WATER, WATER EVERYWHERE

Performance Standard 12E/11A/11B.C
Students will apply the process of scientific inquiry to analyze Earth's land, water and atmosphere as systems accordingly:

- *Knowledge*: Identify the importance and the phases of the water cycle worldwide.
- *Application*: Illustrate the water cycle over generalized land, water and atmospheric regions.
- *Communication*: Explain the possible phase options in the water cycle in different circumstances.

Procedure

1. ***In order to know and apply concepts that describe the features and processes of Earth and its resources (12E) and know and apply the concepts, principles and processes of scientific inquiry (11A) and/or know and apply the concepts, principles and processes of technological design (11B),*** students should experience sufficient learning opportunities to develop the following:
   - Identify the importance and volumes of water in a worldwide system.
   - Sequence the water cycle using generalized (and more specific) geographic locations around the world.
   - Describe patterns associated with the generalized water cycle.
   - Demonstrate a simplified water cycle in a closed system as a technological design 'dilemma.'
   - Propose scenarios for alterations in the water cycle processes.

   Note to teacher: This activity relates to knowledge associated with standard 12E, while addressing the performance descriptors for stage C within standard 11A and/or 11B. Applying scientific habits of mind noted in standard 13A are foundational to these activities. Using various technologies to estimate, measure and record data address some performance descriptors in 13B. ***The Illinois Department of Natural Resources may be contacted for assistance: http://www.dnr.state.il.us***
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Begin inquiry investigation by displaying a classroom closed terrarium which probably has water droplets forming on its walls. Ask "How did the water travel to get on the walls?" After recording their ideas on a classroom chart, pose a technological dilemma: "How can we replicate the travels of water?" Offer large, wide-mouthed glass jars (with caps) and small cups of water as the only resource materials for solving this dilemma. Students should plan an investigation which could make water appear on the walls of their jars. They must generate "success criteria" (their rules for solving the dilemma) and safety precautions, as well as data tables to record variables such as time, temperature, classroom location and amounts of water (probably suggested by teacher). This activity may be accomplished over several days with students recording their data accurately. Students can taste the water that is collected. (Colored water may be used in the small cup; the condensed water will not be colored. Additional questions about evaporation could be generated from this phenomenon.) Ask students to describe the patterns from their data tables and offer suggestions for making their design better.
4. Continue the inquiry investigation by asking questions such as: Where in the world is water? How does it get there? Encourage students to generate their own questions by using globes, maps, outdoor observations, and photographs to identify Earth's water features (including cloud formations). This can be done orally or by having students "map" their responses. Introduce the distinction of fresh water and salt water, available and unavailable water, groundwater, etc. Guide students toward answering their questions using applicable scientific vocabulary terms and resources. Ask students to diagram their explanations of the "travels" of water using colored arrows to identify the three major steps (condensation, evaporation, precipitation) in specific settings such as: a) over an ocean, b) over an Arctic or Antarctic land mass, c) over Illinois (your county will be better, so that they can include local water resources), d) over a desert, e) over a mountainous area, etc.
5. Ask students to explain their geographic illustration of the water cycle and suggest scenarios which could alter the "travels" of water in these diagrams.

6. Evaluate each student's work using the Science Rubric as follows and add the scores to determine the performance level:
   - *Knowledge*: Part I: The success criteria, safety precautions and data tables were acceptable.
     Part II: Identification of water's importance and water cycle steps is correct.
   - *Application*: Part I: The design, process and data tables were complete and correct.
     Part II: The water cycle sequence is complete and correct for assigned setting.
   - *Communication*: The explanations for both parts were well-reasoned and well-detailed.

Examples of Student Work not available

Time Requirements

- Technological design phase: Approximately 20 minutes for introduction, approximately 20-30 minutes to set up student-designed terrariums, and approximately 10 minutes for periodic checks to terrarium

Resources

- Large glass jars with lids, small cups which can fit into jars
- Thermometers for whole class and individual terrarium use
- Globe, maps, different outdoor pictures (with and without clouds)
- Colored pencils and drawing paper
- Science Rubric