CURRICULUM GUIDE FOR

WATER CYCLE

(Based on Delta DSM II Science Kits Water Cycle and Weather Instruments)

Wallingford Public Schools
Third Grade
Science

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Table of Contents

Unit Design

Unit Summary 3

Stage 1: Standards/Goals 3

Stage one identifies the desired results of the unit including the related state science content standards and expected performances, enduring understandings, essential questions, knowledge and skills. What should students understand, know, and be able to do?

The knowledge and skills in this section have been extracted from Wallingford's K-5 Science Scope and Sequence.

Stage 2: Determine Acceptable Evidence 6

Stage two identifies the acceptable evidence that students have acquired the understandings, knowledge, and skills identified in stage one. How will we know if students have achieved the desired results and met the content standards? How will we know that students really understand?

Stage 3: Lesson Activities 8

What will need to be taught and coached, and how should it best be taught, in light of the performance goals in stage one? How will we make learning both engaging and effective, given the goals (stage 1) and needed evidence (stage 2)? Stage 3 helps teachers plan learning experiences that align with stage one and enables students to be successful in stage two. Lesson activities are suggested, however, teachers are encouraged to customize this stage to their own students, maintaining alignment with stages one and two.

Inquiry Investigation: 12

- Appendix 1: Investigation Plan Template 20
- Appendix 2: Preparing to Share 21
- Appendix 3: Sample Science Journal Rubric 22

Literature Resources 23

These literature resources have been purchased to supplement the kit and are housed in each elementary school library.

Materials List 24

This list identifies the list of materials found in the kit. In many cases, the original kit material list has been modified from the manufacturers list.

Appendix A: Exploratorium's Description of Inquiry 25

Appendix B: Map of IFI Inquiry Structure 26

(3 Phases of Inquiry Diagram)

UNIT SUMMARY

During this unit students investigate how the sun's energy impacts the water cycle and the effect of heat energy on the melting, evaporation, condensation and freezing of water. Students will also recognize that water can be found many places on earth. Different cloud types and weather tools such as a thermometer, barometer, wind vane and water gauge will be explored.

STAGE 1- STANDARDS/GOALS

What should students understand, know, and be able to do? Stage one identifies the desired results of the unit including the related state science content standards and expected performances, enduring understandings, essential questions, knowledge and skills.

Enduring Understandings *Insights earned from exploring generalizations via the essential questions (Students will understand THAT…) K-12 enduring understandings are those understandings that should be developed over time, they are not expected to be mastered over one unit or one year.*	**Essential Questions** *Inquiry used to explore generalizations*
<u>*Overarching Enduring Understandings:*</u> • Science is the method of observation and investigation used to understand our world. (K-12) • Inquiry is the integration of process skills, the application of scientific content, and critical thinking to solve problems. (K-12) <u>*Unit Specific Enduring Understanding*</u> • A change in temperature can affect the physical properties of water. • Water circulates through a continuous cycle. • The sun's energy drives weather patterns. • Scientists use various tools to measure and describe weather in order to help predict future weather patterns.	• How is inquiry used to investigate the answers to questions we pose? • How does water change states as it travels through the water cycle? • How does the water cycle impact the environment? • How does energy from the sun affect the weather? • How does heat energy (temperature) change the state of a liquid/solid/gas? • How do you measure and describe weather? • Why do we need to predict the weather?

Knowledge and Skills

What students are expected to know and be able to do

The knowledge and skills in this section have been extracted from Wallingford's K-5 Science Scope and Sequence.

Knowledge

The students will be able to…

K1. Identify the stages in the water cycle (evaporation, condensations, precipitation, ground water, transpiration).

K2. Explain the relationship between evaporation and condensation within the water cycle.

K3. Describe that melting and evaporation require the addition of heat energy and condensations and freezing require removal of heat energy.

K4. Recognize that water can be found many places on earth. (plants, animals, humans, soil, etc.)

K5. Explain the function and purpose of weather tools such as a thermometer, barometer, wind vane, and rain gauge.

K6. Recognize that different cloud types determine weather conditions.

K7. Identify different forms of precipitation.

Skills

S1. Generate investigable and non-investigable questions.

S2. Observe objects (water, soil, plants) and describe commonalities and differences among them.

S3. Classify, based on observations of properties of water.

S4. Predict:
- The state of water dependent upon temperature
- Future weather conditions based on clouds
- The effects of the addition or removal of heat on solids, liquids, or gases

S5. Design an investigation to help answer an investigable question.

S6. Conduct simple investigations.

