Geneva CUSD 304
Content-Area Curriculum Frameworks
Grades 6-12
Science

Mission Statement	<u>The Mission of Science Education Is:</u> 1) To nurture an active interest in science that continues throughout life. 2) To teach the learning skills and concepts necessary for the scientific process. 3) To develop student understanding of the interrelationships between science, society, and the environment 4) To encourage students to discover and develop their talent in science.
Course Sequence (Grades 6-12)	General Science Earth Science Biology Biology Honors Chemistry Chemistry Honors Physics Astronomy Natural Disasters Anatomy and Physiology I and II Horticulture I and II AP Chemistry AP Biology AP Environmental Science

Course Framework

Course Title	**Advanced Placement Environmental Science**
Grade Level	11th/12th
Semesters (1-2-3-4)	2
Prerequisite	Biology and chemistry required, Earth Science and Physics recommended
Course Description	AP Environmental Science is an advanced, capstone science course that is presented in a rigorous and analytical manner. This course allows students to pursue college-level environmental science while still in high school and to receive advanced placement credit upon entering college. It should not be considered as a simple continuation of the science curriculum. AP EnSci covers topics and laboratories typically encountered during the freshman year of college Environmental Science, and should be taken only by those students who intend to major in science or a science related field. Students who are not strong in science should not take Environmental Science. There is a great deal of individual work, and the pace is rapid. A high level of individual responsibility on the part of the student is expected. Topics are based upon attaining a deeper understanding of the natural system. Environmental science is examined from a biological, geographical, sociological, and meteorological basis including the human population, ecosystems, changes in the world's systems, agriculture and the world food supply, forests and landscapes, wildlife, pollution, energy sources, waste management, and planning for a sustainable future. More specific course information is available from the science department. *From the College Board* Environmental science is interdisciplinary; it embraces a wide variety of topics from different areas of study. Yet there are several major unifying constructs, or themes, that cut across the many topics included in the study of environmental science. Students enrolled in AP courses are expected to take the AP exam offered in May.

District-approved Materials and/or Resources	Environmental Science Publisher: Wiley ISBN: 04713-89145 Copy write: 2003

Unit Frameworks

Unit of Study: major topics	**UNIT I: INTRODUCTION TO ENVIRONMENTAL SCIENCE** **Topic 1: Basic Issues In Environmental Science**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.	

	11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data

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Objectives o **Conceptual** o **Factual** o **Procedural**	An overview and introduction of recurring themes that will be used all year in the course. Topics covered include, but are not limited to: •Why rapid human population growth is the fundamental environmental issue. •Why we must learn to sustain our environmental resources so that the will be available in the future. •How human beings affect the environment of the entire planet and why we must take a global perspective on environmental problems. •Why urban environmental issues and the effects of urban areas on environments elsewhere need to be given primary focus. •Why developing solutions to environmental problems requires making value judgments based on knowledge of scientific facts.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT I: INTRODUCTION TO ENVIRONMENTAL SCIENCE** **Topic 2: Thinking Critically about the Environment**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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Objectives o **Conceptual** o **Factual** o **Procedural**	Students explore the ideas of accurate and intelligent thought and analysis of information as regards the environment, and that environmental science is not a collection of facts to be memorized but rather a process of refining our understanding of nature through continual questioning and active investigation. Topics covered include, but are not limited to: •That thinking about environmental issues involves thinking scientifically. •That scientific knowledge is acquired through observations of the natural world that can be tested through additional observations and experiments. •The difference between deductive and inductive reasoning and how both are used in scientific thinking. •That every measurement involves some degree of approximation - that is

	uncertainty - and that a measurement without a statement about its degree of uncertainty is meaningless. •That scientific discovery involves a number of processes, including the scientific method, and that science and scientists are too diverse to be described by just one method. •That technology is not science but science and technology interact. •That decision making about environmental issues involves society, politics, culture, economics, and values as well as scientific information.	
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Unit Frameworks

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•Article Analysis items
•Lecture notes
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Objectives o **Conceptual** o **Factual** o **Procedural**	Changes in systems may occur naturally or may be induced by humans. Many complex and far-reaching interactions can result. Topics covered include, but are not limited to: •Why solutions to many environmental problems involve the study of systems and rates of change. •How positive and negative feedback operate in a system. •What are the implications of exponential growth and doubling time. •That natural disturbances and changes in systems such as forests, rivers, and coral reefs are important to their continued existence. •What an ecosystem is and why sustained life on Earth is a characteristic of ecosystems. •What the Gaia hypothesis is and how life on Earth has affected the Earth itself.

