Teacher Reference Materials

Article 6

Assessing a Child's Science Abilities

ScienceCompanion® CHICAGO SCIENCE GROUP

A primary goal of the Science Companion program is for every child to know what it means to be a scientist. All children have the ability to ask questions, explore, and explain what they discover. Through the Science Companion curriculum, children strengthen their ability and desire to observe, appreciate, contemplate, and communicate about the world around them.

Science Companion's approach to assessment is based on the following beliefs:

- Children should be assessed "in the act" of being scientists: questioning, observing, describing, predicting, developing ideas and explanations, keeping records, using models, and more.
- Assessment and instruction should be closely linked. Assessment should inform instructional decisions and, whenever possible, occur as a seamless part of instruction.
- Assessment should be ongoing. It should aim to track children's development over time and to ensure that meaningful learning is occurring.
- Assessment should take different forms and should enable children to show what they know in age-appropriate ways, using skills that they are comfortable with.
- Assessment should not be threatening or stressful, for children or for teachers.
- Teachers should tailor assessments to meet the needs of their children, school, and district, as well as the workings of their classroom.

One teacher's experience…

"My class was experimenting with shaking particles in bottles and one kid said, 'They are all different because the lima beans sing the blues but the mung beans play snare drums.' He turned out to be right, and demonstrated it: the larger particles made a lower-pitched rattle. That was his way of explaining it."

The same teacher continues, "Sometimes I worry that teachers don't know what brilliance looks like. It often masquerades as stubbornness, when kids don't believe the scientific fact a teacher is trying to prove through an experiment, or slow-pokiness when kids aren't ready to leave an activity the teacher thinks is completed..."

You'll Find Inside:

Deciding What to Assess

You may be acutely aware of the relative lack of experience the children in your class have, and you might be wary of overwhelming them with scientific information. A good guideline to use with young children is: *Tell the truth*. But you don't need to tell all of it. The Science Companion curriculum exposes children to ideas they will hear again later, in their experiences outside of school or in greater depth in later grades. Many of these ideas may take the whole year to master; others will not be fully understood by children until they are older. It's alright for children to miss an idea on first exposure; it builds a foundation for their future understanding. For the same reason, you can use correct scientific terminology without expecting children to master it right away. Keep in mind that you need not assess children's understanding of every concept and skill, particularly those which have been introduced primarily for the purposes of exposure.

Assessing children's skills and understanding at these early stages can help you guide their learning. Good assessment should inform good teaching. By understanding areas of confusion or difficulty, you are better equipped to address them by providing additional exposure to particular concepts or practice with skills.

The Science Companion curriculum focuses its assessment approach on factors that enable children to demonstrate their scientific knowledge, as well as the skills that are critical to each child's development as a scientist. This approach provides all children with the opportunity for success because it assesses what they know, as well as what they do and how they go about doing it. This assessment methodology enables you to capture your children in the moments when they are thinking and doing their best science.

Children need to know the criteria by which you will evaluate them. It is important that you provide models of what you want them to accomplish so they understand your expectations. If you value science notebook drawings that exhibit close observation, show the class some examples of good work by other children or by scientific illustrators. Advertise a child's work in progress when it demonstrates what you're looking for. This encourages others to do the same. At the same time, support children who are inventive and take risks. Let the children know when they make valuable connections.

In addition to using the assessment charts included in each Science Companion unit—– described later in this article—and the specific assessment suggestions in each Science Companion lesson, there are several areas that you can focus on to help you decide which concepts and skills are most important to assess.

Big Ideas

Each Science Companion unit is developed around several significant ideas that capture the core knowledge and understanding of the unit's topic. Ultimately, it's these "big ideas" that the children will glean from the curriculum. Therefore, these central concepts are an important part of planning, teaching, and evaluating the Science Companion program for your class. The big ideas also address the science education standards and benchmarks generated by the National Research Council (*National Science Education Standards*. Washington, D.C.: National Academy Press, 1996.) and the American Association for the Advancement of Science (*Project 2061 Benchmarks for Scientific Literacy*. New York: Oxford University Press,1993.) The following are examples of the big

ideas about living things that capture the science studied in the Collecting and Examining Life Unit:

- Many different kinds of living things share our neighborhood environment.
- Animals are living things. They have many parts that help them move, breathe, eat, and sense their environment.
- Plants are living things. They have many parts that work together to help them grow and make new plants.
- Fungi are living things that are neither plants nor animals.

