FRQ rubrics in this PDF that are the property of the College Board © are marked with the College Board AP logo. They are freely available on the 🔗College Board AP Environmental Science Past Exam Questions website🔗 to anyone on the internet. They've simply been organized and aligned to the practice FRQs at the end of each of Jordan Dischinger-Smedes' YouTube videos and included in this document for students' convenience.

All FRQ scoring guides created by Jordan Dischinger-Smedes are designated at the bottom of each page and subject to the following usage guidelines:

FRQ Practice 9.1

SUGGESTED SKILL

Concept Explanation

1.A

Describe environmental concepts and processes.

Describe how stratospheric ozone protects organisms on earth from UV radiation. (1 pt.)

- **Stratospheric ozone molecules absorb UV rays/radiation, which prevents much of this radiation from reaching earth's surface and damaging organisms' tissues/cells/skin/eyes**

Describe how CFCs deplete stratospheric ozone. (2 pts.)

Correct descriptions of the decomposition of CFCs include one of the following:

- Absorption of UV radiation by CFC molecules releases chlorine atoms
- $CCl_3F + UV \rightarrow CCl_2F + Cl$

Correct descriptions of the destruction of stratospheric ozone include one of the following:

- Chlorine atoms break down ozone molecules
- $Cl + O_3 \rightarrow ClO + O_2$

FRQ Practice 9.2

SUGGESTED SKILL

Concept Explanation

1.A

Describe environmental concepts and processes.

Explain how the Montreal Protocol decreased ozone depletion.

- **The Montreal Protocol mandated the phase-out use of CFCs in developed countries, which decreased the release of these ozone-depleting molecules into the atmosphere**

FRQ Practice 9.3

SUGGESTED SKILL

Concept Explanation

1.B

Explain environmental concepts and processes.

Explain how greenhouse gases in the atmosphere contribute to the heating of earth's climate. (1 pt.)

- **Greenhouse gases are molecules capable of absorbing infrared radiation/heat in earth's atmosphere and re-radiating/directing it back to earth's surface**

Identify a greenhouse gas that has a GWP greater than 1. (1 pt.)

- **CFCs or HFCs**
- **CH_4 (Methane)**
- **N_2O (nitrous oxide)**

Explain why this greenhouse gas has a higher GWP than 1. (1 pt.)

- **All greenhouse gases have a greenhouse warming potential measured relatively to carbon dioxide; each of these greenhouse gases either persists longer in the atmosphere or re-radiates/traps heat more effectively than carbon dioxide (or both)**

FRQ Practice 9.4

SUGGESTED SKILL

Visual Representations

2.C

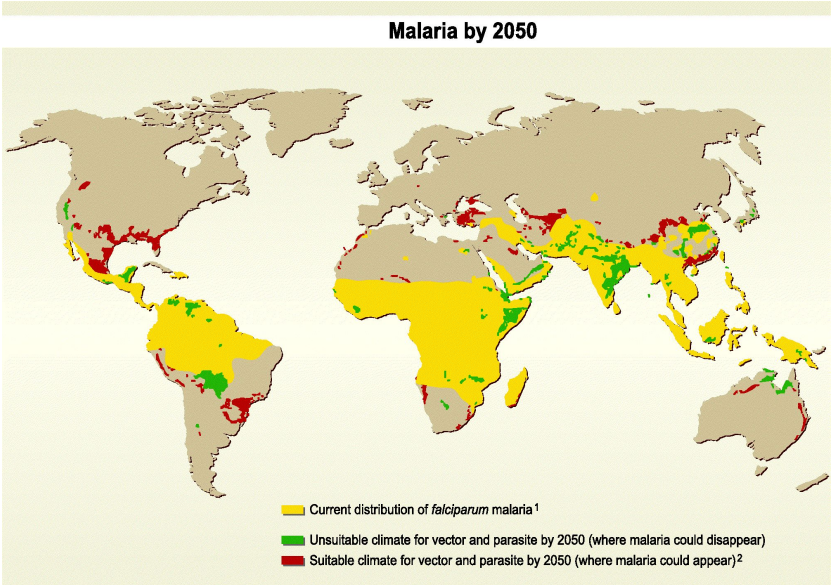
Explain how environmental concepts and processes represented visually relate to broader environmental issues.

