

FOSS® MIXTURES AND SOLUTIONS TEACHER PREPARATION VIDEO TRANSCRIPT

<Larry Lowery Introduction to FOSS Program>

Lowery: Hello. Welcome to the Full Option Science System. This program was funded by the National Science Foundation. Its goal was to develop materials that would involve youngsters with both the processes and the content of science.

The program is developed with the Lawrence Hall of Science, with scientists, science educators and teachers working together as a team to develop the materials. The materials are tested in the hands of teachers and children in classrooms. It takes about two years to turn out a module.

Each module begins with firsthand experiences. This is done because it has been found that firsthand experiences are the best way for youngsters to learn about the concepts of science. As the module progresses, children are introduced to abstractions and reading materials. The sequence from firsthand experiences through reading materials is deliberate because it has been found that youngsters, when they have some experience before they read, learn and understand more from the reading. Authors of reading materials can then take youngsters to greater abstractions.

Trust the materials that you are getting acquainted with. They have been well tested. We found that they work extremely well in the hands of all teachers and are effective for youngsters in learning about science.

<Larry Lowery Introduction to Mixtures and Solutions>

This module is an introduction to chemistry and to two very important concepts: The concept of mixtures and the concept of solutions. These concepts are often confused. Solutions are a very special kind of mixture. Through the investigations in this module, students will clearly understand the difference between the two.

This module begins with the concept of mixture. This is done through the exploration of different mixtures and through techniques used to separate the mixtures or to return them to their original components. This module continues to develop the understanding of solutions and the relative amounts of substances within a solution. The concept of saturation is introduced through several guided and open-ended explorations. This sets the foundation for understanding the concept of concentration.

The module ends with the introduction of simple chemical reactions. They take place as students continue to make different solutions. The chemical reactions are surprises to the students and they set the foundation for further explorations into chemistry.

<Ted Stoeckley Introduction to Module>

Narrator/Ted Stoeckley: Hi. I'm Ted Stoeckley. I'm here to help you get started with the FOSS Mixtures and Solutions kit. The Mixtures and Solutions module consists of four investigations

that introduce students to basic chemistry concepts. Most of the equipment that you will need to teach this module comes in the kit. Everything that you see here comes in these two boxes. There's enough permanent equipment in the kit for a class of 32 students and enough consumable equipment for at least two classes. You'll need to check the inventory sheet in the Materials folio to see which materials are consumable and which are permanent.

From the FOSS measurement kit you will need the pitchers, the balances, the mass pieces and the measuring spoons, the one liter beaker, the one liter containers and the half liter containers, the syringes, the hand lenses and the basins. You will need to supply transparent tape, three-ounce paper cups, chalk, a stirring spoon, a permanent black marker, food coloring, lined paper, sugar sweetened powdered drink mix like Kool-Aid and paper towels.

Before you begin teaching this module, it is important to look through the entire Teacher's Guide. First you will find the Overview folio which points out the national standards addressed in this module as well as information about how to make best use of the Teacher Guide. It also includes valuable background information specially written for teachers who have not had extensive science training. The suggested teaching schedule will be particularly helpful as you plan.

Next you'll find the Materials folio. If you are the first teacher using the kit, you will want to turn to the section that describes first time prep. If the kit has been used before, check the section called Preparing Your Kit For Your Classroom. Both of these sections will give you helpful hints and will save you lots of preparation time later.

The next four folios are the Investigation folios. These are the heart of the program. Each takes one or two weeks to complete. The first page provides overview information. The At A Glance chart summarizes the investigations and helps you plan for assessment and extension activities.

Next you'll find background information specific to this investigation. There is a section called Teaching Children About which gives you some insight into research about how children think and learn. Each investigation has several parts. For each part of the investigation, you will find a materials list, Getting Ready section, and step-by-step instructions for how to proceed through the investigation.

At the end of the folio, you'll find interdisciplinary extensions. You can do some of these extensions with the class or save them for students to use as projects at the end of the module. Next are the investigation duplication masters. Each master is labeled with a number so it will be easy to find when you need it.

Shortly before beginning this module, duplicate the letter to the parents and send it home with the students. This letter tells parents about the module and suggests some activities that they can do at home with their children.

It is important to read the Assessment folio before you begin teaching. It describes a system for assessing students throughout the investigations and also gives you ideas for the end-of-the-module testing or portfolio assembly.

The folio contains scoring guides for each of the assessments suggested.

Next are the assessment duplication masters. Here you'll find all the masters for the assessment charts and end-of-the-module assessments. As part of the kit, there are Science Stories for the students to read. The Science Stories folio gives you background information, recommends when to read the stories and suggests follow-up activities. You may want to read the Science Stories during a reading period rather than during science time, especially if you only teach science a couple times a week. In the Resource folio you will find lists of trade books, videos, computer software and other resources that you can use to enrich the program.

The final tab is the FOSS website folio. On the website you'll find simulations for each module in the program. The students can contact scientists and FOSS students across the country. You'll need to check the website to see the many features available there, including resources for teachers. Now you're ready to begin.

<Investigation 1, Part 1>

Narrator: This investigation begins with students making mixtures of solid materials in water and then separating them. You will want to set up two materials stations for each part: One a chemical storehouse and one for everything else. Here is what you'll need for this part: From the kit you will need diatomaceous earth, kosher salt, gravel, sticky labels, craft sticks, filter papers, five milliliter spoons, FOSS funnel stand, screens and plastic cups.

From the FOSS measurement kit you will need basins, pitchers, half liter containers, 15 milliliter spoon, syringes, hand lenses. And you will need to supply water, transparent tape, lined paper and paper towels. Make copies of the student sheets Separating Mixtures and Thinking About Mixtures and make one copy of Assessment Chart For Investigation 1.

Assessment opportunities are embedded throughout the module. It is important to read over the note about assessment in the Getting Ready section and also read about the assessment opportunities in the folio to make the best choices for you and your class.

Practice setting up the FOSS funnel with filter. Take the sticks and put them in the brackets like this and take the filter, fold it into fourths, and open one flap to make a cone shape. Put it in the funnel and place a cup underneath.

For each group, fill a one half liter container with water and place it at the materials station. For this module we recommend setting up two materials stations. To avoid congestion at the regular materials station, set up a chemical storehouse for the solid materials. Have two sets of materials available so that two getters can get the materials at the same time like this.

If the materials are in a plastic bag, empty them into the containers and have a five milliliter spoon in each. For this part we use diatomaceous earth called powder, salt and gravel. You'll notice that on the diatomaceous earth there is a warning. Tell your students that breathing in the dust can be a health hazard. But if handled properly, it won't be a problem at all.

