

# Errata sheet for AP Environmental Science

This document lists corrections and/or refinements made to the AP Environmental Science Course and Exam Description since it was published in May of 2019.

## Corrections as of September, 2019

The items listed below have been corrected in the online version of the CED. Teachers can print out the individual pages in order to update their printed CED binders.

- In Topic 3.5 (p. 69) one of the Essential Knowledge statements is improperly labeled. The EK currently labeled as ERT-3.F.5 has been corrected and is now labeled as ERT-3.F.4
- Multiple Essential Knowledge statements for topics found in Unit 6 have been refined to more precisely describe how electricity is produced by a generator. The list of impacted Essential Knowledge statements and the corresponding topics/pages are:
  - EK ENG-3.E.2 from Topic 6.5 (p.124)
  - EK ENG-3.G.1 from Topic 6.6 (p. 125)
  - EK ENG-3.L.1 from Topic 6.9 (p.129)
  - EK ENG-3.N.1 from Topic 6.10 (p. 130)
  - EK-ENG-3.R.1 from Topic 6.12 (p.132)
- In Topic 6.11 (p.131) Essential Knowledge statement ENG-3.P.1 which concerns hydrogen fuel cells has been refined for accuracy and clarity.
- In the Answer Key for sample items (p. 235), the skills assessed in FRQ 2 (Analyze an environmental problem and propose a solution) and in FRQ 3 (Analyze an environmental problem and propose a solution using calculations) were inadvertently swapped and have been corrected.
  - The complete list for FRQ 2 is: 1.A, 1.B, 5.A, 5.B, 7.A, 7.E, 7.F
  - The complete list for FRQ 3 is: 1.A, 6.B, 6.C, 7.C, 7.F

## 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.4**

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

 Environmental Solutions

## 7.A

Describe environmental problems.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > [Chief Reader Report 2018, Q1](#)
- The Exam > [Samples and Commentary 2018, Q1](#)

## TOPIC 6.5

# Fossil Fuels

### Required Course Content

#### ENDURING UNDERSTANDING

**ENG-3**

Humans use energy from a variety of sources, resulting in positive and negative consequences.

#### LEARNING OBJECTIVE

**ENG-3.E**

Describe the use and methods of fossil fuels in power generation.

**ENG-3.F**

Describe the effects of fossil fuels on the environment.

#### ESSENTIAL KNOWLEDGE

**ENG-3.E.1**

The combustion of fossil fuels is a chemical reaction between the fuel and oxygen that yields carbon dioxide and water and releases energy.

**ENG-3.E.2**

Energy from fossil fuels is produced by burning those fuels to generate heat, which then turns water into steam. That steam turns a turbine, which spins a generator, producing electricity.

**ENG-3.E.3**

Humans use a variety of methods to extract fossil fuels from the earth for energy generation.


**ENG-3.F.1**

Hydrologic fracturing (fracking) can cause groundwater contamination and the release of volatile organic compounds.

## TOPIC 6.6

# Nuclear Power

### SUGGESTED SKILL

 *Visual Representations*

### 2.B

Explain relationships between different characteristics of environmental concepts, processes, or models represented visually:

- In theoretical contexts
- In applied contexts



### AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > [Student Performance Q&A 2014, Q1](#)
- The Exam > [Samples and Commentary 2014, Q1](#)

## Required Course Content

### ENDURING UNDERSTANDING

#### ENG-3

Humans use energy from a variety of sources, resulting in positive and negative consequences.

### LEARNING OBJECTIVE

#### ENG-3.G

Describe the use of nuclear energy in power generation.

### ESSENTIAL KNOWLEDGE

#### ENG-3.G.1

Nuclear power is generated through fission, where atoms of Uranium-235, which are stored in fuel rods, are split into smaller parts after being struck by a neutron. Nuclear fission releases a large amount of heat, which is used to generate steam, which powers a turbine, which spins a generator, and produces electricity.

#### ENG-3.G.2

Radioactivity occurs when the nucleus of a radioactive isotope loses energy by emitting radiation.

#### ENG-3.G.3

Uranium-235 remains radioactive for a long time, which leads to the problems associated with the disposal of nuclear waste.

#### ENG-3.G.4


Nuclear power generation is a nonrenewable energy source. Nuclear power is considered a cleaner energy source because it does not produce air pollutants, but it does release thermal pollution and hazardous solid waste.

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## TOPIC 6.9

# Hydroelectric Power

**SUGGESTED SKILL**

 *Environmental Solutions*

**7.F**

Justify a proposed solution, by explaining potential advantages.

**AVAILABLE RESOURCES**

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > [Chief Reader Report 2018, Q1 & Q4](#)
- The Exam > Samples and Commentary ([2018, Q1, 2018, Q4](#))

## Required Course Content

### ENDURING UNDERSTANDING

**ENG-3**

Humans use energy from a variety of sources, resulting in positive and negative consequences.

### LEARNING OBJECTIVE

**ENG-3.L**

Describe the use of hydroelectricity in power generation.

