Module 2 Task

Module 2: Humans of the World
Unit 3 (p. 59)

1) **Graph and Switch**. Use the data explorer tool for Humans of the World to choose 5 countries that have similar populations according to the world map. (You will need to make the selections under the scatterplot section on the left where there is a "countries" button.)
   Use your knowledge of different forms of data visualizations (scatterplots, bar graphs, etc.) to visualize the data presented in the Ranking section for your selected countries. Exchange your visualization with a partner and analyze their graph. Make 3 observations about their representation's characteristics, accuracy, and precision.

2) **Quick Write**. Explore the scatterplot filters for your countries, or all 52 available countries. Take 60 seconds to list as many relevant topics related to the data, data characteristics, trends, etc. on your paper (at least 3 total). Think of this as brainstorming a direction to take for future research related to human populations or movement around the world.

3) **Error Analysis**. An analyst in training reviews the scatterplot that has "Women % of pop" on the vertical axis and "population growth" on the horizontal axis. They conclude that having a higher percentage of women in the population guarantees negative or very tiny population growth rates. They cite the countries of Lithuania and Latvia as examples. Provide critical feedback to their conclusion. Use counterpoints and/or clarification using the scatterplot and your prior knowledge of statistics.

CollegeBoard AP

INCLUDES
- Course framework
- Instructional section
- Sample exam questions

AP® Environmental Science

COURSE AND EXAM DESCRIPTION

Effective
Fall 2020

Instructional Strategies

The AP Environmental Science course framework outlines the concepts and skills students need to master to be successful on the AP Exam. In order to address those concepts and skills effectively, it helps to incorporate a variety of instructional approaches into daily lessons and activities. The following table presents strategies that can help students apply their understanding of course concepts.

Strategy	Definition	Purpose	Example
Ask the Expert (or Students as Experts)	Students are assigned as "experts" on problems they have mastered; groups rotate through the expert stations to learn about problems they have not yet mastered.	Provides opportunities for students to share their knowledge and learn from one another.	Assign students as "experts" on environmental legislation. Have students rotate through stations in groups, working with the station expert to complete a series of questions on the topic.
Construct an Argument	Students use scientific reasoning to present assumptions about biological situations, support conjectures with scientifically relevant and accurate data, and provide a logical progression of ideas leading to a conclusion that makes sense.	Helps develop the process of evaluating scientific information, developing reasoning skills, and enhancing communication skills in supporting conjectures and conclusions.	Present students with a written or visual scenario of the results of a laboratory investigation and then have them work together to draw conclusions about scientific investigations. They can support their conclusions with data by having each student or group of students add a sentence to the conclusion. Once the conclusion is complete, read it (or show it on a screen) and then facilitate a class discussion.
Debate	Engaging in an informal or formal argumentation of an issue.	Provides an opportunity for students to collect and orally present evidence supporting the affirmative and negative arguments of a proposition or issue.	Have students debate realistic solutions to environmental problems. This can be more meaningful for students if the problem selected is specific to the school and students have the opportunity to present their solutions to school administrators.

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Strategy	Definition	Purpose	Example
Error Analysis	Students analyze an existing solution to determine whether (or where) errors have occurred.	Allows students to troubleshoot errors and focus on solutions that may arise when they do the same procedures themselves.	Have students analyze their work to determine whether their answer is realistic. For example, if they are working on an energy calculation, they can't end up with more energy than they started with.
Fishbowl	Some students form an inner circle and model appropriate discussion techniques, while an outer circle of students listens, responds, and evaluates.	Provides students with an opportunity to engage in a formal discussion and to experience the roles of both participant and active listener; students also have the responsibility of supporting their opinions and responses using specific evidence.	Divide students into two groups and ask them to form two concentric circles. The inner circle can explain ecosystem services to the students in the outer circle, and the outer circle can explain ecological services to students in the inner circle. The circles rotate to enable students to share their knowledge and learn to communicate with their peers.
Graph and Switch	Generating a graph to represent data and then switch papers to review each other's representations.	Allows students to practice creating different representations of data and both give and receive feedback on each other's work.	Give students a data table and ask them to graph the data. Then have them switch papers and offer one another feedback on whether they graphed the data appropriately. This can be scaffolded by distributing multiple data tables that require different types of graphs.
Idea Spinner	The teacher creates a spinner marked into four quadrants and labeled "Predict," "Explain," "Summarize," and "Evaluate." After new material is presented, the teacher spins the spinner and asks students to answer a question based on the location of the spinner. For example, if the spinner lands in the "Summarize" quadrant, the teacher might say, "List the key concepts just presented."	Functions as a formative assessment technique.	Present students with a written or visual scenario of the results of a laboratory investigation. Using the spinner, ask students to predict what would happen if one of the experimental conditions changed, explain the results, summarize the results, and evaluate the methods used.