Lesson Goals

Lesson goals are a tailored list of what the children should know or be able to do as result of each lesson. The lesson goals encompass the science concepts and the science skills that are central to each lesson. The discreet nature of lesson goals makes them a clear and simple indicator of the learnings you can expect from that lesson. The following examples of lesson goals from the Motion Unit illustrate both concepts (forces cause motion) and skills (use of experimentation):

- Use experimentation to identify many different ways to start things moving.
- Discover that a force (a push or a pull) is always involved when something starts to move.

Approach to Tasks

Science Companion lessons also provide opportunities for children to practice and use a variety of strategies and skills that are important in science, as well as in other curriculum areas. For example, the way children organize their workspace and materials, how they prioritize tasks and pace themselves, how they work in groups, and their ability to communicate their questions, ideas, and discoveries are important skills to observe and assess. Children will develop these skills as the year progresses, but may require modeling and frequent reminders from you, especially early in the year. Throughout the year, take advantage of the opportunities to assess these important skills while teaching the Science Companion program.

Seeking Assessment Opportunities

The Science Companion program emphasizes and values ongoing, informal assessment—especially for young children. There are many opportunities for this type of assessment within the lessons themselves. Each lesson includes an Assessment section that suggests strategies for evaluating children's emerging understanding, skills, or both. Additionally, the Assessment section indicates specific assessment opportunities within the lesson. Each assessment opportunity is also detailed with a margin note in the appropriate section of the lesson. Class discussions, explorations and activities, science notebook entries, reflective writing, and interviews with children are frequently highlighted as useful assessment opportunities.

Introductory and Reflective Discussions

Ask probing questions, such as those included in the teacher lesson manuals, to help children extend their questions and observations during discussions. Be sure to document interesting comments. You might use a tape recorder for discussions you know you'll want to revisit. Try capturing some or all of these discussions on the board or on large flip charts as they progress.

Introductory discussions give you the opportunity to gauge class interest and the children's prior knowledge of a topic so you can fine-tune your approach. During reflective discussions, you can note how well children communicate their experiences, observations, interpretations, and questions. You can also see whether children are making connections to other experiences and learning.

During discussions, make it a priority to encourage all children to listen and participate. If some children are consistently reluctant, search for non-threatening ways to draw them into discussion. Engage them in conversation about science in smaller, more informal settings, such as while they are working on a lesson exploration or in the Science Center.

Explorations and Activities

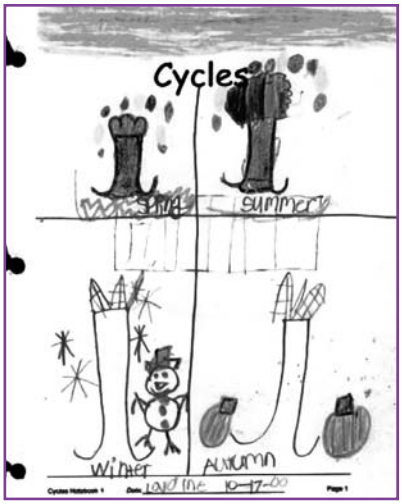
Use the lesson's exploration time to monitor science performance. As you circulate among the children, pay attention to their behavior, comments, and interactions. Use this information to monitor their development of skills—such as measuring, sorting, or following directions—as well as their understanding of concepts. Note which children have difficulty with the activity and which find it easy; who enjoys the activity and who dislikes it.

Science Notebooks

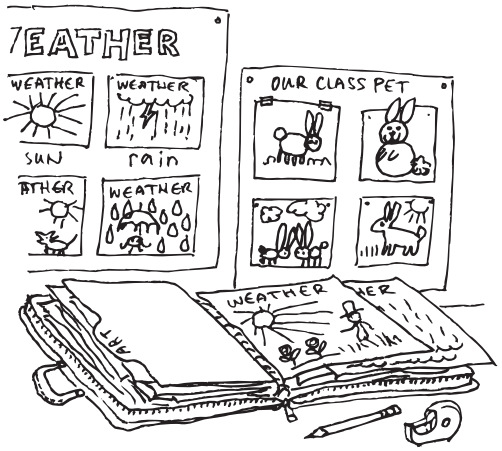
Review children's science notebooks regularly to assess their understanding of the lesson activities, as well as their record keeping ability. These reviews may help you discover teaching strategies or offer suggestions that enhance the children's work.

