Unit 1 - Introduction to Environmental Sciences

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Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Environmental Science, Unit 1
Environmental Systems

Belleville Board of Education

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Unit Overview

1. Safety in the Laboratory - Proper laboratory techniques and safety protocols are essential in the high school science laboratory
2. Data Collection and Analysis - The crosscutting concepts of structure and function, patterns, energy and matter, and stability and change are called out as the framework for understanding the disciplinary core ideas. Students use developing and using models,planning and conducting investigations, using mathematical thinking, and constructing explanations and designing solutions.
3. Data Collection and Analysis -Students are also expected to use the science and engineering practices to demonstrate proficiency with the core ideas.
4. Data Collection and Analysis -Students analyze major global problems. They begin by breaking these problems into smaller problems that can be tackled with engineering methods. To evaluate potential solutions, students are expected not only to consider a wide range of criteria, but also to recognize that criteria need to be prioritized.

Enduring Understanding

- The environment consists of many interacting systems in which there are dynamic consequences to upsetting the balanced equilibrium.
- Environmental Science is a problem-based, multidisciplinary science, which integrates the physical sciences, life sciences, and social sciences.
- Environmental Science is designed to provide students with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems, both natural and human-made, and to evaluate the relative risks associated with these problems.
- A learning schedule and procedures are imperative to create a safe, structured, and enthusiastic learning environment.
- Ecosystems are the result of the interactions among Earth's biosphere, geosphere, atmosphere, and hydrosphere.
- We can live more sustain-ably by relying more on solar energy, preserving biodiversity, and not disrupting the earth's natural chemical recycling processes.
- Major causes of environmental problems are population growth, wasteful and unsustainable resource use, and exclusion of harmful environmental costs from the market prices of goods and services.
- Our lives and economies depend on energy from the sun and natural resources and natural services (natural capital) provided by the earth.
- Scientific evidence is used for building, refining, and/or critiquing scientific explanations.
- Climate is influenced by interactions of multiple physical, chemical and biological factors, including human actions.

Essential Questions

- What methods are used to study environmental science?
- How are classroom expectations and rules needed to promote the process of science?
- How is scientific knowledge constructed?
- How does scientific knowledge benefit – deepen and broaden, from scientists sharing and debating ideas and information with peers?
- Why is it important to think in terms of systems of systems when considering environmental issues?
- To what extent can human behaviors impact our planet's environment?
- What is biodiversity and why is it important?
- What factors contribute to our ecological footprint?
- How have humans contributed to our Environmental Problems?
- What Is Pollution and what can we do about It?
- How are our ecological footprints affecting the Earth?
- What are the major components of the atmosphere?
- How does the Atmosphere relate to climate?
- What are the layers of the geosphere?
- How does the composition of earth explain plate tectonics and other geologic events such as volcanoes and earthquakes?
- What are the biotic and abiotic factors that define an ecosystem?
- What are the characteristics of the aquatic and terrestrial biomes?
- Why is it important to think in terms of systems of systems when considering environmental issues?
- What is sustainability?

Exit Skills

1. Analyze a problem, developing hypothesis, and design a scientific experiment to test those hypothesis
2. Use statistical analysis of data collected to make an argument based on purely scientific evidence
3. Develop a vernacular of scientific terms and current environmental problems
4. Data mine from scientific journals and articles evaluating their scientific methodology for validity

New Jersey Student Learning Standards (NJSLS-S)

HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
HS-ETS1-4	Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects).
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
HS-LS4-1	Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
HS-LS4-2	Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3)

	competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.
HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
HS-LS4-3	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
HS-LS4-4	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
HS-LS4-5	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Emphasis is on testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.

Interdisciplinary Connections

LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
LA.WHST.11-12.2.A	Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
LA.WHST.11-12.2.B	Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MA.A-REI.B.4	Solve quadratic equations in one variable.

Learning Objectives

1. Describe safety precautions and equipment in the laboratory.
2. Describe what to do in case of thermal burns, chemical burns, cuts, fainting, poisoning, and burns.
3. Students will then demonstrate their knowledge of safe laboratory practices.
4. Relate the role economics plays on the environment.
5. Graph the average ecological footprints of several countries, select two countries with different sized footprints and research the lifestyles of the citizens of the several countries of varying GDP.