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Strategy	Definition	Purpose	Example
Index Card Summaries/ Questions	Periodically, distribute index cards and ask students to write on both sides, with these instructions: (Side 1) Based on our study of (unit topic), list a big idea that you understand and word it as a summary statement. (Side 2) Identify something about (unit topic) that you do not yet fully understand and word it as a statement or question.	Functions as a formative assessment technique.	At the beginning or end of class, show students an image of food chains or food webs. On one side of an index card, have students summarize energy flow through ecosystems. On the other side, have them write a question they have about the topic. Collect the cards and read through them, noting any trends in student responses. Address all questions that day (if done at the beginning of class) or the next day (if given at the end of class).
Misconception Check	Present students with common or predictable misconceptions about a designated concept, principle, or process. Ask them whether they agree or disagree and to explain why. The misconception check can also be presented in the form of a multiple-choice or true or false quiz.	Functions as a formative assessment technique.	Provide students with a statement on the board, or on paper, such as, "Climate change and ozone depletion are the same." Ask them whether the statement is true or false and then ask them to explain their reasoning. Address any misconceptions according to the answers they give.
One-Minute Essay	A one-minute essay question (or a one-minute question) is a focused question with a specific goal that can, in fact, be answered within a minute or two.	Functions as a formative assessment technique.	Give students one minute to respond to a prompt, such as, "Explain the relationship between photosynthesis at the cellular level and environmental carbon cycling."
Quickwrite	Writing for a short, specific amount of time about a designated topic related to a text.	Helps students generate multiple ideas in a quick fashion that could be turned into longer pieces of writing at a later time (may be considered as part of the drafting process).	Prior to teaching about endangered species, ask students to take a few minutes to explain whether the Endangered Species Act is necessary. At the conclusion of the lesson, students can revisit their answer and revise it to reflect what they learned.

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Strategy	Definition	Purpose	Example
Think–Pair–Share	Considering and thinking about a topic or question and then writing what has been learned; pairing with a peer or a small group to share ideas; and sharing ideas and discussion with a larger group.	Helps students to construct meaning about a topic or question; test thinking in relation to the ideas of others; and prepare for a discussion with a larger group.	When engaging students in a post-lab discussion, have students reflect on their analysis of the data by asking them, "What is the relationship between the dependent variable and the independent variable?" After 1–2 minutes of reflection, have students turn to a neighbor and share their answer. After 2–3 minutes of sharing, engage the class in a whole-group discussion to ensure that students are building the necessary foundational understandings.

UNIT 3

10–15% AP EXAM WEIGHTING | ~12–13 CLASS PERIODS

Populations

BIG IDEA 2
Interactions Between Earth Systems ERT
How do changes in habitats influence changes in species over time?

BIG IDEA 3
Interactions Between Different Species and the Environment EIN
How is educational opportunity for women connected to human population changes?

Developing Understanding

Populations within ecosystems change over time in response to a variety of factors. This unit examines the relationship between the type of species and the changes in a habitat over time. Specialist species are advantaged by habitats that remain constant, while generalist species tend to be advantaged by habitats that are changing. Different reproductive patterns, including those exhibited by K- and r-selected species, also impact changes to population. Population growth is limited by environmental factors, especially by the availability of resources and space. In subsequent units, students will explore how increases in populations affect earth systems and resources, land and water use, and energy resources.