As you review children's science notebooks, you can monitor children's development in a variety of areas, such as the following:

- **Drawing and Writing**—Do children attempt to both draw and write or do they use just one medium? Are their words and drawings detailed and accurate? Are they done carefully, or rushed?
- **Observing**—Have details in observations become more complex? Are they accurate? What do the children tend to focus on? Do they consistently ignore a particular sense?
- **Making Sense of Records**—Do children use the information in their science notebooks after the activity?
- **Being Thorough**—Are numerous details included? Is attention to the task evident? Is the work complete?
- **Following Directions**—Are children following through on their work? Did they meet the specific challenge of the assignment (i.e., were they on task)?
- **General progress** —Has there been progress in the areas detailed above?



Periodically conduct one-on-one interviews with children about their science notebooks. You may also want the children to regularly share something from their science notebooks with the class during reflective discussions.



Children's science notebooks are ideal components to include in student portfolios. Consider including the entire science notebook or encouraging children to choose sample pages that reflect high quality work, and topics or tasks that particularly interested them. Photocopy the selected pages, in order to keep the science notebook intact.

If you maintain separate portfolios for different subject matter, the science notebook can serve as a science portfolio. Consider supplementing it with photographs of the children doing science and with children's comments about their interests, growth, strengths, and weaknesses in science.

Seeking Assessment Opportunities

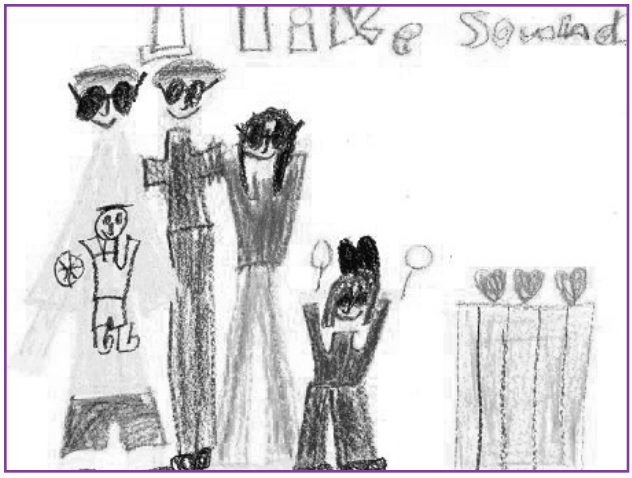
Reflective Writings or Reviews

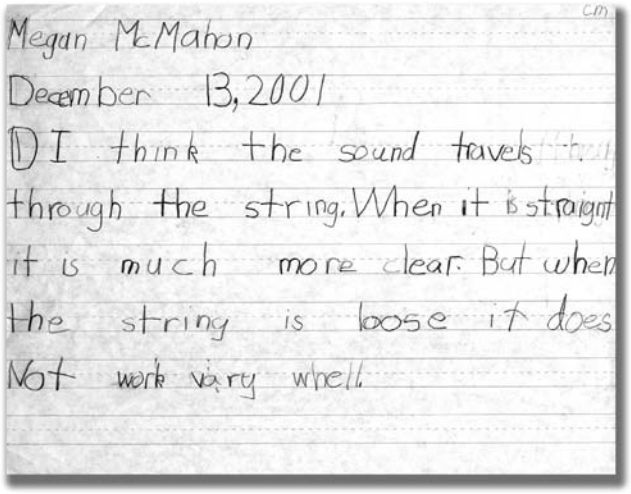
For older children especially, writing about science topics offers a useful and integrated assessment opportunity. Level 3 Science Companion units suggest questions and free-write topics that are useful for assessment.

You can also ask children to describe their feelings about science. Have them write about the parts of science they think are good or bad, easy or hard, fun or boring. For example, ask:

- What do you like best about science?
- What do you like least about science?
- What would you change about this lesson?
- Which lesson did you like the best? Why?
- What makes you a great scientist?
- What can you work on to be an even better scientist?
- Where do you see or find science in your life?

As the children develop writing skills, you can look forward to collecting great examples of their writing about science.




Megan McMahon
December 13, 2001
I think the sound travels through the string. When it is straight it is much more clear. But when the string is loose it does Not work very whell.