	•What the principle of uniformitarianism is and how it can be used to anticipate future changes. •Why the principle of environmental unity is important in studying environmental problems. •How human activities amplify the effects of natural disasters.	
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Objectives o **Conceptual** o **Factual** o **Procedural**	Life is composed of many chemical elements, which must exist in the right amounts, the right concentrations, and the right ratios to one another. If these conditions are not met, then life is limited. The study of chemical availability and biogeochemical cycles is important to the solution of many environmental problems. Topics covered include, but are not limited to: •What are the major biogeochemical cycles. •What are the major factors and processes that control biogeochemical cycles. •Why some chemical elements cycle quickly and some slowly. •How each major component of Earth's global system (the atmosphere, waters, solid surfaces, and life) are involved and linked with biogeochemical cycles. •How the biogeochemical cycles most important to life, especially the carbon cycle, generally operate.

	•How humans affect biogeochemical cycles.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study:
major topics</td><td>UNIT III: POPULATIONS
Topic 5: Human Population Description and Problems</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
•Selected Laboratory Activities (see explanation at end of document)</td></tr>
<tr><td>Illinois Learning Standards, Benchmarks,

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1. Science is a process
•Science is a method of learning more about the world
•Science constantly changes the way we understand the world.
2. Energy conversions underlie all ecological processes.
•Energy cannot be created; it must come from somewhere
•As energy flows through systems, at each step more of it becomes unstable.
3. The Earth itself is one interconnected system.
•Natural systems change over time and space.
•Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
•Humans have had an impact on the environment for millions of years.
•Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
5. Environmental problems have a cultural and social context.
•Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
•A suitable combination of conservation and development is required.
•Management of common resources is essential.

ISBE Goals
11.A.4a Formulate hypotheses referencing prior research and knowledge.
11.A.4b Conduct controlled experiments or simulations to test hypotheses.
11.A.4c Collect, organize and analyze data accurately and precisely.
11.A.4d Apply statistical methods to the data to reach and support conclusions.
11.A.4e Formulate alternative hypotheses to explain unexpected results.
11.A.5a Formulate hypotheses referencing prior research and knowledge.
11.A.5c Conduct systematic controlled experiments to test the selected hypotheses.
11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.
11.B.4a Identify a technological design problem inherent in a commonly used product.
11.B.4b Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.
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Objectives o **Conceptual** o **Factual** o **Procedural**	The current human population represents something unprecedented in the history of the world. Never before has one species had such a great impact on the environment in such a short time and continued to increase so rapidly. These qualities make human population the underlying environmental issue. Topics covered include, but are not limited to: •That ultimately, there can be no long-term solutions to environmental problems unless the human population stops increasing. •That two major questions about the human population involve what controls its rate of growth and how many people the earth can sustain. •That the rapid increase in the human population has occurred with little or no change in the maximum lifetime of an individual.

	•That modern medical practices, as well as improvements in sanitation, control of disease spreading organisms, and supplies of human necessities, have decreased death rates and accelerated the net rate of human population growth. •That even under the best imaginable scenario that experts in human populations have put forward, the human population will double before it stops increasing. •That countries with a high standard of living have moved more quickly to a lower birth rate than have countries with a low standard of living. •That although we cannot predict with absolute certainty what the future human carrying capacity of Earth will be, understanding of human population can help us make useful forecasts.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study:
major topics</td><td>UNIT IV: ECOSYSTEMS
Topic 6: Ecosystem Structure and Functions</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
•Selected Laboratory Activities (see explanation at end of document)</td></tr>
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National Standards Assessment Frameworks, or other standards that will be taught in this unit</td><td colspan="2">College Board Foundations
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•Science is a method of learning more about the world
•Science constantly changes the way we understand the world.
2. Energy conversions underlie all ecological processes.
•Energy cannot be created; it must come from somewhere
•As energy flows through systems, at each step more of it becomes unstable.
3. The Earth itself is one interconnected system.
•Natural systems change over time and space.
•Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
•Humans have had an impact on the environment for millions of years.
•Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
5. Environmental problems have a cultural and social context.
•Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
•A suitable combination of conservation and development is required.
•Management of common resources is essential.

ISBE Goals
11.A.4a Formulate hypotheses referencing prior research and knowledge.
11.A.4b Conduct controlled experiments or simulations to test hypotheses.
11.A.4c Collect, organize and analyze data accurately and precisely.
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11.A.4e Formulate alternative hypotheses to explain unexpected results.
11.A.5a Formulate hypotheses referencing prior research and knowledge.
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11.B.4a Identify a technological design problem inherent in a commonly used product.
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Objectives o **Conceptual** o **Factual** o **Procedural**	Life on Earth is sustained by ecosystems which vary greatly, but have certain attributes in common. Topics covered include, but are not limited to: •What basic characteristics of ecosystems allow them to sustain life. •What are the basic concepts of the ecological communities and their processes within ecosystems. •What are food chains, food webs, and trophic levels. •What the concept of ecosystem management involves. •Why the ecosystem is the basic system that supports life and allows it to persist. •How conservation and management of the environment might be improved through ecosystem management. •What a community level effect is. •What a keystone species is.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
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Topic 7: Importance and Maintenance of Diversity</td><td>Resources that will support instruction
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Objectives o **Conceptual** o **Factual** o **Procedural**	People have long wondered how the amazing diversity of life on Earth came to be. This diversity has developed through biological evolution and is affected by interactions among species and by the environment. Topics covered include, but are not limited to: •How the conservation of biological diversity involves an understanding of the intricate relationships among species and between species and their environments. •Why people value biological diversity. •What are the ecological functions of biological diversity. •What major problems are associated with biological diversity. •How mutation, natural selection, migration, and genetic drift lead to evolution of new species. •Why so many species have been able to evolve and persist.

