

FOSS® NATIONAL INSECTS AND PLANTS TEACHER PREPARATION VIDEO TRANSCRIPT

<Linda De Lucchi Introduction to Module>

Narrator/Linda De Lucchi: There are a number of things that you need to think about when you enter into this module. First thing, you do need to plan ahead and consider how you're going to get the organisms and when they are going to arrive. You also need to stay quite flexible. We'll try to guide you through the activities. But we can't determine—we can't predict exactly what's going to happen in your classroom. You need to stay flexible and go with things as they come up.

And a third thing is that you need to be patient. The kids will want to observe, and we want them to make discoveries on their own. So try not to give them information. Try not to tell them things that they'll observe. But let them do it on their own. At times you will have to provide information. But most of the time we want the students to do the telling and thereby make the discoveries themselves.

Let's take a look at the equipment that you'll need for this module. There's enough equipment in these two boxes for your class of 32 students to do all of the activities.

<Teacher Guide Introduction>

Narrator: Before you begin teaching this module it's important to look through the entire Teacher Guide. The FOSS teacher guides for this module includes these folios: Overview, Materials, Investigation Folios, Science Notebook Masters, Teacher Masters, Assessment, Assessment Masters, Science Notebooks, Reading Extensions, FOSS Website, and Investigation Outline by Session.

Be sure to read the overview folio before you begin teaching the module. It contains many helpful suggestions for getting started. In it are an overview matrix, the standards that are addressed in this module, background information, ideas for teaching science to young children, and suggestions for scheduling the activities.

In the Materials folio, you will find an inventory list for the kit, lists of any materials you'll need to provide for the investigations and directions for ordering the insects and planning for their care when they arrive. This is critically important information, so read it thoroughly and plan ahead for getting the organisms to your classroom.

The FOSS publisher provides coupons for ordering the insects. Plan ahead. Order them at least three weeks in advance and specify a delivery date for each type of insect to your classroom. Information on ordering any replacements is found on the back page.

Next are the investigation folios. These are the heart of the program and will be described in detail in this video. The first page gives overview information. The At a Glance chart summarizes the investigation and helps you plan for assessments 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 the research on how children think and learn.

Each investigation has several parts. For each part you'll find a materials list, Getting Ready section and step-by-step directions for conducting the activity with yours students. Step 2 in each of the Getting Ready sections includes assessment opportunities found in that part. The interdisciplinary section at the end of each investigation has many ideas for extending the activity into other areas of your curriculum.

The next sections contain the Science Notebook Masters and the Teacher Masters. Here you'll find all of the student sheets used in the investigations. There are also masters for math extensions, and Home/School Connections for each investigation.

There are many ways to assess your students' learning as they progress through the investigations. Read through the Assessment folio for more information about formative and summative assessments. After the assessment section, you'll find the Assessment Masters. On the anecdotal notes sheet you can record your students' insights or the difficulties they run into. You'll use the assessment checklist and the summative assessment chart when assessing specific skills and concepts. End-of-module assessments provide performance and written assessments to assess student learning.

The Science Notebooks folio describes the benefits of using science notebooks with FOSS. It offers many suggestions for using notebooks with your grade level.

Check out the Reading Extensions. This annotated list includes both nonfiction books and fiction books for student reading, along with teacher resources.

The FOSS Website folio introduces you to the interactive, multimedia website for teachers, parents, and students.

In the last folio, you'll find a complete outline of the modules by session.

In the kit you'll find a class big book and 32 matching student books, the FOSS Science Resources for Insects and Plants. These are designed to be read periodically throughout the module, after students have had the hands-on experience of the activities.

<Before You Begin>

Narrator: There are a few things to get ready that you'll use throughout the module. Make copies of the anecdotal notes and the assessment checklist sheets for assessing student understanding during the investigations. Some teachers write in students' names before making copies. Word Bank and Content charts are used to help students remember the new vocabulary and concepts they learn as the module progresses. Students will add to these charts at the end of each session.

Before you begin teaching be sure to put up the FOSS Safety poster where it can easily be seen by students. The poster is included in your kit.

<Investigation 1, Part 1>

Narrator: The activities in this module can be done in any order. The time from egg or larva to

adult is highly variable, depending upon the temperature. But we suggest that you start with Activity 1, Mealworms, because these insects are very easy to care for in the classroom and the students will be able to observe their life cycle in the ten-week period. Let's take a look at the equipment that you will need for Part 1.

From the kit you'll need to get these items: The clear basin that's going to be the class mealworm habitat, the plastic cups used to distribute materials, the vials with snap lids that each student will use to create their own individual mealworm habitat, the screen that you can use to sift out the bran from the mealworms, labels to cut apart that each student will use to put on the lid of their vial with their name, push pins that the students use to poke holes in the lid of the vials so the mealworms have some air, and hand lenses, one for each student for observing the mealworms.

You'll also need a paper plate for each student.

Before beginning this part, make copies of the Letter to Parents, and send it home so parents will know about the insects their students are investigating. Also send home the Mulberry-Tree Alert so you'll have mulberry leaves for the later silkworm investigation. You will also need to make copies of science notebook sheet number 1, called Life of a Mealworm.

For the class you'll want to keep this large calendar that includes information on the changes that occur in the insects over time.

These are the items that the teacher needs to provide for Part 1: A strawberry basket or some other kind of container to hold one groups' four vials, a marking pen—an erasable marking pen for recording on the class calendar, scissors to cut the labels apart, a knife to cut the food that will provide moisture for the mealworms.

Some of those foods include a sweet potato, a white potato, apple. You can also use carrots. You'll need to get some wheat bran from the grocery store. That's the food for the mealworms. And most importantly, you'll need to secure 200 mealworms from your local pet store.

Teacher: Today we are going to learn a very important science word. Say observe.

Class: Observe.

Teacher: Let's clap the parts in observe.

Class: Ob-serve.

Teacher: Again...

Narrator: If this is the first time students are making observations, introduce the word observe with a minilesson.

Teacher: ...it means to look at something carefully. What does observe mean?

Narrator: One way to do this is to have students respond chorally.

Teacher: So when I look at something carefully, I...

Class: Observe.

Teacher: When I use my senses to find out more about something, I...

Class: Observe.

Teacher: Today we are going to use our senses to learn more about the mealworms. So we are going to...

Class: Observe.

Teacher: When you observe you make an observation and observations can be recorded so that you can remember what you observed. And we've been recording observations in our...

Class: Science notebooks.

Teacher: When was the last time you saw an insect? When did you see an insect last?

Narrator: The teacher starts the discussion by asking the students when was the last time they saw an insect and what was that insect doing and how did they know it was an insect. Students will say a variety of things, but it'll get the students starting to think about insects.

Teacher: Well, we've got something living to show you today.

Narrator: Then the teacher introduces the mealworms as an insect. She tells the class that everybody will get one to observe. The insects are distributed to each group of four students in a cup. Each group gets eight mealworms. Each student gets a paper plate and a hand lens to observe. After 10 or 15 minutes, the teacher calls the students back to the rug and engages them in a discussion about what they observed.

Teacher: What did you see? What did you notice about the mealworms? Tammy?

Student: I saw on the tail there was two dots.