S7. Collect and record data utilizing simple equipment and measuring tools.
- thermometer
- tumbler
- graduated cylinder/rain gauge

S8. Organize results in an appropriate manner, using:
- Graphic organizers
- Charts and graphs.
- Illustrations or diagrams.
- Simple reports
- Journaling

S9. Communicate results or information in an appropriate manner, using:
- Presentations
- Visuals
- Simple reports
- Journal
- Writing Prompt

Content Standard(s) *Generalizations about what students should know and be able to do.*	
CSDE Content Standards (CSDE Science Framework 2004)	**CSDE Primary Expected Performances** (CSDE Science Framework 2004)
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **3.1 - Materials have properties that can be identified and described through the use of simple tests.** • Heating and cooling cause changes in some of the properties of materials. *Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems?* **4.3 - Water has a major role in shaping the Earth's surface.** • Water circulates through the Earth's crust, oceans and atmosphere.	B2. Describe the effect of heating on the melting, evaporation, condensation and freezing of water. B12. Describe how the sun's energy impacts the water cycle.
Scientific Inquiry	B INQ.1 Make observations and ask questions about objects, organisms and the environment. B INQ.2 Seek relevant information in books, magazines and electronic media. B INQ.3 Design and conduct simple investigations. B INQ.4 Employ simple equipment and measuring tools to gather data and extend the senses.
Scientific Literacy	B INQ.5 Use data to construct reasonable explanations. B INQ.6 Analyze, critique and communicate investigations using words, graphs and drawings. B INQ.7 Read and write a variety of science-related fiction and nonfiction texts.
Scientific Numeracy	B INQ.8 Search the Web and locate relevant science information. B INQ.9 Use measurement tools and standard units (e.g., cm, m, g, kg) to describe objects and materials. B INQ.10 Use mathematics to analyze, interpret and present data.

Common Misconceptions Children Have *By identifying misconceptions early, teachers can design appropriate lessons to address and change student misconceptions.*
Some students hold the misconception that: • Water is blue. • Water is non-recyclable. (Water they drink could have been drunk by a dinosaur). • When a solid melts, it makes more water. • Evaporation is not affected by type or condition of container (Water will evaporate at different rates in covered versus uncovered containers and will evaporate faster if there is a larger surface area.). • Water is always visible. Water is only there if you can see it. (They don't recognize that there is water in the air, animals, plants, soil, humans, even when you can't see it.) • Weather is the same everywhere at all times. • Weather is caused by an external force (i.e. someone in the sky, God, leprechauns). • Weather is random, mysterious, and unpredictable with no discernable patterns. • Clouds are solid and form randomly.

STAGE 2 – DETERMINE ACCEPTABLE EVIDENCE

How will we know if students have achieved the desired results and met the content standards? How will we know that students really understand? Stage two identifies the acceptable evidence that students have acquired the understandings, knowledge, and skills identified in stage one.

Performance Task(s) *Authentic application in new context to evaluate student achievement of desired results designed according to GRASPS. (Goal, Role, Audience, Setting Performance, Standards)*	**Other Evidence** *Other methods to evaluate student achievement of desired results.*
You are a Newberry Award winning author. You have been asked to write a children's book explaining the water cycle, which will be read by first graders. Your job is to explain the water cycle in as much detail as possible. It is important to include illustrations and appropriate vocabulary. Remember, good authors always edit their work and write neatly! **Note: If you are planning to use this assessment, you may want to share the books included in the kit at various points throughout the unit.* *To make this assessment even more authentic, you may want to have the children share their books with younger students or their book buddies.*	**- Writing Prompt** Imagine that you are a drop of water. Write a narrative describing your journey through the water cycle. Think about how your form will change and what will cause the changes as you go through your journey. Remember, you are writing your narrative from the point of view of a drop of water! You also need to include a picture of yourself going through your journey. (You may choose to draw your picture either before of after your narrative.) **Note: Answers should include information referencing evaporation, condensation, precipitation, water storage, and water vapor.* ***The Following Essential Questions Should Be Addressed:*** • *How does water change states as it travels*

	through the water cycle? • *How does the water cycle impact the environment?* • *How does temperature change the state of a liquid/solid/gas?* - **Daily Weather Log** - **Diagram and label the water cycle** **- Weather graph** **Note: Using the Daily Weather Log, you may want to graph the number of sunny days, rainy days, snowy days, etc.* **- Writing stems** Complete a "I used to think (misconception)….Now I know." - **Cloud Picture** Children create different types of clouds using cotton balls and draw a corresponding weather scene. Detailed description located in Lesson Activities, "Clouds, Clouds, Everywhere." -**Terrarium**

STAGE 3 – LESSON ACTIVITIES

What will need to be taught and coached, and how should it best be taught, in light of the performance goals in stage one? How will we make learning both engaging and effective, given the goals (stage 1) and needed evidence (stage 2)? Stage 3 helps teachers plan learning experiences that align with stage one and enables students to be successful in stage two. Lesson activities are suggested, however, teachers are encouraged to customize these activities, maintaining alignment with stages one and two.