Building the Science Practices

5.A 5.C 5.E 6.B

Comparing trends and patterns in data helps students interpret experimental data in order to explain environmental changes that occur over time. These skills can help predict short- and long-term changes in an environment. As students build their skills in data analysis, they will learn how the data illustrate environmental concepts. It is also important that they learn to predict patterns and trends based on information provided in graphs and tables. Analyzing population growth, age structure diagrams, and survivorship curves can help students develop these skills.

While calculator use is permitted on the AP Exam, students still have to show their work, including the numbered steps they used to obtain an answer, with appropriate units. Without the appropriate units, a calculation is meaningless, even with correct computation. In this unit, students may benefit from having multiple opportunities to practice calculations such as population growth and the application of the rule of 70. Students can also practice selecting the appropriate calculation that is required in the analysis of a data set.

Preparing for the AP Exam

On the AP Exam, students must be able to explain trends in population data for organisms. To practice this, students can look at a variety of human population graphs from various countries and then explain the trends in the data to draw conclusions about changes in the populations. This is also an opportunity for students to explain population density and population growth. Students can also practice interpreting population growth curves for other species. When explaining the survival of a species, students should consider population size and emphasize problems associated with reduced genetic diversity. It is helpful for students to connect data represented by tables, charts, and graphs to real-life examples of population changes.

UNIT AT A GLANCE

Enduring Understanding	Topic	Suggested Skill	Class Periods
			~12–13 CLASS PERIODS
ERT-3	3.1 Generalist and Specialist Species	1.B Explain environmental concepts and processes.	
	3.2 K-Selected r-Selected Species	5.A Describe patterns or trends in data.	
	3.3 Survivorship Curves	5.C Explain patterns and trends in data to draw conclusions.	
	3.4 Carrying Capacity	5.E Explain what the data implies or illustrates about environmental issues.	
	3.5 Population Growth and Resource Availability	6.B Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).	
EIN-1	3.6 Age Structure Diagrams	5.C Explain patterns and trends in data to draw conclusions.	
	3.7 Total Fertility Rate	5.A Describe patterns or trends in data.	
	3.8 Human Population Dynamics	7.A Describe environmental problems.	
	3.9 Demographic Transition	1.C Explain environmental concepts, processes, or models in applied contexts.	
	Go to AP Classroom to assign the **Personal Progress Check** for Unit 3. Review the results in class to identify and address any student misunderstandings.		

SAMPLE INSTRUCTIONALACTIVITIES

The sample activities on this page are optional and are offered to provide possible ways to incorporate various instructional approaches into the classroom. They were developed in partnership with teachers from the AP community to share ways that they approach teaching some of the topics in this unit. Please refer to the Instructional Approaches section beginning on p. 201 for more examples of activities and strategies.

Activity	Topic	Sample Activity
1	3.2	**Think-Pair-Share** Ask students to respond to the following prompt: Which reproductive strategy is more prone to creating an invasive species, and which is more prone to creating an endangered species? Have them develop a claim and support it with evidence (e.g., characteristics of species). After writing for two to three minutes, they can pair with a nearby partner to share responses. Select one group to share their response with the class. The class can add additional information or challenge a response.
2	3.5	**Error Analysis** Have students perform per capita ecological footprint calculations using dimensional analysis to compare developed vs. developing countries. Have them compare answers with a partner to determine errors in their calculations. Then ask them to explain the concept of per capita resources consumption as compared to the size of the population.
3	3.9	**Idea Spinner** Create a spinner with four quadrants labeled “Predict,” “Explain,” “Summarize,” and “Evaluate.” After new material is presented, spin the spinner and ask students to answer a question based on the location of the spinner. For example, after providing students with demographic data and characteristics that describe different phases of the demographic transition, ask students to predict what would happen if there were a change in one of the variables that affects a demographic transition.

Unit Planning Notes

Use the space below to plan your approach to the unit.

SUGGESTED SKILL

Concept Explanation

1.B

Explain environmental concepts and processes.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

TOPIC 3.1
Generalist and Specialist Species

Required Course Content

ENDURING UNDERSTANDING

ERT-3

Populations change over time in reaction to a variety of factors.

