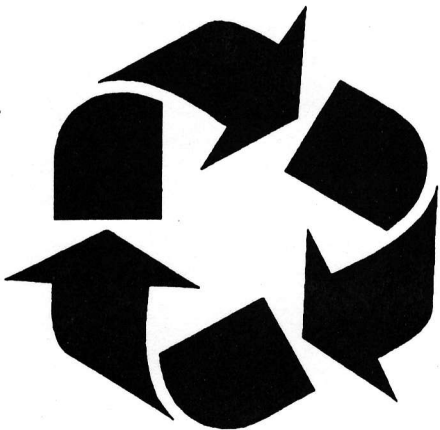


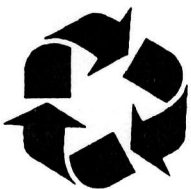
**NEW YORK CITY REGENTS ENVIRONMENTAL SCIENCE
CONCEPT PROGRAM GUIDE
VARIANCE**



Developed by the Office of the Bronx High School Superintendent

First Edition - June 1996

Concept Program Guide for Environmental Science



The content of this curriculum is organized around nine major themes:

- I. Introduction to the Non-Living Environment
- II. The Living Environment
- III. The Structure of Ecosystems
- IV. Populations
- V. People in the Global Ecosystem
- VI. Urban Ecology
- VII. Energy and Technology
- VIII. Land and Water Resources
- IX. Managing Human Impact.

On the following pages are a compilation of the major ideas associated with each theme. The performance indicators and associated laboratory/activity relating to the major concepts are included for easy reference. The performance indicators express what students should be able to do to demonstrate their knowledge and understanding of the concepts. The labs and activities provided can be used by teachers to help students achieve the performance indicators listed, but there are many alternative laboratory experiences which may be used to accomplish the same result.

UNIT 1. Methods and Skills Used by Scientists

Performance Indicators	Labs	Activities
<p>Explain what scientists do</p> <p>Identify what can be studied scientifically</p> <p>Explain the steps followed in conducting an experiment</p> <p>Evaluate a scientific hypothesis using the Scientific Method</p> <p>Interpret data, including graphic representations of information</p> <p>Construct graphs, data tables, etc., to represent information</p> <p>Gather information and record and analyze data</p> <p>Propose an hypothesis and do research</p> <p>Describe the limitations of scientific inquiry</p> <p>Communicate interpretation of data to classmates</p> <p>Test hypotheses through hands-on laboratory experiences</p> <p>Explain why science, while precise, is not always certain</p> <p>Name the steps in the scientific method and utilize them conducting experiments, lab activities, projects, etc.</p>	<p>Safety in the Environmental Science Lab</p> <p>Use of the Scientific Method to solve a problem</p> <p>Build a bird feeder to observe, predict and draw conclusions (data table to label included)</p> <p>Measure the physical properties of an object</p> <p>The senses and the power of observation</p> <p>Learn how to use a microscope</p> <p>The use of the survey to study the local environment</p> <p>Solving density problems</p>	<p>Redi's experiment to demonstrate scientific method and enhance observation skills</p> <p>Observe and follow all science safety rules in the classroom, laboratory, and on field trips</p> <p>Identify equipment used by a scientist in a laboratory</p> <p>Examples of fossils using pictures, video laser disks, etc.</p> <p>Basic skills (measurements): length (metric ruler), mass (triple beam balance), volume (graduated cylinder), temperature</p>

Explain how parts of the environment interact with each other

Explain why there is a need to develop legislation to balance the needs of society with preservation of the environment.

Let students discuss the role of parts of the environment

Communicate the characteristics of gases to classmates

Describe the limitations of scientific inquiry

Propose an experiment and do research

Get scientific information and record and analyze data

Construct graphs from tables, etc. to represent information

Interpret data - including graphs to represent portions of information

Evaluate a scientific hypothesis using the Scientific Method

Explain the steps followed in conducting an experiment

Identify what can be studied scientifically

Explain what scientists do

Performance indicators

(thermometer)

Use video laser disks to show various plants and animals

Use of case studies in environmental science

Use concept maps in environmental science.