The suggested lesson activities are not sequenced in any particular order. Teachers may select which lesson activities will best meet the needs of their students and the unit objectives. Each lesson activity is coded with the corresponding knowledge (K) and/or skill (S) objectives that are found in stage one.

After examining the Connecticut state standards, the following lessons in Water Cycle DSMII and Weather Instruments DSM II do not align with our current curriculum. <u>The materials used for these lessons may not be included in the kit.</u>

Lessons that are not aligned:

- **Water Cycle DSM II Activity 5 Puddle Watching**
- **Water Cycle DSM II Activity 9 A Model Cloud**
- **Water Cycle DSM II Activity 10 Making a Rainbow**
- **Weather Instruments DSM II Activity 3 Barometric Changes**
- **Weather Instruments DSM II Activity 5 Wind Strength**
- **Weather Instruments DSM II Activity 7 Changes in Water**
- **Weather Instrument DSM II Activity 8 Humidity**
- **Weather Instruments DSM II Activity 9 Making a Cloud**

<u>ELICIT PRIOR KNOWLEDGE</u>

Have the children do a Brain Drain for 10 minutes listing all of the facts they think they know about water, the water cycle and weather. (During a "Brain Drain" children write independently for 10 minutes about any facts they think they know about a particular topic.) Then take five minutes to write questions they have about water/weather. Students can then share their facts and questions with the class. During the discussion, please review solids, liquids, and gases (Grade 1 Curriculum).

Note: If you choose to have your students keep journals throughout this unit, you may want to use this activity as the first journal entry and take this opportunity to show your students the format you would like them to use and review the sample journal rubric (See Appendix 3 on page 22). Also, consider having your students keep a "Daily Weather Log" and record the day's weather. If you are not doing a daily log, be sure to do Activity 6 in DSM II Weather Instruments.

Time: 45 minutes

Possible Literature Connection: *Water Dance* (can be found in your school library – was purchased for the first grade Solid, Liquids and Gases kit)

Knowledge and Skills: S1

A DROP AROUND THE WORLD
Show students illustrations (suggestion: you can photocopy pictures from books like A Drop Around the World) that have multiple sources of water such as humans, animals, plants, rivers, etc. If you choose, you may want students to color in or circle water sources. The goal of this activity is to disprove the misconception that water only comes from rivers, lakes, streams, etc. Review student responses and point out the many sources of water. Then read, A Drop Around the World aloud. Go back and review all of the sources of water.
Note: Look ahead to Water Cycle Teacher's Guide (WC DSM II) Activity 1, Session 2 to adequately prepare for next science lesson.
Time: 45 minutes
Literature Connection: A Drop Around the World (see school library)
Knowledge and Skills: K4, K7, S4

WHERE IS WATER?
WC DSM II Activity 1, Where is Water, Session 2. Session 1 can be omitted if you did A Drop Around the World Lesson. Students investigate water in its liquid and solid form. This lesson addresses one of the misconceptions centered on the idea that the amount of water you have as a solid is the same as the amount of water that you have as a liquid.
Time: 40 minutes
Knowledge and Skills: K1, K3, S2, S6, S7, S8

WATER IN SOIL
WC DSM II Activity 2. Students investigate the ability of soil to hold water and infer that water is stored in other soils on earth and discover that water is found not only in oceans and rivers, but in the ground as well.
*__Note__: The kit will now include graduated cylinder to measure water. You might choose to omit this lesson if you have completed a similar lesson in the "Plant Life Cycle and Soil Properties" Science kit earlier in the year.
Time: 40 minutes
Knowledge and Skills: K1, K4, S2, S4, S6, S7, S8

WATER IN PLANTS
WC DSM II Activity 3. Students observe that plants dry out and infer that water is also stored in plants. They will observe pieces of fruit and vegetable to infer that living things contain water.
*__Note__: The kit includes samples of dried fruit such as raisins and bananas to provide a stronger contrast between fruits that contain water and those that do not. You must provide your own fresh fruits/vegetables.

EVAPORATING WATER
WC DSM II Activity 4. Students observe evaporation of water and compare the rate of evaporation at different temperatures. Students will also observe changes in water level due to evaporation and infer where it goes. Lastly, students will determine the effect of temperature on evaporation rate.
Note: To shift this lesson to make it more inquiry based, allow students to raise questions related to

different factors that effect (or may effect) evaporation rate (such as temperature, size of container, surface area, color of container, color of water, etc.). You may want to do this by showing them some related pictures and/or after doing this guided experiment together. After students select a question to investigate, have them develop a plan and then use this plan to conduct the investigation. After the collection of their observations and results, have student share their findings and conclusions with the rest of the class.

