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# FRQ Practice 8.1

## SUGGESTED SKILL

 *Concept Explanation*

**1.A**

Describe environmental concepts and processes.

**Describe** the difference between a point and nonpoint source of pollution. **Identify** ONE point source of NO<sub>x</sub> emissions and ONE nonpoint source of NO<sub>x</sub> emissions. (3 pts.)

### Describe (1 pt.)

- A point source pollutant enters the environment from an easily identifiable and confined place, while nonpoint source pollutants enter the environment from diffuse, difficult to pinpoint sources

### Identify (2 pts.)

<b>Nonpoint NO<sub>x</sub> Sources</b>	Manure lagoons, agricultural fertilizer use, traffic, forest fires
<b>Point NO<sub>x</sub> Sources</b>	A single coal-fired power plant, a single vehicle, a specific coal mine

# FRQ Practice 8.2

**SUGGESTED SKILL**  
 *Mathematical Routines*

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

The United States uses approximately 20 million barrels of oil per day. According to the USGS estimate, for how many days would the technically recoverable oil resource in the ANWR supply the total United States demand for oil?

**Calculate (2 pts.)**

- **1 pt. for correct setup with units**
- **1 pt. for correct answer with units**

$$\frac{10 \times 10^9 \text{ barrels}}{20 \times 10^6 \text{ barrels per day}} = 0.5 \times 10^3 \text{ days} = 500 \text{ days}$$

**OR**

$$\frac{10,000,000,000 \text{ barrels}}{20,000,000 \text{ barrels per day}} = 500 \text{ days}$$

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# FRQ Practice 8.3

## SUGGESTED SKILL

 *Concept Explanation*

**1.A**

Describe environmental concepts and processes.

**Identify** a toxic metal other than mercury that has a negative effect on human health and **describe** how it is introduced into the environment.

Identify (1 pt.)	Describe (1 pt.)
Lead	Old paint in homes, lead water pipes, toys & jewelry, soil near airports
Selenium	Food in soils with selenium, drinking water contaminated with selenium, coal mining runoff exposure
Chromium	Emissions from incineration, cement dust, tobacco smoke, antifreeze, glassmaking
Arsenic	Pesticide residue in soils, groundwater contaminated by arsenic, wood treatment products, leather preservatives, glass manufacturing
Aluminum	Cosmetics, antiperspirants, emissions from aluminum manufacturing or mining locations
Cadmium	Emissions from metal smelting, waste incinerators, coal/oil combustion, tobacco smoke, cadmium-contaminated foods (grown in soils with cadmium)

# FRQ Practice 8.4

**Describe** how one specific human activity can lead to increased phosphorus levels in an estuary ecosystem. (1 pt.)


- Runoff from fertilizer or pesticides\* used in agriculture, residential lawn care or golf courses
- Seepage from septic systems located near canals
- Discharges from wastewater treatment plants that lack tertiary or advanced wastewater treatment
- Combined sewer overflows (CSOs) when rain volume exceeds wastewater treatment plant capacity
- Runoff of animal waste from feedlots
- Use of phosphate-containing detergents

*\*Pesticides are acceptable only if they are identified as an organophosphate.*

**Describe** one step that could be taken to reduce the phosphorus inputs from the activity you described above. (1 pt.)

- Buffer zones/retention ponds/waste lagoons around agricultural areas
- Swales/rain barrels/cisterns/rain garden/green roofs in residential areas
- Artificial wetlands created to capture runoff from agricultural areas (Storm water treatment areas (STA) are planted with cattails)
- Permeable pavements/permeable pavers to treat runoff
- Fertilizer used more efficiently/precision agriculture/more efficient irrigation techniques
- Restrictions on phosphate-containing detergents or pesticides
- Restrictions on the use of phosphate-containing fertilizers
- Wastewater treatment plants upgraded to remove phosphates from wastewater (tertiary or advanced treatment)
- Public education campaign about efficient use of fertilizers or alternatives to fertilizers (Note: better use of fertilizers is not the same as efficient use of fertilizers)

## SUGGESTED SKILL

 *Environmental Solutions*

**7.B**


Describe potential responses or approaches to environmental problems.