Identify a region where malaria rates may increase by the year 2050. (1 pt.)

- Central Mexico
- South-eastern USA
- Southern Brazil/Uruguay/Paraguay
- North-western coast of Africa
- Central Asia
- East coast of Australia

Explain how climate change may contribute to this increase in malaria in this region. (1 pt.)

- As average global temperature increases, this region of the world that was previously too cold to support the mosquitoes that carry Malaria will now be warm enough to support this mosquito



FRQ Practice 9.5

SUGGESTED SKILL

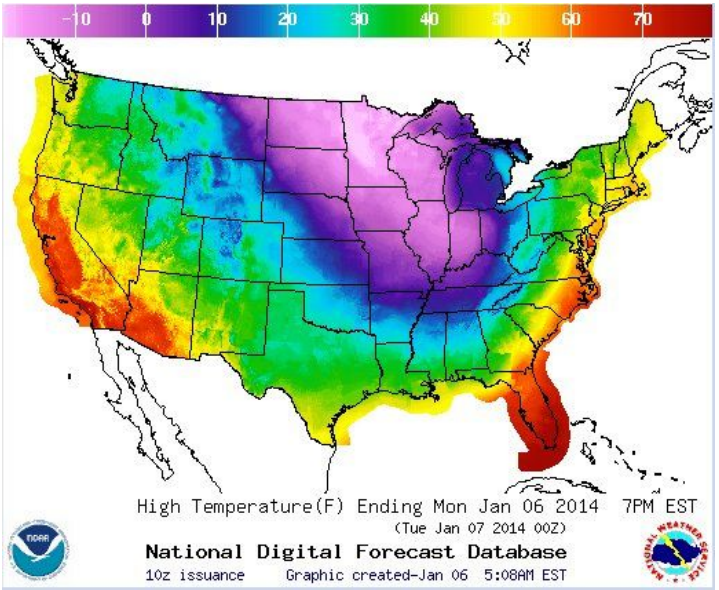
Data Analysis

5.D

Interpret experimental data and results in relation to a given hypothesis.

Explain how the data above support the hypothesis that a destabilized polar jet stream caused the cold spell seen in the midwest. (1 pt.)

- **Because the cold spell extends so far into the southern portion of the midwest and doesn't impact the northern portion of the western US, it is likely that warming ocean and land temperatures on the western coast created a warm front that pushed the jet stream northward in that region, resulting in a southward "ripple" effect of polar temperatures in the midwest**



FRQ Practice 9.6

SUGGESTED SKILL

Environmental Solutions

7.A

Describe environmental problems.

Describe one climate change-related threat to a marine species other than coral. (1 pt.)

- **Warming ocean may force organisms (fish, marine mammals, etc.) to migrate to new waters that are within their temperature range of tolerance**
- **Reproductive, hunting, or mating communication/behaviors may be disrupted if they are tied to changing water temperature**

Describe one climate change-related threat to coral reef ecosystems. (1 pt.)

- **Warming ocean temperatures could drive photosynthetic algae out of the reef, removing energy/food source for other organisms**
- **Warming ocean temperatures could lead to coral bleaching as photosynthetic algae leave the reef ecosystem**
- **Ocean acidification could destabilize reef as lower pH deteriorates/prevents growth of calcium carbonate reef**

FRQ Practice 9.7

SUGGESTED SKILL

Concept Explanation

1.C

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

Identify a human activity that leads to ocean acidification. (1 pt.)

- **Combustion of fossil fuels for electricity generation/transportation/manufacturing/fertilizer production/cement production**
- **Deforestation for lumber/agriculture/housing/roads/etc.**

Explain how ocean acidification can threaten marine organisms. (1 pt.)

- **Organisms with calcium carbonate shells or exoskeletons may experience deterioration or decreased growth of shell/exoskeleton as decreased ocean pH dissolves these structures/decreases carbonate ion availability**
- **Organisms like fish may experience physiological stress such as difficulty reproducing, finding food, or avoiding predators if pH moves outside their range of tolerance**
- **Photosynthesizing organisms may experience increased rates of photosynthesis with higher levels of carbon dioxide in the ocean water**

FRQ Practice 9.8

SUGGESTED SKILL

Concept Explanation

1.C

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

Identify a specific example of an invasive species and **propose a solution** to limit the spread of that invasive species. (1 pt.)

