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Test Creation

<u>Overview</u>

<u>Description of subject and its major goals</u>

Science can be described as the study of the physical and natural world through observation and experiment. The Virginia Standards of Learning have outlined eight major goals for science instruction. They are:

- Develop and use an experimental design in scientific inquiry

- Use the language of science to communicate understanding

- Investigate phenomena, using technology

- Apply scientific concepts, skills, and processes to everyday experiences

- Experience the richness and excitement of scientific discovery of the natural world through the collaborative quest for knowledge and understanding

- Making informed decisions regarding contemporary issues

- Develop scientific dispositions and habits of mind

- Explore scientific-related careers and interests

It is the expectation that these goals are addressed within every science unit that is taught.

<u>Description of specific unit</u>

This assessment will measure how well students understood a unit on the water cycle. In this unit, students will explore how water moves around the Earth through the processes of evaporation, condensation, and precipitation. Students will also learn about places water is stored on Earth, and analyze the importance of water to life. It is also expected that students will use scientific investigation, reasoning, and logic skills throughout this unit.

<u>Description of students</u>

This assessment will be administered in a third grade class of 22 students at Norge Elementary School in Williamsburg, VA. The students range in age from 8 to 9. The majority of the class is on grade level in science. During testing, students have mostly been exposed to multiple choice science tests. Students have been exposed to short answer questions on science tests, as well. Matching questions are not usually seen on classroom assessments in this class.

<u>Description/explanation of intended learning outcomes</u>

There are 8 intended learning outcomes within this water cycle unit. Six will be tested with this assessment. The other 2 will be assessed through a class project and an report. Below are all of the intended learning outcomes. Listed with each intended learning outcome is the target content, and the level of cognitive demand required by each outcome. The highlighted outcomes will NOT be assessed through this test.

- ==Appraise the importance of water to people and other living things==
  - Content – importance of water to people and other living things
  - Cognitive Indicator – Appraise
  - Level of Bloom's Taxonomy – evaluating
- Explain methods of water conservation in the home and school
  - Content – methods of water conservation for home/school
  - Cognitive Indicator – explain
  - Level of Bloom's Taxonomy – comprehension
- ==Construct and interpret a model of the water cycle==
  - Content – the water cycle (model)
  - Cognitive Indicators – construct, interpret

- o   Level of Bloom's Taxonomy – synthesis and analysis, respectively

- Realize that living things get water from the environment in different ways

  - o   Content – how living things get water from the environment

  - o   Cognitive Indicator – realize

  - o   Level of Bloom's Taxonomy – knowledge

- Identify the Sun as the origin of energy that drives the water cycle

  - o   Content – the origin of energy that drives the water cycle

  - o   Cognitive Indicator – Identify

  - o   Level of Bloom's Taxonomy – knowledge

- Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.

  - o   Content – evaporation, condensation, and precipitation in relation to the water cycle

  - o   Cognitive Indicator – describe

  - o   Level of Bloom's Taxonomy – analysis

- Identify major water sources for a community, including rivers, reservoirs, and wells. Describe the major water sources for the community.

  - o   Content – major water sources for communities

  - o   Cognitive Indicators – identify, describe

  - o   Level of Bloom's Taxonomy – knowledge and comprehension, respectively

- Analyze possible sources of pollution in their neighborhood, in the school, and the local community. This includes runoff from over-fertilized lawns/fields, oil from parking lots, eroding soil, and animal waste.

        o   Content – sources of runoff in the neighborhood, school, and community, including, over-fertilization, oil from parking lot, eroding soil, and animal waste.

        o   Cognitive Indicator – analyze

        o   Level of Bloom's Taxonomy – analysis.

Purpose of Test

This test will be used as a summative assessment for a unit on the water cycle. The test should give a good indication of how well students grasped the topics covered during the unit at certain cognitive levels. The test will also be used to improve student learning. The results of this test will be analyzed to see how well students grasped the concepts that were taught. The results will inform my decisions on what needs to be taught again, and what students understand.

Design Elements of the Test

Intended Learning Outcomes

These are the intended learning outcomes for Virginia Science Standard 3.9 on the Water Cycle. The standard is: "The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include:

a) the energy from the sun drives the water cycle;

b) processes involved in the water cycle (evaporation, condensation, precipitation);

c) water is essential for living things; and

d) water supply and water conservation."

The intended learning outcomes are:

- Appraise the importance of water to people and other living things

- Explain methods of water conservation in the home and school

- Construct and interpret a model of the water cycle

- Realize that living things get water from the environment in different ways

- Identify the Sun as the origin of energy that drives the water cycle

- Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.

- Identify major water sources for a community, including rivers, reservoirs, and wells. Describe the major water sources for the community.

- Analyze possible sources of pollution in their neighborhood, in the school, and the local community. This includes runoff from over-fertilized lawns/fields, oil from parking lots, eroding soil, and animal waste.

Construct validity

Construct validity, or face validity, is concerned with if an assessment looks like it is measuring what it set out to measure. In other words, construct validity is concerned with whether it looks like a science test. All questions on this test are based on the intended learning outcomes for the water cycle. They are also designed to reach the cognitive levels in each of the outcomes. Based on this, I would determine that the test has strong construct validity.