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# FRQ Practice 8.5

## SUGGESTED SKILL

 Visual Representations

### 2.C

Explain how environmental concepts and processes represented visually relate to broader environmental issues.

**Make a claim** about which state's fishing industry likely had lower than average profits in the summer of 2011. (1 pt.)

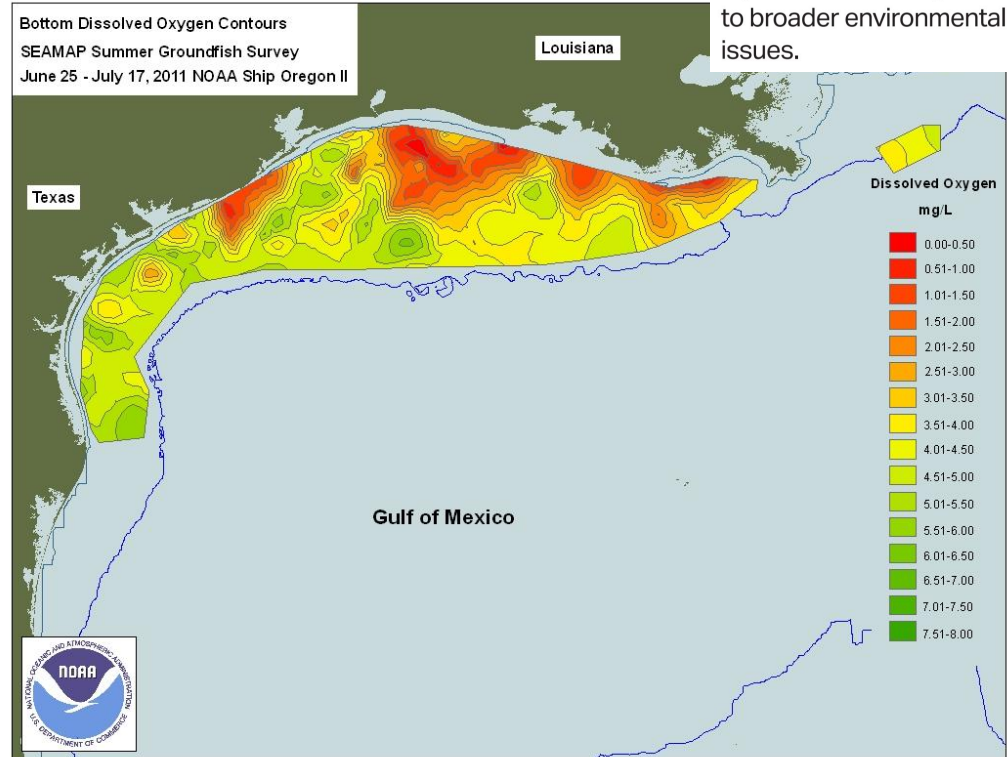
**Justify** this claim with evidence from the map. (1 pt.)

### Make a claim (1 pt.)

- Louisiana likely had a lower than average fishing industry profit in the summer of 2011

### Justify (1 pt.)

- Louisiana's coastal waters had waters with very low dissolved oxygen levels, well below the 6 mg/L (too low for many fish to survive) required by many fish species, likely resulting in fish die-offs or smaller than average populations of fish in the region



# **FRQ Practice 8.6**

**Explain** how an increase in nuclear power generation in a town may lead to a decrease in biodiversity in nearby aquatic ecosystems.

## **Explain (1 pt.)**

- Nuclear power generation requires water to be converted into steam/cool the nuclear reactor; this water is often returned to nearby bodies of water without being allowed to first return to ambient temperatures, resulting in water temperature in the stream being elevated outside the range of tolerance of many aquatic species
- Nuclear power plants produce extremely high temperature wastewater that is sometimes returned to nearby bodies of water before being allowed to cool down enough. This raises the temperature of the body of water and may kill aquatic organisms due to thermal shock

## **SUGGESTED SKILL**

 *Concept Explanation*

### **1.C**

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

## **FRQ Practice 8.7**

**Explain** why the release of PCBs into an aquatic ecosystem may have longer-lasting negative impacts on organisms than the release of synthetic nitrates.