At the fifth and sixth grade level it is a good idea to have students keep careful notes in a journal. Prepare Word Bank and Content/Inquiry charts using large sheets of paper or a flip chart. Make a Project Folder for the class. As the students think of ideas for projects during the investigations, ask them to write them down and put them in the folder to choose from at the end of the module.

The session begins with the teacher explaining to the students that they will be investigating the properties of solid and liquid materials.

Teacher: Today we're going to be starting a new science unit called Mixtures and Solutions. And there's one very important rule that you need to know as we begin this unit. And that is that we don't taste the powders, even if we know what they are.

Narrator: The teacher goes on to explain that occasionally she will give permission for students to taste. But only then will they taste any of the materials they work with.

Teacher: We're going to be working with salt.

Narrator: The teacher introduces the three materials they will be using.

Teacher: We'll be working with gravel, which is like the little rocks that you would find on a gravel driveway or maybe as part of your dirt. And then we're going to be working with a powder that's called diatomaceous earth.

Narrator: After Getters 1 get hand lenses and the student sheet, Getters 2 get three cups and sticky notes. The recorders label one cup G for the gravel, P for the powder, which is the diatomaceous earth, and S for the salt.

The getters now bring one cup to the chemical storehouse at a time and using the five milliliter spoon measure out one level spoonful of each material into the labeled cup.

Student: This isn't like this one.

Narrator: The students observe the properties of the materials with their hand lenses. They record the color, texture, shape and size of particles.

Student: Kind of like --

Student: Round with jagged edges.

Student: Yeah.

Narrator: After the students share their observations with the class, she then asks the students what they think might happen if they add water to each cup with the dry materials.

Student: Go to the bottom of the 50. Okay. There. Stop.

Narrator: Each group has three craft sticks so that they can use one in each cup. To prevent contamination, they label the craft sticks P, S and G.

Teacher: Okay. What we have created here are mixtures. And you get a mixture any time that you mix any two substances together. So we have a mixture of gravel and water, powder and water and salt and water. What are some of the mixtures that you work with or have or drink or

eat or whatever in your everyday life?

Rocky?

Student: Chocolate milk when you stick the Quick in the milk.

Teacher: Okay. Very good.

Jessica?

Student: Well, there's lots of fruit drinks that you drink that's a combination of two different kinds of fruits.

Teacher: Okay.

Andy?

Student: When you make tuna salad, you put tuna and mayonnaise together.

Teacher: Very good. Every mixture can be separated. And what we're going to do now is try to separate the mixtures that you have. In order to separate them, the getter will have to come get a screen, three more cups and three more labels. The recorder will want to label the cups again G, P and S.

Narrator: With three additional labeled cups, the students strain the mixtures through a screen and observe the results. The students should observe that only the gravel was separated with the screen. The powder and salt go through the screen.

Student: For powder everything got through and for salt everything got through on the screen..

Narrator: The students record the results of their tests.

Teacher: Okay. You've just used the screen filter --

Narrator: After discussing the results of the first test, the teacher demonstrates how to use the filter paper.

Teacher: So we're going to use a new filter. And this one is a coffee filter. It's a paper filter. And it works just like the screen filter. If you hold it up to the light, you can see little holes in between the screens of the paper. But it's a lot tighter than the metal screen that you've just used. And so it will separate your mixture differently than when you used the metal filter.

Now, you're not going to filter the gravel because you've already filtered the gravel. It already worked with the screen. But with your powder and your salt, you're now going to use the paper filter. Now, the way that you use it is you get a paper filter. You fold it in half. Then you fold it in fourths. And then you pull out one side so it's like a cup. Okay?

Narrator: After assembling the funnel and stand, the students place the funnel on a paper towel. They place the empty cup labeled P or S under the funnel as the receiver. They stir the mixture in the matching cup and pour it through the filter.

Student: There's some powder in there and it's on the side.

Student: It's all on the side.

Student: Is the water still clear?

Student: The water isn't clear.

Student: No.

Student: Most of the powder got out.

Student: See, look at all of the powder it got out.

Student: Wow.

Student: Let's see if --

Student: The salt?

Student: The salt is really tiny.

Student: Let me see.

Student: There's no salt.

Student: There's no salt.

Teacher: Did the filter paper work differently than the screen?

Class: Yes.

Teacher: Okay. What was different about it?
Nick?

Student: Well, the screen -- the holes were kind of bigger. So like when the powder went -- when the powder -- when you poured the powder, it went through the holes. But when I used the filters, the holes were smaller so it caught the powder.

Teacher: Okay. Did it work with the salt?

Student: Um, no, because the salt melted in the water.

Teacher: Okay; okay. Very good.

Narrator: The discussion continues. The students observed that the salt dissolved in the water. The teacher explains that if a solid material and a mixture can't be separated from the water with the filter, it is a special kind of mixture called a solution. So the salt water is a solution.

The students can now complete their student sheets. This part concludes with the teacher listing new words on the Word Bank and formulating concept statements for the Content/Inquiry chart with the students. In this part the students should learn that a mixture of water and a solid can be separated by screening or filtering. There are readings in the FOSS Science Stories about mixtures and solutions. Be sure to check the Science Stories folio for the best time for the students to read these stories.

<Investigation 1, Part 2>

Narrator: In Part 2 of this investigation, students use evaporation to separate salt from water in a solution. Here is what you'll need for this part: From the kit you will need vials, sticky notes, craft sticks, five milliliter spoons, plastic cups, kosher salt, evaporating dishes and the FOSS trays.

From the measurement kit you will need the balances, the mass sets, which include 25 gram pieces, five 5 gram pieces, two 10 gram pieces and one 20 gram piece. Also the syringes, the half liter containers, two pitchers and the basins. You will need to supply transparent tape, water to put in the half liter containers and paper towels.

Make copies of Making a Solution and the response sheet Separating Mixtures and have available the Assessment Chart For Investigation 1. Plan to store the evaporation dishes in the FOSS trays by putting them in the wells like this and then placing a vial in each corner in order to stack the FOSS tray on top of it.

Let me show you how to zero the balance. First take the top and then the indicator and place it inside so that the rounded edge is pointing up. This is the slider that we will use to zero the balance. Place it on the base, then take your cups, one on each side, and use the slider to position the indicator on the raised bar like this.

Begin this session by asking students what is a mixture and how can a mixture be separated. The teacher reminds the students that all mixtures can be separated. They review that the gravel and water mixture was separated with a screen and the powder and water mixture was separated with the paper filter. Today they would tackle the problem of putting together and taking apart a salt solution.

Teacher: We're going to see how much the 50 milliliters of water weighs.