	•How species interactions affect diversity. •The concepts of the ecological niche and habitat. •How people can affect biological diversity.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT IV: ECOSYSTEMS** **Topic 8: Biogeography and Global Patterns**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

	blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	If we are to conserve biological diversity, we must understand the large-scale, global patterns of biogeography. Topics covered include, but are not limited to: •How large-scale global patterns and the environment affect biological diversity. •How climate, bedrock, souls, and the geography of life are related to one another. •What biotic provinces and biomes are and how they differ. •How plate tectonics affects biogeography. •What island biogeography is and what it implies for the general geography of life, especially the geography of biological diversity. •What are the major patterns in the distribution of biomes on Earth and the major characteristics of each of the 17 biomes found on Earth. •How people affect the geography of life. •How the introduction of exotic species into new habitats typically affects the new

	habitats. •What ecological islands are and how we can help to conserve their biological diversity.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT IV: ECOSYSTEMS** **Topic 9: Energy Basics and Conservation**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	To conserve and manage our biological resources wisely, we must understand the basic concepts of energy, energy flow in ecosystems, and biological production. Topics covered include, but are not limited to: •How energy flow determines the upper limit on the production of biological resources, including forests, fisheries, wildlife, and endangered species. •Where energy comes from and how it is transferred from one living thing to another. •How the first and second laws of thermodynamics affect energy and production. •That energy flows is one way through the ecosystem. •That a basic quality of life is its ability to create order from energy on a local scale. •Why little of the energy available to an organism is fixed in new organic matter

	and how little of the energy available moves on to the next trophic level.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT IV: ECOSYSTEMS** **Topic 10: Ecological Conservation and Remediation**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

	blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Restoration ecology is a new field. In this topic, we explore the concepts of restoration ecology, with a special emphasis on how ecosystems restore themselves through the process of ecological succession. Topics covered include, but are not limited to: •What ecological restoration means. •What kinds of goals are possible for ecological restoration. •What basic approaches, methods, and limits apply to restoration. •How an ecosystem restores itself following a disturbance through ecological succession. •What role disturbances play in the persistence of ecosystems. •How physical forces and biological processes affects the land. •Why ecosystems do not maintain a steady-state condition.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT V: AGRICULTURE AND FOOD PRODUCTION** **Topic 11: World Food Supply and Distribution**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.	

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Objectives o **Conceptual** o **Factual** o **Procedural**	The major agricultural challenges facing us today are to achieve sustainable production of crops and domestic animals; to distribute food adequately around the world and to decrease negative environmental effects of agriculture; and avoid creating new kinds of environmental problems as agriculture advances. Topics covered include, but are not limited to: •What it means to take an ecological perspective on agriculture. •How agroecosystems differ from natural ecosystems. •How the food supply depends on the environment. •What role limiting factors play in determining crop yield and what the likelihood is that water will become the major limiting factor for crop growth in the next decade for many areas of the

	world. •How the growing human population, the loss of fertile souls, and the lack of water for irrigation can affect future food shortages worldwide. •What are the possibilities and limitations of some of techniques of modern agriculture that may lead to increased food production. •What is the relative importance of food distribution and food production. •What are the potential benefits and environmental effects of genetic engineering of crops.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study: major topics</td><td>UNIT V: AGRICULTURE AND FOOD PRODUCTION
Topic 12: Agriculture Practices and Effects</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
•Selected Laboratory Activities (see explanation at end of document)</td></tr>
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•Energy cannot be created; it must come from somewhere
•As energy flows through systems, at each step more of it becomes unstable.
3. The Earth itself is one interconnected system.
•Natural systems change over time and space.
•Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
•Humans have had an impact on the environment for millions of years.
•Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
5. Environmental problems have a cultural and social context.
•Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
•A suitable combination of conservation and development is required.
•Management of common resources is essential.