Interviews

It takes time for some children to feel comfortable and to share their ideas. Brief, non-threatening interviews with small groups or individual children can be a useful means of assessment. You'll want to encourage oral communication skills about science in a safe environment. Interviews are often the most direct way to examine children's ideas about certain concepts. Because some young children are not skilled in verbal expression, use clear, probing questions to clarify and enhance their science observations. Take time to record your observations about the interview as soon as possible.

Sometimes you may want the children to interview each other. Be sure to record any observations you make during these interviews that could help you with your own interviews.

Choosing Assessment Tools

The Science Companion curriculum provides tools to help you assess your children's understanding of both the knowledge they gain and the skills they learn as they progress through the school year. You can use these to assess children either individually or in groups and to track how their ideas and understandings develop over time.

It's important to record the information you collect so that you have a record of each child's progress during the year. Feel free to adapt the Science Companion tools and suggestions to make them more useful to you.

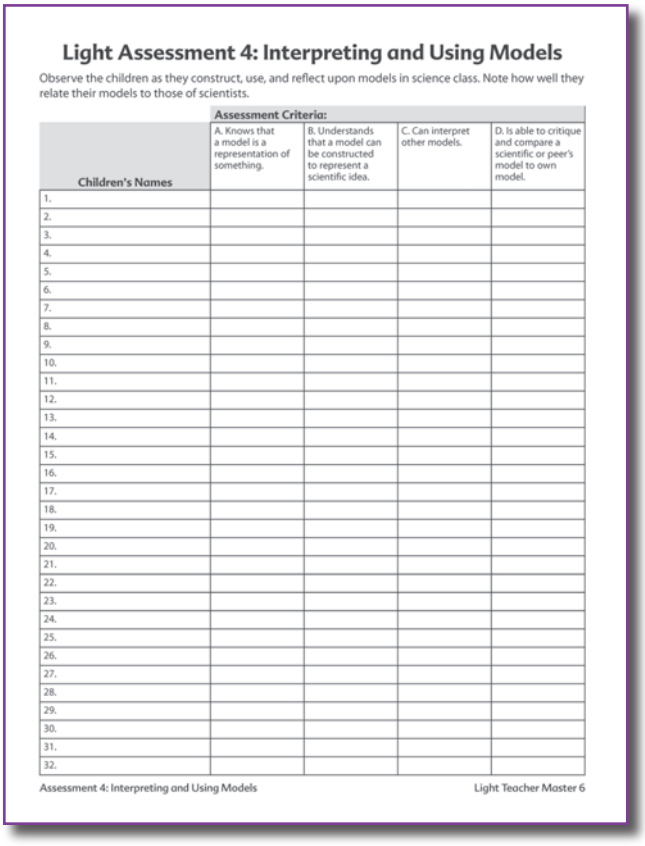
Assessment Charts

The Teacher Masters for each unit include assessment charts for the important knowledge and skills addressed in the unit. Each chart lists key criteria that relate to the big ideas and science skills addressed by the unit.

These assessment charts help you determine which skills and concepts are most important to assess. The checklist format also provides a vehicle for recording and tracking assessment information.

These assessment tools are flexible: adapt them to best support your instruction and assessment needs. The assessment opportunity notes and assessment section of each lesson include suggestions for using the assessment charts in conjunction with that lesson.

Although each lesson suggests times and methods for evaluating particular criteria, you do not need to record assessment information at every opportunity that is suggested. We highlight more opportunities than necessary to provide flexibility.



Light Assessment 4: Interpreting and Using Models

Observe the children as they construct, use, and reflect upon models in science class. Note how well they relate their models to those of scientists.