Narrator: The teacher demonstrates weighing 50 milliliters of water and finds that it weighs 50 grams.

Teacher: And it looks about like 50 milliliters of water weighs 50 grams.

Narrator: Using the student sheet, students make the salt solution by adding 50 milliliters of water to five milliliters of salt. They use the balance to weigh the solution and record the mass on their student sheets. The salt and water solution should have a mass of about 55 grams.

Student: That is enough. Otherwise, you're going to put it overboard.

Narrator: Knowing the mass of 50 milliliters of water and the mass of the salt and water solution, students can subtract to find the mass of five milliliters of salt equals five grams. Now, to separate the solution, the students decide to try evaporation. The evaporation of the water may leave the salt behind.

The students label the evaporation dishes with their names and pour just enough solution to cover the bottom of the evaporation dish. The students place the evaporation dishes on the FOSS trays and the teacher will store them until the water is evaporated.

In this part students have set up an investigation and will have to wait a day or two to see the results. Before ending this session, introduce the Project Folder. Explain to the students that at the end of the module they will be selecting projects to investigate further. This is a good time for the students to add their ideas into the folder.

<Investigation 1, Part 3>

Narrator: In Part 3 of this investigation, students observe salt crystals that are left behind when the water has evaporated from the solution. This is what you'll need for this investigation: The hand lenses from the measurement kit and the FOSS trays with the salt crystals in the evaporation dishes. Make copies of the student sheet called Mixtures and Solutions Journal. Take the student sheet, place it on top of several sheets of lined paper and staple the top left corner. And have available the copy of the Assessment Chart For Investigation 1.

Observe the salt crystals with a hand lens. You should be able to see a square shape with an X pattern on each crystal. Begin this session when all of the water has evaporated from the dishes. Ask the getters to get the dishes.

The teacher introduces the purpose of a journal. She tells the students that scientists keep track of their investigations in journals. They title their page and draw a picture of the crystals in the dish.

Student: How come they grew?

Student: I don't know. That's what I thought was (inaudible).

Narrator: After the students have completed recording their observations, the teacher explains that the residue is sodium chloride crystals or salt. A crystal is a solid form of a material that can be identified by its special shape or pattern. The students may want to add water to the crystals to see if they will dissolve and reappear again. Encourage them to do so.

In this part students should learn that a solid material in a solution can be separated through evaporation.

<Investigation 1, Part 4>

Narrator: In Part 4 of this investigation, students are given diatomaceous earth, gravel and salt to separate using the appropriate techniques. Here is what you'll need for this part of the activity: From the kit you will need plastic cups, evaporating dishes, screens, sticky notes, FOSS funnel, filter paper, gravel, diatomaceous earth, kosher salt, five milliliter spoons and craft sticks.

From the measurement kit you will need hand lenses, syringes, half liter containers, pitchers and basins. You will need to provide transparent tape, student journals, water for the half liter containers at the materials center and paper towels.

Duplicate the student sheet Separating A Dry Mixture and have the Assessment Chart For Investigation 1 available. Set up the chemical storehouse with two sets consisting of gravel, powder and salt. Place a five milliliter spoon in each. Have eight plastic cups available.

Begin this session by explaining that you are making a dry mixture of gravel, powder and salt. The teacher demonstrates by placing a five milliliter spoon of each material in a half liter container and stirrers. She explains that she has just created a dry mixture. The teacher challenges the students to design a method to separate the three materials so that the gravel ends up in a G cup, the powder in a P cup and the salt in an S cup. The students read over the sheet called Separating A Dry Mixture and put a plan together.

Teacher: Part 2 what you're going to do is describe your plan for separating the mixture. You'll need to list your materials that you're going to use. And then you'll need to list a 1, 2, 3, 4 step which is your procedure for completing the separation. Then Part 3 asks you to write your results which is what happened as you carried out your procedure in Part 2 and all of the steps that you did.

Narrator: The getters make the dry mixture.

Student: I think we should use the filter because -- for the powder, to separate the powder.

Student: But we can't use water.

Student: Uh-huh, there's water up there.

Student: We can use the filter.

Student: Yeah. But the salt wouldn't come and then we could evaporate it.

Student: I know. But if the salt and the powder is still in it, then the -- because the powder just dissolves.

Student: We've already separated the gravel let's pretend and we could get it wet. And then we could put it through the funnel. And then the water that was left we could evaporate and see if there was salt in it still.

Student: We should do the filter.

Student: Yeah.

Student: How many filters?

Narrator: The teacher visits each group to check their plan before they begin. She only checks that they have a plan, not that their plan will work.

Student: We use all 50 milliliters.

Student: Should we use all 50?

Narrator: The teacher circulates from group to group. This part is a performance assessment. She is evaluating how each student uses the equipment, how each student participates in developing the plan and the part each student plays in executing the plan. Later she will call on several groups to report to the class how they were able to separate the mixture.

Student: And stir it at the same time.

Student: You have to have the stick.

Narrator: Some groups may come up with creative ways of separating the mixture. It is a good experience for the students to see that there can be more than one way to do something in science.

Student: Salt is coming down.

Student: All right. So let's put the gravel in the cup and let that evaporate.

Student: We need to evaporate --

Student: Just let that evaporate.

Student: Just let that evaporate.

Student: The water will.

Student: Cool.

Student: Is it working?

Student: Yeah.

Student: Yeah.

Student: And then we have to put -- here is the powder cup.

Narrator: The students record their procedures, observations and results in their journals. In this part students have applied what they have learned about mixtures and solutions to separate a dry mixture. This brings us to the end of Investigation 1. Be sure to select several of the interdisciplinary activities for your students and have them do the math problem of the week before moving on.

<Investigation 2, Part 1>

Narrator: In the first part of this investigation, students will be making a saturated solution by

adding salt to water until no more will dissolve. Here is what you'll need for this part: From the kit you will need the FOSS funnels, filter papers, plastic cups, plastic bottles, the sticky notes, five milliliter spoons and the kosher salt.

From the measurement kit you will need the balances, the plastic mass sets, the 25 milliliter spoon, the hand lenses, the syringes, the half liter containers, the pitchers and the basins. You will need to supply transparent tape, the student journals, water for the half liter containers at the materials station and paper towels.

Duplicate Student Sheet No. 8 called Saturating A Solution. Make a copy of the Assessment Chart For Investigation 2, which you should keep with you so you can make notes about how your students are working. Place two 25 milliliter spoons of salt in a cup for each group like that.

Begin this lesson by asking the students how they would test a mixture to find out if it is a solution.