Teacher: You saw two dots on the tail? Bonnie?

Student: They only moved with their front and they steered with their front. They didn't steer with their back.

Teacher: Oh, I see.

Narrator: Invariably during this discussion one student will ask "Can we keep them?" And that's perfect because now you can guide the discussion towards what do we need to know and what do we need to do if we're going to keep these mealworms.

The teacher needs to work with the students to come up with four important items: The

mealworms, like all living things, need food. They need a place to live or space. They need air so they can breathe. And they need water or moisture. Those are the four things that are introduced here and will be introduced when all the other insects are brought into the classroom.

This is how we prepare the insects: First thing we do is get a vial. Each student gets their own vial and a label. Students write their name on the label and then take it off, put it on the lid. It doesn't quite fit. There's a little bit of overlap, but that's fine.

Then take a push pin and make, oh, about 20 holes in there. Right through the label, that's fine. That provides the air. We're going to put a couple pinches of bran in here. The number of pinches depends on the size of your pinch. That's pretty good, just about that much.

Then we're going to put in a tiny bit, just one piece, of potato. Put in our very own two mealworms. Then secure the lid on. Each student will make this kind of a mealworm habitat and keep it right on their desk to observe over time.

Four students in a group can put their vials in a strawberry basket to form a corral so they won't knock the vials over.

Student: Look; look. They're just playing.

Narrator: Towards the end of Part 1 you'll want to set up a class mealworm culture in the clear basin. Add some bran to the bottom of the basin and then add all of the extra mealworms that you have that are not in the individual student vials. A little bit of potato should be added for moisture. And the students can observe the changes that occur in the class culture as well as in their own individual vials.

Mark the class calendar and then give each student a copy of science notebook sheet number 1, Life of a Mealworm. Have them find today's date and mark it as the day that the mealworms arrived.

In the Wrapping Up after each part you'll review new vocabulary from the Word Bank and add concepts to a content chart, called What We Learned. For Part 1, you'll want to use prompts such as: What structures do mealworms have on their body? How did they behave? What do insects need? What are the most important things to remember when working with live insects? You can also list student questions here.

Teacher: Our new insect that we observed today is a...

Class: Mealworm

Narrator: In the Wrapping Up section of most parts, you'll use a cloze review to reinforce new words. This is what a cloze review might look like for this part.

Teacher: ...source of...

Class: Water.

Teacher: Good. Mealworms need to eat...

Class: Food.

Teacher: And the last need of all living organisms is...

Class: Space.

Teacher: Good. The dry cereal that we used to feed the mealworms is called...

Class: Bran.

Teacher: Good.

<Investigation 1, Part 2>

Narrator: Part 2 can take anywhere from two to four weeks. The materials that you'll need to get from the kit include the posters which you make copies of from the duplication masters.

For each student, make a copy of science notebook sheet number 2, called Insect Record.

You also want to get some chart paper and a pen for recording class observations over time: observations of structures, behaviors and changes in the mealworms.

Over the two to four weeks that the students have their mealworms, they'll be seeing lots of changes or life sequences. One thing they'll notice is that the mealworm changes color. It turns white. That happens when the mealworm molts its skin. Mealworms, like all insects, molt in order to grow.

The students may observe some tiny orange granules in the bottom of the vial. They often think that those are eggs. But they are not. And you can suggest that if they are not eggs, they might be something else that the students can think about. They are the droppings of the mealworm. First and second graders refer to these droppings as mealworm poop.

The students will then observe that their mealworm changes into a different form. Some students may think that their mealworm has died because it's not moving. It looks like a little ghost. That's when you can bring out the pupa poster and introduce that term, pupa, as a resting stage of the life sequence of the mealworm.

Finally, the students will observe that the pupa changes into an adult beetle, the darkling beetle, or the tenebrio beetle. The students will be able to observe the adult beetles over time. Their observations will be heightened if they use a hand lens on a vial and create a bug box. It just so happens that this vial and this hand lens have a perfect match so by putting a mealworm or beetle on the bottom of the vial, slipping the hand lens on the top of the vial and looking straight down, you're right in focus.

As the students observe the adult beetles, you want to call to their attention the distinct body parts of the adult insect. They have three parts, the head, the abdomen and the thorax. You can draw it on the board and have the students draw it so they can identify these three different parts.

Have student's record changes on their Insect Record sheet and Life of a Mealworm calendar. Make entries on the class calendar as well.

In the Wrapping Up, review the words added to the word bank by using a cloze review. Ask students for their ideas to add to the content chart.

At the end of Part 2, introduce *So Many Kinds, So Many Places*, the first reading in the *Insects and Plants Science Resources* book.

Give students a few minutes to look at and talk about the cover of the book.

Teacher: Okay, open the cover...

Narrator: Introduce the table of contents.

Teacher: ...called the table of contents and let's see what the first story is going to be...*So Many Kinds*...

Narrator: Explain that this story will describe some interesting insects.

Choose the best strategy for reading the article with your class. You can use the big book with the whole class or have students read in small groups with the student readers. Questions will be posed throughout each article. You can discuss these as you go along, or after you've finished reading each article.

Teacher: Animal is an insect. Flies, ants, and crickets are...

Narrator: Introduce the glossary and show the students how to identify the bold face words as glossary words.

Teacher: Flowers. Flowers starts with F.

Narrator: For more on reading strategies, see the *Reading and Writing in Science* chapter in your Teacher Guide.

Teacher: The word flower, point to the word flower in the glossary.

<Investigation 1, Part 3>

Narrator: Part 3 is called life cycle. And if you're lucky, you'll be able to observe it along with your students in the classroom. We suggest that you establish an adult beetle only habitat in a clear basin like this one here. Put some bran in there, provide potato for moisture and just let the beetles do their thing.

After about two weeks or three weeks, ask the students if they think there might be anything else in there with the adult beetles. Scoop up some of the bran, put it in the cup and distribute it to the students on a paper plate or on a sheet of paper. Then ask them to observe very closely. At first the students will say that there's nothing there. But invite them to look closer and then they'll exclaim that there are baby mealworms in there. And here for comparison is a newly

hatched baby mealworm and another mealworm that's pretty well along his life cycle and probably will pupate shortly.

Ask them where the baby mealworms came from. And then you can engage them in a discussion about the adults mating, laying eggs, the eggs hatching and the little baby mealworms coming out. At this point the kids will want to establish a new habitat in a vial for their baby mealworms. And that's perfectly fine. You can do that. Another thing you can do is just put the baby mealworms back in with the adults and keep them as an ongoing culture.

When you have to pack up the equipment and put it back in the kit to pass it on to another classroom, you can maintain the culture in a separate plastic container. Something like this one. This one has been going on for years. We add more bran, more potato on a weekly basis and just let the complete life cycle go on.

We've got adults. We've got pupa. We've got larva. There are eggs in here. But they are so tiny you can never really find them. There are droppings in there. Everything is in together. And they live very happily. This can go on for years.

So that's what might happen in your classroom with mealworms over ten weeks.

To assess your student's progress, have them make a final entry about the life of mealworms in their notebooks.

In Wrapping Up Part 3, review the words added to the word bank by using a cloze review.

At the end of the session, introduce the summary chart and work with the class to fill in the structures and behaviors.