ISBE Goals
11.A.4a Formulate hypotheses referencing prior research and knowledge.
11.A.4b Conduct controlled experiments or simulations to test hypotheses.
11.A.4c Collect, organize and analyze data accurately and precisely.
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11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.
11.B.4a Identify a technological design problem inherent in a commonly used product.
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	11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data

	presented and potential sources of error. **13.A.4c** Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Agriculture changes the environment in many ways, both locally and globally. Topics covered include, but are not limited to: •How agriculture can lead to soul erosion, the severity of the problem, what methods are available to minimize erosion, and how application of these methods has reduced soil erosion in the United States. •How farming can deplete soil fertility and why agriculture in most cases requires the use of fertilizers. •Why some lands are most effectively used for grazing and how overgrazing can damage land. •What causes desertification. •How farming creates conditions that tend to promote pest species, the importance

	of effective pest (including weed) control, and the problems associated with chemical pesticides. •How alternative agricultural methods, including integrated pest management, no-till agriculture, mixed cropping, and other methods of soil conservation, can provide major environmental benefits. •How new methods of genetic modification of crops could improve food production and benefit the environment and how these methods could create new environmental problems.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT VI: NATURAL RESOURCES** **Topic 13: Natural Resource Conservation and Management**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	Conservation and management of natural resources have begun to take account of a larger view in which populations, species, and ecosystems are connected across landscapes. Topics covered include, but are not limited to: •What ecological services are provided by landscapes of various kinds. •What is the landscape context for conservation and management of forests and parks. •What are the basic principles of forest management, including its historical context. •What roles parks and nature preserves play in the conservation of wilderness.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study: major topics</td><td>UNIT VI: NATURAL RESOURCES
Topic 14: Threatened and Endangered Species</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
•Selected Laboratory Activities (see explanation at end of document)</td></tr>
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•Science is a method of learning more about the world
•Science constantly changes the way we understand the world.
2. Energy conversions underlie all ecological processes.
•Energy cannot be created; it must come from somewhere
•As energy flows through systems, at each step more of it becomes unstable.
3. The Earth itself is one interconnected system.
•Natural systems change over time and space.
•Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
•Humans have had an impact on the environment for millions of years.
•Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
5. Environmental problems have a cultural and social context.
•Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
•A suitable combination of conservation and development is required.
•Management of common resources is essential.

ISBE Goals
11.A.4a Formulate hypotheses referencing prior research and knowledge.
11.A.4b Conduct controlled experiments or simulations to test hypotheses.
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Objectives o **Conceptual** o **Factual** o **Procedural**	There are many reasons for preserving wildlife and endangered species. Much can be done to improve the ways in which we go about the conservation of species. Topics covered include, but are not limited to: •Why habitat is important in the conservation of endangered species and the management of all species. •What is the ecosystem context for wildlife management and endangered species conservation. •What is the landscape perspective for wildlife management and endangered species conservation. •What is the traditional role of the S-shaped curve in wildlife and fisheries management and the conservation of endangered species and what are the limitations and problems with this method.

	•What steps we can take to achieve sustainability of wildlife, fisheries, and endangered species. •What are the major current causes of extinction. •Why we conserve wildlife and endangered species. •What are the major concepts and terms related to conservation, including carrying capacity, maximum sustainable yield, and minimum viable population size. •How the goals and emphasis of modern wildlife management differ from those of traditional wildlife management.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT VII: ENVIRONMENTAL HEALTH** **Topic 15: Pollution**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	Serious environmental health problems and diseases may arise from toxic elements in water, air, soil, and even the rocks on which we build our home. Topics covered include, but are not limited to: •How the terms toxic, pollution, contamination, carcinogen, synergism, and biomagnification are used in environmental health. •What the classification and characteristics are of major groups of pollutants in environmental toxicology. •Why there is controversy and concern about synthetic organic compounds such as dioxin. •Whether we should be concerned with exposure to human-produced electromagnetic fields. •What the dose-response concept is and how it relates to LD-50, TD-50, ED-50,

	ecological gradients, and tolerance. •How the process of biomagnification works and why it is important in toxicology. •Why the threshold effect of environmental toxins are important. •What is the process of risk assessment in toxicology and why such processes are often difficult and controversial?	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT VIII: ENERGY** **Topic 16: Energy Basics and Flow**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Understanding the basics of what energy is, as well as the sources and uses of energy, is essential for effective energy planning. Topics covered include, but are not limited to: •That energy is neither created nor destroyed but is transformed from one kind to another. •Why in all transformations energy tends to go from a more usable to a less usable form. •What energy efficiency is and why is always less than 100%. •That people in industrialized countries consume a disproportionately large share of the world's total energy and how efficiency and conservation of energy can help make better use of global energy resources.

	•Why some energy planners propose a hard-pate approach to energy provision and others a soft-path approach, and why both of these approaches have positive and negative points. •Why moving toward global sustainable energy planning with integrated energy planning is an important goal. •What elements are needed to develop integrated energy planning.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT VIII: ENERGY** **Topic 17: Fossil Fuels**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	We rely almost completely on fossil fuels (oil, natural gas, and coal) for our energy needs. However, these are nonrenewable resources, and their production and use have a variety of serious environmental impacts. Topics covered include, but are not limited to: •Why we may have serious unprecedented supply problems with oil and gasoline within the next 20 to 50 years. •How oil, natural gas, and coal form. •What the environmental effects are of producing and using oil, natural gas, and coal.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT VIII: ENERGY** **Topic 18: Alternative Energy**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	Alternatives to fossil fuels include geothermal energy, solar energy, water power, wind power, and biomass fuels. Some of these alternatives are already being used, and efforts are underway to develop other. Topics covered include, but are not limited to: •What passive and active solar systems are, the advantages and limitations of each, and the environmental effects of developing and using the various types of active solar systems. •What are the potential uses of photovoltaics. •Why hydrogen may be an important fuel of the future. •The advantages, disadvantages, and environmental impacts of developing hydropower. •Why wind power has considerable potential, and how its development and