Teacher: Remember our first lesson when we were separating solutions in our Mixtures and Solutions unit? Who can tell me how you test if a mixture is a solution or not?
Michelle?

Student: We use a filter to see if it filters -- if it separates, it's not a solution. And if we really want to separate a solution, we let it outside and it evaporates.

Narrator: The teacher asks the students to find out how much salt would dissolve in 50 milliliters of water. Students talk in their groups to come up with a plan. After the teacher introduces the materials, the students, working in pairs, begin their investigations. The first step is to place 50 milliliters of water in the bottle.

Student: Good job.

Narrator: Next the students mark the water level by placing a sticky note so that the bottom edge is even with the water level. Using the funnel, each pair adds one spoonful of salt at a time and shakes the bottle until all the salt is dissolved. They continue doing this until no more salt can be dissolved in the water.

Teacher: Did any not dissolve? So you may have a saturated solution. Yeah, it looks like you have some little salt particles left over.

Student: We stop?

Teacher: So you'll know it took you four of those spoonfuls, four 5 milliliter spoonfuls to get a saturated solution.

Student: It says 20 milliliter.

Teacher: What happened to the salt when we put it into the water?

Student: It dissolved.

Teacher: That's true. Now where is the salt after it dissolved?
Brian?

Student: Um, it's -- now the salt is like kind of a part of the water. After it dissolved, it's mixed in with the water. So now we have salt water.

Teacher: Now, how do you know that, Brian?

Student: Because the water level is higher than it was when we -- the water level is higher than it was when we first poured the water in. It's not a lot, lot higher. But it's about at least half a centimeter higher.

Narrator: The teacher explains that when they added salt to the point where no more would dissolve, they have a saturated solution. Now the teacher asks how they can find out how much salt 50 milliliters of water can hold before no more will dissolve. How can they find out how many grams of salt it took to saturate 50 milliliters of water? The teacher asks the group to come up with a plan.

Student: Use the gram cubes.

Student: Use the extra salt in one and the gram cubes in the other. And if it was balanced, find out how much it was.

Narrator: The plan begins with the students removing the undissolved salt. First they sprinkle the filter with water so that the paper filter does not absorb the salt solution. They label a cup with an S. This cup will be the receiver for the salt solution. The cup is placed under the funnel. The solution flows quickly through the filter. It is exciting for the students when they see the undissolved salt caught by the paper.

The teacher reminds the students to zero their balances with two empty cups before working with their solutions. Although the salt solution was made with 50 milliliters of water, when the students placed the salt solution on one side of the balance and 50 milliliters of water on the other, they discover that the salt solution has a mass greater than 50 milliliters of water. Now they can find out how much more.

Student: Where's the paper towel? Quick, get a paper towel.

Student: There's a paper towel right here.

Student: All right. Great. Good.

Student: One, two, three --

Teacher: All right. I'm interested to see your response to this question: How many grams did it take of salt to saturate your solution. And I wanted to record up here each of your groups' responses.

So could I get the response from the first group?

Group: It was 12 grams.

Teacher: 12 grams for the first bottle. How about the second bottle?

Group: 13.

Teacher: We have a good variation of data here. We have everything from 9 grams all the way up to 17 grams.

Narrator: In this part students should remember that in a salt solution, you reach a point where no more solid material will dissolve in a given amount of water. Check the folio for the FOSS Science Stories so you can plan to read them with the students during the activity.

<Investigation 2, Part 2>

Narrator: In this part, the students make a second saturated solution. This time using citric acid. They compare the mass of the dissolved citric acid with the mass of the dissolved salt from Part 1. Here is what you're going to need for this activity: From the kit the FOSS funnels, the filter paper, citric acid, the five milliliter spoons, plastic bottles, plastic cups, the evaporating dishes, sticky notes, the plastic vials and the FOSS trays.

From the measurement kit you will need the balances, the plastic mass sets, the 25 milliliter spoon, the hand lenses, the syringes, half liter containers, the pitchers and the basins. You need to supply journals, transparent tape, water for the half liter containers at the materials station and paper towels.

Duplicate Student Sheet No. 9 called Response Sheet - Reaching Saturation, which you can use for assessment. Have Assessment Chart For Investigation 2 available.

Place four heaping 25 milliliter spoons of citric acid in a cup and label it with a sticky note for each group. Place these at the materials center. To begin Part 2, review what saturated solution means. The teacher introduces citric acid to the class and asks if the students can give examples of food that contains citric acid.

Teacher: What is an example of something that we eat that has citric acid in it?
David?

Student: Jolly Rancher.

Teacher: Jolly Rancher. Good example.
Catherine?

Student: Oranges.

Teacher: Michelle?

Student: Soft drinks like Slice and soft drinks and sodas.

Narrator: The teacher challenges each pair of students to find out how much citric acid it takes to make a saturated solution in 50 milliliters of water. They take the challenge and begin.

Student: Now put the water in.

Teacher: It takes the strong guy to do it.

Student: Actually I'll just do it.

Teacher: This is a strong one here. What does it look like? Should you add another one?

Student: It's clear.

Teacher: Yeah.

Student: Okay. Come on.

Teacher: Uno más...

Narrator: The teacher reviews the process for separating the undissolved material and the filtering begins.

Student: Da dada dah . . .

Teacher: Pour the whole thing in there.

Student: Measure it.

Student: No. It's definitely going to have to be higher than that.

Student: Just put it in.

Student: I'm just putting it in here for now.

Student: Is that one orange?

Student: One big one.

Student: I want another one.

Student: Just shove them in there.

Narrator: The teacher records the results for each group on the board. Students should get between 45 and 65 grams of citric acid compared to the 10 to 20 grams of salt. The teacher leads a class discussion comparing the solubility of citric acid to salt and water.

Teacher: What did you dissolve more of?

Narrator: The students cover the bottom of an evaporation dish with the citric acid solution to find out if the citric acid solid material will be left behind when the water evaporates. When citric acid dries, it is very sticky. Have some of the students rinse out the bottles, balances, cups and funnels before putting them away.

In this part, students should learn some substances are more soluble in water than others. Encourage students to add ideas and questions to the Project Folder.

<Investigation 2, Part 3>

Narrator: This part of the investigation is a performance assessment. Students will identify an unknown material using their knowledge of solubility. Here is what you'll need for this part: From the kit the FOSS funnels, filter paper, the evaporating dishes, plastic cups, plastic bottles, sticky labels, the five milliliter spoons and Epsom salts.

From the measurement kit you will need the balances, the plastic mass sets, the 25 milliliter spoon, the hand lenses, the syringes, half liter containers, the pitchers and the basins. You will need to provide the student journals, transparent tape, water in the pitcher to fill the half liter containers at the materials station and paper towels. Duplicate Student Sheet No. 10 called Chemical Data Sheet. Have Assessment Chart For Investigation 2 available.