Inform students of careers in environmental science

Build a bird feeder

Method to solve a problem

Use of the Scientific

Science Lab

Safety in the Environment

Pages

Observe and follow

skills

enhance observation scientific method and phenomena

Keep a notebook to

Activities

UNIT II. The Non-Living Environment

Performance Indicators	Labs	Activities
Describe the structure of an ecosystem	Measurement of abiotic factors in an environment (soil, air temperature, pH, relative humidity)	Measure pH of soil using a pH meter or pH paper
Describe an abiotic factor	Plants and the water cycle	Students measure the amount of water they use each day and graph their data
Explain how abiotic factors affect the ecosystem	Photosynthesis and the environment	Display igneous, sedimentary and metamorphic rocks
Predict how changes in the ecosystem will affect its inhabitants	Study of elements, compounds and mixtures	Compare the capacity of different soils to hold water.
Describe how the abiotic factors have changed over time	Structure of the atom	Display pictures of earth taken
Relate the destruction of a habitat to biodiversity loss	Study of chemical reactions	
Describe and diagram the layers of the lithosphere	Acids and bases	
Describe and diagram the layers of the atmosphere	Acid rain	
Describe and diagram the layers of the hydrosphere	Measuring rainfall using a rain gauge	
Explain the importance of water in supporting life on Earth		
Describe the Biosphere and its characteristics		
Explain how the organisms in Biosphere interact with each other		
Describe the greenhouse effect and its impact on the Biosphere		

Describe how a population's growth can be limited or affected by abiotic factors. How the elements in Biosphere interact with each other.

Explain how the layers of the atmosphere have changed in the last 100 years

<p>Explain the importance of water in arthropods and on the environment.</p> <p>Describe and explain the layers of the hydrosphere.</p> <p>Describe and explain the layers of the stratosphere.</p> <p>Describe and explain the layers of the troposphere.</p> <p>Outline the destruction of a habitat to illustrate loss.</p> <p>Describe how the abiotic factors have changed over time.</p> <p>Predict how changes in the ecosystem will affect its inhabitants.</p> <p>Explain how abiotic factors affect the ecosystem.</p> <p>Describe an abiotic factor.</p> <p>Describe the structure of an ecosystem.</p> <p>Performance indicators</p>	<p>Acid rain</p> <p>Acids and bases</p> <p>Study of chemical reactions</p> <p>Structure of the atom</p> <p>Compounds and mixtures</p> <p>Study of elements</p> <p>Chemical reactions</p> <p>Photosynthesis and the</p> <p>Water and the water cycle</p> <p>Relative humidity</p> <p>Soil in temperate, dry</p> <p>Structure in an environment</p> <p>Measurement of abiotic</p> <p>Type</p>	<p>soil types</p> <p>Distribution of types of</p> <p>water</p> <p>different soils to hold</p> <p>capacity of</p> <p>Conductivity</p> <p>metamorphic rocks</p> <p>metamorphic and</p> <p>diapiric processes</p> <p>and Earth's heat flow</p> <p>they use each year</p> <p>amount of water</p> <p>Students measure the</p> <p>by paper</p> <p>rainfall by water</p> <p>Measure by of soil</p> <p>Activities</p>
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UNIT III. The Living Environment

Performance Indicators	Labs	Activities
Distinguish between a consumer, producer and decomposer	Measure various environments and compare them	Grow small cactus plants
Explain the trophic levels	Classification of living things	Set up salt and freshwater aquariums
Explain how organisms in a food chain or food web interact	Identification of living things	Analyze food chains and food webs
Explain the relationship between the ecosystem and the size of a population	Analysis of owl pellets	
Determine how pollution affects the Biosphere, an ecosystem, etc.	Use of a microscope	
Explain how energy is recycled in an ecosystem	Microscope study of pond water	
Diagram and explain a pyramid (food, energy, population, etc.)	Study of a food chain using a microscope	
Explain how materials are cycled in an ecosystem (water, carbon and nitrogen)	Study of how living things adapt to their environment	
Explain the role of an organism in its environment (niche)	Create a mini-ecosystem	
Construct a concept map to illustrate how a species adapts to its niche		
Explain how evolution allows an organism to adapt to its environment		
Describe and give examples of the various types of evolution, i.e., co-evolution, convergent and divergent evolution		