**** See Page for Inquiry Investigation**

**Note*: You may want to do Activity 5 Puddle Watching as an extension to this lesson.
Time: Two sessions, Session 1: 15 minutes. Session 2, 30 minutes, 1-2 days after Session 1.
Knowledge and Skills: K1, K2, K3, S4, S6, S7, S8.

AIR TEMPERATURE (Thermometer)
Weather Instruments (WI DSM II) Activity 1. Students learn to use a thermometer and measure air temperature. They are introduced to Celsius and Fahrenheit scales.
Note: If you have already taught how to use these tools, you may choose to omit this lesson. You may already be doing this on a daily basis if you are using a daily weather log.
Time: about 30-40 minutes
Knowledge and Skills: K5, S6, S7, S8, S9

MORE WATER INTO THE AIR
WC DSM II Activity 6. Students observe that water evaporates not only from bodies of water, but also from soil and plants.
Note: Instead of bagging individual tree leaves, you may want to use house plants (provided by teacher) and bag the entire plant. Teachers may choose to shorten this lesson by doing a demonstration one day and having the students observe the following day.
Time: 2 Sessions, about 30 minutes each (See above to abbreviate the lesson.)
Knowledge and Skills: K1, K4, S2, S4, S6, S7, S8

HOW MUCH WATER?
WC DSM II Activity 7. Students use cobalt paper to compare the amount of water vapor in the air in different locations and over a period of time.
**Note:* Advance preparation is required for next lesson.
Time: 2 Sessions, Session 1 is 40 minutes followed by daily observations for a week. Session 2 is 20 minutes, about 1 week after Session 1.
Knowledge and Skills: K1, K3, S2, S3, S4, S6, S7

CONDENSING WATER
WC DSM II Activity 8. Students observe the condensation of water vapor and investigate the conditions under which condensation occurs.
Note: Use paint cans included in kit, instead of tumbles to obtain better results.
Time: About 50 minutes
Knowledge and Skills: K1, K2, K3, S2, S4, S6, S7

CLOUDS, CLOUDS, EVERYWHERE

While it is important to recognize that different cloud types determine weather conditions, naming the clouds is not in the state standards and therefore this is optional. This lesson can replace the lessons in the books or can be combined with WI DSM II Activity 10. Read The Cloud Book by Tomie de Paola and discuss the different clouds illustrated with the weather conditions that correspond with each.
Note: As a follow-up activity, you may choose to create three different cloud scenes (possibly fold a large piece of constructions paper into thirds). Clouds will be made using cotton balls. For example, to make a stratus cloud, pull a cotton ball apart into a thin line. Then have the children glue clouds on paper and draw a corresponding weather scene with makers or crayons. Teachers may choose to focus on the main clouds such as cirrus, cumulus, and stratus since most other types are derived from these.
Time: 45 – 60 minutes
Knowledge and Skills: K6, S2, S8, S9

TERRARIUM
WC DSM Activity 11. The students set up a terrarium. They observe the water cycle in the terrarium and relate their observations to what they have learned. They discuss the cycling of the world's water supply.
Note: This activity can be used in a variety of ways. You may choose to make this an inquiry activity, a directed lesson, or as an assessment. To do an inquiry, you may want to set the materials out and then have your students design their own terrarium without little/any direction. Teacher may also want to substitute ice cubes instead of water (using ice cubes will reinforce the three states of water; solid, liquid, and gas as stated in the CT state standards).
Time: to be determined by the teacher
Knowledge and Skills: K1, K2, K3, S2, S4, S5, S6, S7, S8, S9

OTHER WEATHER INSTRUMENTS
CT state standards do not require students to construct or use each tool. **It is recommended that students be familiar with and understand the uses of: a wind vane, rain gauge, and barometer.**
Note: It is suggested that teachers use a combination of Activities 2, 4, and 11 in Weather Instruments DSM II. Teachers should give a brief explanation/demonstration of each instrument.
Time: 45 min. (total)
Knowledge and Skills: K5, S6, S7

*** See page 5 for assessment ideas ***

Lessons that are no longer aligned with the curriculum but can be done as an extension to the lessons listed above if time permits. Weather Lessons: Lesson 3, Lesson 5, Lesson 7, Lesson 8, Lesson 9, Lesson 10. Water Lessons: Lesson 5, Lesson 9, Lesson 10. **Some materials for these lessons may not longer be included in kit.**
****Note***: The goal of this unit was to condense similar lessons into one kit and to make sure all lessons align with new state standards.