Put three heaping 25 milliliter spoons of the mystery material, which is Epsom salts into a cup labeled Mystery Material for each group. After filling the cups, put the Epsom salts container out of sight.

Begin this session by introducing the chemical data chart. Challenge the students to use this chart to come up with a plan to identify an unknown material.

Student: We could -- we could do what we did with the salt and the citric acid. We could have 50 milliliters of water.

Narrator: Jennifer goes on to describe the process used in the earlier parts.

Teacher: And what's really important is that when you use your notebook today and your journal, you're going to write out a plan. And you're going to describe the details in each step of your plan on how you're going to saturate this solution. So whatever step you take in your experiment today, you need to have that included in the plan that you're writing down step by step just like Jennifer explained in your journal today.

Narrator: The getters get their cup of mystery material and the groups observe it and record its properties in their journals. Then each group discusses a plan to solve the challenge. As the teacher visits each group, he will look at their observations and how they develop and write their plans.

Student: Because it's bigger.

Student: Yeah.

Student: It could take longer to dissolve.

Student: So write down --

Narrator: The teacher is looking for details in the student observations.

Teacher: Coarse. Good words; good words. Two millimeters. Hard. Okay. Now you can continue working on your plan.

Student: We put a sticky on it.

Student: To show the line of the water.

Student: Yeah.

Narrator: Once the teacher has approved the group's plan, the getter goes to the materials station to get the equipment they will need.

Student: Get the sticky note.

Student: Okay. Do you want to shake it?

Student: Okay.

Student: Here. I'll pour it in.

Student: Okay. You can get it wet. Damp I mean.

Student: We need another cup.

Student: We need two of them.

Student: We need fresh water.

Student: How many grams did you have?

Student: Five. And --

Student: 15.

Narrator: The students use the Chemical Data Sheet to determine the unknown material. The teacher is observing and talking with the students. He will record how they are working on his assessment chart.

Here is where they can identify the material. If they have followed their plan and correctly identified the material, the teacher will give them a plus on the assessment chart. This group will allow the water to evaporate to find out if the crystals will be left behind. Students should understand that solubility is a property of solid materials and can be used to identify them.

<Investigation 2, Part 4>

Narrator: In this part, students compare the evaporating dishes of salt, citric acid and Epsom salts. Here is what you'll need for this part: The evaporating dishes of salt from Investigation 1, evaporating dishes of citric acid from Part 2 and the evaporating dishes of Epsom salts from Part 3 along with the hand lenses. Have Assessment Chart For Investigation 2 available.

Begin this session by asking the getters to get the dry evaporating dishes for their group.

Teacher: Just tell your partner with you what you see.

Student: I see a bunch of icicle things.

Student: They look like icicles.

Student: Oh . . .

Student: It has a bunch of different designs.

Student: It's heavier.

Student: Look. There's a star in the middle. If you look in here, there's a little star.

Student: Yeah.

Student: Little ones.

Narrator: In this part, students should learn that crystals of different solids have different characteristics which can be used to identify them. This brings us to the end of Investigation 2. Be sure to select several of the interdisciplinary activities for your students and have them do the math problem of the week.

<Investigation 3, Part 1>

Narrator: In this part, students compare Kool-Aid solutions with different concentrations. Here is what you'll need: From the kit you'll need the plastic vials and the sticky notes. From the measurement kit you will need the one liter beaker and two plastic pitchers. You will need to provide a mixing spoon, sugar sweetened drink mix, paper cups and a permanent marking pen. Duplicate the Student Sheet called Soft-Drink Recipes and make one copy of Assessment Chart For Investigation 3.

Purchase a can of sugar sweetened Kool-Aid to make eight quarts of drink. Choose strawberry, cherry, fruit punch or grape flavor. Avoid lemonade. The acid taste of lemonades might confuse the students when comparing sweetness. Other sugar sweetened drink mixes could be substituted for Kool-Aid. But artificially sweetened drink mixes are not suitable. Remove the part of the label that shows the recipe. You'll want to make sure that students on sugar restricted diets limit their intake of Kool-Aid.

Label four vials 1, 2, A and B. Each student will need two paper cups labeled 1A and 2B. You'll

only want to pour about 20 milliliters of Kool-Aid into each cup to be sure there's enough to go around. To see what 20 milliliters will look like in the cup, measure 20 milliliters into the syringe and place it in one of the cups to see how much it fills it up.

Begin this session by showing the students the Kool-Aid powder with the label removed and tell them that you can't remember the recipe for the mixture.

Teacher: We're going to make one of your favorite drinks, Kool-Aid, today. But the recipe isn't on the canister. It disappeared. So we are going to figure out which recipe is the correct recipe for Kool-Aid today.

Narrator: The teacher explains that today the students will get to taste the mixtures they are working with so that they can help figure out how much Kool-Aid needs to be added to the water. The students have the Kool-Aid recipe sheet so they can record their own observations during the activity.

Teacher: We're going to mix the Kool-Aid. First we'll do -- in Jar 1 we're going to put one scoop of Kool-Aid. Then in Jar No. 2 we'll put three. One, two, three. And this is already presweetened so we don't have to add sugar. But we do have to add water.

So Anthony, will you please go fill this to the 1,000th milliliter mark with water? Thank you. All right. Anthony has filled our beaker. We're going to put it into No. 1. And I'm going to stir it up.

And while I do that, Nick is going to go get another 1,000 milliliters of water. Okay. Thank you. Now we'll add 1,000 milliliters of water to mixture No. 2. Stir it up.

Is Kool-Aid a mixture?

Alex?

Student: Yeah, it's a mixture.

Teacher: Yes, it is a mixture. Is Kool-Aid a solution?
Shadia?

Student: Yes.

Teacher: Yes; that's correct. Okay. If we wanted to look at these two, how would we know if one of them was a saturated solution?

Frank?

Student: We could look at the Kool-Aid to see if there was any powder floating around. And if there isn't, then it's probably not saturated.

Teacher: That is correct.

Narrator: After the getters get two cups for each student in their group, the teacher circulates around the room pouring about 20 milliliters of Solution 1 into Cup 1A and 20 milliliters of Solution 2 into Cup 2B for each student. The students begin by making visual observations and

recording them on their student sheet. The teacher will pour a small amount of each solution into the demonstration vials for comparison.

Student: They are both red but one is darker.

Student: Uh-huh.

Student: The darker --

Student: They smell the same.

Student: Not -- these two don't. That one smells different.