LEARNING OBJECTIVE

ERT-3.A

Identify differences between generalist and specialist species.

ESSENTIAL KNOWLEDGE

ERT-3.A.1

Specialist species tend to be advantaged in habitats that remain constant, while generalist species tend to be advantaged in habitats that are changing.

TOPIC 3.2
K-Selected r-Selected Species

SUGGESTED SKILL

Data Analysis

5.A

Describe patterns or trends in data.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

Required Course Content

ENDURING UNDERSTANDING

ERT-3

Populations change over time in reaction to a variety of factors.

LEARNING OBJECTIVE

ERT-3.B

Identify differences between K- and r-selected species.

ESSENTIAL KNOWLEDGE

ERT-3.B.1

K-selected species tend to be large, have few offspring per reproduction event, live in stable environments, expend significant energy for each offspring, mature after many years of extended youth and parental care, have long life spans/life expectancy, and reproduce more than once in their lifetime. Competition for resources in K-selected species' habitats is usually relatively high.

ERT-3.B.2

r-selected species tend to be small, have many offspring, expend or invest minimal energy for each offspring, mature early, have short life spans, and may reproduce only once in their lifetime. Competition for resources in r-selected species' habitats is typically relatively low.

ERT-3.B.3

Biotic potential refers to the maximum reproductive rate of a population in ideal conditions.

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LEARNING OBJECTIVE

ERT-3.B
Identify differences between K- and r- selected species.

ESSENTIAL KNOWLEDGE

ERT-3.B.4
Many species have reproductive strategies that are not uniquely r-selected or K-selected, or they change in different conditions at different times.

ERT-3.B.5
K-selected species are typically more adversely affected by invasive species than r-selected species, which are minimally affected by invasive species. Most invasive species are r-selected species.

TOPIC 3.3
Survivorship Curves

SUGGESTED SKILL

Data Analysis

5.C

Explain patterns and trends in data to draw conclusions.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

Classroom Resource > Quantitative Skills in the AP Sciences (2018)

Required Course Content

ENDURING UNDERSTANDING

ERT-3

Populations change over time in reaction to a variety of factors.

LEARNING OBJECTIVE

ERT-3.C

Explain survivorship curves.

ESSENTIAL KNOWLEDGE

ERT-3.C.1

A survivorship curve is a line that displays the relative survival rates of a cohort—a group of individuals of the same age—in a population, from birth to the maximum age reached by any one cohort member. There are Type I, Type II, and Type III curves.

ERT-3.C.2

Survivorship curves differ for K-selected and r-selected species, with K-selected species typically following a Type I or Type II curve and r-selected species following a Type III curve.

SUGGESTED SKILL

Data Analysis

5.E

Explain what the data implies or illustrates about environmental issues.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

TOPIC 3.4
Carrying Capacity

Required Course Content

ENDURING UNDERSTANDING

ERT-3

Populations change over time in reaction to a variety of factors.

LEARNING OBJECTIVE

ERT-3.D

Describe carrying capacity.

ESSENTIAL KNOWLEDGE

ERT-3.D.1

When a population exceeds its carrying capacity (carrying capacity can be denoted as K), overshoot occurs. There are environmental impacts of population overshoot, including resource depletion.

ERT-3.E

Describe the impact of carrying capacity on ecosystems.

ERT-3.E.1

A major ecological effect of population overshoot is dieback of the population (often severe to catastrophic) because the lack of available resources leads to famine, disease, and/or conflict.

TOPIC 3.5
Population Growth and Resource Availability

Required Course Content

ENDURING UNDERSTANDING

ERT-3

Populations change over time in reaction to a variety of factors.

LEARNING OBJECTIVE

ERT-3.F

Explain how resource availability affects population growth.

ESSENTIAL KNOWLEDGE

ERT-3.F.1

Population growth is limited by environmental factors, especially by the available resources and space.

ERT-3.F.2

Resource availability and the total resource base are limited and finite over all scales of time.

ERT-3.F.3

When the resources needed by a population for growth are abundant, population growth usually accelerates.