EVAPORATION INQUIRY INVESTIGATION

Water Cycle Science Kit
Grade 3

This guide is a tool for helping you plan an inquiry activity. The prime factor is that your students get the opportunity to practice choosing their own question and planning and carrying out an investigation to find out what they can learn from investigating that question.

Related State Content Standard(s):	Related State Expected Performance(s):
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **3.1 - Materials have properties that can be identified and described through the use of simple tests.** • Heating and cooling cause changes in some of the properties of materials. *Energy in the Earth's Systems – How do external and internal sources of energy affect the Earth's systems?* **4.3 - Water has a major role in shaping the Earth's surface.** • Water circulates through the Earth's crust, oceans and atmosphere.	B2. Describe the effect of heating on the melting, evaporation, condensation and freezing of water. B12. Describe how the sun's energy impacts the water cycle.
Related Enduring Understanding(s):	**Related Essential Question(s):**
• A change in temperature can affect the physical properties of water. • Water circulates through a continuous cycle. • The sun's energy drives weather patterns. • Scientists use various tools to measure and describe weather in order to help predict future weather patterns.	• How is inquiry used to investigate the answers to questions we pose? • How does water change states as it travels through the water cycle? • How does energy from the sun affect the weather?

What simple **content objectives**/goals do you want to accomplish with this investigation? (see district curriculum documents)	What simple **process skills** do you want to improve with this investigation?
Students will: K1. Identify the stages in the water cycle (evaporation, condensations, precipitation, ground water, transpiration). K2. Explain the relationship between evaporation and condensation within the water cycle. K3. Describe that melting and evaporation require the addition of heat energy and condensations and freezing require removal of heat energy.	See page 3 of curriculum guide for detailed list including: • Raising questions • Predicting • Designing a plan and a "fair test" • Investigating • Collecting and organizing data • Drawing conclusions • Communicating

What phase of this investigation will you provide the most modeling/templates/mini-lessons/scaffolding for better skill development?

Raising questions and developing a plan

Materials/Resources:

- Water
- Containers of varying size and shape
- Various locations representing different temperatures
- Thermometer
- Graduated cylinders or tools to measure water

Optional materials:
Food coloring (to make different colored water)
Different color containers
Different liquids (rubbing alcohol, oil, soda, etc.)

What kinds of investigations do you anticipate students designing?

Sample student investigation questions:

- Will water in a warm location evaporate faster (more) than water in a cool location?
- Will water near the window evaporate faster or slower than water in the closet?
- Will the same amount of water in a tall skinny container evaporate faster than a wide shallow container?
- Will water in a red bowl evaporate faster than water in a yellow or green bowl?
- Will blue water evaporate faster than regular water?
- What type of liquid will evaporate the fastest?
- How long will it take 250 mL of water to evaporate in different locations?
- Will water evaporate faster in front of a fan?
- Does the size of the container affect the rate of evaporation? Color? Material? Location?

PHASE 1 – Observing and Questioning

INQUIRY STARTERS

- What is the launching activity or **inquiry starter** for the investigation?
- What will be your **inquiry starter prompt**? How will you "invite" your audience to work with the materials?
- What **materials** will you use for the inquiry starters?
- How will you **elicit and collect or display student's questions**? Will they share questions orally? In writing?
- **Choosing investigation questions**: How will you help your students determine which questions they can choose from to investigate? How will you or the students form investigation groups?

Time	Task	Hints
	Setting the context -	
	Put several containers of water (different shapes and colors) around the room where they will not be disturbed for a few days. Have students observe the starting mark (water line) of the water. After a few days observe how they have changed. <u>Discuss:</u> • How are they different? • What might contribute to the differences • How are they the same? • What variables "things" would cause water to evaporate at different rates? • What other things do you wonder about? On chart paper list all the questions they have that could be investigated based on your discussion.	• **Assessment note:** This is an opportunity for the teacher to formatively assess the ability of your students to write detailed observations and questions. • Another way to help children raise questions is to create a T-chart on the board with "I notice" and "I wonder". Chart the student's observations (I notice). These will naturally lead to questions (I wonder). • **Guided Lesson/Thinking Tool:** Try to help students rephrase their questions into investigable questions that can be investigated in the "here and now" with the materials that we have available. "XXXXXX" is a great question, but not investigable with our materials. • See page 2 of this inquiry investigation for some of the sample questions that students may generate

	• Teacher should choose the most appropriate questions for investigation based on the content objectives of this lesson.	• Students and/or may need to bring some additional materials from home for the investigation.
	Teacher can create groups for planning and investigating, (groups of 2-3 are recommended). • Things to consider: How will you help your students determine which questions they can choose from to investigate? How will you or students form investigation groups?	• The teacher may want to form groups based on student interest in a particular question. • Assigning group roles such as materials manager, recorder, timer, etc. may be helpful.