Narrator: When the students complete their visual observations, they taste.

Student: This one is good.

Student: 2B is good.

Student: 1A is just --

Narrator: Too watery.

Student: Too watery.

Student: And this one has all the sugar so it's really good.

Student: It's sweeter.

Student: So we can say A1 is --

Student: More watery.

Student: And 2B is sweeter.

Student: 2B is sweeter.

Student: And 2B is darker than 1A.

Narrator: The teacher introduces the concept of concentration.

Teacher: Can you tell me what the difference was between the colors from Solution 1 and Solution 2 of the Kool-Aid?

Student: Cup 2 was darker than Cup 1.

Teacher: Yes, exactly. When one solution is darker than the other, that has to do with concentration or the amount of Kool-Aid -- powder that we put in. We put 1,000 milliliters of

water in both Solution 1 and Solution 2. But one was darker than the other. And you can see that here in these that we have. This one that's darker, which was Solution 2, is more concentrated because we put more Kool-Aid powder in with the same amount of water.

We are now going to do some more work with concentration. We're going to make two new solutions. Solution A and Solution B. And this time instead of putting different amounts of Kool-Aid in, we're going to put the same amount of Kool-Aid in both containers. So we're going to put two scoops in A and two scoops in B. But the difference is going to be that in A we're going to put 1,000 milliliters of water. And in B we're going to only put 500, which is the halfway mark right here.

Anthony, will you go fill that to the 500 mark, please, with water?

Student: Okay.

Teacher: Halfway between 4 and 6.

Student: Okay.

Teacher: Okay. Which one do you think is more concentrated, A or B?
Michael?

Student: I think it's B.

Teacher: Why?

Student: Because it is like only a little water and taste is so sweet. But you put more water, it will make the taste not as sweet.

Teacher: Okay. Thank you. I'm going to make some samples up here of B and A. And now you are going to get the same opportunity that you had with 1 and 2 to make a comparison observation. So you'll need to look, smell and all of those kinds of things and then taste Solution A and Solution B to try to determine which one is more concentrated.

Narrator: The teacher pours just a little bit of Mixture B to be sure there's enough for all of the students. The students observe the appearance and smell of the two solutions and record their observations. Then they taste the two solutions and record their findings.

Student: Taste B then A.

Student: Yeah, B is darker.

Student: What are the similarities?

Student: Red.

Student: This one was put less water in.

Student: This one is lighter, because it's like more water in there.

Student: There's too much water in this one. Not enough water in this one.

Student: This one has too much and this one has too little.

Student: Yeah -- I'm going to go write it down.

Student: This one is using more water.

Student: Because it's saturated.

Teacher: Pick which one of those is the correct recipe for Kool-Aid and write it on the bottom line right now.

Narrator: In this part the students should learn that the concentration of a solution can be changed by changing the amount of a solid material in a given amount of water or by changing the amount of water in a given amount of solid material. The concentration of a drinkable solution affects the taste. Be sure to check the FOSS Science Stories folio and plan time for the students to read the stories.

<Investigation 3, Part 2>

Narrator: In this part, the students make three different salt solutions and compare their concentrations. Here is what you'll need for this activity: From the kit the kosher salt, stirring sticks, five milliliter spoons, plastic cups and sticky notes. From the measurement kit you will need the balances, hand lenses, the 25 milliliter measuring spoon, the syringes, half liter containers, pitchers and basins. You'll need to provide transparent tape, student journals, water for the half liter containers at the materials station and paper towels.

Duplicate Student Sheet No. 12 called Salt Concentration and Student Sheet No. 13 called Response Sheet - Concentration, which you can use for assessment. Have Assessment Chart For Investigation 3 available.

Place two 25 milliliter spoonfuls of salt for each group into a cup and label it. To begin this part, review what the word concentration means.

Teacher: How do we make a concentrated solution?

Student: We put less water and put more Kool-Aid in.

Teacher: Exactly.

Student: So it tastes more sweet.

Teacher: To make a concentrated solution, the more powder you put in it, the more concentrated the solution becomes. What if I asked you how we make the solutions more dilute?

Student: If it's already made, you have to put in more water so it doesn't taste as strong.

Teacher: Exactly. Today we are going to work with different levels of concentration of salt in a solution.

Narrator: The students follow the directions on their student sheets and label their cups.

Student: I need this. Stir that. And then put this up here. And put this --

Student: Wait.

Student: Then what one do we put up there?

Student: I need 50 milliliters of water.

Student: Yeah. This one is heavier.

Teacher: In this investigation we want to make sure that we always work with the same amount of the solution. We didn't in the Kool-Aid experiment but we are going to today. If we always want to work with 50 milliliters of solution, how could we make sure that we always have 50 milliliters of solution?

Frank?

Student: We could use a syringe.

Teacher: Exactly; exactly. We can take the syringe, which has already been placed in your basins. And we can measure out 50 milliliters of the solution. Now, you need to make sure just like we did when we were doing experiments before that you don't have air at the top of the syringe and that you keep it low enough in that all you're sucking is the solution and that you're not sucking out air, also, with the syringe. Okay?

Student: Let's weigh the solution.

Narrator: After the solutions are made, the students use the balances to see whether they can tell which solution is the more concentrated.

Student: Do we agree that's Solution 2?

Student: Yeah.

Student: Yeah.

Teacher: Look at your results. Which one was heavier, Solution 1 or plain water?
Amanda?

Student: Solution 1.

Teacher: Solution 1. Now, Solution 1 or Solution 2, which one was heavier?
Armen?

Student: Solution 2.

Teacher: Yes, Solution 2. So what can we determine from that? If Solution 1 is heavier than water and Solution 2 is heavier than Solution 1, what happens with concentration? What conclusion can we make?

Ankur?

Student: Solution 2 is the most concentrated one because it's the heaviest.

Teacher: Very good. Thank you.

Narrator: The teacher explains that to make Solution 3, the students need to use 150 milliliters of water or three syringes full. So before they can compare Solutions 2 and 3, they will need to have another labeled cup in which to place 50 milliliters of Solution 3. Then the students will have equal volumes in the cups being used for comparing.

Student: Hey! Okay.

Student: Stir one. You have all three of them.

Student: It's not doing anything.

Narrator: Part 3 provides an opportunity for teachers to see how well the students have transferred their understanding of concentration from the concrete experience of tasting Kool-Aid to the abstract experience of comparing different concentrations of salt. Continue to add ideas to the Project Folder.

