Unit of Study

Unit Title: Water Cycle
Length of Unit: 10 class periods

Organizer: Sue Dillery, Taylor County High School

Essential Questions: (3-5)

1. **How does water move through various reservoirs on Earth?**
2. **How do human activities change the water cycle?**
3. **What substances are present in water that indicates human activity?**
4. **How can our understanding the water cycle help us solve problems about water quality?**

Standards:

Science H 114.

Academic Expectations

2.2
Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.
2.3
Students identify and analyze systems and the ways their components work together or affect each other.
2.4
Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics that might be observed.
2.5
Students understand that under certain conditions nature tends to remain the same or move toward a balance.
2.6
Students understand how living and nonliving things change over time and the factors that influence the changes.

Program of Studies

S-HS-ESS-6
Students will analyze Earth's chemical reservoirs and recognize that each element can exist in several reservoirs (e.g., carbon in carbon dioxide reservoirs and carbonate reservoirs).

Core Content for Assessment

SC-H-2.2.1

Earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different reservoirs. Each element on Earth moves among reservoirs in the solid Earth, oceans, atmosphere, and organisms as part of geochemical cycles.

SC-H-2.2.2

Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.

National Standards

NSS12_4.5

The earth is a system containing essentially a fixed amount of each stable chemical atom or element. Each element can exist in several different chemical reservoirs. Each element on earth moves among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.

NSS12_4.6

Movement of matter between reservoirs is driven by the earth's internal and external sources of energy. These movements are often accompanied by a change in the physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life.

Science H 131.

Academic Expectations

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2.4

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics that might be observed.

2.5

Students understand that under certain conditions nature tends to remain the same or move toward a balance.

2.6

Students understand how living and nonliving things change over time and the factors that influence the changes.

Program of Studies

S-HS-LS-10

Students will explore how human activities alter ecosystems.

Core Content for Assessment

SC-H-3.5.5

Human beings live within the world's ecosystems. Human activities can deliberately or inadvertently alter the dynamics in ecosystems. These activities can threaten current and future global stability and, if not addressed, ecosystems can be irreversibly affected.

National Standards

NSS12_3.19

Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

Curriculum Web: (how unit integrated with other content areas)

Culminating Performance: Students will prepare a portfolio quality feature article on The Human Impact on the Water Cycle. (Attached)

Culminating Performance Rubric: Students will prepare a portfolio quality feature article on The Human Impact on the Water Cycle. (Attached)

Lesson Plan

Name: Sue Dillery **Grade Level :9**

Date: 10-23-04

Content/Subject: Integrated Science

Unit Title: Water Cycle

Objectives:

- **Students will evaluate how human activities affect the water cycle.**
- **Students will evaluate common water monitoring techniques and processes.**
- **Students will collect and interpret water monitoring data; summarize results.**

Targeted Standards for this Lesson:

Science H 131.

Academic Expectations

2.2
Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.
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Students identify and analyze systems and the ways their components work together or affect each other.
2.4
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NSS12_3.19

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Context:

This is the second unit in the school year. The students have previously studied energy flow (food chains and food webs) and nutrient cycles (nitrogen and carbon cycles). The water cycle was introduced, compared to other nutrient cycles, and the uniqueness of water was discussed (same compound/change of state). After completion of the water cycle, students will study soil formation. The impact of soil type and rate of soil formation will be discussed and related to the water cycle.

Resources/Materials:

Poster board, markers
LaMotte Water Monitoring Kit (code 5886)

Procedures:

Beginning Review: Diagram.
Students will prepare poster size colored diagrams of the water cycle and present them to the class.

Anticipatory Set: Brainstorm!
Students will identify human activities that degrade water quality. These brainstorm activities will be added to Water Cycle Diagrams in red. (Fertilizer and manure runoff, erosion, burning fossil fuels, garbage and pollution thrown in water)

Concept Development: Discussion/Lecture
Teacher lead discussion/lecture on substance that are commonly tested for in water and what human activity this substance indicates.

Test For (Indicators):	Measures:	Impact:
Fecal Coliform Bacteria	Naturally present in digestive tract of all warm blooded organisms including humans	High levels: Sewage from humans, manure runoff
Dissolved Oxygen	Important to the health of aquatic ecosystems	Low: High levels of bacteria, pollution, large amounts of rotting plants.