	utilization could affect the environment. •What are the potential environmental consequences of using biomass as an energy source. •What geothermal energy is, and how developing and using it affects the environment. •What important policy issues will affect large-scale use of alternative energy sources.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
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major topics</td><td>UNIT VIII: ENERGY
Topic 19: Nuclear Energy</td><td>Resources that will support instruction
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•A suitable combination of conservation and development is required.
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Objectives o **Conceptual** o **Factual** o **Procedural**	As one of the alternatives to fossil fuels, nuclear energy generates much controversy. Topics covered include, but are not limited to: •What nuclear fission is and what are the basic components of a nuclear power plant. •What nuclear radiation is and what are the three major types. •Why it is important to know the type of radiation and the half-life for a particular radioisotope. •What are the basic parts of the nuclear fuel cycle, and how each is related to our environment. •How radioisotopes affect the environment and the major pathways of radioactive materials in the environment. •What the breeder reactor is, and why it is important for the future of nuclear

	energy. •What are the relationships between radiation doses and health. •What we have learned from accidents at nuclear power plants. •How we might safely dispose of high-level radioactive materials. •What the future of nuclear power is likely to be.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT IX: WATER** **Topic 20: Water Resources**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

	blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Although water is one of the most abundant resources on Earth, many important issues and problems are involved in water management. Topics covered include, but are not limited to: •Why the total abundance of water on Earth is not a problem, but making it available where and when it is needed is a problem. •Why the residence times of water in various parts of the hydrologic cycle are important to water use and pollution potential. •What a water budget is, and why it is useful in analyzing water supply problems and potential solutions. •What groundwater is, and what environmental problems are associated with its use. •How water can be conserved at home and in industrial and agricultural practice.

	•Why sustainable water management will become more difficult as the demand for water increases. •What the environmental impacts are of water projects such as dams, reservoirs, canals, and channelization. •What a wetland is, how wetlands function, and why they are important. •What hazards are presented by river flooding.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT IX: WATER** **Topic 21: Water Pollution**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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Objectives o **Conceptual** o **Factual** o **Procedural**	Degradation of our surface water and groundwater resources is a serious problem, the effects of which are not fully known. There are a number of steps we can take to treat water and to minimize pollution. Topics covered include, but are not limited to: •What constitutes water pollution, and what are the major categories of pollutants. •Why the lack of disease-free drinking water is the primary water pollution problem in many locations around the world. •How point and non-point sources of water pollution differ. •What biogeochemical oxygen demand is, and why it is important. •What eutrophication is, why it is an ecosystem effect, and how human activity can cause cultural eutrophication. •Why sediment pollution is a serious problem.

	•What acid mine drainage is, and why it is a problem. •How urban processes can cause shallow aquifer pollution. •What the various methods of wastewater treatment are, and why some are more environmentally preferable that others. •What the environmental laws are that protect water resources and ecosystems.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT X: THE ATMOSPHERE** **Topic 22: Atmospheric Structure and Changes**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	Earth's atmosphere is a dynamic system that is changing continuously while undergoing complex physical and chemical processes. Topics covered include, but are not limited to: •What are the basic composition and structure of the atmosphere. •How the processes of atmospheric circulation, climate, and microclimate work. •What are the four major processes that remove materials from the atmosphere. •How the climate has changed during the last million years. •What is the science behind human-induced global warming. •How human activity has resulted in increased emissions of greenhouse gases. •How positive - and negative - feedback cycles in the atmosphere might affect global temperature change. •What effects global warming might have, and how we can adjust to those changes.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT X: THE ATMOSPHERE** **Topic 23: Outdoor Air Pollution**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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Objectives o **Conceptual** o **Factual** o **Procedural**	The atmosphere has always been a sink - a place for deposition and storage - for gaseous and particulate wastes. When the amount of waste entering the atmosphere in an area exceeds the ability of the atmosphere to disperse or degrade the pollutants, problems result. Topics covered include, but are not limited to: •Why human activities that pollute the air, combined with meteorological conditions, may exceed the natural abilities of the atmosphere to remove wastes. •What are the major categories and sources of air pollutants. •Why air pollution problems are different in different regions. •What acid rain is, how it is produced, what its environmental impacts are, and how they might be minimized. •What methods are useful in the collection, capture, and retention of pollutants before they enter the atmosphere.