<Investigation 3, Part 3>

Narrator: In this part, the students determine the relative salt concentrations of three mystery salt solutions. Here is what you'll need for this part: From the kit plastic cups, kosher salt and sticky labels. From the measurement kit you will need the balances, the half liter containers and syringes. You will need to provide the student journals and food coloring. Have Assessment Chart For Investigation 3 available.

To prepare the first of the three mystery salt solutions, pour 400 milliliters of water into the half liter container. Next add 35 milliliters of salt and stir it until it dissolves. Finally, add two drops of red food coloring.

You'll make the second mystery salt solution by dissolving 75 milliliters of salt in 400 milliliters of water. You'll add two drops of green food coloring. Next you'll pour 400 milliliters of water into a half liter container and add just two drops of blue food coloring. No salt.

Take these three mystery solutions to the materials center. This is a performance assessment. You may want to carry the Assessment Chart For Investigation 3 with you. If the students can determine the most concentrated solution, give them a plus.

Teacher: Today we're going to be working with three mystery solutions. They are each a

different color. But that's just so you can tell them apart. It's not so that -- it's not because there's different things in them. They each have salt in them. And what you're going to do is compare their concentration. You don't know how much salt has been put into each one.

What you're going to need to do is in your group come up with a plan to be able to compare the concentration and decide which one has the most salt in it and which one has the least. You're going to compare all three. And in order to do that, you will need 50 milliliters in a cup of each one of the solutions: Blue, green and red.

Narrator: When the getters have brought 50 milliliters of each solution to their tables, the groups start working on their plans. The teacher will check the plans before students get the equipment they need for their tests.

Student: So what should we do?

Student: So we'll get a balance and balance them. And then we can balance two first and see which one weighs more. And then take the other one and weigh it to see which one --

Student: How about we get like those gram squares and then put one in one side and see how many grams it is in each one?

Student: But I don't think we have those supplies.

Student: Um, well . . .

Student: Ms. Rhodes didn't say we had that as a supply. But we should get the balance and balance it. So like first these two --

Student: Because then it will show us.

Student: Then these two and these two and the heavier one has more concentration or salt or whatever.

Student: Or salt.

Student: So do you want to get a balancer? Okay. I'll write the plan.

Student: What we're trying to figure out right now is which one is heavier out of all of these three.

Student: Yeah.

Student: Let's try the green and blue first.

Student: Yeah.

Student: Put it in.

Student: Green.

Student: The green is heaviest. Circle green.

Narrator: The students will have different ways of recording their information. When the students share their results, the teacher reinforces the idea that different procedures can yield the same results and that the mass of the solutions reveal the relative concentrations of salt in the solutions. If there are discrepancies, it may be because the students didn't zero the balance or they may have had an air bubble in the syringe.

Students should have learned that a balance can be used to compare equal volumes of different concentrations of the same kind of solution. The greater the mass, the more concentrated the solution. This brings us to the end of Investigation 3. Be sure to select several of the interdisciplinary activities for your students and have them do the math problem of the week.

<Investigation 4, Part 1>

Narrator: In this investigation, students observe and compare materials before and after a chemical reaction. Here is what you'll need for this part: From the kit two sets of each material for the chemical storehouse: Calcium chloride, citric acid and baking soda. In addition, plastic cups, craft sticks and sticky notes. Please note that calcium chloride absorbs moisture from the air and will turn from a solid to a liquid if not tightly sealed when not in use.

From the measurement kit you will need syringes, half liter containers, pitchers and basins. You will need to provide transparent tape, the student journals, water put in half liter containers at the materials station and paper towels. You will need to duplicate Student Sheet No. 14 called Fizz-Quiz Place Mat and Student Sheet No. 15 called Fizz-Quiz Observations. Make one copy of Assessment Chart For Investigation 4.

Begin this session by introducing the chemicals that the students will be working with. The three chemicals the teacher is introducing are citric acid, baking soda and calcium chloride. He cautions students not to taste any of these chemicals. He advises that extra care should be taken with calcium chloride because it can irritate the skin. The teacher asks the students what they already know about each chemical.

Student: Like if you have heartburn, some people use it like that.

Teacher: Yeah, baking soda is used for heartburn. We use baking soda for cooking. It's used to help as a leavening for bread, to help the bread rise. And then we have calcium chloride.

Narrator: The teacher reviews what the students know about solutions. The challenge today is to find out if the solid materials listed on the board make solutions in water. The students already know about citric acid so it doesn't need testing. Half of the groups will test baking soda in water and the other half will test calcium chloride in water. Each group has five milliliters of either baking soda or calcium chloride which they mix with 50 milliliters of water and stir.

Student: Can you see that in there?

Student: It's giving off a whole (inaudible).

Student: I can see some. Not much. Kevin, look. It's making little lines in the water. See, there's a line right there. They are growing smaller, too. I think they are going to dissolve in there.

Student: Probably.

Teacher: Okay. You've had your solutions and you've stirred them, you've put your calcium chloride and your baking soda in your cups and you've stirred it up. What did you notice as you looked carefully at your baking soda and the calcium chloride and you compared the two? What did you notice about the solubility of each one?

Student: Well, baking soda, it can't dissolve. Because there's -- I stirred it up for a long time and nothing is happening really.

Teacher: Yeah. What would that tell you about the solubility of baking soda compared to the other one?

Student: Well, that -- what is this called?

Student: Calcium chloride.

Student: Calcium chloride is more soluble than baking soda.

Teacher: Yes. You noticed that the calcium chloride was more soluble. What could we do to make the baking soda more soluble?

Ferron?

Student: We might be able to add more water.

Narrator: The students add 25 milliliters more water to the baking soda and stir.

Student: It looks like it's totally dissolved.

Student: I know but --

Teacher: Okay. As you've noticed, the baking soda made a solution and the calcium chloride made a solution. Did anybody notice anything about the difference between the calcium chloride and the baking soda solutions?

Scott?

Student: We noticed that when we mixed the water with the calcium chloride, that it got warm.

Teacher: Yeah. You noticed the warmth.

Narrator: The teacher explains that a property of calcium chloride is that when it dissolves, energy in the form of heat is released. The teacher proposes a new challenge. The students will now have a chance to see what happens if they mix two of these solid materials with water.

With their student sheets to guide them, students prepare labels for the new mixtures and place them on the cups. Using their Fizz-Quiz Place Mats as guides, the students mix calcium chloride and baking soda with water.

Student: Whoa, it's like shhhh!

Student: I can hear it.

Narrator: Calcium chloride and citric acid in water is No. 2 and is not as exciting.

Student: Nothing really happened. The stuff just moved it up.

Narrator: Baking soda and citric acid in water is No. 3.

Student: Look what I drew!

Teacher: What do you think caused all of that fizzing?
Kevin?