PHASE 2 – Planning and Investigating

INVESTIGATION

- What **additional materials** will you introduce? How will you introduce additional materials participants can use to study the phenomena?
- How will you manage/organize materials, set up and clean up?
- How will you support the groups in **planning** their investigation? Will you provide criteria or planning sheets?
- How will you facilitate during the investigation?

Time	Task	Hints
	Teacher will review the materials available for the groups to use to investigate their questions.	
	Class can brainstorm the elements of an effective plan while the teacher records on chart paper. Items discussed may include: ○ Question ○ Directions – numbered/sequenced steps ○ Revise plans when changes are made ○ List of materials w/ quantities ○ Jobs – if assigned ○ Must be reproducible (someone	• This can be done with minimal teacher input; in order for students to develop their own plans (mistakes are expected). • **Assessment Note:** This is an opportunity to formatively assess student planning. • Teachers may choose to use the "Investigation Plan Template" (Appendix 1). This template can be taped into students' journals for future reference.

	else should be able to duplicate the investigation and get same results ○ Labeled diagrams or drawings ○ Prediction / hypothesis ○ Type of results you will collect and how they might be This can remain as a guide for students to refer to as they plan, or can be utilized to formulate a rubric. Teacher directs each group to develop a plan to use to investigate their question. This should be recorded by each group to share with the class in words or pictures.	• Teacher may choose to model a plan using a question that students are not investigating. • Remind students that they should only be testing or changing one thing (variable) in their experiment. For example, if they chose to test different colored containers then they should try to find the same shape containers, use the same amount of water and put them in the same location.
	Teacher may want to review or have student's peer-edit the plans before the investigation. Students should revisit their plans at this time, making the necessary revisions.	• Teacher should reinforce the fact that most/all of the important plan elements were included in students' shared plans.
	Using their investigation plans and materials, students can conduct their investigations. Students will record their observations during the investigation in their student journals. Teacher will facilitate with reminders to record observations and measurements. Removing students from their materials for a few minutes will help them concentrate on recording observations and noting revisions they made to their plan. If students finish their investigation early they can continue to investigate a related question or start preparing for their presentation/sharing with the larger group. Plan on ample time for clean-up procedures.	• Materials can be distributed to each group by the teacher, or a designated student may gather them for his/her group. Plastic café trays may be helpful to manage the materials. • Teacher should circulate, questioning and guiding groups. • Remind students that a good plan may still need to be revised once you begin your investigation. • **Guided Lesson/Thinking Tools**: Teacher may need to provide a mini-lesson on data collection and organization of this data. Some groups may need a template/chart to help with data collection.

Open Ended Questions and Comments to Help Guide Students During the Investigation

What do you know about…?
What will you need?
What will you add?
I wonder what will happen when…?
Why is that happening?
Show me how that…
How do you know that?
What do you see, notice, hear about…?
What does this do?
Where have you seen…?
What's happening with this?
What would you say about…?
How can we find out about…?
What other way can you try?
What else can you do about…?
What can you use this for?
Tell me about it.
What's your plan for that?
What does this remind you of?
Tell me more about…
How are you going to use…?
How will you use this today?
What does it need?
What else can you do about…?
What will happen if…?
How can we change that?
What happened when you did that?
What is different about that?
What will you do to change that?
Show me…
I'm noticing that…, how did that happen?

PHASE 3 – Interpreting Results and Communicating

SHARING RESULTS AND PROCESSING FOR MEANING

- How will investigation groups present what they have learned from their investigations? (visual, oral presentation, combination, etc.) How will you decide the order of the presentations? (by similar questions, content goals, random, etc.)
- How will the facilitator synthesize the knowledge and findings of the participants for the group?

Time	Task	Hints
	Prepare to share results. Things to consider: How will students visually share their results? (overheads, chart paper, poster, etc.) Teacher will allow an allotted time for each group to share their results (approx 3 minutes).	• **Guided Lesson/Thinking Tool:** Discuss with students what would be in an "effective presentation" (question, hypothesis/prediction, overview of procedure, results, and conclusion). • Teachers may find it helpful to take notes as students present; documenting which groups had evidence of each big idea. • Teachers may choose to use the template, called "Preparing to

		Share Results," to prepare for sharing (Appendix 2) • Consider charting "findings/ conclusions" after each group presentation. This will be helpful later during the synthesis.