6. Evaluate what aspects of lifestyles of the citizens of other countries, evaluating what aspects of lifestyle are most important in calculating an ecological footprint, and decide whether any lifestyle changes should or could be made to alter the value of the ecological footprint.
7. Identify actions that can be taken to deal with the problem of consumption patterns and identify the five categories within the life cycle of consumer goods.
8. Identify Earth's four major life-support components, identify the three factors sustain life on Earth, explaining how solar energy reaches the earth and how this connects to the climate. Students will analyze how humans have enhanced the natural system of the greenhouse affect.
9. Define abiotic and biotic factors and how specific levels of matter interact with each other.
10. Define the field of environmental science and discuss its importance.
11. Identify ways in which humans have altered and continue to alter our environment.
12. Describe key environmental indicators that help us evaluate the health of the planet.

Suggested Activities & Best Practices

Plan

- Chapter 1 Lesson Plans
- Chapter 1 Presentation
- bell-ringer - Eco-Friendly Food Labels

Central Case Studies

- 3D Geo Tour - The Discovery of the Ozone Hole
- Extension of Reading - Ozone Hole at Record Size
- Local Case Study - Local Environmental Agencies

Labs and Activities

- Modeling Activity - Finite Resources
- Scientific Method Laboratory - Green versus conventional cleaners
- Local Case Study - Local Research Activity

Activities

- Guided Reading
- Graphing Activity - Introduction to Environmental Science
- Mapping - Comparing Ecological Footprintspp
- Writing Activity - The Lesson of Easter Island

Assessment

- Self Assessment
- Tests A and B
- Quizzes and Practice

Assessment Evidence - Checking for Understanding (CFU)

Chapter Quizzes and Tests (Summative)

Socratic Questioning (Formative)

Lab Journal (Alternative)

Common Department Benchmark (Benchmark)

Oncourse Assessment Tools (Formative)

Do Now and Exit Tickets (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline

- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Environmental Science: Your World Your Turn - Jay Withgott