### **Explain (1 pt.)**

- PCBs don't degrade quickly in aquatic ecosystems/are highly persistent, so they remain in the water/sediments for long periods of time and eventually become incorporated into organisms bodies where they remain and disrupt the endocrine system. Synthetic nitrates are quickly taken up by aquatic plants/algae and used for growth

### **SUGGESTED SKILL**

 *Concept Explanation*

**1.B**

Explain environmental concepts and processes.

# **FRQ Practice 8.8**

## SUGGESTED SKILL

 *Scientific Experiments*

### 4.A

Identify a testable hypothesis or scientific question for an investigation.


Scientists suspect that the compound smedium, released from worn-down bike tires, biomagnifies in the tissues of aquatic organisms in a nearby lake. **Identify** a testable hypothesis that the scientists may use for their study.

### Identify (1 pt.)

- Smedium will be found in higher concentrations in the tissues of organisms at higher trophic levels **OR** smedium will be found at lower levels in the tissues of organisms at lower trophic levels
- Smedium will be found in higher concentrations in the tissues of older organisms than in the tissues of younger organisms of the same species

# FRQ Practice 8.9

## SUGGESTED SKILL

 Environmental Solutions

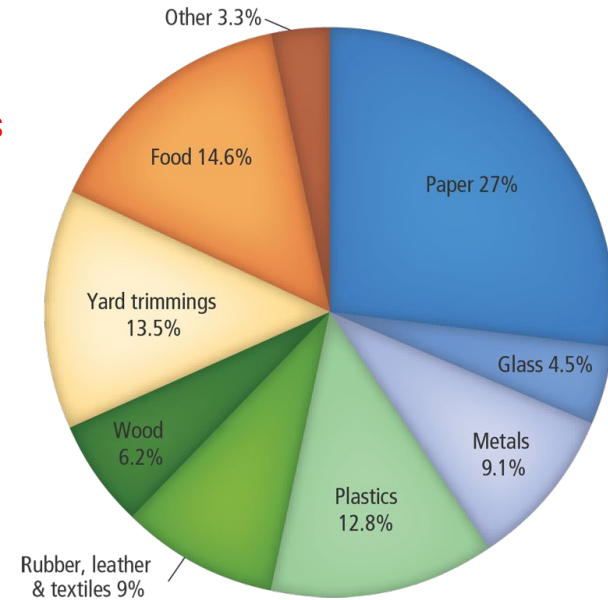
**7.D**

Use data and evidence to support a potential solution.

Above is the MSW stream composition of the United States. **Propose a solution** the federal government could enact that would reduce the volume of waste entering landfills in the US by at least 15%. Use evidence from the graph above to support your proposed solution.

### Propose a solution (1 pt.)

- Enact a recycling education campaign to encourage cities/citizens/corporations to reduce the volume of paper entering landfills by at least 15%
- Offer a tax credit to recycling companies to expand service to reduce the volume of paper entering landfills by at least 15%
- Offer a tax credit to composting companies in order to expand their services and reduce yard waste, food waste, and paper entering landfills by at least 15% combined
- Other acceptable answers that specify a gov. action to reduce paper or compostables (yard/food/paper) entering landfills should also earn a pt.



# FRQ Practice 8.10

## SUGGESTED SKILL

 *Mathematical  
Routines*

**6.B**

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

Approximately 30 million mobile devices were sold in 1998 in the US. The number sold increased to 180 million devices in 2007.

- (a) **Calculate** the percent increase of mobile device sales from 1998 to 2007. (2pts.)