	Assessment Criteria:			
Children's Names	A. Knows that a model is a representation of something.	B. Understands that a model can be constructed to represent a scientific idea.	C. Can interpret other models.	D. Is able to critique and compare a scientific or peer's model to own model.
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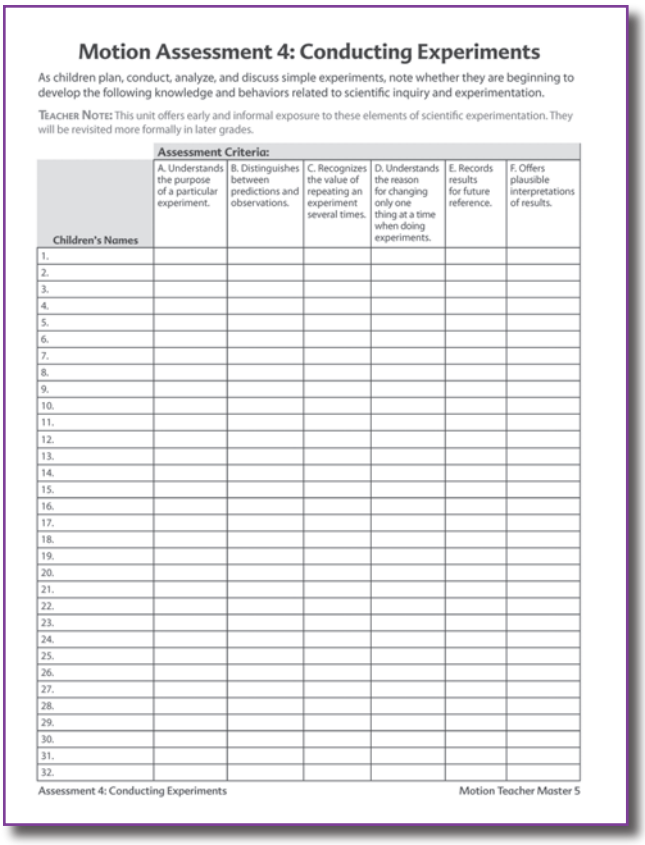
Assessment 4: Interpreting and Using Models — Light Teacher Master 6



Motion Assessment 4: Conducting Experiments

As children plan, conduct, analyze, and discuss simple experiments, note whether they are beginning to develop the following knowledge and behaviors related to scientific inquiry and experimentation.

TEACHER NOTE: This unit offers early and informal exposure to these elements of scientific experimentation. They will be revisited more formally in later grades.

	Assessment Criteria:					
Children's Names	A. Understands the purpose of a particular experiment.	B. Distinguishes between predictions and observations.	C. Recognizes the value of repeating an experiment several times.	D. Understands the reason for changing only one thing at a time when doing experiments.	E. Records results for future reference.	F. Offers plausible interpretations of results.
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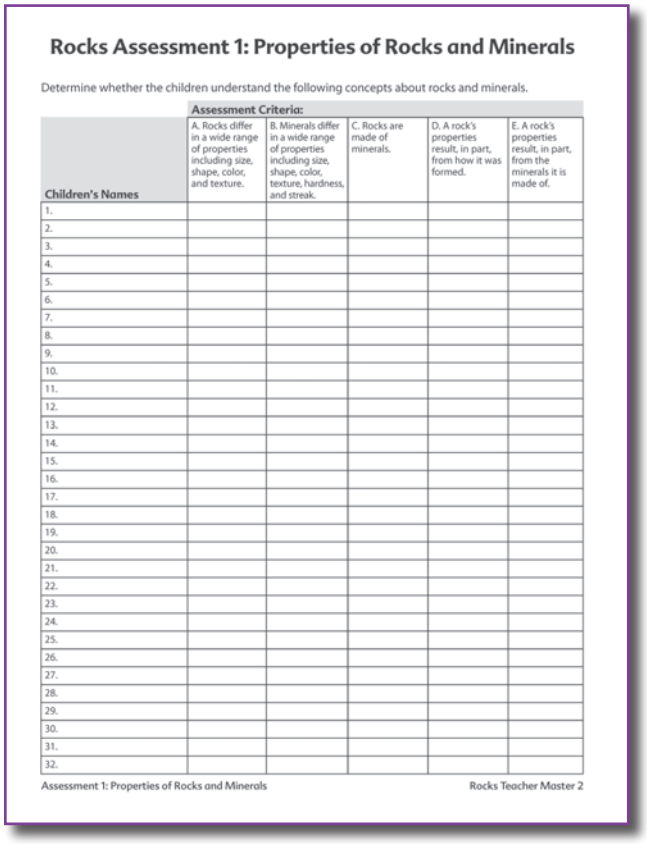
Assessment 4: Conducting Experiments — Motion Teacher Master 5

Choosing Assessment Tools

There are many possibilities for record-keeping on the assessment charts. For each criterion, you might use a checkmark or a +/- notation to indicate the degree of mastery; alternatively, you might use Beginning (B), Developing (D), and Secure (S) designations to note levels of understanding.

If desired, the assessment criteria can be assigned points, be "weighted," or both. For example, consider the following possibilities:

- If there are criteria that are particularly important for meeting your local standards and that you have devoted more time to, you might assign them more points than others.
- If there are criteria on the list linked to lessons you did not teach, you might disregard those criteria or assign them no (0) points.
- You might assign more advanced criteria more points. In most cases, the criteria on the chart become more advanced as you move from left to right.
- Feel free to add criteria for other related concepts, such as those addressed in extension activities.