Ancillary Resources

Teacher and Publisher supplied power points, notes, guides, labs, and worksheets

Resource manuals

Internet Resources

Computer Activities

Technology Infusion

Teacher and Publisher supplied power points, notes, guides, labs, and worksheets

Resource manuals

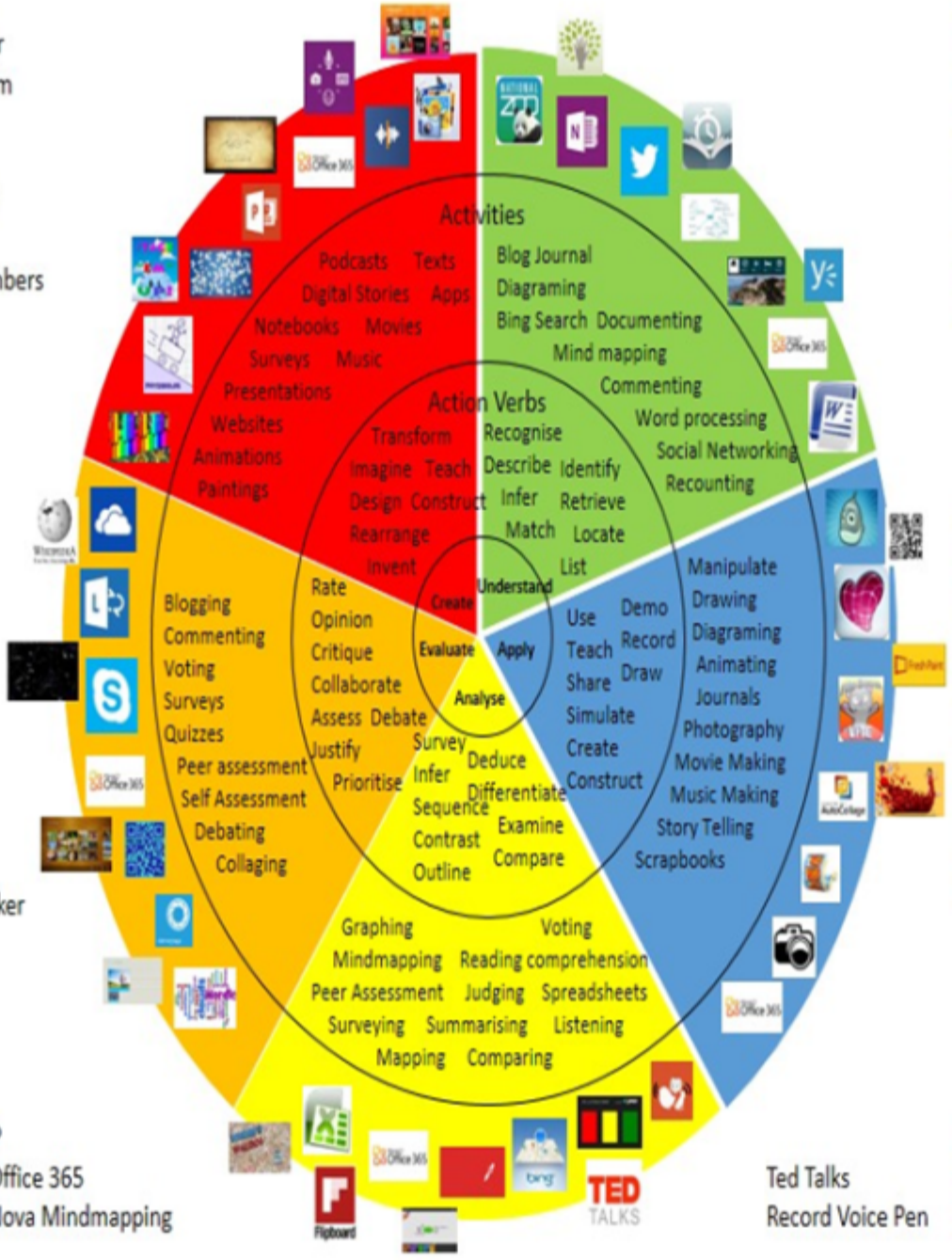
Internet Resources

Computer Activities

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.5	Research career opportunities in the United States and abroad that require knowledge of world languages and diverse cultures.
CAEP.9.2.12.C.7	Examine the professional, legal, and ethical responsibilities for both employers and employees in the global workplace.
TECH.8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.

21st Century Skills/Interdisciplinary Themes

- Communication and Collaboration
- Creativity and Innovation
- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills

- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Small Group Instruction

Study Guides

Project Based Learning

Differentiations:

- Small group instruction
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary

- Preview content & concepts
- Behavior management plan
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Quiz and Test Study Guides

Graphic Organizers

Powerpoints posted on google classroom

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Peer to assist students

Allow tests and quizzes to be taken in ESL room with extra time

Students allowed to use electronic devices for translation

Word Lists provided

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Provide modified test

Tutoring times offered

Allow students to correct test for partial credit

Extended time for assignments

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes

- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Provide enrichment articles and assignments

Allow students to complete independent study assignments

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Lesson Rational - Students are exposed to climate change information and debates within their daily lives; this issue has been raised in the last 4 elections and influences all aspects of current events.

Enduring Understandings: *The two innermost layers of the atmosphere are the troposphere, which supports life, and the stratosphere, which contains the protective ozone layer. Three major outdoor air pollution problems are industrial smog from burning coal, photochemical smog from motor vehicle and industrial emissions, and acid deposition from coal burning and motor vehicle exhaust. The most threatening indoor air pollutants are smoke and soot from wood and coal fires (mostly in developing countries) and chemicals used in building materials and products.*

Lesson Rational:

Essential Questions: *What is the Nature of the Atmosphere? What Are the Major Air Pollution Problems? What is air pollution?*

Objectives:

1.) Understand that air currents carry pollutants across the globe

2.) Distinguish between the atmosphere and the troposphere

3.) List the type of air pollutants

4.) Define industrial smog and photochemical smog

5.) Synthesize how sources of indoor air pollution effect different populations in developing and developed countries and environmental racism and environmental justice

Anticipatory Set:

Name:_____**Date:**_____**Period:**_____

Answer these questions on the back of this sheet:

Prior Knowledge: students were introduced to the atmosphere in the first chapter

Student Centered Inquiry-based Learning Procedure/Method:

1.) Anticipatory set

2.) The massive brown cloud

3.) Didactic presentation

4.) Meaningful closure

Meaningful Closure: Socratic Questioning

Differentiation: Multiple presentation techniques. Access to class website

Accommodations: Accommodations will be made as specified by IEP.

Pre, Formative and/or Summative Assessment Strategies Evaluations: Students will complete the assessment with an accuracy of 100%

Report, Reflect, Discuss:

Independent Practice/Upcoming Tasks: Homework Read and Take Notes on pages 325 – 330 (12.1) Complete questions on page 330 question number 1-6

Integrated Cross Disciplinary Lesson: Assessment