Surface Water Quality Data Interpretation Workbook Curriculum Companion

Overview

The goal of this curriculum is for student to use critical thinking skills and scientific problem solving skills to interpret water quality data. These cross-curriculum exercises are appropriate for classrooms that have been collecting monthly water quality monitoring data at a local site or that are able to download water quality data from the web. Prior water quality knowledge is preferable. This curriculum is appropriate for 8th Grade Science; Aquatic Science classes, Geology, Meteorology, Oceanography; Environmental Systems; 8th Grade Math; Geometry; Integrated Physics and Chemistry; Biology; Chemistry; and Computer Science.

This curriculum companion explores:

* Researching and downloading water quality monitoring data
* Evaluating relationships among water quality data
* Forming testable hypotheses
* Developing conclusions based on water quality parameter relationships

The following pages provide an overview, TEKS correlation, and page numbers.

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CURRICULUM OVERVIEW

SECTION ONE: SURFACE WATER QUALITY DATA INTERPRETATION WORKBOOK

INTRODUCTION

The introduction provides general water quality information. It discusses conventional pollutants, common conventional pollutants, and physical indicators of water quality. This section also includes a glossary of water quality terms, and a section on how to graph data.

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Glossary: 8
Graphing Data: 13

EXERCISE ONE: The Relationship Between Temperature and Dissolved Oxygen

Timeframe: 50 minute class period
Overview: Students plot data on a graph and interpret the graph.
TEKS Overview: §112.24 Science Grade 8 8.3, 8.4, 8.14; §112.46 Aquatic Science 2, 3, 6, 8, 9, 10; §111.24. Mathematics, Grade 8 8.4, 8.5, 8.12, 8.14; Chemistry 2D, 2E; Biology 2C, 2D; §112.42. Integrated Physics and Chemistry 2C, 2D, 3A; Environmental Systems 3 A; Geology, Meteorology, and Oceanography 10A, 10B, 10C;

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EXERCISE TWO: The Relationship Between Water Clarity, Conductivity and Rainfall

Timeframe: 50 minute class period
Overview: Students graph three different water quality parameters on a single graph and use critical thinking skills and scientific problem solving to determine any correlations.
TEKS Overview: §112.24 Science Grade 8 8.3, 8.4, 8.14; §111.34. Geometry; Integrated Physics and Chemistry 2C, 2D, 3A, 3B, 3C; Chemistry 2D, 2E; Biology 2C, 2D; §112.42. Integrated Physics and Chemistry 2C, 2D, 3A; Mathematics, Grade 8 8.4, 8.5, 8.12, 8.14; Environmental Systems 3 A; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;

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EXERCISE THREE: Sudden Changes in Dissolved Oxygen

Timeframe: 50 minute class period
Overview: Students graph dissolved oxygen data and use critical thinking skills and scientific problem solving to determine any correlations.
TEKS Overview: §112.24 Science Grade 8 8.3, 8.4, 8.14; Geology, Meteorology, and Oceanography 10A, 10B, 10C; §111.34. Geometry; Integrated Physics and Chemistry 2C, 2D, 3A, 3B, 3C; Chemistry 2D, 2E; Biology 2C, 2D; §112.42. Integrated Physics and Chemistry 2C, 2D, 3A; §111.34. Geometry; Environmental Systems 3 A; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;

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EXERCISE FOUR: Temperature, Dissolved Oxygen, and pH in an Urban Stream

Timeframe: 90 minute class period or 1 ½ 50 minute class periods.

Overview: Students graph temperature, dissolved oxygen, and pH on several graphs and use critical thinking skills and scientific problem solving to determine any correlations.
TEKS Overview: §111.34. Geometry; §112.42. Integrated Physics and Chemistry 2A, 2B 2C, 2D, 3A; Chemistry 2D, 2E; Biology 2C, 2D; §111.34. Geometry; Environmental Systems 3 A, 3D, 4B, 4C, 5A, 5B 5F; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;
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EXERCISE FIVE: Ammonia and Dissolved Oxygen in Cow Creek
Timeframe: 1 90 minute class period or 2 50 minute class periods.
Overview: Students begin by reviewing background information about Cow Creek and the surrounding town. After reviewing the information, students graph several different water quality parameters and interpret the relationships. Using critical thinking skills and scientific problem solving the students work to determine the potential source of the water quality problem in Cow Creek.
TEKS Overview: Environmental Systems 3 A, 3D, 4B, 4C, 5A, 5B 5F; §111.34. Geometry; §112.42. Integrated Physics and Chemistry 2A, 2B 2C, 2D, 3A;; Chemistry 2A, 2B, 2D, 2E; Biology 2A, 2B, 2C, 2D; §111.34. Geometry; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;
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EXERCISE SIX: Dissolved Oxygen, Temperature, and Fish Kills in Clam Creek
Timeframe: 1 ½ 90 minute class period or 2 ½ 50 minute class periods.
Overview: A fish kill in Clam Creek leaves the community and government agencies concerned about the health of Clam Creek. Students review a map of the area including land use and background information about Clam Creek. After reviewing the information, students graph several different water quality parameters and interpret the relationships. Using critical thinking skills and scientific problem solving skills the students work to determine the potential source of the Fish Kill in Clam Creek.
TEKS Overview: §111.34. Geometry; §112.42. Integrated Physics and Chemistry 2A, 2B 2C, 2D, 3A; Chemistry 2A, 2B, 2D, 2E; Biology 2A, 2B, 2C, 2D; §111.34. Geometry; Environmental Systems 3 A, 3D, 4B, 4C, 5A, 5B 5F; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;
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SECTION TWO: CUMULATIVE STUDENT PROJECT

WORKSHEETS
There are two worksheets included with this curriculum. The worksheets can help assess prior water quality knowledge, can be used as a quiz/review, or can be given as extra credit.
Worksheet 1 is a combination of multiple choice, true/false and listing. Worksheet 2 is a crossword puzzle using words from the glossary.
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TEACHER BACKGROUND
This section provides teachers with the background information on how to implement the cumulative student project.
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STUDENT PROJECT GUIDELINE
Timeframe: Two to three week project or could be a 6-week long project.
Overview: The purpose of this project is for students to collect real-world data, interpret the data, and present the conclusions. Students use the scientific method to describe a problem and formulate a question, gather information, develop hypotheses, analyze information to test hypotheses, and develop conclusions.
TEKS Overview: §112.42. Integrated Physics and Chemistry 2A, 2B 2C, 2D, 3A; §111.34. Geometry; §112.43. Biology 2A, 2B, 2C, 2D; §112.45. Chemistry 2A, 2B, 2D, 2E; §126.22. Computer Science I 2A, 2B; §111.34. Geometry; Geology, Meteorology, and Oceanography 10A, 10B, 10C; Aquatic Science 2, 3, 6, 8, 9, 10;
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RESOURCE LIST
This list provides students with website links where they can find additional information from the TCEQ about water quality assessment in the state of Texas. It also includes links to additional sites with water quality data. The last section of the resource list focuses on websites that provide helpful information about Excel and graphing in Excel.
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GRAPHING STEPS
Student will need to use Excel to create graphs for the student projects. This section gives step by step directions for how to download data from the Texas Watch website, how to import the data into Excel, and then how to create different graphs using Excel's graphing wizard.
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RUBRIC
The rubric provides a standardized way to assess student water quality data interpretation projects.
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SECTION THREE: TEKS CORRELATIONS
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