Content Validity

Content Validity is concerned with how well an assessment measures the intended learning outcomes that it set out to measure. The assessment must measure only those

intended learning outcomes, and no others. To ensure that this test has strong content validity, a table of specifications was made. On this table, the content to be tested, the appropriate cognitive levels, and the corresponding test questions were mapped out.

Rationale

This test uses both select response and supply response items. Multiple choice (select) and short answer (supply) questions were selected for use in this assessment. Multiple choice questions were used because students are accustomed to this type of question, and will be used on the Standards of Learning assessment. Also, this type of question was used to measure if students reached the cognitive levels of knowledge, comprehension, and analysis in their learning. Short answer questions were also used because students have to construct their own responses. Looking at these responses will give me a better indication of information that students missed, or are confused about.

Threats to reliability

This assessment has been designed to be as free from systematic error as possible. It is unbiased, and all students in the class will be able to read and comprehend the questions, answers, and directions. There are enough questions to make inferences about student knowledge, based on the emphasis to be placed on each topic during instruction. Also, proper grammar has been used throughout the test. Based on this, I have determined that the test has a high degree of reliability. However, there are many things cannot be controlled during a test administration. For example, a student may have had a bad day, or a fire alarm may go off during testing. These things will have to be taken into account when analyzing test results.

Predictive validity

Predictive validity is the ability for one assessment to predict the results of another assessment. These assessments must measure the same intended learning outcomes. Since this assessment would be summative, it would hopefully predict student success on the Science Standards of Learning exam. This assessment has strong potential for predictive validity, because both this test and the Standards of Learning exams will be focusing on the same intended learning outcomes.

Scoring and grading procedures

The test will be out of 55 points. Each multiple choice question will be worth 3 points, and each short answer question will be worth 5 points. Scoring rubrics are included in the answer key for the test. A passing grade for this test will be 39 out of 55, which is equivalent to 70%. The multiple choice questions have one clear answer to each question. However, the short answer questions have more than one possible correct answer. All possible correct answers have all been listed in the scoring rubrics.

Table of Specifications

This Table of Specifications shows the content to be taught in the unit. It also shows the cognitive level at which each piece of content should be taught. Each question on the test is placed on the table of specifications in the appropriate box for its content and level of cognitive demand. Lastly, this table shows how each piece of content will be assessed, whether it is through a project or test question.

Content	KNOWLED-GE	COMPREHE-NSION	APPLICATI-ON	ANALYSIS	SYNTHESIS	EVALUATI-ON
Importance of water to people and other living things						X Report
Methods of water conservation for home/school		X 4,8,15				
The water cycle (model)				X Project	X Project	
How living things get water from the environment	X 5,19					
The origin of energy that drives the water cycle	X 1,9					
Evaporation, condensation, and precipitation in relation to the water cycle	16,17,18			X 3,12,20,21*		
Major water sources for communities	X 2,6	X 7,14				
Sources of pollution in the neighborhood, school, and community, including, over-fertilization, oil from parking lot, eroding soil, and animal waste.				X 10,11,12		

*Note – On the test given to students, more raindrops were drawn in the precipitation section. This was done to avoid confusion, and to give students enough information to perform an accurate analysis of the picture.

Name:_____ Date: _____

Water Cycle Test

Directions: Circle the best answer to the questions below.

1) Where does the energy that drives the water cycle come from?
    a) The Moon
    b) The Sun
    c) Evaporation
    d) Clouds

2) What major water source lets people reach and use groundwater?
    a) A river
    b) A reservoir
    c) A well
    d) A lake

3) On Tuesday, Jessica stepped in a big puddle of water on her way to school. The next day, the puddle was smaller. When she walked to school on Monday, the puddle was gone. What caused the puddle to disappear?
    a) Evaporation
    b) Condensation
    c) Precipitation
    d) Conservation

4) What is a way to conserve water at home?
    a) Taking long showers
    b) Washing full loads of laundry
    c) Running water while brushing your teeth
    d) Taking a bubble bath

5) How do plants get water from the environment?
    a) Through their stems
    b) Through their leaves
    c) Through their roots
    d) Through their flowers

6) What major water source can be man-made or natural?
    a) A river
    b) An ocean
    c) A well
    d) A reservoir

7) Which is the major water source for the city of Williamsburg?
   a) A river
   b) A reservoir
   c) A lake
   d) An ocean

8) Allan decides that he is only going to water the plants when they need it. This is an example of _____.
   a) Water Conservation
   b) Water Pollution
   c) Water Collection
   d) Precipitation

9) Evaporation is a process where water is heated and changed into a gas. In the water cycle, where does the heat come from?
   a) The ground
   b) The Sun
   c) The Moon
   d) The clouds

Directions: Use the chart below to answer questions 10 and 11.

