RIALTO UNIFIED SCHOOL DISTRICT
CURRICULUM PROPOSAL

Name of Course:	AP Environmental Science	*Grade Level(s):*	11-12

Brief Course Description:

The AP Environmental Science course is designed to provide students a way to understand the interdisciplinary nature of science and its practical application to understanding the environment. It is important that students complete the sequence of three science classes either embedded or integrated before they enroll in this course. They should be in Math 2 or above.

Proposed By:	Ed D'Souza/Juanita Chan	School:	All district schools	Date:	Sept 12, 2019

The Following is Proposed for this Course:

☒	Addition	☐	Revision	☒	A – G **(AP)**	☐	Deletion
☐	Required Course	☒	Content **(Science)**	☐	Honors	☐	Name of Course
☐	Elective	☐	Name Change	☐	Career Tech. Ed.		

The Following *Maximum* Credits are Proposed for this Course:

10	Units of Credit in (Subject Area):**weighted grade**	**Science**	or in:	**Elective**

The Following Schools will Offer this Course:

☒ Carter High	☒ Eisenhower High	☒ Rialto High	☒ Milor/Zupanic

The Proposed Course will have the Following Budget Implication:

Individual School Site: District Level: Total Estimated Cost:	$13,500 for textbooks (District) Site expense $2000 for start-up lab supplies for each high school

Approval Signatures for the Proposed Course:

Printed Name	Signature	Title	Yes/No	Date
Lance Atkinson		Submitting School Department Chair	☒ Yes ☐ No	
Greg Anderson		Carter High School Principal	☒ Yes ☐ No	
[illegible]		Eisenhower High School Principal	☒ Yes ☐ No	
Cardina Swaney		Rialto High School Principal	☒ Yes ☐ No	
Kayla Griffin		Milor/Zupanic High School Principal	☒ Yes ☐ No	
Ed D'Souza		District Curriculum Committee Chair	☒ Yes ☐ No	
Patricia Chavez		Curriculum Council Chair	☒ Yes ☐ No	

Approved by _____ Curriculum Committee on (Date): _____

Approved by Curriculum Council on (Date): _____

Approved by Rialto Unified School Board on (Date): 06/10/20

Approved by UC (or N/A) on (Date): _____

AP Environmental Science
Course Proposal
2020-2021

Course Overview

This advanced placement course is designed to provide students a way to understand the interdisciplinary nature of science and its practical application to understanding the environment. It is important that students complete the sequence of three science classes either embedded or integrated before they enroll in this course. They should be in Math 3 or above. This course begins with an introduction to the process of science and investigations in areas such as earth systems and resources, the living world, population dynamics, land and water use, energy resources and consumption, pollution, and global changes. As with all science, these topics will be treated in an objective manner allowing for discussion and debate to occur.

Text

Enger, Eldon & Brandley Smith, Environmental Science, AP Edition (2015), New York, McGraw-Hill Higher Education

General Course Outline

Percentages are approximate relative to multiple-choice exam questions on AP exam. Time spent on each topic will be adjusted as necessary to help with student learning.

Main Themes of Environmental Science:

1. Science is a process.
2. Energy conversions underlie all ecological processes.
3. The earth is one interconnected system.
4. Humans alter natural systems.
5. Environmental problems have a cultural and social context.
6. Human survival depends on developing practices that will achieve sustainable systems.

This course will divided into the following components:

I. Key Themes in Environmental Science (10-15%) about 1 week
(% will be constant throughout the course
A. History
B. Sustainability and Carrying Capacity
C. Review of Scientific method

II. Earth Systems and Resources (10-15%) about 3 weeks

A. Earth Science Concepts
(Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and latitude)

B. The Atmosphere
(Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere-ocean interactions; ENSO)

C. Global Water Resources and Use
(Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation)

D. Soil and Soil Dynamics
(Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation

Labs/Activities

Coriolis effect and Atmospheric Circulation – students will investigate the Coriolis Effect using simple lab apparatus to simulate fluid flow and its results while comparing it to ocean currents and the atmosphere.

Chemical Characteristics of Soils- students will investigate soil pH and in nutrient levels on plant growth.

Physical Characteristics of Soils – students will investigate samples from school property and their homes to compare soil characteristics such as organic composition, water holding capacity, permeability, capillary action, etc.

Agricultural land use – in this activity, students will work in small groups to present reports to the class on current agricultural nutrient and erosion management techniques.

III. The Living World (10-15%)

about 6 weeks

A. Ecosystem Structure
(Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes)

B. Energy Flow
(Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids)

C. Ecosystem Diversity
(Biodiversity; natural selection; evolution; ecosystem services)

D. Natural Ecosystem Change
(Climate shifts; species movement; ecological succession)

E. Natural Biogeochemical Cycles
(Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)

Labs/Activities

Exploring Biodiversity – Using Shannon-Weiner biodiversity index students will conduct a study of morphotypes of local invertebrates.

Conducting an Environmental Survey – This will be the introduction to the students' long-term semester project observation of a local stream (Santa Ana river in Colton or Lytle Creek) using the quadrat method for studying communities.

Gypsy Moth Lab – students will conduct an experiment simulating natural selection using predator and prey relationships in different habitats to understand competition and survival among species.