**ENG-3.M**

Describe the effects of the use of hydroelectricity in power generation on the environment.

### ESSENTIAL KNOWLEDGE

**ENG-3.L.1**

Hydroelectric power can be generated in several ways. Dams built across rivers collect water in reservoirs. The moving water can be used to spin a turbine. The turbine spins a generator, producing electricity. Turbines can also be placed in small rivers, where the flowing water spins the turbine, which spins a generator and forms electricity.

**ENG-3.L.2**

Tidal energy uses the energy produced by tidal flows to turn a turbine.

**ENG-3.M.1**

Hydroelectric power does not generate air pollution or waste, but construction of the power plants can be expensive, and there may be a loss of or change in habitats following the construction of dams.

## SUGGESTED SKILL

 *Concept Explanation***1.B**

Explain environmental concepts and processes.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)

## TOPIC 6.10

# Geothermal Energy

## Required Course Content

### ENDURING UNDERSTANDING

**ENG-3**

Humans use energy from a variety of sources, resulting in positive and negative consequences.

### LEARNING OBJECTIVE

**ENG-3.N**

Describe the use of geothermal energy in power generation.

**ENG-3.O**

Describe the effects of the use of geothermal energy in power generation on the environment.

### ESSENTIAL KNOWLEDGE

**ENG-3.N.1**

Geothermal energy is obtained by using the heat stored in the Earth's interior to heat up water, which is brought back to the surface as steam. The steam spins a turbine, which spins a generator, producing electricity.

**ENG-3.O.1**

The cost of accessing geothermal energy can be prohibitively expensive, as is not easily accessible in many parts of the world. In addition, it can cause the release of hydrogen sulfide.

## TOPIC 6.11

# Hydrogen Fuel Cell

**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

**ENG-3**

Humans use energy from a variety of sources, resulting in positive and negative consequences.

#### LEARNING OBJECTIVE

**ENG-3.P**

Describe the use of hydrogen fuel cells in power generation.

**ENG-3.Q**

Describe the effects of the use of hydrogen fuel cells in power generation on the environment.

#### ESSENTIAL KNOWLEDGE


**ENG-3.P.1**

Hydrogen fuel cells are an alternate to nonrenewable fuel sources. They use hydrogen as fuel, combining the hydrogen fuel and the oxygen in air to produce electricity and form water, which is the product (emission) of a fuel cell.

**ENG-3.Q.1**

Hydrogen fuel cells have low environmental impact and produce no carbon dioxide when the hydrogen is produced from water. However, the technology is expensive and energy is still needed to create the hydrogen gas used in the fuel cell.

## SUGGESTED SKILL

 *Environmental Solutions*

## 7.B

Describe potential responses or approaches to environmental problems.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > [Chief Reader Report 2018, Q2](#)
- The Exam > [Samples and Commentary 2018, Q2](#)

## TOPIC 6.12

# Wind Energy

## Required Course Content

### ENDURING UNDERSTANDING

**ENG-3**

Humans use energy from a variety of sources, resulting in positive and negative consequences.

### LEARNING OBJECTIVE

**ENG-3.R**

Describe the use of wind energy in power generation.

**ENG-3.S**

Describe the effects of the use of wind energy in power generation on the environment.

### ESSENTIAL KNOWLEDGE

**ENG-3.R.1**

Wind turbines use the kinetic energy of moving air to spin a turbine, which spins a generator, producing electricity.

**ENG-3.S.1**

Wind energy is a renewable, clean source of energy. However, birds and bats may be killed if they fly into the spinning turbine blades.



# Answer Key and Question Alignment to Course Framework

Multiple-Choice Question	Answer	Skill	Learning Objective	Unit
1	C	2.B	EIN-1.D	3
2	A	1.A	STB-2.D	7
3	C	2.B	ENG-1.B	1
4	C	6.A	ENG-1.C	1
5	D	4.C	ERT-2.H	2
6	B	1.B	STB-3.K	8
7	B	6.C	STB-4.F	9
8	C	5.E	STB-4.F	9
9	C	7.C	EIN-2.G	5
10	D	5.B	ERT-4.A	4
11	D	1.C	ENG-3.H	6
12	A	1.C	ENG-3.G	6
13	B	6.C	ENG-3.H	6
14	B	4.E	ERT-2.D	2
15	D	7.A	ENG-2.C	4

Free-Response Question	Question Type	Skill	Learning Objective	Unit
2	Analyze an Environmental Problem and Propose a Solution	1.A, 1.B, 5.A, 5.B, 7.A, 7.E, 7.F	STB-1.A, STB-3.M, ERT-4.C, EIN-2.D	4, 5, 8
3	Analyze an Environmental Problem and Propose a Solution Doing Calculations	1.A, 6.B, 6.C, 7.C, 7.F	STB-4.D, STB-4.E, STB-4.F, STB-4.G, STB-4.H	9

The scoring information for the questions within this course and exam description, along with further exam resources, can be found on the [AP Environmental Science Exam Page](#) on AP Central.