10) The town of Flowers has a problem. The town's lake is polluted! Look at the chart below to see what pollutants we found in the lake:

Pollutant (impurities)	Amount in Water
Lawn fertilizer	7 grams
Laundry soap	20 grams
Car oil	12 grams
Swimming pool chemicals	8 grams

What is causing the most pollution in the town's lake?
   a. Swimming pool chemicals
   b. Lawn fertilizer
   c. Laundry soap
   d. Car oil

11) What is causing the least pollution in the town's lake?
   a) Swimming Pool Chemicals
   b) Lawn fertilizer
   c) Laundry soap
   d) Car oil

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12) Which is NOT a source of water pollution?
   a) Air pollution
   b) Soapy water
   c) Water treatment
   d) Eroding soil

13) When Lisa was walking to the store, it started to rain. What process in the water cycle happened before this?
   a) Precipitation
   b) Condensation
   c) Evaporation
   d) Conservation

14) I am a water source for a community. I am the largest natural reservoir. I am

   _____.
   a) A lake
   b) A river
   c) An ocean
   d) A sea

15) Robert wants to conserve water. What is the best way for Robert to conserve water?
   a) Running water while washing the dishes
   b) Fixing leaky faucets
   c) Flushing garbage down the toilet
   d) Taking long showers

16) Condensation is a process where water is
   a) Changing from a gas to a liquid
   b) Changing from a liquid to a gas
   c) Falling to the ground
   d) Changing from a solid to a liquid

17) Precipitation is a process where water is
   a) Changing from a gas to a liquid
   b) Changing from a liquid to a gas
   c) Falling to the ground
   d) Changing from a solid to a liquid

18) Water that falls to the ground can flow into rivers, oceans, and lakes. When this happens, it is called
   a) Evaporation
   b) Conservation
   c) Precipitation
   d) Accumulation

Directions: Answer the following questions in one or two sentences. You must write in complete sentences.

(19) What is one way that animals get water from their environment?

(5)	(3)	(0)
Says that animals can get water by drinking it OR by eating food. Uses full sentences.	Says that animals can get water by drinking it OR by eating food. Does not use full sentences.	Gives any other answer, and does not use full sentences.

(20) If condensation did not happen, what would happen to precipitation? Why?

(5)	(3)	(0)
Explains that condensation provides the water for precipitation (or that it causes precipitation), therefore precipitation would not happen. Uses full sentences.	Explains what would happen to precipitation, but does not say why OR provided a good explanation (see exceeds section) without full sentences.	Says that nothing would happen. Did not use full sentences.

(21) Label the processes of the water cycle on the picture below:

CONDENSATION

PRECIPITATION

EVAPORATION
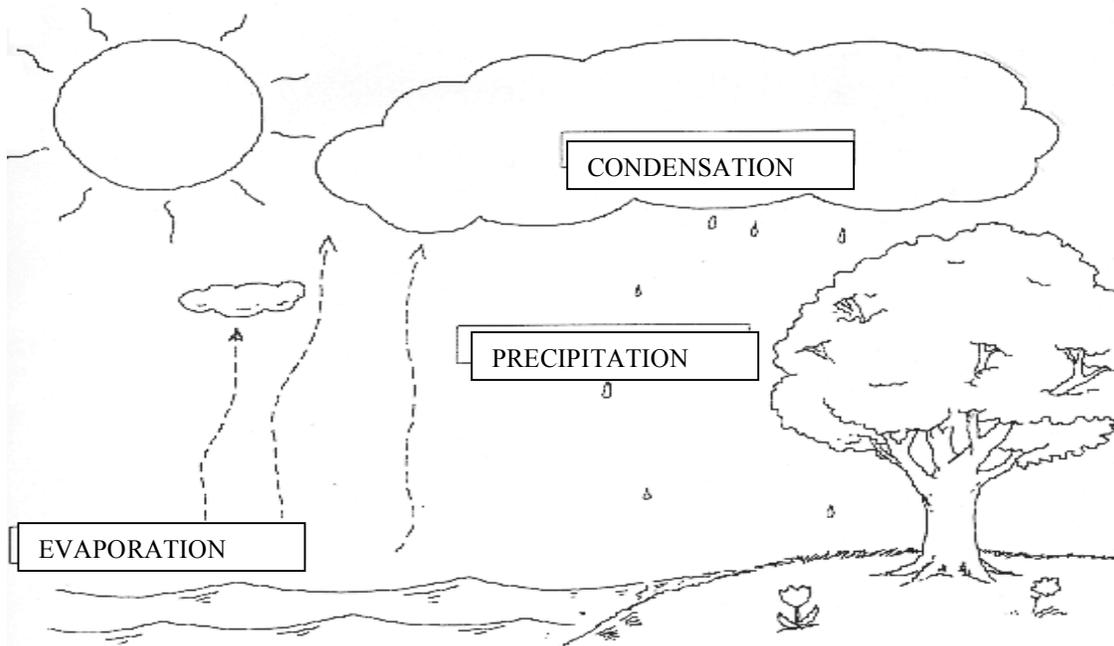
*Note – On the test given to students, more raindrops were drawn to avoid confusion, and ensure that students had enough information to accurately analyze the picture.