*(2 points: 1 point for a correct setup and 1 point for the correct answer)*

$$\frac{(180 \text{ million} - 30 \text{ million})}{30 \text{ million}} \times 100\% = 500\%$$

**OR**

$$\frac{(180 - 30)}{30} \times 100\% = 500\%$$

(Note: Students must show the calculation in order to receive credit for the correct answer. Math setup must be shown for second point.)

- (b) Each mobile device sold in 2007 contained an average of 0.03 grams of gold. **Calculate** the number of grams of gold that were used in the production of the mobile devices sold in 2007. (2 pts.)

*(2 points: 1 point for a correct setup and 1 point for the correct answer)*

$$1.8 \times 10^8 \text{ devices} \times \frac{3 \times 10^{-2} \text{ grams}}{\text{device}} = 5.4 \times 10^6 \text{ grams or } 5,400,000 \text{ grams}$$

**OR**

$$180,000,000 \text{ devices} \times \frac{0.03 \text{ grams}}{\text{device}} = 5,400,000 \text{ grams or } 5.4 \times 10^6 \text{ grams}$$

(Note: Students must show the calculation to receive credit for the correct answer. Math setup must be shown for second point. Mass units and correct numbers must be shown for second point.)

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# FRQ Practice 8.11

## SUGGESTED SKILL

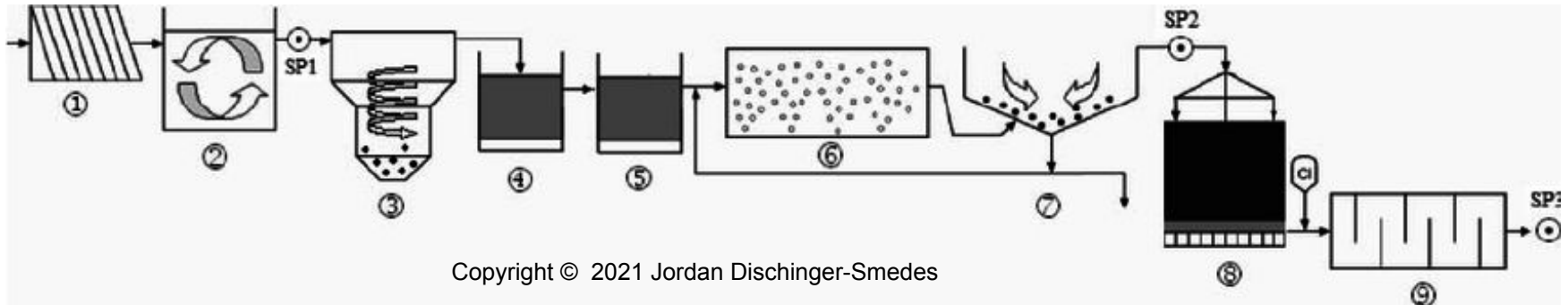
Visual Representations

### 2.A

Describe characteristics of an environmental concept, process, or model represented visually.

**Identify** a number on the wastewater treatment diagram below that represents a step of primary treatment. **Describe** a pollutant removed by this process. (2 pts.)

Identify (1 pt.)	Describe (1 pt.)
<b>Step 1: Screen/grate/filter</b>	Physically removes large debris/waste such as leaves, paper, plastic, garbage
<b>Step 3: Grit/settling chamber</b>	Allows sediment, waste/feces, sand, rocks, small plastics or paper to sink to bottom



# FRQ Practice 8.12 & 13

## Drug Discrimination and Lethality, Rat (PO)

RTI No.	ED <sub>50</sub> (mg/kg)	LD <sub>50</sub> (mg/kg)	TI (LD <sub>50</sub> /ED <sub>50</sub> )	Minimum Lethal, PO mg/kg
336	3.54	180	51	100
177	5.7	48.9	8.57	40-60

\*PO indicates by mouth.

Above are data from the results of a dose-response study for Polonium (PO) toxicity in rats.