Teacher: Let's begin reading with your finger starting under the word "the."

Narrator: At the end of investigation 1, introduce Environment, the next reading in the Insects and Plants Science Resources book.

Teacher: You can tell it is an insect.

Narrator: Tell students that this article will help them understand how the environment can affect the way organisms look.

As always, choose the best strategy for reading the article with your class.

At the end of the reading, have students respond to the review items on science notebook sheet number 3, called Environment Review.

At the end of each investigation, you'll find the interdisciplinary extensions and the home/school connection. The interdisciplinary extensions include language extensions, art extensions, science extensions, and math extensions.

The home/school connections provide activities for use at home. Look ahead in the teacher guide

to see when each activity should go home. Parents can also download the activities for each home/school connection from FOSSweb.

<Investigation 2, Materials Preparation>

Narrator: I'm surrounded by the materials I've taken out of the kit so let's see what those are. This is the simple basin used to distribute dirt, as we get into the activity. Here is liquid fertilizer used after the plants are growing in the tray. Here's a half liter container and the vial that the students use to water the plants initially.

Here are the little cups—planting cups with drainage holes in the bottom that the students use to plant their brassica seeds. Here are labels that you'll cut apart so that the students can label their own cup of seeds. And here's the plastic cup used to distribute the seeds initially to the students. And here is the all important tiny package of brassica seeds, the central players in this module. All of these small items are in this green plastic tray will house the planter cups from each of the students while the brassica plants develop.

Up here I have a copy of the class calendar which is laminated and can be used to keep track of significant events in the life of brassica as they happen. And finally, this lamp and support structure. This all important light source will have to burn 24 hours a day to provide light continuously for the brassica plants as they grow.

Underneath here you'll find two cool white lamps. That doesn't refer to the temperature but the color of the light. It has to be on the blue end of the spectrum. And this frame which obviously is somewhat larger than would fit in the box has to be assembled as part of the activity.

In addition to the items just discussed, there are a few items that you'll have to provide from the classroom or from the local store. A few paper towels of any description, a pair of scissors for cutting the labels apart, a water color pen for marking on the class calendar, a bag of potting soil for planting the seeds and a container for bringing water to the seed.

Okay. Now it's time to take a look at the assembly required for that light support. I've gone to the kit and gotten out all of the pipes, and this is what I've discovered when I inventory them. Four long ones, six short ones with no hooks, two short ones with hooks and eight corners.

Here is how they go together. Now there's no absolutely right way to do this. You just start putting things together. I'm going to build a square first by putting angles on the end of the short ones like this. So I get something that's approximating a square. Okay. And then I'm going to put one of these pieces in with the hooks. Okay. Like this. Now, that looks pretty good.

Now I'm going to build another one like this. And I'm going to get the hooks on this one so that they face the opposite direction. We'll see why that's important in just a few minutes.

Now, okay, now I've got two squares. And I'm making sure that the hooks are facing opposite directions. The hooks are toward me here and away from me on this one.

Now I'm going to separate the two squares using the long pipes. Now we're getting there. Now if I were going to actually use this for suspending the lamp, I would bang things together very securely. But I'm going to dispense with that step now.

Here is what I meant by hooks in opposite directions. These are open on the outside of this enclosure now. And these are also open on the outside of the enclosure. That's so when I hang the light in here, I can have easy access to these hooks. And all I do is slide one of the links over the hook here, over the hook here and come down to the other end and do the same kind of an operation.

Now, we use this chain suspension system so that as the plants, which will be positioned underneath the lamp, grow, I can raise the lamp so that they don't impact the lights. So I'll be lifting this up and finding ever and ever shorter lengths to suspend the lamp. That's the system.

<Investigation 2, Part 1>

Narrator: Part 1 is an orientation to the brassica activity. You call the students to the rug. You discuss what the students know about planting seeds. And you introduce the class calendar.

You'll need to make copies of the Growth of Brassica and Plant Picture science notebook sheets for each student. Students will use these to record the development of their plants.

In the Wrapping Up, use a cloze review to reinforce the new vocabulary, plant, leaves, seed, and alive. Add concepts to the content chart using these questions as prompts: How can we tell if something is a plant? How do you know if plants are alive?

<Investigation 2, Part 2>

Narrator: In Part 2, Planting Brassica, you have to do a few preps ahead of time. First of all, you'll need to cut a couple of these sheets of labels into individual labels so that the students can stick them on their cups. Cut a couple of dozen paper towels in half. Dump your soil into two of these basins where the students can scoop it up easily. And finally, distribute the brassica seeds into eight cups.

Here is the little bag of brassica seeds. Shake them down to the bottom, take your scissors and cut the top off of the bag. Here is one I've already cut. Dump the little seeds out on some white paper so they are easily visible. And using your finger, just press down on the seeds to pick them up.

There I've got three. And there's five more. That's eight. That's how many I need in a cup for a group of four students. Repeat until you've got the seeds distributed into eight cups.

Now we're ready to move into the classroom and do some planting. You should be prepared to demonstrate this planting procedure for the students, which they will then do on their own. First each student will get one of these little planting cups with holes in the bottom and a label. And they'll identify their own planting cup. Next they will in turn go to one of the two strategically positioned soil supplies and scoop up a full measure of soil and then level it off and then tap it down.

Teacher: Okay, how many seeds do you get? Two seeds...

Narrator: They take two of these precious little seeds and place them on the surface of the soil.

You then come back to the soil and put just a pinch of soil on top, just enough to cover it. Pat it down.

Teacher: And then water your plant, but we don't want to get water all over our table, so...

Narrator: You're going to place the cup on a folded paper towel. And then taking the vial and the water supply, scoop up one full vial of water and carefully pour it over the surface of the soil. And then finally, each student places the cup in the tray where it will stay until a big giant plant.

Now the students place their tray of brassica plantings underneath the light, making sure it's close to the light but not touching. And then they make a calendar entry so they can remember the date that they planted their brassica seeds. Mark the date on the class calendar as well. The students from time to time will need to get their tray out from under the lamp. And probably the easiest way to do that is just to get a couple of students to lift the whole framework and slide the tray right out. That's the safest and most convenient way to do this.

Several matters of maintenance must be attended to as the plants grow and mature. First off, any time the tray is dry on the bottom, the plants need to be watered. The way we water the plants is to take one of these half liter containers. And now we're going to add fertilizer each time we water. And I'm going to take this liquid fertilizer and put four drops—two, three, four—into the container. And then fill it up right to the top with water. And then simply pour this half liter of water right into the tray with the plants. The water will come up through the drainage holes on the bottom and provide them with the proper moisture that they need for growth.

Watch the video, How Plants Grow. This video discusses what plants need to grow and develop.

For the Wrapping Up, review the new vocabulary using a cloze review. Add new concepts to the content chart by using the prompt: What do your brassica plants need to grow?

<Investigation 2, Part 3>

Narrator: Here we are in Part 3 of the activity. And as you can see, our plants are doing nicely. They've been growing now, oh, it looks like maybe for a week, two weeks, three weeks because I have plants here of several different ages. Now, if you want to grow viable seeds, seeds that you can plant and grow new plants from yet another time, it's necessary to cross pollinate the plants.