	•What air quality standards are, and why they are important. •Why determining the economics of air pollution is controversial and difficult.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study:
major topics</td><td>UNIT X: THE ATMOSPHERE
Topic 24: Indoor Air Pollution</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
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•A suitable combination of conservation and development is required.
•Management of common resources is essential.

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11.A.5d Apply statistical methods to make predictions and to test the accuracy of results.
11.B.4a Identify a technological design problem inherent in a commonly used product.
11.B.4b Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.
11.B.4c Develop working visualizations of the proposed solution designs (e.g.,</td></tr>
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	blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Indoor air pollution from human fires for cooking and heating has affected human health for thousands of years. Today, lack of adequate ventilation in many energy-efficient homes and offices has increased the risk from pollutants. Topics covered include, but are not limited to: •Why indoor air pollutants cause some of our most serious environmental health problems. •What the major indoor air pollutants are, and where they come from. •Why concentrations of pollutants found in the indoor environment may be much greater than concentrations of same pollutants generally found outdoors. •Why environmental tobacco smoke (ETS) is a serious indoor air pollutant. •What radon gas is, and why it can be considered one of our most serious environmental health problems.

	•How radon gas enters homes and other buildings, and how its indoor concentration may be minimized. •What the major strategies are to control and minimize indoor air pollution.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT X: THE ATMOSPHERE** **Topic 25: Ozone in the Upper Atmosphere**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

	blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data presented and potential sources of error.

	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Ozone depletion in the stratosphere is recognized as a major environmental problem with potentially catastrophic effects. Topics covered include, but are not limited to: •What ozone is and how ozone is naturally formed and destroyed in the stratosphere. •What the so-called ozone shield is, and why it is important. •How chemical and physical processes and reactions link emissions of chlorofluorocarbons (CFCs) to stratospheric ozone depletion. •What role polar stratospheric clouds play in ozone depletion. •Why the problem of ozone depletion is a long-term problem. •What the environmental effects of ozone depletion are, and what options are available to minimize ozone depletion.

	•Why international cooperation, including significant economic aid from wealthy to less wealthy nations is necessary to encourage future reduction or elimination of emissions of ozone-depleting chemicals into the atmosphere.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT XI: HUMANS AND THE ENVIRONMENT** **Topic 26: Environmental Economics**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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	13.A.4c Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	This topic introduces some basic concepts of environmental economics and shows how these concepts have been applied in the analysis of environmental issues. Topics covered include, but are not limited to: •What the "tragedy of commons" is, and how it leads to an over-exploitation of resources. •How the perceived future value of an environmental benefit affects our willingness to pay for it now. •What externalities are, and why it is important to evaluate them in determining the costs of actions that affect the environment. •What factors may be involved in determining a level of acceptable environmental risk and risk to human life. •Why it is difficult, yet important, to evaluate environmental intangible, such as

	aesthetics. •What issues are involved in determining who pays the direct and indirect costs of controlling pollution and minimizing environmental damage. •What kinds of policy methods are available to control pollution and harvesting of resources.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT XI: HUMANS AND THE ENVIRONMENT** **Topic 27: Cities and Urban Environments**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time.	

	11.B.4c Develop working visualizations of the proposed solution designs (e.g., blueprints, schematics, flowcharts, cad-cam, animations) **11.B.5a** Identify a design problem that has practical applications and propose possible solutions, considering such constraints as available tools, materials, time and costs. **11.B.5b** Select criteria for a successful design solution to the identified problem. **11.B.5e** Apply established criteria to evaluate the suitability, acceptability, benefits, drawbacks and consequences for the tested design solution and recommend modifications and refinements. **12.A.4a** Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms. **12.A.4b** Describe the structures and organization of cells and tissues that underlie basic life functions including nutrition, respiration, cellular transport, biosynthesis and reproduction. **12.A.4c** Describe processes by which organisms change over time using evidence from comparative anatomy and physiology, embryology, the fossil record, genetics and biochemistry. **12.A.5a** Explain changes within cells and organisms in response to stimuli and changing environmental conditions (e.g., homeostasis, dormancy). **12.A.5b** Analyze the transmission of genetic traits, diseases and defects. **12.B.4a** Compare physical, ecological and behavioral factors that influence interactions and interdependence of organisms. **12.B.4b** Simulate and analyze factors that influence the size and stability of populations within ecosystems (e.g., birth rate, death rate, predation, migration patterns). **12.B.5a** Analyze and explain biodiversity issues and the causes and effects of extinction. **12.B.5b** Compare and predict how life forms can adapt to changes in the environment by applying concepts of change and constancy (e.g., variations within a population increase the likelihood of survival under new conditions). **12.C.4a** Use kinetic theory, wave theory, quantum theory and the laws of thermodynamics to explain energy transformations. **12.C.5a** Analyze reactions (e.g., nuclear reactions, burning of fuel, decomposition of waste) in natural and man-made energy systems. **12.C.5b** Analyze the properties of materials (e.g., mass, boiling point, melting point, hardness) in relation to their physical and/or chemical structures. **12.E.4a** Explain how external and internal energy sources drive Earth processes (e.g., solar energy drives weather patterns; internal heat drives plate tectonics). **12.E.4b** Describe how rock sequences and fossil remains are used to interpret the age and changes in the Earth. **12.E.5** Analyze the processes involved in naturally occurring short-term and long-term Earth events (e.g., floods, ice ages, temperature, sea-level fluctuations). **13.A.4a** Estimate and suggest ways to reduce the degree of risk involved in science activities. **13.A.4b** Assess the validity of scientific data by analyzing the results, sample set, sample size, similar previous experimentation, possible misrepresentation of data