ERT-3.F.5

When the resource base of a population shrinks, the increased potential for unequal distribution of resources will ultimately result in increased mortality, decreased fecundity, or both, resulting in population growth declining to, or below, carrying capacity.

SUGGESTED SKILL

Mathematical Routines

6.B

Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

The Exam > Chief Reader Report 2017, Q1

The Exam > Samples and Commentary 2017, Q1

SUGGESTED SKILL

Data Analysis

5.C

Explain patterns and trends in data to draw conclusions.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

TOPIC 3.6
Age Structure Diagrams

Required Course Content

ENDURING UNDERSTANDING

EIN-1

Human populations change in reaction to a variety of factors, including social and cultural factors.

LEARNING OBJECTIVE

EIN-1.A

Explain age structure diagrams.

ESSENTIAL KNOWLEDGE

EIN-1.A.1

Population growth rates can be interpreted from age structure diagrams by the shape of the structure.

EIN-1.A.2

A rapidly growing population will, as a rule, have a higher proportion of younger people compared to stable or declining populations.

TOPIC 3.7
Total Fertility Rate

SUGGESTED SKILL

Data Analysis

5.A

Describe patterns or trends in data.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

Required Course Content

ENDURING UNDERSTANDING

EIN-1

Human populations change in reaction to a variety of factors, including social and cultural factors.

LEARNING OBJECTIVE

EIN-1.B

Explain factors that affect total fertility rate in human populations.

ESSENTIAL KNOWLEDGE

EIN-1.B.1

Total fertility rate (TFR) is affected by the age at which females have their first child, educational opportunities for females, access to family planning, and government acts and policies.

EIN-1.B.2

If fertility rate is at replacement levels, a population is considered relatively stable.

EIN-1.B.3

Factors associated with infant mortality rates include whether mothers have access to good healthcare and nutrition. Changes in these factors can lead to changes in infant mortality rates over time.

SUGGESTED SKILL

Environmental Solutions

7.A
Describe environmental problems.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

The Exam > Chief Reader Report 2017, Q3

The Exam > Student Performance Q&A 2016, Q1

The Exam > Samples and Commentary (2017, Q3, 2016, Q1)

TOPIC 3.8
Human Population Dynamics

Required Course Content

ENDURING UNDERSTANDING

EIN-1
Human populations change in reaction to a variety of factors, including social and cultural factors.

LEARNING OBJECTIVE

EIN-1.C.1
Explain how human populations experience growth and decline.

ESSENTIAL KNOWLEDGE

EIN-1.C.1
Birth rates, infant mortality rates, and overall death rates, access to family planning, access to good nutrition, access to education, and postponement of marriage all affect whether a human population is growing or declining.

EIN-1.C.2
Factors limiting global human population include the Earth's carrying capacity and the basic factors that limit human population growth as set forth by Malthusian theory.

EIN-1.C.3
Population growth can be affected by both density-independent factors, such as major storms, fires, heat waves, or droughts, and density-dependent factors, such as access to clean water and air, food availability, disease transmission, or territory size.

EIN-1.C.4
The rule of 70 states that dividing the number 70 by the percentage population growth rate approximates the population's doubling time.

TOPIC 3.9
Demographic Transition

SUGGESTED SKILL

Concept Explanation

1.C

Explain environmental concepts, processes, or models in applied contexts.

AVAILABLE RESOURCES

Classroom Resource > AP Environmental Science Teacher's Guide

Required Course Content

ENDURING UNDERSTANDING

EIN-1

Human populations change in reaction to a variety of factors, including social and cultural factors.

LEARNING OBJECTIVE

EIN-1.D

Define the demographic transition.

ESSENTIAL KNOWLEDGE

EIN-1.D.1

The demographic transition refers to the transition from high to lower birth and death rates in a country or region as development occurs and that country moves from a pre-industrial to an industrialized economic system. This transition is typically demonstrated through a four-stage demographic transition model (DTM).

EIN-1.D.2

Characteristics of developing countries include higher infant mortality rates and more children in the workforce than developed countries.

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