So as they grow, it will be necessary to find blooming plants, different plants. And gently bump the flowers together. Flowers from the same plant can't pollinate each other. So they need to cross pollinate. This ensures that the pollen from one plant gets to another and that the seeds that develop will be fertile.

For each student you'll want to make copies of the Plant Picture sheet, as well as the *Flowers and Seeds* Review, and either Brassica A or Brassica B science notebook sheets.

As the plants grow and mature, the students will make entries in their science notebooks.

They'll make entries in the calendar as important events emerge. They will be learning the names and descriptions of the different structures that develop on the plants. After students have completed their drawings, the teacher can use the class calendar to record the events in the development of the brassica plants and to guide discussions at later dates.

Teacher: Anything else? Okay, this is what we have. We got flowers. We got more roots. Got bigger leaves and we've got more buds. Any other changes you've noticed since last Friday? Anything else?

Narrator: They will notice the development of seed pods. And I can see on this plant that there are some tiny ones just starting to show. And these will get bigger and bigger. And eventually they will look like little string beans. The little seed pods will start to appear probably after three, three and a half weeks. And they will continue to expand and grow to their full size at about the end of the fourth week.

At that time you can stop watering the plants. And then in short order they will shrivel up and die. And at that time the students will be able to harvest the mature seed pods. Open them up, take out the tiny seeds and these can either be planted immediately to confirm the life cycle or they can be saved for the next class that will engage in the brassica planting activity.

Let's review the development of our brassica plants over time. Here is planting day. After a week we can see the plant is starting to develop nicely with the first leaves. After two weeks pods are forming. After three weeks the plants are in full bloom and the first indication of some little seed pods are fairly visible. And after five weeks the plants have dried up, are dead, the seed pods are mature and inside are the viable seeds that can be planted immediately to restart the life cycle.

Read the story *Flowers and Seeds* in the *FOSS Science Resources* book. Discuss the review questions at the end of the article.

Students respond to the same review items on science notebook sheet no. 6 called *Flowers and Seeds Review*.

For the Wrapping Up, use the cloze review to reinforce the new words. Add any new concepts or questions to the content chart. Use these questions as prompts: How does a new brassica plant start? In what order do the new plant parts grow? What did we do to the classroom plants that bees would do in nature?

To finish up the investigation, review the concept of life cycle as it applies to brassica plants. Have students complete science notebook sheet number 7 or 8 where they label the mature brassica plants.

<Investigation 3, Part 1>

Narrator: In Activity 3, the students investigate milkweed bugs. Now milkweed bugs are true bugs. They're not butterflies. They're not beetles. They're true bugs. And this is the first bug the students have investigated. And like all bugs, it goes through not complete metamorphosis but incomplete metamorphosis. This is quite different from the mealworm that the students have

observed before.

The milkweed bug starts from an egg. When the egg hatches, a tiny little bug emerges. The bug grows, goes through five instars, molting each time, and emerges as an adult. These milkweed bugs that your students will be working with are found in the wild. But these have been particularly raised in a laboratory for laboratory use and classroom use. In the wild they eat milkweed seeds. But these eat only sunflower seeds. That makes them particularly easy to take care of in the classroom.

The students will be able to compare the life cycle of the milkweed bug to that of the mealworm that they've already observed.

Here is the equipment that you'll need for Part 1 of this activity: From the kit you'll need to get vials with lids, one for each group of four students, a label for each vial, hand lenses for pairs of students. And you'll need the paint brush that is in the kit. You use that to transfer the eggs to the vials.

In addition, you'll need to supply for yourself one piece of paper for working with the eggs and you'll need to order the eggs. You'll need to order the eggs just right before you're going to do the activity. The eggs will arrive and they will hatch within about three or four days. So timing is critical here. The eggs must come from a biological supply house. You can't get these eggs locally. So plan ahead, order them. And plan to use them as soon as they arrive.

Let's take a close look at the eggs. This is what they look like when they arrive. They are orange tiny little eggs. And they are sitting on some fibrous cotton. There are a lot of them in there. And what you need to do is to divide those eggs into eight parts and put one part in each vial.

I'm going to show you how to do that. Take out this cotton here. And what I'm going to do is I'm going to tease it apart so that some of the eggs—in fact, I want all of the eggs to fall onto the paper. You can see them getting on there. Once all of the eggs are on the paper, then you can separate the eggs into those eight groups so that you've got equal portions. Take one of those portions, scoop it up with the paint brush and put it in a vial. That's all you need to do. That's the preparation for starting Part 1.

Part 1 is a short session. Tell the students that you have some new insects for them to observe. And then give each group a vial with some tiny yellow round things in there. You can give each pair of students a hand lens and invite them to take a close look. Don't tell them what they are. Invite them to speculate, to guess what they might be and what they might change into.

Each group will be able to keep their vial. They'll need to label it so provide a label. And they can put their identification on the lid. The students can either keep their vials at their desks or if you feel they might not be safe there, you can put them on a side counter where the students can observe them each day.

For the Wrapping Up, review key vocabulary using a cloze review. No new concepts were introduced in this part, but some questions might be added. Select one of those questions as a writing/drawing prompt for students to respond to in their science notebooks.

<Investigation 3, Part 2>

Narrator: Part 2, Milkweed Bug Habitat, starts a few days later after the students have observed that tiny little bugs are crawling around in their vials. This is a time when the students will need to set up habitats, one for each group, and put their tiny bugs inside the habitats to observe over time. Let's take a look at the equipment that you'll need for this part.

Each group will need their vial of bugs and eggs, a label, pair of hand lenses, a large Ziploc bag, ball of cotton, piece of netting cut to about ten centimeters by ten centimeters, a vial with a lid, sunflower seeds—the sunflower seeds in the kit come already shelled—rubber bands, a push pin, a piece of cardboard. That's what each group will need.

And these are the tools that you'll need during the activity: You'll need a paint brush, a wooden dowel with a pointed end, and a hole punch. The materials you'll need to provide include jumbo paper clips, a pair of scissors, some absorbent paper towel, and some twigs.

For the assessment, duplicate science notebook sheet number 9 called Milkweed Bug Habitat. You'll also need to make a copy of science notebook sheet number 10 called *Variation* Review. The students will use this sheet after they've read the article in the science resource book.

In this activity each group of students makes a milkweed bug habitat. You'll need to demonstrate this to the class, so practice making one ahead of time. Let me show you what's involved.

You need to consider the space for the bugs. And this is the space we're going to put them in this one Ziploc bag. And they need some air. So we're going to take a push pin. And we're going to put a bunch of air holes towards the top. And that's with what this cardboard is for. Kids can just poke into the cardboard not damaging their desks or their fingers, and get a bunch of holes up there. We have space and we have air.

Now, to improve the space so that the bag doesn't collapse on us, we're going to put some twigs in there and make a small branching tree. We're going to get some twigs. And see if they are going to fit in there. These I'm going to have to break off just a little bit. Keep in mind that each collaborative group is going to make one. And each student in the group will be assigned one of the responsibilities. So one of the students will be making the tree.

We're also going to take a little bit of cotton. Spread it apart a bit and put it in that tree securely. Now, let me see if it's going to fit inside. Very good. Okay. I'm going to take it back out right now.