	presented and potential sources of error. **13.A.4c** Describe how scientific knowledge, explanations and technological designs may change with new information over time (e.g., the understanding of DNA, the design of computers). **13.A.4d** Explain how peer review helps to assure the accurate use of data and improves the scientific process. **13.A.5b** Explain criteria that scientists use to evaluate the validity of scientific claims and theories. **13.A.5c** Explain the strengths, weaknesses and uses of research methodologies including observational studies, controlled laboratory experiments, computer modeling and statistical studies. **13.A.5d** Explain, using a practical example (e.g., cold fusion), why experimental replication and peer review are essential to scientific claims. **13.B.4a** Compare and contrast scientific inquiry and technological design as pure and applied sciences. **13.B.4b** Analyze a particular occupation to identify decisions that may be influenced by a knowledge of science. **13.B.4c** Analyze ways that resource management and technology can be used to accommodate population trends. **13.B.4d** Analyze local examples of resource use, technology use or conservation programs; document findings; and make recommendations for improvements. **13.B.4e** Evaluate claims derived from purported scientific studies used in advertising and marketing strategies. **13.B.5a** Analyze challenges created by international competition for increases in scientific knowledge and technological capabilities (e.g., patent issues, industrial espionage, technology obsolescence). **13.B.5b** Analyze and describe the processes and effects of scientific and technological breakthroughs. **13.B.5c** Design and conduct an environmental impact study, analyze findings and justify recommendations. **13.B.5d** Analyze the costs, benefits and effects of scientific and technological policies at the local, state, national and global levels (e.g., genetic research, Internet access). **13.B.5e** Assess how scientific and techno-logical progress has affected other fields of study, careers and job markets and aspects of everyday life.
Objectives o **Conceptual** o **Factual** o **Procedural**	Because the world is becoming increasingly urbanized, it is important to learn how to improve urban environments, to make cities more pleasant and healthier places in which to live, and to reduce undesirable effects on the environment. Topics covered include, but are not limited to: •How to view a city from an ecosystem perspective. •What a city's site and situation are, and how they determine the location and qualities of the city. •How cities have changed with changes in technology and with ideas about city planning. •How a city changes its own environment and affects the environment of the surrounding areas, and how we can plan cities to minimize some of these effects.

	•Why trees and other vegetation in cities are important as pleasing elements and as habitats for animals, and how we can alter the urban environment to encourage wildlife and to discourage pests. •How cities can be designed to promote biological conservation and become pleasant environments for people. •What are the two paths available for the future of the human population in regards to habitation of cities, and what are the requirements of the second path. •What fundamental choices face us in deciding what kind of future we want and what will be the role of cities in that future.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT XI: HUMANS AND THE ENVIRONMENT** **Topic 28: Waste Management**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
Illinois Learning Standards, Benchmarks, **National Standards Assessment Frameworks, or other standards that will be taught in this unit**	College Board Foundations 1. Science is a process •Science is a method of learning more about the world •Science constantly changes the way we understand the world. 2. Energy conversions underlie all ecological processes. •Energy cannot be created; it must come from somewhere •As energy flows through systems, at each step more of it becomes unstable. 3. The Earth itself is one interconnected system. •Natural systems change over time and space. •Biogeochemical systems vary in ability to recover from disturbances. 4. Humans alter natural systems. •Humans have had an impact on the environment for millions of years. •Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment. 5. Environmental problems have a cultural and social context. •Understanding the role of cultural, social, and economic factors is vital to the development of solutions. 6. Human survival depends on developing practices that will achieve sustainable systems. •A suitable combination of conservation and development is required. •Management of common resources is essential. ISBE Goals **11.A.4a** Formulate hypotheses referencing prior research and knowledge. **11.A.4b** Conduct controlled experiments or simulations to test hypotheses. **11.A.4c** Collect, organize and analyze data accurately and precisely. **11.A.4d** Apply statistical methods to the data to reach and support conclusions. **11.A.4e** Formulate alternative hypotheses to explain unexpected results. **11.A.5a** Formulate hypotheses referencing prior research and knowledge. **11.A.5c** Conduct systematic controlled experiments to test the selected hypotheses. **11.A.5d** Apply statistical methods to make predictions and to test the accuracy of results. **11.B.4a** Identify a technological design problem inherent in a commonly used product. **11.B.4b** Propose and compare different solution designs to the design problem based upon given constraints including available tools, materials and time. **11.B.4c** Develop working visualizations of the proposed solution designs (e.g.,	