Explain how food chains and food webs develop in a area and how they impact on each other

Describe how evolution has impacted on the survival of various species in a particular environment

Describe how organisms are adapted to living in their biomes

Explain how grasslands impact on agriculture

(10 marks)

Explain how nutrients are cycled in an ecosystem (water, carbon and nitrogen)

Explain why explain a biomass (food energy, biodiversity etc.)

Explain how energy is recycled in an ecosystem

Explain how biomass affects the phosphorus in ecosystem etc.

Explain how

Explain the relationship between the ecosystem and the size of a population

Explain how organisms in a food chain or food web interact

Explain the trophic levels

Explain the difference between a consumer, producer and decomposer

Identify a part of ecosystem
 Explain to their environment
 Explain of how plants
 Explain of a microscope

Identify
 Microscopic study of pond
 Use of a microscope
 Analysis of soil
 Identification of living things
 Classification of living things
 Identify
 Microscopic study of pond
 Microscopic study of pond

Identify
 Analyze food chains and food webs
 Analyze food chains
 Identify
 Identify
 Identify

UNIT IV THE STRUCTURE OF ECOSYSTEMS

Performance Indicators	Labs	Activities
Graph and explain population of Ecosystems growth	Identify and explain the various factors in an ecosystem using a field map	Climatograms to analyze precipitation of different biomes using graphs
Explain a known population change e.g., Kaibab Deer	Study of soil pH	Display and use a large biome map
Describe a predator-prey relationship	Describe the characteristics of a local biome by preparing and using a histogram	Display products of the tropical rain forest
Explain symbiosis	Measuring dissolved oxygen and biological oxygen demand	Set up a classroom aquarium and terrarium
Describe how symbiotic relationships affect populations	Study of world biomes	Use video discs to analyze different biomes
Explain how succession changes a community	Study of differences between salt and freshwater ecosystems	Demonstrate the amount of salt found in ocean water
Describe primary and secondary succession		
Explain how ecological succession can lead to evolutionary change		
Provide examples which demonstrate evolutionary change		
Explain how an ecosystem can be in equilibrium		
Describe how an ecosystem can be disturbed		
Explain the term biome		
Identify the Earth's major biomes Describe the characteristics of the Earth's biomes		

Describe how the organisms of each biome are adapted to their specific environment

Explain how each biome was formed

Compare similar organisms in different biomes

Describe the complex biodiversity in each biome and how the organisms interrelate

Describe the vertical profile of rain forests (to include the canopy) and marine or aquatic zones (benthic, etc.)

Describe the horizontal profiles of marine biomes (tidal, intertidal, etc.)

Describe the Earth's currents

Explain how currents and water circulation affect climate, agriculture, fishing industry, etc.

Name and discuss the various types of nutritional relationships in an ecosystem

Explain how succession is affected by the changes in an environment

Explain how biomes developed relative to environmental factors

Discuss how the factors of an area support life

Explain how destruction of habitat impacts on ecosystems.