Energy Consumption – Students will track their diets for 5 days and make a comparison to the energy consumed by other organisms in a food cha

IV. Population (10-15%)

about 2 weeks

A. Population Biology Concepts
(Population ecology; carrying capacity; reproductive strategies; survivorship)

B. Human Population

1. Human population dynamics
(Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams)

2. Population size
(Strategies for sustainability; case studies; national policies)

3. Impacts of population growth
(Hunger; disease; economic effects; resource use; habitat destruction)

Labs/Activities

Estimating Population Size – In this activity, students will estimate the population size of *Daphnia pulex* in a fish tank.

Exponential Growth and Decay – Using a computer or calculator students will determine the effects of doubling a number as a model of population growth.

Populations worldwide – Internet Research project in which students will try to determine the causes of various birth and death rates of countries from around the world

V. Land and Water Use (10-15%)

about 5 weeks

A. Agriculture

1. Feeding a growing population
(Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture)

2. Controlling pests
(Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws)

B. Forestry
(Tree plantations; old growth forests; forest fires; forest management; national forests)

C. Rangelands
(Overgrazing; deforestation; desertification; rangeland management; federal rangelands)

D. Other Land Use
1. Urban land development
(Planned development; suburban sprawl; urbanization)
2. Transportation infrastructure
(Federal highway system; canals and channels; roadless areas; ecosystem impacts)
3. Public and federal lands
(Management; wilderness areas; national parks; wildlife refuges; forests; wetlands)
4. Land conservation options
(Preservation; remediation; mitigation; restoration)
5. Sustainable land-use strategies

E. Mining
(Mineral formation; extraction; global reserves; relevant laws and treaties)

F. Fishing
(Fishing techniques; overfishing; aquaculture; relevant laws and treaties)

G. Global Economics
(Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties)

<u>Labs/Activities</u>

How much water do you use – Students will collect data individually to estimate how much water they use during the course of a week. The class will then make estimates about consumption as a class, community, and population.

Sustained Use of the land – Students will conduct a lab on the effects on plant growth by salinization, problem caused by irrigation in arid areas.

Tragedy of the Commons- Students will investigate the effects of resource exploitation.

Research Historical Involvement of the Public in Causing Change – Students will research the impacts on public opinion by the Love Canal and PCB use.

Risk Determination – Students will design their own tests on daphnia or invertebrates by manipulating their exposure to various concentrations of chemicals such as rubbing alcohol or soaps

VI. Energy Resources and Consumption (10-15%)

about 4 weeks

A. Energy Concepts
(Energy forms; power; units; conversions; Laws of Thermodynamics)

B. Energy Consumption
   1. History (Industrial Revolution; exponential growth; energy crisis)
   2. Present global energy use
   3. Future energy needs

C. Fossil Fuel Resources and Use
(Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources)

D. Nuclear Energy
(Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion)

E. Hydroelectric Power
(Dams; flood control; salmon; silting; other impacts)

F. Energy Conservation
(Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit)

G. Renewable Energy
(Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy; small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages)

<u>Labs/ Activities</u>

Home Energy Audit – Students will develop and observe the amount of electricity is consumed locally.

Effective Alternative Sources of Energy Investigation – students will research the development of new technologies designed to reduce energy consumption and make a presentation to the class.

Solar House Design – Students will develop and design a small model building to determine the maximum energy production from the sun in our local area.

VII. Pollution (25-30%)

about 7 weeks

A. Pollution Types
   1. Air pollution
      (Sources—primary and secondary; major air pollutants; measurement units; smog; acid deposition—causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws)
   2. Noise pollution
   3. Water pollution
      (Types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws)
   4. Solid waste
      (Types; disposal; reduction)

B. Impacts on the Environment and Human Health
   1. Hazards to human health
      (Environmental risk analysis; acute and chronic effects; dose response relationships; air pollutants; smoking and other risks)
   2. Hazardous chemicals in the environment
      (Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws)

C. Economic Impacts
   (Cost-benefit analysis; externalities; marginal costs; sustainability)

Labs – Acid Rain and Its Effects – Students will test the effects of simulated acid rain on pH in the lab using various soils and rock as a filtering media for water. The goal is to stimulate student thought about how sediments can affect the management of water resources.

Air Pollution – Students will determine the forms in which air pollution can occur by looking at particle size and the use of model scrubbers. Additionally,

Estimating Pollution Generated Driving - students will investigate the output of the exhausts of their cars using Vernier Probes to collect data.

Wastewater Treatment Simulation- Students will use a model to learn

the importance of physical, chemical, and biological processes of water treatment.

Long-term Observation of Local Stream and Pond Project- Finish with presentations and reports of data to class.

VIII. Global Change (10-15%)

about 3 weeks

A. Stratospheric Ozone
(Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties)

B. Global Warming
(Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties)

C. Loss of Biodiversity
1. Habitat loss; overuse; pollution; introduced species; endangered and extinct species
2. Maintenance through conservation
3. Relevant laws and treaties

Labs – Report of Historical Laws and Their Impacts – Students will investigate such laws as the Clean Water Act of 1972 and the Resource Conservation and Recovery Act of 1976 and their impacts on society by presenting their findings as small groups.

Report of Current Debates Surrounding Local and National Development of Natural Resources – Students will study and debate the pros and cons of development in our local area as compared to other surrounding areas.