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Objectives o **Conceptual** o **Factual** o **Procedural**	The waste management concept of "dilute and disperse" (for example, dumping waste into a river) is a hold-over from our frontier days, when we mistakenly believed land and water to be limitless resources. We next attempted to "concentrate and contain" waste in disposal sites ≠a practice that also proved to pollute land, air, and water resources. We are now focusing on managing materials to eliminate waste. Finally, we are getting it right! Topics covered include, but are not limited to: •What are the advantages and disadvantages of each of the major methods that constitute integrated waste management. •How the physical and hydrologic conditions at a site affect its suitability for a landfill. •What multiple barriers for landfills are, how landfill sites can be monitored.

	•Why management of hazardous chemical waste is one of our most serious environmental concerns. •What are the various methods of managing hazardous chemical waste. •What are the major pathways by which hazardous waste from a disposal site can enter the environment. •What problems are related to ocean dumping, and why these problems are likely to persist for some time.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

<table>
<tr><td>Unit of Study: major topics</td><td>UNIT XI: HUMANS AND THE ENVIRONMENT
Topic 29: Mineral Resources</td><td>Resources that will support instruction
•Teacher Made Handouts
•Video Analysis activities
•Article Analysis items
•Lecture notes
•Selected Laboratory Activities (see explanation at end of document)</td></tr>
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2. Energy conversions underlie all ecological processes.
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•As energy flows through systems, at each step more of it becomes unstable.
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•Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
•Humans have had an impact on the environment for millions of years.
•Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.
5. Environmental problems have a cultural and social context.
•Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
•A suitable combination of conservation and development is required.
•Management of common resources is essential.

ISBE Goals
11.A.4a Formulate hypotheses referencing prior research and knowledge.
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Objectives o **Conceptual** o **Factual** o **Procedural**	Modern society depends on the availability of mineral resources, which can be considered a nonrenewable heritage from the geologic past. Topics covered include, but are not limited to: •The standard of living in modern society is related in part to the availability of natural resources. •Why minerals are not uniformly distributed throughout the Earth's crust. •What processes are responsible for the distribution of mineral deposits. •What the differences are between mineral resources and reserves. •What factors control the environmental impact of mineral exploitation. •How wastes generated from the use of mineral resources affect the environment. •What the social impacts are from mineral exploitation.

Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**UNIT XI: HUMANS AND THE ENVIRONMENT** **Topic 30: Sustainability and the Future**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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Objectives o **Conceptual** o **Factual** o **Procedural**	Environmental law can contribute to sustainability, as can evaluating the landscape for environmental impact and land-use. Topics covered include, but are not limited to: •How we might move toward achieving sustainability. •How mediation is used as a tool in environmental law. •Why the development of international environmental agreements has created problems and controversy. •What are the major components of an environmental impact statement (EIS). •What processes of scoping and mitigation in environmental impact assessment include. •What are the steps in land-use planning.

	•Why increases in human population linked to changes in land use is increasing the occurrence of catastrophes resulting from natural hazards.	
Assessments	Performance Tasks •Chapter Examinations •Unit Examinations •Completion of Assignments •Laboratory Analyses •Video Analyses •Article and Topical Events Analyses	Other Evidence Professional observation and subjective evaluation by teacher, especially during laboratory activities

Unit Frameworks

Unit of Study: major topics	**LABORATORIES**	Resources that will support instruction •Teacher Made Handouts •Video Analysis activities •Article Analysis items •Lecture notes •Selected Laboratory Activities (see explanation at end of document)
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Objectives o **Conceptual** o **Factual** o **Procedural**	Labs are not designated a specific number of class periods or times. Some labs are one day activities, while others take several days or months to complete. If more time is needed for students to meaningfully complete a lab, more time is taken. As stated above, all activities designated as labs include methods for and requirements of data gathering, organization and interpretation, calculations and analysis of data, and conclusions and communications in tabular, graphical, and written form. Laboratories are teacher-written using material from a wide array of sources, as well as several labs from supply companies. There is no specific laboratory manual that is needed or utilized. Backyard Bacteria Longitudinal Compost Column Lab Bacterial Zones Of Tolerance Longitudinal Plant Study Of Monocot And Dicot Species

	Biodegradables Population Ecology Biomass And Competition Population Studies With Yeast Biomass And Productivity Quadrat Analysis Of A Plant Community Byron Nuclear Power Plant Qualitative Water Analysis Carbon Cycle Game Recyclables And Types Of Plastics Carbon Dioxide And Plant Growth Sewage Treatment Plant Observation And Analysis Detergents And Algal Blooms Soils I: Composition, Compaction, And Water Retention Effects Of Air Pollution Soils II: Nutrients And Salination Forest Preserve Study Waste Treatment Hydroponic Plant Culturing	
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