Student: Well, I think it was actually a chemical reaction. Because it seemed that right when we mixed the water with some of the stuff on the -- that was in one of the cups, then they kind of just exploded or started fizzing, you know.

Teacher: What's in those bubbles, in that fizz? What do we call that?
Vanessa?

Student: Gas.

Teacher: Gas, yes. Can you describe to me any new material that was left in the cups after your reaction?

Student: See, look. Right there. See right there. They are all like -- the color is a lot different right there.

Student: I know it's a lot --

Student: It's a lot darker. So I think the material is there.

Teacher: Shaneise?

Student: Like there's white gunk stuff.

Teacher: There was some white gunk stuff in the bottom of Cup No. 1. Yeah. And we call that a precipitate. Whenever a chemical reaction creates another solid that's in the water, it may make the water look white. But it will create another solid. We call that extra solid that's left over after the chemical reaction a precipitate.

Narrator: The getters place Cup No. 1 in a safe place to be used in Part 2. Everything else should be rinsed clean. In this part, students learn evidence of a chemical reaction includes formation of a gas, temperature change or formation of a solid material. Be sure to check the Science Stories folio to plan time for student reading.

<Investigation 4, Part 2>

Narrator: In this part, students separate and study material produced in a chemical reaction. Here is what you'll need for this part: From the kit the FOSS funnels, filter paper, plastic cups and evaporating dishes. You will also need to provide transparent tape, a small piece of chalk, student journals and paper towels.

For each group you will need to provide Cup 1 from Part 1 that contains the precipitate. Duplicate Student Sheet No. 16 called Response Sheet - Fizz Quiz, which you can use as an assessment. Have Assessment Chart For Investigation 4 available.

Begin this part by reviewing precipitate. The students had no trouble remembering the chemical reactions from the previous lesson. When asked how they could separate the precipitate from the liquid, they all thought of filtering and evaporation.

Student: Be careful; be careful. Okay. Hold on.

Student: What is that?

Student: It looks like cotton.

Teacher: That precipitate that we got is a combination from the sodium bicarbonate and the calcium chloride. And it's actually what's used on the chalkboard, regular chalk. That's what makes chalk.

Narrator: Each group pours enough remaining liquid to cover the bottom of an evaporation dish. They will wait for the water to evaporate to see what is left. When the solutions have evaporated, the students observe the crystals and discover another product of the reaction between calcium chloride and baking soda, salt. They should recognize salt crystals from their observations in Investigation 2.

They record their observations in their journals. In this part, students should learn that in a chemical reaction new products are formed. This is a good time for students to add questions and ideas to the Project Folder.

<Investigation 4, Part 3>

Narrator: In Part 3, students use combinations of materials used in the first two parts to produce chemical reactions in zip bags. This is what you'll need for this part: From the kit you'll need two containers of each chemical for the chemical storehouse. Those include citric acid, calcium chloride and baking soda. Place a five milliliter spoon in each container.

In addition, you'll need plastic cups, zip bags and sticky notes. Please remember to cover the calcium chloride when not in use. From the measurement kit you will need syringes, half liter containers and pitchers. You will need to provide transparent tape, the student journals, water

for the half liter containers at the materials center and paper towels. Have Assessment Chart For Investigation 4 available.

Begin this part by asking the students what might happen if you put calcium chloride, baking soda and water in a zip bag.

Student: It could maybe like overflow it or something.

Teacher: Yeah. So you think that it will fizz up just like it did in the cup and then maybe expand the bag and fizz up?

Narrator: Notice how the students close the zip bag leaving an opening only large enough for the syringe to fit in. This makes sealing it easier.

Student: Don't put the thing so deep so you could take it out really quick.

Student: Air bubbles. Are they still in there?

Student: Just little ones.

Student: Ready? Ready to lock it?

Student: Hurry up; hurry up; hurry up.

Student: It's not doing anything.

Student: Our plan worked! It was bubbling. I'm a genius.

Student: And it's also (inaudible).

Student: Yeah. See the bag won't even close.

Narrator: Now they try citric acid and baking soda with 50 milliliters of water.

Student: Hurry up.

Student: Sorry.

Student: Oh.

Student: Close it; close it.

Student: I did.

Student: Oh. It's bubbling. It's fizzing.

Student: Wow. It's going to blow up; it's going to blow up.

Teacher: The next thing we're going to do is see what happens when all three of these are mixed together in a bag.

Class: Oh . . .

Teacher: And let's find out. We have one level scoop. The second level spoon.

Student: Is it going to explode?

Student: Shhh . . .

Teacher: Okay. Let me get my bag sealed up a bit. You might need to cover your ears.

Teacher: Here we go.

Student: Oh, God.

Teacher: Here is the side view.

Student: It's getting bigger.

Teacher: It's bubbling and fizzing like mad. Side view.

Class: Oh . . .

Teacher: See, this one is pretty -- do you think it's going to be bigger than the baking soda and citric acid? Now it's really getting hard to hold.

Student: Put it in both of your hands before it pops out the top.

Teacher: Shhh . . . and now I'm going to put this one up on the board, also.

Class: No.

Narrator: The students record their observations in their journals. In this reaction carbon dioxide and a precipitate is produced. This precipitate is not chalk. It is calcium citrate. In this investigation the idea is that the formation of a gas is one change that occurs in some reactions.

<Investigation 4, Part 4>

Narrator: In the last part of this module, students work on their own investigations. As they work on their projects, you will gain insight as to how well students understand these basic concepts of chemistry. This is the time to bring out the Project Ideas folder. As much as possible, you want students to use their own ideas and investigate the questions that they have come up with during the module. If you don't have enough ideas in the Project Folder for everyone to investigate, you can use the project ideas sheet to help students think about more investigations.

The project plan sheet should be completed by each student or team of students doing a project.

This sheet helps you control materials and keep tabs on what the students are working on. You will need to decide whether or not you will be able to supply any additional equipment the students ask for. You will also want to make sure that the projects the students propose are realistic and will be of some benefit to the class.

FOSS suggests students give three-minute presentations following the guidelines on the Presentation Guidelines sheets. They can also make a poster to help them explain their investigation to the class. You should plan about two weeks for the students to work on their projects. You can give them time at school or suggest that they work on part of the project at home.

The Assessment folio has suggestions for scoring the students' work on the projects. Also in that folio you will find information and masters for two kinds of summative assessment: An end-of-the-module test given in a variety of formats and suggestions for assembling portfolios.

This is the end of the Mixtures and Solutions module. Keep in mind that there are details in the Teacher's Guide that we weren't able to show you in the video. I really hope you have as much fun teaching this module as I do with my students.