Space and air is taken care of. Now we need to consider food. Milkweed bugs eat only one thing—these milkweed bugs—sunflower seeds.

This little piece of netting is going to hold all of these seeds. And I'm going to catch them all up in the netting, take a rubber band, and secure the netting with the rubber band. Watching kids put rubber bands on the netting is an interesting process. Now, this food package can be put right on one of the limbs of the tree. Up top is good.

There's one more thing we need to consider. And that's water. We're going to make a fountain using this vial. Take the vial. And you'll probably need to do this for the students. Punch a hole

in the center of the lid with the hole punch. Then cut a small piece of absorbent paper towel just big enough to fit in that vial with some hanging out the top. And roll this into a tube. You might twist a little bit and then put the paper towel through the lid. Let's check size here. Oh, that's going to work just fine. We'll fill that with water. The wick will stay wet and that's how the bugs will drink by coming to the wick on the vial.

Now, we have to put this fountain inside our habitat. This is one of the trickiest parts. I'm going to take the bag. And this is a job that you, the teacher, will do for each group. Take the wooden dowel with the point. And you want to make a hole in the bottom off to one side a little bit. Just push the point through and pull the dowel out.

After you fill your vial with water, then you put the bottom of the vial towards that hole and then press. It will make a nice tight seal and the bugs will have water. And that will be hanging down like that. You do need to fill it with water before you put it in. And that amount of water in that vial will take care of the bugs probably for a month or so.

Let's put our tree in. One thing you want to be careful of is you don't want the branches of the tree to be touching the wick. Because then they will absorb the water. You don't want that.

The last thing that we need is a support system to hang the bag. So what we use is a jumbo paper clip. You can open it up, put the paper clip through the bag. And now you've got something that you can hang onto a push pin in the wall.

Temperature will affect the growth rate of the bugs—the warmer the environment is the faster the bugs advance through their life cycle. If your school reduces the temperature at night and on the weekends here's one option for keeping the bugs warm. Get a large cardboard box, run a string or stick from one side to the other near the top, hang all the bags on the stick and cover the top with aluminum foil. Direct a 60-watt lamp on to the foil on top of the box.

Part 2 begins with the students observing the vials. They'll see some eggs in there but they might see some other things moving around. Let's listen to some of their conversations.

Student: It looks like little animals.

Student: See.

Student: They look like spiders.

Student: They are not little spiders.

Student: They are like those things on the package.

Student: Did you see the little tail?

Teacher: Are they still in there?

Student: Yes, no.

Teacher: Did anything happen to them?

Student: Yes.

Teacher: What?

Student: They turned into little bugs. See on the box. They got the little red tail.

Teacher: Now, are some of them still eggs and some of them little bugs?

Student: Are the bugs still in the egg?

Teacher: Look closer. See if you can see anything that is still in the egg.

Student: Oh, yes.

Student: It looks like it is the bug.

Teacher: That's a good indication that there is some in there and ready to come in.

Student: One is all red. See it? It's all red.

Student: That one is a different color. Is that yellow?

Student: Uh-huh.

Student: Maybe not orange but something else.

Student: Is that like a black?

Student: Do you think they can fly?

Narrator: Identify the milkweed bug. Tell the students that the insects in their vials are milkweed bugs. They hatched out of those little orange eggs. Baby milkweed bugs are called nymphs. And the nymphs are going to live in the classroom. And we'll learn more about them.

At this point you'll want to review the basic needs of insects and then demonstrate for the students how to assemble the habitat. Organize the students into groups. And in each group one student should take one job responsibility. One takes care of the space. One takes care of the air. One takes care of the water. And one takes care of the food.

They'll need help doing some things. They'll need help installing the water supply. You'll need to come around with the dowel and help them do that.

When it's time to introduce the milkweed bugs, tell them to dump the bugs vial and all right into the bag. They might want to try to get them out of the vial. But it's okay to put the vial right inside the bag.

Students will label their habitats with their group number. Give them labels to do that and then find a place in the classroom where they can hang up the habitats, a place where the students can easily observe the bugs moving around. You want to be sure that they can see them several times during the day, that it's not difficult for them to get at them.

One other thing about location, the milkweed bugs do enjoy sunlight. They seem to be very active in the sunlight. You don't want them to get too warm. But if you have a place that gets afternoon sun, that would be a good place to put them. If you're keeping a class calendar, this is the time to record the arrival of the milkweed bug nymphs.

Distribute the Milkweed Bug Habitat sheet to students. Have them draw a picture of their habitat and label all the things milkweed bugs need to survive.

To wrap up Part 2, review the words added to the work bank using a cloze review.

Add new concepts to the content chart. Ask, What do milkweed bugs need in their habitat?

Read the story *Variation* in the Science Resources book. Discuss the review questions at the end of the article. Students respond to these review questions on science notebook sheet number 10, *Variation Review*.

<Investigation 3, Part 3>

Narrator: In Part 3, the students observe the milkweed bugs grow and change over time. There's no new equipment that you need for this part. But we do have some posters that you can use. Bring the posters out when the students observe the changes.

We've got one called Milkweed Bug Stages, Milkweed Bug Male and Female, and Milkweed Bug Pictures. Milkweed Bug Pictures is actually one that the students can color in after they can tell the males from the females.

You'll also need to make copies of the Insect Record sheet, and notebook sheet number 11 called Life Cycle of the Triangle Bug. You'll need to supply scissors and glue for the students.

Here is a milkweed bug habitat that has been going for, oh, about a month or more. The students will observe many things in their bug habitats. They may see that there are some black things accumulating on the bottom of the bag. They sometimes refer to these as black spiders. That's kind of what they look like. But there aren't any spiders in this bag so you'll want to ask the students what else they might be.

And the students might notice that at one time one of their milkweed bugs turned quite orange and even had orange legs, not black legs. You want to help the kids think through the fact that these milkweed bugs need to shed their skin. They need to molt in order to grow. And what those black spiders down at the bottom really are, are the milkweed bug molts. And those will accumulate over time.

The students will observe the milkweed bugs drinking from the fountain using their beak to get water. They will see them on the sunflower seeds also using their beak to get the oils from the seed. And the students may observe the seeds shriveling over time. You may even need to add a

new little net full of sunflower seeds after three or four weeks.

They may observe the milkweed bugs cleaning their antenna, washing their antenna. There is one doing that right here now. I can see him. Students may see the adults mating. They mate for long periods of time. So the likelihood that your students will observe that is great.

And they may even see them lay eggs. The females lay eggs in the cotton. There's some eggs in here.

Now, one other thing that the students will see is that the bag will get dirty. There's little brown spots on this bag. And over time, the bags might get quite dirty. Those are droppings from the milkweed bugs. And if the bag gets too dirty, you can build a new habitat and transfer all of the bugs from this bagging into a new habitat.

One question we often get is: How do you refill the vial when it needs more water? Well, the only way to really do that is to take the vial out. Either make a new wick or just add water and put the vial back in. And that's not too hard to do because these milkweed bugs, although they have wings and they can fly, they don't fly very well. And usually they just drop to the ground. It's perfectly fine to open the bag and have the students hold the milkweed bugs, have them walk on the table. That's no problem.