Sample Student Visual for Presentation:

Question: Will water evaporate faster near the window or in the closet?

Plan:

1. Fill 2 cups with 50 mL of water.
2. Use a marker and mark the water line.
3. Put one cup on the windowsill.
4. Put the other cup in the closet.
5. Wait 5 days and measure how much lower the water line is and measure the water in the cup.

Hypothesis: I think more water will evaporate from the cup on the window because the hot sun will make it evaporate faster than the cup in the closet.

Results (data):

Cup 1 – window – end with 27 mL of water

Cup 2 – closet – end with 35 mL of water

**many groups may chose to do this section as a picture or diagram*

Conclusion:

The cup near the window evaporated more water than the cup in the closet. It was easy to see the differences in the water line. The water line in the cup near the window was much lower than the other cup and there was only 27 mL left when we measured it. 23 mL of the water evaporated from the cup near the window. Only 15 mL of the water evaporated from the cup in the closet.

	Synthesis – What have we learned about …….? Use specific examples from the class to support new learning/findings. Provide a copy (or have students copy into their journal) of the big ideas/summary of investigation findings.	• Use the big ideas (see below) to question students to guide them toward the content goals of the inquiry investigation.

Sample – Big Ideas/Summary of Investigation Findings:
• **The sun's energy increases the amount of water that evaporates.** • **More water evaporates when the temperature is warmer.** • **More water evaporates when there is a large surface area or mouth/opening.** • **Different liquids evaporate at different rates.**

	Follow up activity after synthesis. Students will be prompted to write in their science journals about why …… Students will then Pair Share their journal entries with a student who was not in their investigation group.	• What did they learn from revising their plans? • What did they notice about their plans as they investigated? • Was sequence important? • Did they develop/consider new questions during their investigation? • Did their partners notice the same things?
	Whole class discussion regarding student journal entries and Pair Share discussions.	• You might ask, "How was this different than how you have done science before?" • **Assessment Note**: Teacher will collect the student science notebooks for summative assessment.

Investigation Plan Template

Appendix 1

Team member names:_____
_____

Our **question** is:_____
_____

Our **hypothesis/prediction** is:_____
_____

Materials we will use:_____
_____
_____

PLAN

First, we will_____
_____
_____
_____

Then we will_____
_____
_____
_____

Next we will_____
_____
_____
_____

Finally we will_____
_____
_____
_____

What **changes/revisions** did you make to your original plan?

_____
_____
_____

Preparing To Share Results

Appendix 2

Question: _____

Hypothesis/Prediction: _____

_____

Summary of what you did (plan) _____

_____

_____

_____

_____

We found out that (data or results)_____

_____

Conclusion (WHY?) _____

_____

_____

Space for illustration/diagram of investigation plan and/or results.

Sample Science Journal Rubric

Appendix 3

3	• Journal has written descriptions that contain many details and are easy to understand. • The pictures and diagrams are drawn carefully and include labels. • Printing is neat and easy to read. • Journal contains "brain-stretching" questions and accurate observations.
2	• Journal has written descriptions that contain some details. • Some of the pictures and diagrams are drawn carefully. • Printing is somewhat easy to read. • Journal contains questions and observations
1	• Journal has written descriptions that contain few details and can be hard to understand. • The pictures are drawn sloppily and are missing details and labels. • Printing is hard to read and messy. • Journal contains simple questions and/or inaccurate or incomplete observations.

LITERATURE RESOURCES

These literature resources have been purchased to supplement the kit and are housed in each elementary school library.

Guided Reading Sets (6 copies in each school)

What Makes It Rain?, Keith Brandt
Magic School Bus, Wet All Over, Joanna Cole
Water, Water Everywhere, Melvin Berger
The Cloud Book, Tomie DePaola
Down Comes The Rain, Franklyn Branley
Wonders of the Seasons, Keith Brandt
Magic School Bus: Inside a Hurricane, Joanna Cole

Read Aloud (1 copy per school)

Non-Fiction	**Fiction**
A Drop Around the World, Barbara McKinney	*The Storm*, Marc Harshman
The Drop in My Drink, Meredith Hooper	*Cloudy with a Chance of Meatballs*, Judi Barrett
Weather Words and What They Mean, Gail Gibbons	*Tornado*, Betsy Byars
Weather Forecasting, Gail Gibbons	*Thunder Cake*, Patricia Polacco
Tornadoes, Seymour Simon	*Where the River Begins,* Thomas Locker
	Water Dance, Thomas Locker