Rocks Assessment 1: Properties of Rocks and Minerals

Determine whether the children understand the following concepts about rocks and minerals.

	Assessment Criteria:				
Children's Names	A. Rocks differ in a wide range of properties including size, shape, color, and texture.	B. Minerals differ in a wide range of properties including size, shape, color, texture, hardness, and streak.	C. Rocks are made of minerals.	D. A rock's properties result, in part, from how it was formed.	E. A rock's properties result, in part, from the minerals it is made of.
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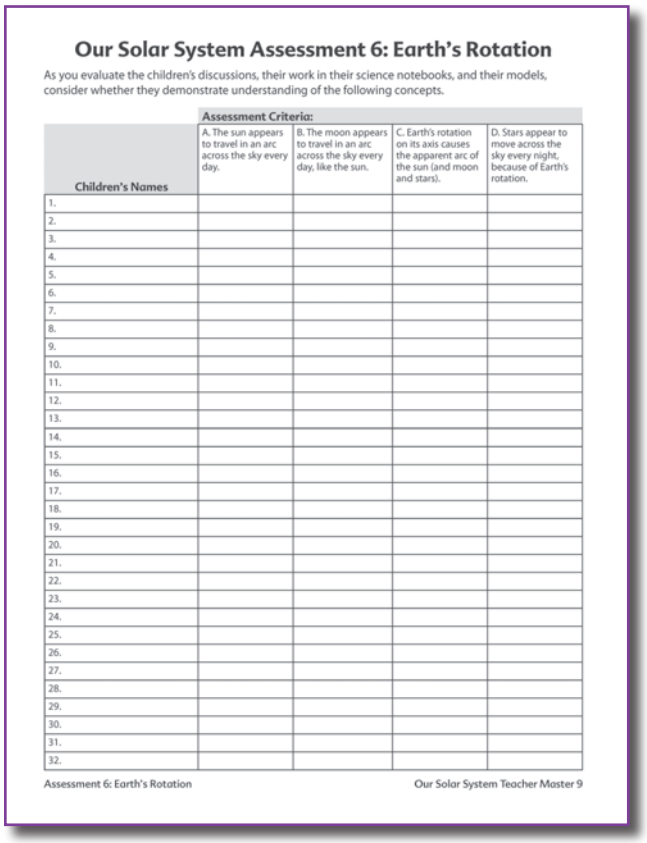
Assessment 1: Properties of Rocks and Minerals — Rocks Teacher Master 2



Our Solar System Assessment 6: Earth's Rotation

As you evaluate the children's discussions, their work in their science notebooks, and their models, consider whether they demonstrate understanding of the following concepts.

	Assessment Criteria:			
Children's Names	A. The sun appears to travel in an arc across the sky every day.	B. The moon appears to travel in an arc across the sky every day, like the sun.	C. Earth's rotation on its axis causes the apparent arc of the sun (and moon and stars).	D. Stars appear to move across the sky every night, because of Earth's rotation.
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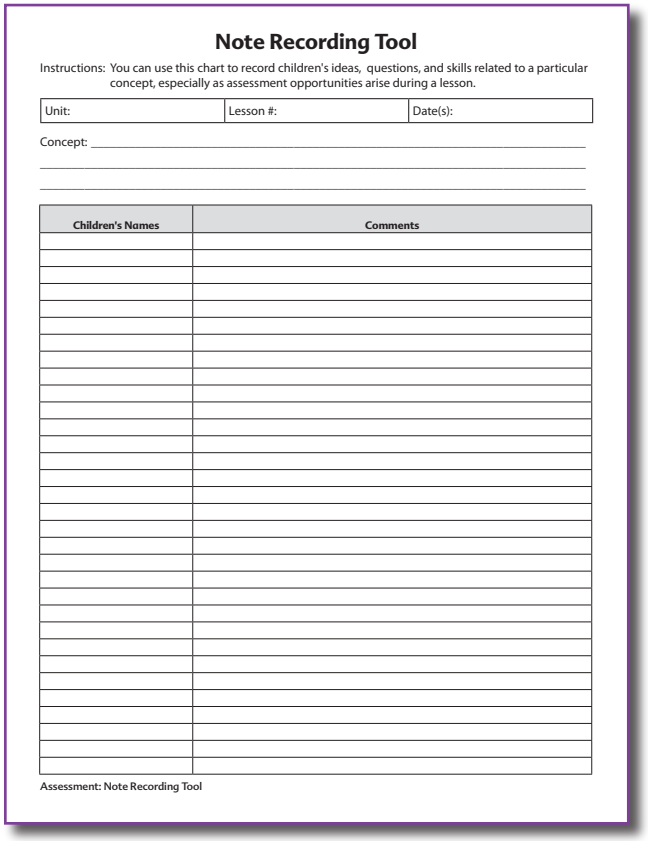
Assessment 6: Earth's Rotation — Our Solar System Teacher Master 9