So taking the vial out shouldn't be a problem, either. Let me show you how you can do that. What I'm going to do is get a box just in case any of them get away. I'm going to stand up for this. And I'm going to open the bag. And when you open the bag, the milkweed bugs tend to drop down. That's their defense mechanism. When they are frightened, they drop down.

Now I'm just going to reach my hand down in here. And I'm going to pull this vial out. Now I have a bug crawling on my hand. That's no problem. It's so light I can't even feel him on my hand. But I'm going to shake him back down into the bag. And the only other thing you have to worry about is making sure that the hole down here doesn't let any escape. But this is going to be fine.

So I can even set this bag down, go change the water. And then when I'm ready to put the new vial of water in, just open the bag and reach down in here, find that same spot and push the vial in and close it up. Oh, I got another one on my finger. Brush him down. And only one of them got away. Here is one that crawled out. I can put him back in. Now, this is a job that your students will love to help you with.

And we're all set. So that's how you change the water or add water to the vial. There is a modified water fountain that allows you to add water without removing the water from the bag. You use a syringe to add the water through to the vial through a tube. Read the Getting Ready for Part 2 for the details on this system.

Here you can see in this habitat the adults have laid eggs. The adult females have laid eggs. Those eggs will hatch in maybe a week or so. The young nymphs will emerge and they can go through their entire life cycle in this milkweed bug habitat. This activity will never end if you don't want it to.

To assess progress, give each student a copy of the Life Cycle of the Triangle Bug, scissors and glue. Have them cut out the different stages and place them in the correct order.

Review the key vocabulary added to the word bank earlier and use the cloze review technique to review new words. Add new concepts to the content chart.

Review the milkweed bug life cycle by making a chart. Have students recall the structures and behaviors of the different stages.

Next, read the story Insect Shapes and Colors in the Science Resources book. Discuss the article, using these questions as a guide. Why are some insects hard to see? Why are some insects so colorful?

<Investigation 4, Introduction>

Narrator: The fourth activity is called Silkworms. The organism that the students investigate in this activity is the same one that produces the silk fiber used to make fine commercial silk fabric. This organism has been domesticated for over 4500 years and can't survive on its own. It relies on humans to provide it with protection and food.

This organism is probably one of the best organisms for students to investigate. And here are some of the reasons: The students can see it go from egg to larva to pupa to adult. They can see all of those stages clearly occur. The larva is very large and it moves very slowly. The adult doesn't fly and the students can also handle it very easily.

Another advantage is that you can save the eggs that are laid by the adult, stick them in the refrigerator and use them again next year. So it's an easy organism to maintain year from year. There are a couple of disadvantages. This organism eats only one thing, mulberry leaves, fresh mulberry leaves that you need to supply. You can only get them between the months of April to October, maybe November. So you have to plan to do the activity during that time.

Not only do they eat mulberry leaves but they eat voraciously. And you have to feed them on a daily basis, actually several times a day during certain stages of their life cycle. So you can't leave them during vacation. You can't even leave them at school on the weekends. You have to make sure that they are fed every day.

If you use eggs that you've saved and stored in the refrigerator, plan to take them out two to three weeks before you'll need to start the activity. If you order them from a biological supply house, plan on starting the activity within a week after the eggs arrive. Then you'll be ready to start Part 1.

<Investigation 4, Part 1>

These are the materials you'll need from the kit for Part 1: Each group of students will need a vial, a label and two hand lenses. For the class you'll need a brush to transfer the larva and the class calendar. You'll need to provide the scissors to cut the labels as before, a marker for the calendar and most importantly, the silkworm eggs. These I took out of the refrigerator two weeks ago.

Here is another way to store eggs. I took these out of the refrigerator a couple of weeks ago, too.

They are from last years' container that's been cut up and put in plastic bags. Eggs are stuck right onto the cardboard.

To prepare for Part 1, tease off some of the silkworm eggs by bending and tearing the cardboard or the egg carton that they are stuck onto. Get about ten or so eggs onto a piece of paper and transfer those to the vial. You'll need to prepare a vial like this for each group of four students.

Now you're ready to begin the activity. Give each group a vial and two hand lenses. Ask them to look closely and see what is inside the vials. Tell the students they will be able to keep the vials and see if anything inside changes. Give each group a label so they can identify their vial and then have them secure the vials in a safe place.

Mark the class calendar noting the day the mystery insects arrived in class.

<Investigation 4, Part 2>

Narrator: Part 2 begins when some of the larva have hatched out of the eggs and the students can actually see the larva moving around inside the vial. These are the materials you'll need: You'll need the vials with the eggs and larva, a hand lens for each pair of students. For the class you'll need a brush to transfer the larva to the habitat.

For each student you'll need the Insect Record sheet, and the Life of a Silkworm calendar.

These are the materials you'll need to supply: You'll need to get a nursery for the young larva, either a cardboard box like this one with a plastic cover over it or a margarine tub with a lid. You'll also need to get the mulberry leaves. I've got a bag here. And I'm going to keep them in the refrigerator until I need them. You'll also need a pen to record on the class calendar and some chart paper to record students' comments on silkworm structures and behavior.

You'll need to locate a mulberry tree to provide the leaves for your silkworms. If you don't know where one is, check around, ask some people at your school or in your neighborhood or go to a nursery and ask them to help you find one. Once you identify what a tree looks like, a mulberry tree, you'll see them everywhere.

Begin the part by asking the students to get their vials and to see what's inside. Then call the students to the rug and discuss their observations.

Teacher: I want to ask you some questions about the vials. Now that you've looked at them, what are some of the things that you saw in the vial? Let's see. What did you see? Karli?

Student: I saw eggs.

Teacher: Eggs? Can you describe the eggs?

Student: They were real small and they have kind of gray dots.

Student: No, black.

Teacher: Small and have kind of gray dots?

Student: Yeah.

Student: Mine was climbing up.

Teacher: You mean it was climbing up the vial?

Student: Yeah. It wanted to get at the top.

Teacher: You think it wanted to get at the top.

Student: It has teeny little legs on it.

Teacher: Raise your hand if you saw those little teeny legs. We're looking at how many legs that tiny thing had in there. They are kind of dark and black. That has a special name. That's called a larva. Can you say that word?

Class: Larva.

Narrator: Review what all organisms need in order to survive.

Teacher: We need to make a habitat for our larva, where our larva can grow and live and be safe. And some of the things we need to have in that habitat...

Student: Some leaves.

Teacher: We need to have some leaves. That's right. And we need to have a special kind of a leaf. But that larva only eats a very special kind of a leaf. They are leaves from a mulberry tree. And that larva is a silkworm larva. And it's the only food that it eats. So we'll have to put the leaves in a special spot where the larva will be safe.

Narrator: Introduce the habitat and describe for the students what they'll need to put inside. They will need to put some of the leaves—the mulberry leaves, you'll need to pass them around so the students can see them and feel them. Then put some of the leaves inside of the box, inside the habitat, and have students come up a couple of groups at a time and transfer their larva and the eggs into the habitat.

It's okay if the eggs are spread around the box. But try to get the larva onto the leaves. A brush will be handy for that. Then put the habitat in a place where the students can observe it over time. Make sure you cover it. The covering is to prevent the desiccation of the leaves so they stay humid. But you don't want to create too humid of an environment for the silkworms. They like it dry. But the leaves need to stay moist so you need to compromise there.