Related Materials that May Be Found in Your Library

Come Back, Salmon, Molly Cone
Drip Drop: The Trip of a Water drop, Eve and Al Stwertka (Julian Messner, 1991)
Letting Swift River Go, Jane Yolen
Magic School Bus at the Waterworks, Joanna Cole
Magic School Bus on the Ocean Floor, Joanna Cole
A River Ran Wild, Lynne Cherry
The Cloud Book, Tomie de Paola
Cloudy with a Chance of Meatballs, Judi Barrett
Eyewitness Books: Weather, Alfred A. Knopf
How the Weather Works, Michael Allaby (Reader's Digest)
Our World: Weather and Climate, John Mason (Silver Burdett Press)
Weather Words, Gail Gibbons
Weather, Seymour Simon (Morris Junior Books)

Additional Teacher Resources That Are Suggested

Seasons: A Book of Poems, Charlotte Zolotow
Videos:

- Water Cycle, Bill Nye, Science Guy, Disney Studios
- All About Meteorology, Weather for Children, Schlessinger Meida
- All About Climate and Season, Weather for Children, Schlessinger Meida
- All About the Water Cycle, Earth Science For Children, Schlessinger Meida
- Weather, Eye Witness, Schlessinger Media

Materials List

Water Cycle – Grade 3

Revised February 16, 2006

(Based on the Delta Kit- Water Cycle and Weather Instruments)

Expendable materials
2 plastic bags 6 x 12 with ties
30 fluted containers (hinged)
30 paper cups (6 oz.)
15 hot drink paper cups (8 oz.)
27 pieces cobalt chloride paper
200 blue dots
1 roll masking tape
1 box paper clips
1 Air temp/weather chart
1 Cloud chart
1 Water Cycle chart
5 yellow cardstock windvane cards
5 jumbo straws
1 bag large cotton balls
1 bottle red food coloring (1 oz.)
2 packages of soil (4 qts. ea. package)
1 pkg. alfalfa seeds
½ cup clover seeds
1 plastic spoon
1 box raisins
1 dried fruit
** teacher provides fresh fruit to compare with dried*

Reusable Materials
Teacher guide – Water Cycle - Delta
Teacher guide – Weather Instruments - Delta
1 set water cycle pictures
1 plastic jar (16 oz.)
1 barometer
1 barometer Dial chart
1 rubber sheet
15 graduated cups/graduated cylinders (8 0Z)
15 plastic cloudy containers (4 oz.)
15 medicine cups (1 oz.)
15 tumbler lids (8 oz.)
30 tumblers
15 small paint cans
15 plastic trays
5 T- pins
5 beads
1 baster
25 thermometers
1 large sponge
15 sponges (1 inch)
1 spray bottle
1 box modeling clay
1 compass
5 wooden dowels/ bases
2 desk lamps with 2 100 watt bulbs
2 ice trays
1 rain gauge

I N S T I T U T E · F O R · I N Q U I R Y
A DESCRIPTION OF INQUIRY

Appendix A

⁄1998 The Exploratorium

At the *Exploratorium Institute for Inquiry* our work in science education is deeply rooted in the belief that human beings are natural inquirers and that inquiry is at the heart of all learning. The work that we do with educators is designed to give them an opportunity to personally experience the process of learning science through inquiry. Our hope is that this experience will stimulate their thinking about how to create classrooms that are supportive environments for children's inquiry.

Inquiry is an approach to learning that involves a process of exploring the natural or material world, that leads to asking questions and making discoveries in the search for new understandings. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science.

The inquiry process is driven by one's own curiosity, wonder, interest or passion to understand an observation or solve a problem.

The process begins when the learner notices something that intrigues, surprises, or stimulates a question—something that is new, or something that may not make sense in relationship to the learner's previous experience or current understanding.

The next step is to take action—through continued observing, raising questions, making predictions, testing hypotheses and creating theories and conceptual models.

The learner must find her or his own pathway through this process. It is rarely a linear progression, but rather more of a back and forth, or cyclical, series of events.

As the process unfolds, more observations and questions emerge, giving occasion for deeper interaction and relationship with the phenomena—and greater potential for further development of understanding.

Along the way, the inquirer collects and records data, makes representations of results and explanations, and draws upon other resources such as books, videos and the expertise or insights of others.

Making meaning from the experience requires reflection, conversations and comparison of findings with others, interpretation of data and observations, and the application of new conceptions to other contexts. All of this serves to help the learner construct new mental frameworks of the world.

Teaching science using the inquiry process requires a fundamental reexamination of the relationship between the teacher and the learner whereby the teacher becomes a facilitator or guide for the learner's own process of discovery and creating understanding of the world.

Map of IFI Inquiry Structure

(3 Phases of Inquiry Diagram)

Appendix B