UNIT V. POPULATIONS: PEOPLE IN THE GLOBAL ECOSYSTEM

Performance Indicators	Labs	Activities
<p>Describe the impact humans have had on the environment through history</p> <p>Describe how historic events have affected human population (growth rate, mutations, etc.)</p> <p>Construct a time-line of human population growth, indicating major events which changed growth rate</p> <p>Explain currents trends in population growth rates around the world</p> <p>Describe how overpopulation impacts on the Earth's natural resources</p> <p>Describe the variation in nutritional need of population around the world</p> <p>Describe how populations are supported by agriculture, farming, etc.</p> <p>Describe how ecosystems affect all areas of the earth</p> <p>Characterize the various industrial societies present on the earth and how they interact and impact on each other</p> <p>Explain how overpopulation and soil over-utilization and other factors affect food production rate</p> <p>Discuss alternate food production sources</p> <p>Explain the role of proper nutrition in population growth</p>	<p>Using age structure histograms to predict the population growth in two different societies and through analysis of these, predict population growth</p> <p>Characteristics of population growth</p> <p>The relationship between predator and prey. Analysis of Arizona's Kaibab Deer population</p> <p>The effects of insecticides on living populations.</p> <p>The study of endangered species</p>	<p>Students collect articles pertaining to environmental issues</p> <p>Map the block around your high school</p> <p>Examine geological features of NYC and New York State</p> <p>Common plants and animals in NYC</p>

UNIT VI. ENERGY AND TECHNOLOGY

Performance Indicators	Labs	Activities
Describe a typical urban environment	The effect of acid precipitation on plants	Analyze Indian Point nuclear power plant
Explain the role of the water treatment plant in an urban environment	Test pH values of collected rainwater or snow	Recycling of aluminum cans and paper in the school
Explain how a water treatment plan works	Measurement of particulate matter	Study of lead in drinking water
Name the problems associated with maintaining air quality in an urban society	Measurement of gaseous pollutants	Analyze radon gas in the home
List several types of air pollution in an urban society and explain how they are being dealt with	Demonstrate the greenhouse effect	
Describe the problems associated with solid waste dispersal in an urban society	Study the effect of mining on the environment	
Explain how local, state and federal agencies are dealing with environmental maintenance including legislation	Design a program to minimize solid waste in a fast food restaurant	
Define noise pollution and explain environment its impact on the environment	Compare mass transit versus automobile with	
Describe how overpopulation impacts on the maintenance of an urban environment		
Define recycling and why it is necessary		

Describe how recycling plants operate

Explain how human population growth affected habitats

relation to pollution and preservation of the environment

<p>1. Recycling plants operate by sorting waste into different categories such as paper, plastic, glass, and metal. These materials are then processed into new products, reducing the need for raw materials and energy.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>2. The recycling process involves several steps: collection, sorting, processing, and distribution. Each step is designed to maximize efficiency and minimize waste.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>3. Recycling plants also play a role in reducing the carbon footprint of various products. By using recycled materials, manufacturers can significantly reduce their energy consumption and emissions.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>4. The recycling process is a continuous cycle that helps maintain a sustainable economy. By recycling, we can reduce the need for raw materials and energy, leading to a more sustainable future.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>5. Recycling plants also help reduce the amount of waste sent to landfills, which can help reduce the risk of water and air pollution. This is particularly important in densely populated areas.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>6. The recycling process is a key component of a circular economy, where resources are used efficiently and waste is minimized. This helps reduce the environmental impact of our activities.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>7. Recycling plants also help reduce the amount of waste sent to incinerators, which can help reduce the risk of air pollution. This is particularly important in densely populated areas.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>8. The recycling process is a key component of a sustainable future. By recycling, we can reduce the need for raw materials and energy, leading to a more sustainable future.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>9. Recycling plants also help reduce the amount of waste sent to landfills, which can help reduce the risk of water and air pollution. This is particularly important in densely populated areas.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>
<p>10. The recycling process is a key component of a circular economy, where resources are used efficiently and waste is minimized. This helps reduce the environmental impact of our activities.</p>	<p>Human population growth has led to increased demand for resources, resulting in deforestation, loss of biodiversity, and habitat destruction. This has significantly impacted the environment.</p>	<p>Recycling plants help reduce pollution by diverting waste from landfills and incinerators. This reduces greenhouse gas emissions and conserves natural resources.</p>