Identify	Propose a solution
Zebra Mussel	Physical removal from boats that transport zebra mussels between bodies of water
Kudzu Vine	Physical removal/control and planting of native species to replace and compete
Asian Carp	Incentives for hunting/capturing; physical barriers in waterways to prevent movement
Emerald Ash Borer	Cutting down infected trees to reduce host density; strict trade/inspection laws to prevent transport of insects in infected timber or firewood
Cane Toad	Incentives for hunt/capture; search and removal of eggs from bodies of water
Python	Incentives for hunting/capture; strict enforcement of animal trade laws/pet store sales
Other invasives acceptable	Solution must be specific and realistic to invasive species identified

FRQ Practice 9.9

SUGGESTED SKILL

Environmental Solutions

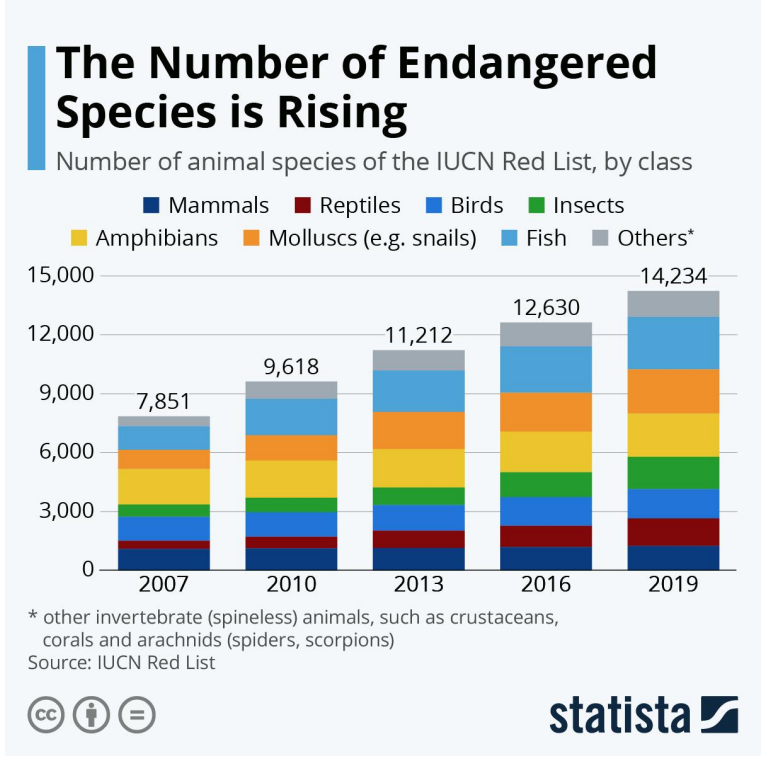
7.D

Use data and evidence to support a potential solution.

The US FWS proposes 2 action plans to reduce threats to endangered species in the US.
Plan #1 focuses on regulating surface water pollutants with stricter laws while Plan #2 focuses on purchasing and preserving more intact forest ecosystems.

Justify plan #1 or plan #2 as being more effective in reducing threats to endangered species.

- **Since aquatic species like fish, molluscs, and amphibians make up the majority of endangered species, plan #1 would be more effective in reducing threats to endangered species; it would directly improve the aquatic organisms' habitats and also indirectly benefit mammals, reptiles, and insects by providing cleaner water sources for drinking**



FRQ Practice 9.10

SUGGESTED SKILL

Environmental Solutions

7.C

Describe disadvantages, advantages, or unintended consequences for potential solutions.

Describe ONE economic disadvantage and advantage of preserving a piece of land as a wildlife preserve. (2 pts.)

Advantage (1 pt.)	Disadvantage (1 pt.)
Intact ecosystem may provide regulating ecosystem services such as flood prevention or carbon sequestration	Area cannot be developed for residential or commercial use
Intact ecosystem may provide supporting ecosystem services such as pollinator habitats or nutrient cycling decomposers	Area cannot have roads built that enable easier transport or trade
Area may be used for ecotourism and bring in revenue	Area cannot provide provisioning ecosystem services such as timber, hunting, etc.
	Natural resources (ore, coal, oil, etc. - must name one) cannot be extracted for profit