**Explain** how these data could be used to determine a max. allowable level for humans. (1 pt.)

- The ED<sub>50</sub> or LD<sub>50</sub> level for rats could be divided by 1,000 to determine a maximum allowable level for humans

**Identify** the lowest dose that resulted in death in the RTI No. 336 rats and the dose that resulted in 50% of the RTI 336 rats dying. (2 pts.)

- 100 mg/kg was the lowest dose that resulted in death
- 180 mg/kg resulted in 50% of rats dying

### SUGGESTED SKILL

 *Mathematical  
Routines*

### SUGGESTED SKILL

 *Data Analysis*

#### 5.E

Explain what the data implies or illustrates about environmental issues.

#### 6.A

Determine an approach or method aligned with the problem to be solved.

# Practice FRQ 8.14

## SUGGESTED SKILL

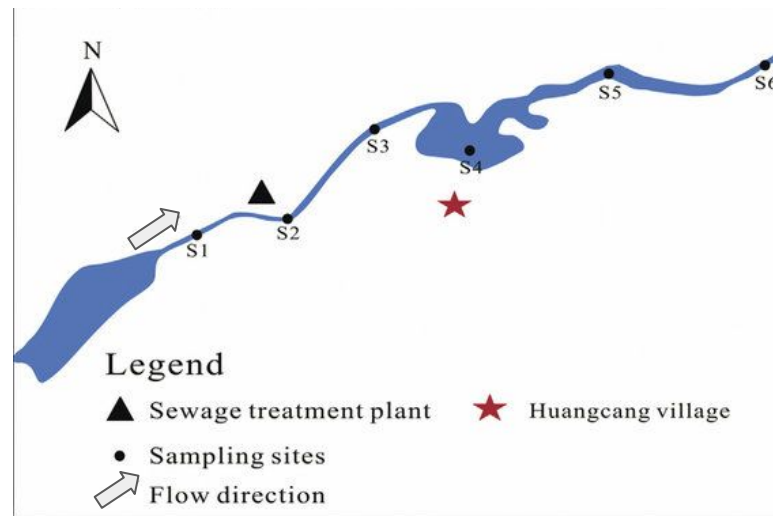
 *Scientific Experiments*

### 4.C

Describe an aspect of a research method, design, and/or measure used.

Below is a map of a river that is used as the main drinking water source for the Chinese village of Huangcang. Chinese scientists suspect that the sewage treatment plant is releasing untreated sewage into the river.

- a) If scientists plan to measure fecal coliform bacterial counts at the six sampling sites below, **make a claim** about which site should serve as the control group in the experiment. **Justify** your answer with evidence.
- b) **Identify** a disease that scientists could test for in the people of Huangcang and **explain** how the prevalence of this disease would help the researchers determine whether the sewage treatment plant is releasing untreated sewage into the river.



# FRQ Practice 8.14

## SUGGESTED SKILL

 Scientific Experiments

### 4.C


Describe an aspect of a research method, design, and/or measure used.

- a) **Make a claim** about which site should serve as the control group in the experiment. **Justify** your answer with evidence. (1 pt.)
- Site 1 should serve as the control group because it is upstream of the sewage treatment plant and cannot be contaminated with any potential waste from the plant
- b) **Identify** a disease that scientists could test for in the people of Huangcang and **explain** how the prevalence of this disease would help determine whether the sewage treatment plant is releasing untreated sewage into the river. (1 pt.)

Identify	Explain
Cholera	Caused by bacterial infection from drinking human waste-contaminated water
Dysentery	Caused by bacterial infection from drinking human waste-contaminated water
E. coli poisoning	Caused by bacterial infection from drinking human waste-contaminated water

# FRQ Practice 8.15

## SUGGESTED SKILL

 Visual Representations

### 2.B

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

a) Based on this map, make a claim about a region of the world that likely has a high incidence of Cholera. (1 pt.)

- Any region of the world with lower than 70% access to improved drinking water, such as:
  - Central or sub saharan Africa
  - Central Asia or Mongolia
  - Papua New Guinea

Share of the population with access to improved drinking water, 2015

Our World in Data