To assess progress, have students mark the date the larvae are added to the habitat on their Life of a Silkworm calendar. They should also record their observations of the new larva on their Insect Record sheet.

To wrap up this part, review the key vocabulary by using a cloze review. Add new concepts to

the chart by using these questions as prompts: What do silkworms need to live? What stages of the silkworm have you observed so far?

<Investigation 4, Part 3>

Narrator: Part 3 begins when the silkworms have reached a length of about two centimeters. Prior to that time it's better to keep the young larva all together. They do better that way. But now the students can make a silkworm habitat and groups can have them on their table to observe each day.

These are the materials you'll need for this part: You'll need a silkworm habitat sheet for each group of four students so that they can make their silkworm habitat box. You need a plastic bag for each habitat. And for each pair of students, a hand lens. These come out of the equipment kit.

You'll need to provide transparent tape, more mulberry leaves and the silkworms in their habitat. And here they are about two centimeters long. These are actually a little bit longer.

The first thing you'll want to do is to demonstrate to the students how to make the silkworm habitat. Let me show that to you now. Have them put the writing down on the table. And then fold the sheet of paper along each of the dotted lines here. Remember, each group of four students will make a habitat for their group.

Okay. Now we're going to open it up. And this part is kind of tough for young students. Have them bring the walls—two walls of the habitat up. And they will see that there's this part sticking out. You need to crease that and fold it over. You need to put a small piece of tape over that. Do that again. Bring the two walls up, crease the side and bring it over. Put a piece of tape on that. We'll repeat it on the other side. Let me do it with the other side, as well.

Looks are not too important here. Children just need to be satisfied with it. And you don't have to worry about the silkworms crawling out. They won't do that. They'll stay on their leaves.

Now you go around and give each group a few leaves and evenly distribute the silkworms so there are about four silkworms in each habitat. The students can observe them and watch them eat. And then the last step is to put the silk worm habitat inside the plastic bag.

You don't seal the bag. You leave it loose like that. But this will again help to retain the moisture in the leaves.

This is what sits on the students' desks. And they can make observations daily. They can take their silkworms out. But if the students start playing too much with the silkworms, you might want to have them remove the habitats to a central location.

Student: He tickles; he tickles. Put him on your hand. He tickles.

Student: Tickle, tickle, tickle.

Student: Watch. It's so funny.

Student: Tickle.

Student: Don't bite me. Mmmmm . . . that's a no-no. You go in the box.

Student: Okay.

Student: He's all alone.

Student: Let's put him in the bag.

Student: Don't close the bag.

Student: I'm not.

Narrator: Review key vocabulary, and add any new vocabulary to the word bank. Add new concepts to the chart. Use some of these questions as prompts: What do silkworms eat? What silkworm structures have you observed? What changes have you observed in the silkworms?

<Investigation 4, Part 4>

Narrator: Part 4 is called silkworm structure. Now, this is the second larva that the students have investigated. They looked at mealworm larva, and now the very large silkworm larva. So this is a good time to have them take a close look at the structures and to identify those structures and attach the language associated to all insect larva.

You'll need to make copies of the Insect Record sheet and the What Makes an Insect an Insect? review sheet for each student. You will also need to provide metric rulers so students can measure their silkworm larvae, and modeling clay so they can make three dimensional silkworm models.

Start off by introducing the term segment and ask the students to count the segments on the silkworm. They'll count 13. Then you can draw on the chalkboard 13 segments as shown here.

Ask the students to look at the first segment, the head. And see if it's the same size as all of the others. They'll say no so you want to modify your drawing so that the first segment, the head, is a little bit smaller.

Then ask the students to look at the second segment. They'll see that the second segment along with the third and fourth are larger and they are the segments that have a pair of legs on each one for a total of six legs. You can introduce those three segments as the thorax. The thorax always has the walking legs. All the rest of the segments form the abdomen. From the end of the thorax all the way back to the tail, that's the abdomen.

Now, ask the students to take a close look at the abdomen. And they will see that there are some leg-like structures on 7, 8, 9 and 10 segments. Those are called prolegs. They are not true legs. They are prolegs. And they have little claspers on the end. They help the silkworm to attach to things.

Students will refine their drawing and help you refine your drawing by adding things like the

false eye on the third segment. The spiracles or dots on each segment. That's how the silkworm breathes. They'll see the point back here near the tail and a couple of claspers at the very end.

You can ask the students to see if they can figure out where the silk comes from on the silkworm. You'll have to have them take a look at the silkworms on their desks and see if they can identify where the spinnerets are. The spinnerets are close to the head right up here. And that's where they will find the threads of silk coming from the silkworm. After you and your students have completed the chalkboard drawing, you can end this part by displaying the silkworm larva poster.

To assess your student's progress, have them create three-dimensional models of a silkworm larvae using modeling clay. Conduct 30-second interviews with the students as they work to note if they are including larvae-structures accurately.

Provide metric rulers and have students measure the length of a few silkworm larvae and their clay models in centimeters.

For the Wrapping Up, review the new words added to the Word Bank using a cloze review. Add concepts to the content chart by asking: Which body part do all insects have? What changes have you observed in the silkworms?

In the next session, read and discuss the article in the Science Resources book called, *What Makes an Insect an Insect?* Have the students respond to the review prompts on science notebook sheet number 14.

<Investigation 4, Part 5>

Narrator: Part 5 begins when the larva are three to four weeks old and they've gone through their five instars and they are ready to spin their cocoons. These are the materials that you'll need: You'll need those mature larva. These are the—these are the larva. They are about ready to start spinning.

You'll also need a hand lens. Materials you'll need to provide include a sheet of paper to line the box, more mulberry leaves—always more mulberry leaves—an egg carton, and a box.

You will also need a copy of the Insect Record sheet for each student, and the Silkworm Pupa, Adult and Stages poster for the class.

There will be a lot of excitement in the classroom when the student observes the first larva spinning its cocoon. That's your cue that all of the silkworms should then be put into a different habitat. The habitat will be the box. You'll get a piece of paper to line the bottom of the box. The egg carton will serve as a structure, a substrate for the silkworms to spin. You'll want to attach that securely inside.

Then have all of the students bring their silkworms and leaves. Put them inside the box. You'll want to provide plenty of leaves. You can leave it open. At this point the silkworms are so big; they'll eat the leaves so quickly, that you won't need to cover this with plastic. Then over the next week you'll see all of the silkworms spin. Students might even be able to watch it in progress.

Student: It looks like spider webs.

Student: Well, it looks like spider webs but it's not.

Student: Then how do they climb up?

Student: They spin it almost like spiders.

Narrator: This is what the pupa or cocoon of the silkworm looks like. Usually they'll spin white silk. But occasionally you'll have one that's yellow. I don't know why. But they'll be viable.

You can also introduce the silkworm pupa poster at this time. Put it up on the board so the students can see it. In about two weeks the adults will emerge from the pupa and again it will be great if the kids can watch this. The adults look different. The males are a little bit smaller and have longer antenna. The females are a little bit bigger in the abdomen.