UNIT VII: ENERGY AND TECHNOLOGY

Performance indicators	Labs	Activities
<p>Describe how changes in human societies have changed the demand for energy</p> <p>Compare and contrast the various types of fuels presently in use</p> <p>Explain how coal is formed</p> <p>Describe how petroleum and natural gas are formed</p> <p>Describe advantages and disadvantages of fossil fuel use.</p> <p>Describe biomass fuels and compare them to fossil fuels</p> <p>Explain the advantages and disadvantages of atomic fuels</p> <p>Define radioactive waste and outline associated hazards</p> <p>Describe solar energy and outline its various uses</p> <p>Explain how electricity is generated from waterways</p> <p>Analyze the costs and benefits of hydroelectric power and compare it to that of other energy sources</p> <p>Describe how the sun's influence helps to drive wind and the Earth's air circulation</p>	<p>Construct an use a survey to study local environment</p> <p>The study of radioactivity and half-life; nuclear reactors</p> <p>Measure and calculate the amount of energy used in a classroom in a given period</p>	<p>Construct and use a survey to study the local environment</p> <p>Investigate alternative energy sources</p> <p>Study the chemical nature of fossil fuels</p> <p>Conservation of energy in the home and schools</p> <p>water</p>

Discuss the potential value of nuclear fusion

Describe geothermal energy and its uses

Describe the difficulties of generating energy from nuclear fusion

UNIT VIII. LAND AND WATER RESOURCES

Performance Indicators	Labs	Activities
Describe the role of minerals as a resource	Determine the safety of local drinking water: basic water testing	Investigate the noise level in decibels in the surrounding community
List ways in which minerals are used	Measurement of energy content in food	Investigate disease caused by air pollution
Evaluate how recycling and reuse can reduce pollution generated by mineral extraction and processing	The study of the properties of water	Measure the effects of acid rain on the growth of plants
Identify the characteristics of soil and its role as a resource	Measure salinity from water samples	
Describe the formation of soil and how its formation is related to climate and living organisms	Study the effects of pollution on the environment	
Explain how soil depletion has affected the Earth's food supply	Chemistry of air pollution	
Describe topsoil erosion and how it is lost	Measurement of air pollution	
Identify and describe methods of soil conservation		
Explain how fires affect erosion		
List and describe the types of solid wastes and their sources		
Discuss the history of solid waste disposal		
Discuss past problems in solid waste removal		
Classify and describe hazardous waste materials and the methods needed		

for proper disposal

Outline the methods that are used to dispose of various wastes including hazardous wastes

Discuss the advantages and disadvantages for the different methods that are used in waste disposal

Explain how local/state/federal laws attempt to control pollution

Discuss the difficulties of enforcing these laws

Explain why water is the Earth's most valuable resource

Explain the methods presently used to conserve water

Trace the path of water from rain to reservoir to treatment process to home.

Explain the relationship between water pollution and disease

Identify and describe two different types of water pollution including pathogens, chemicals, radiation, and thermal

Identify the sources of the above types of pollution

Describe air pollution; its history, common air pollutants

being a character in a River amount of energy used in nuclear and chemical the energy of radioactivity and high-level nuclear The study of radioactivity to study local environment Conserving an use of energy

water and agriculture conservation of water of fresh water Study the chemical sources alternative energy investment local environment survey to study the Conserving and use a Activities

UNIT IX: MANAGING HUMAN IMPACT

Performance Indicators	Labs	Activities
Describe how habitats around the world are being destroyed, including Tropical Rain Forest and Marine Biomes	Causes of soil erosion	Tree planting
Discuss soil mismanagement	Analysis of the content of local soils	Recycling project
Discuss extinction	Restoring the balance of nature	Students tape s segment from television on an environmental topic
Describe the relationship between habitat destruction and extinction	Preparation and study of a soil culture	Students write to the EPA for information on environmental issues
Discuss the many species which are endangered or extinct	Cleaning an oil spill	
Describe how biodiversity is important to human health		
Discuss how global warming is affecting habitats		
Discuss global warming's relationship to biodiversity		
Describe how habitat loss affects the predator-prey relationship		
Discuss the Endangered Species Act and how federal, state and local regulations affect the maintenance of species diversity		
Discuss how human need for water has contributed to habitat destruction.		