Biochemical Oxygen Demand	Measure of the quantity of dissolved oxygen used by bacteria as they break down organic waste	Same as above
Nitrates	Needed by plants and animals to build protein	High: Sewage, manure, and/or fertilizer runoff
pH	Measure of acidity (pH 1-6) Neutral pH 7 Measure of alkalinity (pH 8-14)	High or Low: Industrial waste, agricultural runoff, acid rain
Phosphate	Nutrient needed for plant and animal growth (DNA)	High: same as nitrates
Temperature	Varies greatly by season, relates to DO	High: Thermal pollution
Turbidity	Relative clarity of water	High: Soil erosion, urban runoff, agal blooms, bottom sediment disturbances

Guided Practice: Lab Activity
Testing of water from Green River Lake in school lab. Students take turns as the demonstrator while teacher acts as assistant. Remaining students read along in test booklet and identifies needed test equipment.

Independent Practice: Clay Hill Water Monitoring
Ten student groups conduct water monitoring at 3 sites.

Ending Review: Data Analysis/Summary
Students compare water monitoring data and prepare summary of results at sites; present to class.

Student Assessment:
Formative: Students will be assessed on their water cycle diagrams and presentation to the class. Students must correctly label and explain the processes: evaporation, transpiration, condensation, precipitation, and percolation.

Summative: Students will be assessed on a written comparison summary of water monitoring sites at Clay Hill Memorial Forest. Students are expected to incorporate data from 2 to 4 replications per site and explain any differences in data on water monitoring indicators.

Adaptations: Students are placed in mixed ability groups to accommodate the high numbers of exceptional students. In addition, a collaborating special education teacher was present for every lesson and Theresa Spurling from Campbellsville University was present at Clay Hill to assist with water monitoring groups.

Related Activities:
Sink Hole from Mammoth Cave Area Biosphere Reserve Program
Transpiration from Ward's Transpiration Kit

Technology:
Internet References (included below)

References:

Avakian, Robert W. *et al*. Science Interactions Course 4. Glencoe McGraw-Hill: Columbus, OH, 1999.

"BMP Spotlight-Streambank Restoration". The Green Riber Reader. The Nature Concervancy. Spring, 2004.

Kessler, Richie. "Green River", Conserving Kentucky. The Nature Conservancy. 2003. p. 14.

LaMotte. Water Monitoring Test Kit Booklet. LaMotte Company. Chestertown, MD

"Straight Talk about Ground Water and You", Cumberland-Green Lakes Resource Conservation and Development Council, Inc.

USDA Natural Resources Programs: Financial, Technical, and Education Assistance for Landowners. May, 1998.

"Water quality report gigs two local reservoirs", Central Kentucky News-Journal. September 6, 2004. p. 1.

"What is a Watershed?", USDA. Program Aid Number 420, 1994.

Water Quality and Water Cycle helpful Cites:

http://www.wqa.org/

http://www.wqa.org/

http://mbgnet.mobot.org/fresh/cycle/

http://www.epa.gov/region7/kids/drnk_b.htm

http://ga.water.usgs.gov/edu/watercycle.html

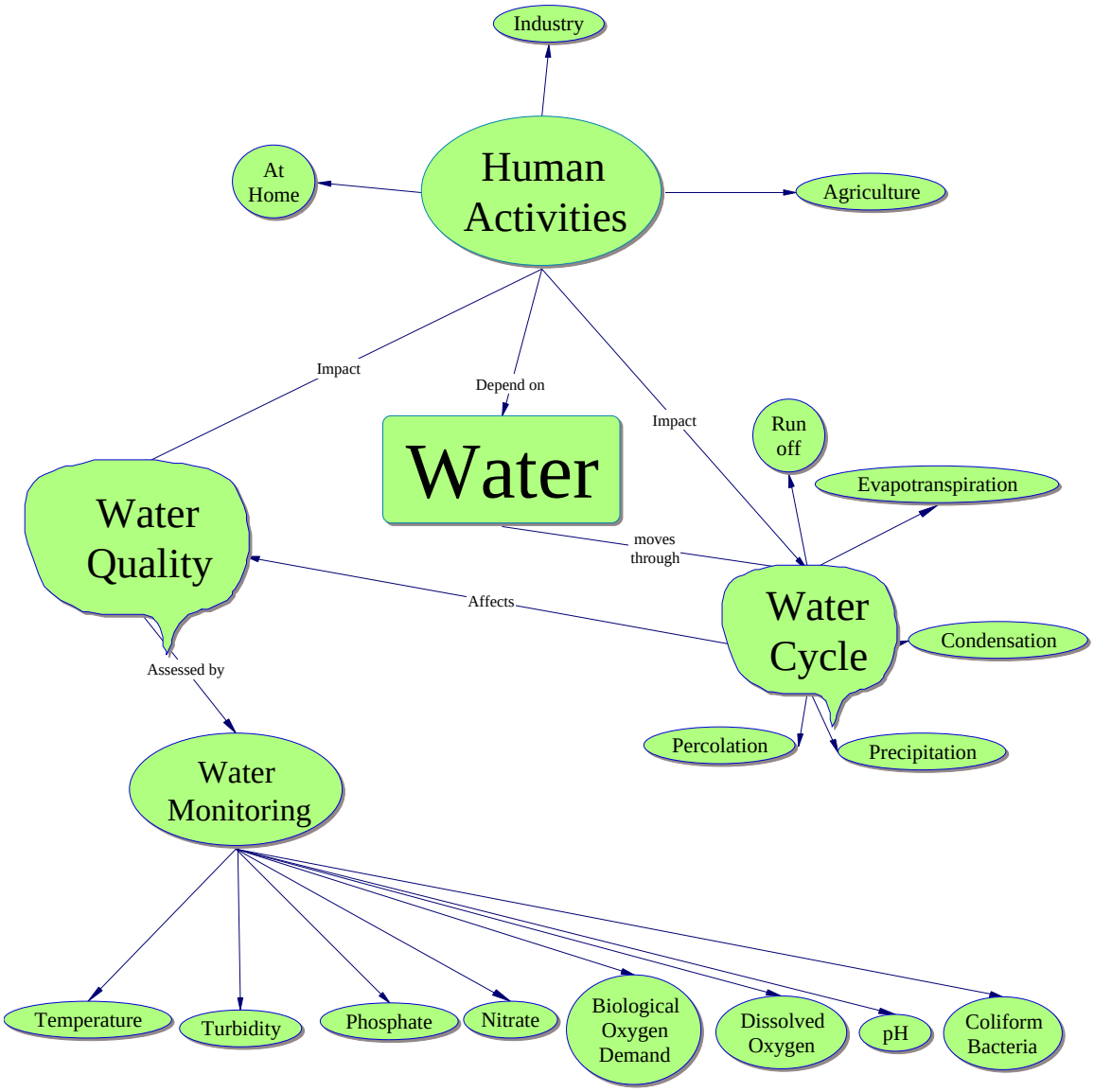
http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/hyd/home.rxml

http://web-savvy.com/river/schuylkill/water_issues.html

http://ga.water.usgs.gov/edu/

http://www.earthforce.org/

Appendix I


Industry
Human Activities
At Home
Agriculture
Impact
Depend on
Impact
Water
Run off
Evapotranspiration
Water Quality
moves through
Affects
Water Cycle
Condensation
Assessed by
Percolation
Precipitation
Water Monitoring
Temperature
Turbidity
Phosphate
Nitrate
Biological Oxygen Demand
Dissolved Oxygen
pH
Coliform Bacteria

Appendix II

Water Monitoring Clay Hill Memorial Forest

_____

date

Test	Location:	Rank	Location:	Rank
Temperature p.28				
pH p.24				
Dissolved Oxygen p.16				
BOD p. 20				
Nitrate p.22				
Phosphate p.26				
Turbidity p.30				
Coliform Bacteria p.11				

TOTAL RANK	**XXXXXXXX**		**XXXXXXXX**	

After each test throw out the used water in wastewater container.

Appendix III

Integrated Science

Water Feature Article Grading Rubric

First Draft (30 points)

Due Date _____

Opening paragraph

Topic (2) _____

Audience (2) _____

Supporting paragraph
Topic sentence (2) _____
On topic

Supporting paragraph
Topic sentence (2) _____
On topic

Supporting paragraph
Topic sentence (2) _____
On topic

Closing paragraph
Summary (3) _____

Audience (2) _____

References (6) _____
Missing/incomplete

Grammar/Spelling/Punctuation (4)
_____

Typing (5) _____

TOTAL _____

Integrated Science

Water Feature Article Grading Rubric

Final Draft (20 points)

Due Date _____

Opening paragraph

Topic (1) _____

Audience (1) _____

Supporting paragraph
Topic sentence (1) _____
On topic

Supporting paragraph
Topic sentence (1) _____
On topic

Supporting paragraph
Topic sentence (1) _____
On topic

Closing paragraph
Summary (2) _____

Audience (1) _____

References (3) _____
Missing/incomplete

Grammar/Spelling/Punctuation (4)
_____

Typing (5) _____

TOTAL _____