Note Recording Tool

A note recording tool is provided in the Teacher Master packet for each unit. Make copies of this tool and use it to attribute ideas, questions, and skills to specific children, especially when assessment opportunities arise during a lesson. Use these notes to support your ongoing, anecdotal assessment efforts. Optimal times to record notes include moments when you circulate during an exploration, during or immediately following a class discussion, and when you talk with children about their science notebook pages.



Note Recording Tool

Instructions: You can use this chart to record children's ideas, questions, and skills related to a particular concept, especially as assessment opportunities arise during a lesson.

Unit:	Lesson #:	Date(s):

Concept: _____

_____

_____

Children's Names	Comments

Assessment: Note Recording Tool

Understanding Three Forms of Assessment

There are three forms of assessment suggested in the Science Companion curriculum. The following chart explains the forms and their uses.

Use this form…	To…
Pre-assessment	• Gauge level of interest • Monitor misconceptions • Determine initial understanding
Formative	• Assess what you teach • Redirect as you teach • Watch performance change • Measure growth • Adjust pacing • Individualize instruction
Summative	• Measure growth • Measure content mastery

Understanding Three Forms of Assessment

Pre-assessment

Pre-assessments enable you to assess a child's initial understanding of a topic, point out any misconceptions the child might hold, and gauge their level of interest. Often, pre-assessments are embedded in K-W-L charts, science talks, introductory discussions, or the initial lesson in a cluster of lessons. Opportunities for pre-assessment occur at logical places in the Science Companion lessons. The advantage of pre-assessments is that they provide you with snapshots of how well a child initially understands a topic or a lesson's big idea. Think of pre-assessments as a gauge that indicates how you should adjust your teaching to fit a child's needs. Pre-assessments can be an informal appraisal using the note recording tool, or they can be more formally conducted using one of the Science Companion assessment charts.

You probably already integrate pre-assessment strategies in your classroom. This happens naturally as you listen to the children's ideas about new topics, or observe them as they use tools for the first time and learn new skills. Consider pre-assessments as a starting point for what you teach. Children's ideas are rich and diverse, but are often not the same ideas that scientists have. It is important to determine what your children's initial understanding of a topic is so that you can plan your teaching, and their opportunities for learning, accordingly.

Formative Assessment

Formative assessments measure a child's understanding of knowledge and skills as those understandings develop. Ongoing in nature, formative assessments enable you to assess the children as you teach and while they are in the act of doing science. By assessing the children's learning in a continuous fashion, you might realize that you need to revisit topics that children find confusing, provide enrichment activities, or integrate skill building activities into the unit. The development of science content knowledge and science process skills can be tracked using formative assessment.

You can use the Science Companion note recording tool and assessment charts included in each unit's Teacher Master packet for formative assessment.

Summative Assessment

Many Science Companion units include a summative lesson or project that synthesizes many of the important skills and concepts from the unit. These culminating activities often feature valuable summative assessment opportunities to help evaluate children's progress and level of skill or understanding at the end of a unit. Summative assessment can also be used when you complete a cluster of lessons. In many cases, summative assessments can be made by using the assessment charts for a final time, to note children's progress on each of the criteria. Some units include additional summative assessment suggestions for the end of each lesson cluster.

Integrating all three types of assessments—pre-assessments, formative assessments, and summative assessments—in your teaching can illuminate the ideas and experiences your children bring to and take from your classroom. However, these are merely suggestions. Only you know the best assessment strategies to use with your children. You might want to try our suggestions in conjunction with assessments that you currently use or ones you develop in the future. Many teachers who use the Science Companion curriculum regularly share the assessments they develop with the Science Companion development team. Please share your ideas at **www.sciencecompanion.com.**

Notes