The adult silkworms don't need food or water. They have only one purpose. And that is to find a mate and for the female to lay eggs. The female will lay hundreds of eggs. And the students will be able to see the female doing that. The eggs will stick to the cardboard and to the paper on the bottom of the box. That's what you can use to then cut up and put in a plastic bag and save in your refrigerator for the next year. Display the Silkworm Adult poster and the Silkworm Stages poster and review the life cycle of the silkworm.

For the Wrapping Up, review key vocabulary added to the word bank, and create a Silkworm Life Cycle chart noting the interesting structures and behaviors at each stage.

In the next session, read the article in the Science Resources book called, Same But Different. Discuss the reading, using these questions as a guide. How are these insects alike? How are they different?

<Investigation 5, Part 1>

Narrator: Activity 5 is called Butterflies. Your students may be very familiar with the adult stage of the butterfly. But they may not know what the larval stage looks like. That's what they'll have a chance to investigate in this activity.

Now, this is a class project. We don't have enough larva for every individual student to have. But they will be able to enjoy it as a class project. You'll need to order the larva. They come in a container that looks like this. Five or six larva in one container and plenty of food for them to go through their life cycle.

For each pair of students you'll need a hand lens. For each student you'll want to make a Caterpillar Structure sheet for them to record their observations.

And for the class, make one Painted Lady Class Notebook by stapling 8 insect records sheets together with a construction paper cover.

Start the activity by introducing the container of larva. The students will identify them as

caterpillars. And you can add that they are Painted Lady larva. When they are small, the students shouldn't handle them. They can only look at them in the container. But when they are about a week old—well, maybe about a week and a half, you can let the students at a center handle the caterpillars and observe their structures. This is a time when you might have them complete the Caterpillar Structures form.

Encourage the students to watch the larva and observe for molting, silk formation and pupation. The larva, when they're ready, will climb to the lid of the container and form into a J-shape and pupate. That's when you want to go onto Part 2 of the activity.

Review the key vocabulary with a cloze review, and add new concepts to the content chart using these questions as prompts: What do caterpillars need to live? How are caterpillars like other insect larvae? How are caterpillars different than other insect larvae?

<Investigation 5, Parts 2–3>

Narrator: Here are the materials you'll need for these parts: Go to the kit and find the butterfly cage. It comes in parts. There are four wooden dowels, two plastic platforms, a net and a vial holder. Also get one vial with a lid, the hole punch and a plastic clear cup with a lid.

These are the items that you'll need to provide: Sugar, transparent tape, Painted Lady pupa, sheet of paper to line the bottom of the butterfly cage, absorbent paper towel to make the wick for the fountain. And you'll need to find some mallow. This is optional. But if you can find it, that's great.

I recommend that you practice assembling the butterfly cage ahead of time. You'll do it in the classroom with the students. But do it once by yourself. This is how it goes: Put a wooden dowel in each of the depressions. Push them in firmly. Now, put the other platform down and turn it upside down. And once again, push the dowels into the depressions. Okay. Things are taking shape.

Now, find the net. The net has an opening on one side. And push the net over the cage frame. Turn it upside down. Pull the elastic on top so that it's nice and secure. Let me turn it around so that you can see that there's an opening here that I can put my hand in. But it won't allow the butterflies to fly out.

Now you'll need to make a fountain. This is the vial holder. Just like we did before, punch a hole in the lid, put in a paper towel wick. But this time, instead of using water, we'll use a sugar water solution. The adult butterflies need sugar water as their nectar source.

Now, this vial will go in that holder. And then I can put that holder right in there. But before I do that, I want to line the bottom of the cage with this paper. And then I can put in—now we're all ready to go.

If you can find some fresh mallow, that will be great for the adult butterflies to lay their eggs on. Get a plastic cup with a lid, poke some holes in the lid of the cup so you can stick the stems of the leaves through there. Add some water. And now you can put that inside the butterfly cage, as well.

<Investigation 5, Part 2>

Narrator: Before you begin, you'll want to make copies of the *Insect Life Cycle* Review sheet and have the Painted Lady Larva and Pupa posters ready.

Begin Part 2 by having the students observe the Painted Lady pupa and identify it as a chrysalis. Suggest that it's now time to move the chrysalis from the container into a more suitable habitat. This is a time when you bring out the butterfly cage and assemble it for the students.

Then you need to transfer the pupa to the top platform of the butterfly cage and you need to do it in this fashion: Carefully remove the lid. And under the lid you'll find a piece of paper. The pupa are attached to the paper. Now what I need to do is put this down and take out two pieces of tape, one on each side. And then carefully attach this to the top of the cage. I'm going to add one more piece of tape right there. I think maybe even another one on this side just so it's secure.

Students may observe them wiggling on their own, not from the table shaking. And the last thing that you do is to pull up the net so that the elastic comes up on top of the plastic. Now all you have to do is wait.

To wrap up Part 2, review the words added to the word bank using a cloze review. Add new concepts to the content chart. Ask the students, How are the painted lady pupae different than the pupae of the silkworm?

In the next session, read and discuss the article in the Science Resources book called, *Insect Life Cycles*. Discuss what students learned about life cycles from their investigation of insects. Have students respond to the review prompts on science notebook sheet number 16.

<Investigation 5, Part 3>

Narrator: Part 3 begins as soon as a week later when the adult butterflies begin to emerge. The students will see a red splat or several of them on the bottom liner of the cage. And they may be alarmed. They may think it's blood. But it's not. Tell them that's the waste product that was in the cocoon and emerged as the adult butterfly emerged.

This is when you need to tell the students that the adults need nectar. We're going to provide that in the vial. We have sugar water in here. And that will provide their nectar. And we're also going to provide a substrate, some leaves, mallow leaves, for the adults to lay their eggs on. So we'll put those in the cage right now.

You will need to make copies of the *Life Goes Around* Review sheet for each student, as well as the Life Cycle of the Square Moth sheet for assessing progress. Have the Painted Lady Adult and Stages Poster ready to show to the class.

Now, this cage can go almost anywhere in the room where the students can observe it. But it seems—or the butterflies seem to prefer sunlight. So if you can put it somewhere near the window where it will get some sunlight in the afternoon that seems to be better for the butterflies.

The students may observe mating. And if you're lucky, they'll see eggs deposited on the mallow leaves. In a week or two, those eggs will hatch and tiny little black Painted Lady larva will

emerge. They will graciously eat the mallow and the students may see some silk and some droppings in the mallow plant. If you're courageous and want to go through it again, you can allow those larva to go through their life cycle as the first larva did.

Review the butterfly life cycle by making a chart. Have students recall the structures and behaviors of the different stages.

To assess progress, distribute a Life Cycle of a Square Moth sheet to each student. Have them cut apart the stages and sequence them in the correct order.

For Wrapping Up, review the key vocabulary added to the word bank earlier and use the cloze review technique to review new words. Add new concepts to the content chart. Ask the students, How do butterflies and milkweed bugs eat and drink? What is the life cycle of the painted lady butterfly?

Have your class read and discuss the final article in the Science Resources book called, Life Goes Around. Brainstorm with students what they know about life cycles. Ask your students to respond to the review prompts on science notebook sheet number 18.

When you've completed the five investigations give your students the End-of-Module Assessment.