions for **A Slimy Chemical Reaction**, Chapter 2

Does the glue simply harden and this causes the mixture to thicken?

Why is it that carbon can form so many different kinds of matter?

How is it that the human body and a sheet of plastic can still be made of carbon atoms?

Are their different kinds of matter in space vs here on Earth?

Where do all the elements come from?

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[4] https://s3.amazonaws.com/nstacontent/tst0811_33.pdf?AWSAccessKeyId=AKIAIMRSQAV7P6X4QIKQ&Expires=1668776634&Signature=bmd3YE6f%2bQkqXGXI9YTqJZBSZxs%3d

Ideas for Getting Started

These short outlines are provided for each chapter and can be modified as needed. These provide a semi-scripted way to use an investigative phenomenon that students can read about, do, or watch a short video of – depending on teacher preference – and follow this up with use of Driving Question Board strategies to surface what students already know about content in the chapter and using student questions to help drive instructions.

All chapter openers begin with Getting Started. We have provided short (2-3 min) video treatments of the hands-on investigations but strongly suggest teachers take the time and effort, when possible, to make this a hands-on activity. This following sequence is from Chapter 2 and is intended to give an overview of the main steps in the process.

Sample *Getting Started* from Chapter 2.

Tell students they are about to begin the unit on matter and atoms.

Ask students to read the opening text on the first page of the Getting Started section for the chapter. Post the three opening questions on the whiteboard. Students may have some ideas about this from previous science classes; elicit a few student answers to show the range of responses in the class.

Decide whether you will use the video of A Slimy Chemical Reaction, the text description only, or make materials available to pairs of students themselves to do the reaction at their lab stations. *Note:* These materials are intended to be local supply items and, except for a few specialty items from time to time, are not included in the equipment kit package.

Each group of students will need:

- Safety eyewear
- Small cup containing 30 mL water mixed with 30 mL white glue (Elmer's or regular school glue)
- Small cup containing 4g borax powder dissolved in 100 mL water
- Food coloring, if desired
- Plastic straw or stir stick

Tell students to follow the procedure in the student book, making sure to record their observations carefully before and after mixing.

Ask students, *"How are the properties of the mixture similar to, and different from, the two liquids you mixed?"*

Typical similarities include noting that the reactants and products are both green and appear cloudy, not clear. Differences include much greater viscosity of the products – depending on amounts used, you might observe a solid or semi-solid which gradually becomes more solid with repeated stirring.

Ask students, *"What do you think the particles in the glue and water mixture look like? The borax and water mixture? The new mixture made from combining the two?"*

Setting up the Driving Question Board

Begin setting up a Driving Question Board (DQB) for the chapter to collect student questions. (You will revisit it and add to it throughout the chapter.) Ask students to come up with questions about matter and atoms that they would like to investigate as they work through this chapter. Where possible, ask them to relate the questions to personal experiences (e.g., they have just seen glue turn into slime, etc.). You can use the cover image for the chapter and/or the questions listed at the beginning of the Getting Started section to help start the process.

Students should work in small groups to come up with initial questions and then narrow down their questions to come up with 2-3 questions per group that they present to the class and ideally post in the classroom. Students can collect these questions on sticky notes, chart paper, index cards, or electronically, using a Google Jamboard (or the like) provided by the teacher. Students may want to take a great deal of time to polish and refine their questions and may even start to try to answer peer questions as they are posted. Remind them that this activity qualifies as initial brainstorming and that they will have many opportunities to engage with these questions while working on this chapter and later in the course.

The questions can be used to focus class discussion at the end of each chapter section. Ask "*What have you learned that would help you answer these questions?" "How has your thinking changed?"*

Sample student DQB questions

- Does the glue simply harden and this causes the mixture to thicken?
- Why is it that carbon can form so many different kinds of matter?
- How is it that the human body and a sheet of plastic can still be made of carbon atoms?
- Are their different kinds of matter in space vs here on Earth?
- Where do all the elements come from?