AP®

AP® Environmental Science
Scoring Guidelines
Set 1

Question 1: Design an Investigation   10 points

A   **Describe** one reproductive strategy used by a K-selected species such as the chickadee.   **Point 01**

Examples of acceptable responses may include the following:

- (K-selected species) provide considerable parental care for offspring.
- (K-selected species) have few offspring.
- (The parents) expend significant energy for each offspring.
- (Individuals) reproduce more than once in their lifetime.
- (K-selected species) have a long gestation period/reach reproductive maturity later.

B   Based on the information provided, **explain** how a decrease in spider populations could affect a lower trophic level.   **Point 02**

Examples of acceptable responses may include the following:

- Insects/insect populations would increase because the insects are not being preyed on/eaten as much.
- Plants/plant populations would decrease because the number of insects that eat plants will increase.

C   Based on the data in Figure 1, **identify** the number of spiders per sample at 25% nonnative plants.   **Point 03**

Examples of acceptable responses may include the following:

- 2.0
- 2

D   Based on the data in Figure 1, **describe** the trend in the number of insects per sample in relation to the percentage of nonnative plants.   **Point 04**

Examples of acceptable responses may include the following:

- As nonnative plant percentage/percent increases, the number of insects decreases.
- As nonnative plant percentage/percent decreases, the number of insects increases.
- They have an inverse/indirect/negative relationship.

E   Scientists hypothesized that the population of chickadees would be stable or growing with fewer than 25% nonnative plants. **Describe** one way that the data in Figure 2 support this hypothesis.   **Point 05**

Examples of acceptable responses may include the following:

- Below this level/With fewer than 25%, the growth rate is at/above replacement level.
- Below this level/With fewer than 25%, enough reproduction is occurring to replace the population.
- Below this level/With fewer than 25%, the population growth rate is positive.

| F | **(i) Identify** a likely scientific question for the students' investigation of ant diversity. | **Point 06** |

Examples of acceptable responses may include the following:

- Does the number of species/species richness/biodiversity differ between an urban park and a grassland?
- Does mowing affect the number of species/species richness/biodiversity?

| | **(ii) Identify** the dependent variable in the students' investigation. | **Point 07** |

Examples of acceptable responses may include the following:

- Number of ant species
- Ant species richness
- Presence/absence of different ant species

| G | **(i) Explain** why the ant community of the unmowed grassland would be more likely to recover from a disturbance, such as a flood or fire, than the ant community in the mowed urban park would. | **Point 08** |

Examples of acceptable responses may include the following:

- With a larger number of species, the grassland is more likely to have some species/individuals with adaptations that allow them to survive.
- The grassland is more diverse, so the loss of one species is less likely to cause a collapse (of the whole ecosystem).

| | **(ii) Explain** how the results of the investigation could have been altered if students had measured ant biodiversity at a paved playground rather than in the grassland. | **Point 09** |

Examples of acceptable responses may include the following:

- (The playground) would have fewer species (than the grassland/urban park) because the paved area is not suitable habitat for many ant species.
- (The playground) would have fewer species (than the grassland/urban park) because humans could trample the ants/ant habitat.

| H | **Describe** one effect a paved road in a forest can have on animal species such as deer or bears. | **Point 10** |

Examples of acceptable responses may include the following:

- Animals can get hit by cars when trying to cross the road/hunt/migrate.
- Fragmentation can lead to isolation of individuals/loss of genetic diversity.
- Noise pollution can damage hearing/cause stress/mask the sounds used to communicate/hunt.
- The road/noise pollution can cause changes in migratory routes/prevent movement of animals (to access resources).
- Species that thrive in edge habitats might increase.

Question 2: Analyze an Environmental Problem and Propose a Solution
10 points

A	**Identify** the sea surface condition for the eastern equatorial area of the Pacific Ocean illustrated in Figure 1.	**Point 01**

Acceptable identification point:

- (Ocean water) cooler than average

B	Based on the information in Figure 1, **identify** the climate phenomenon associated with the sea surface conditions shown in the equatorial area of the Pacific Ocean.	**Point 02**

Acceptable identification point:

- La Niña

C	Based on the information in Figure 2, **describe** a difference in climate patterns between the regions A and B.	**Point 03**

Examples of acceptable responses may include the following:

- Region A has an increased chance of precipitation, while Region B has a decreased chance of precipitation.
- Region A will be wetter, while Region B will be drier.

D	**Describe** one reason why there is an increased risk of flooding in urban areas during extended periods of precipitation.	**Point 04**

Examples of acceptable responses may include the following:

- Impervious/paved surfaces increase runoff/reduce infiltration/reduce absorption.
- Parking lots/roads/buildings/sidewalks increase runoff/reduce infiltration/reduce absorption.
- There is less vegetation and, therefore, less infiltration/absorption.

E	**Propose** a realistic solution a city could implement to decrease the risk of flooding in urban areas.	**Point 05**

Examples of acceptable responses may include the following:

- Use permeable pavement
- Plant vegetation/establish parks/create rain gardens/build green roofs
- Install retention ponds/stormwater basins

F	**Justify** the solution proposed in part E by providing an additional advantage other than a reduction in the risk of flooding.	**Point 06**

Examples of acceptable responses may include the following:

Solution from part E	Justification of solution with additional advantages
Use permeable pavement	• Increased recharge of nearby aquifers/groundwater • Decreased pollution in runoff
Plant vegetation/establish parks/create rain gardens/build green roofs	• Vegetation absorbs pollutants • Vegetation stores carbon dioxide/produces oxygen • Decreased erosion • Increased/restored habitat for wildlife • Increased biodiversity • Helps reduce urban heat island effect • Aesthetic enjoyment/improved quality of life • Creates jobs (in landscaping/park maintenance)
Install retention ponds/stormwater basins	• Decreased pollution in runoff • Increased habitat/biodiversity

G	**Describe** one difference between the climate of a temperate seasonal forest and that of a savanna.	**Point 07**

Examples of acceptable responses may include the following:

- Temperate seasonal forests have a cooler climate than a savanna.
- Temperate seasonal forests have a stronger/colder winter than a savanna.
- Temperate seasonal forests have four distinct seasons while savannas do not.
- Temperate seasonal forests receive more annual precipitation than savannas.
- Temperate forests receive precipitation throughout the year while savannas have a rainy season/dry season.

H	**Identify** the ecological process that occurs following a forest fire that leaves the soil intact.	**Point 08**

Acceptable identification point:

- Secondary succession

I	**Describe** one way burning forests contribute to atmospheric pollution.	**Point 09**

Acceptable description point:

- Burning of trees releases CO_2/CO/NO_X/particulate matter/VOCs.

J	**Describe** one sustainable forestry practice that could be used to reduce the occurrence or severity of forest fires.	**Point 10**

Examples of acceptable responses may include the following:

- Prescribed burns can remove excess fuel/dead leaves/underbrush.
- Brush removal can remove excess fuel/dead leaves/underbrush.
- Selective cutting can create a fire break.
- In agroforestry, ground crops that might otherwise be fuel can be harvested/removed.

Question 3: Analyze an Environmental Problem and Propose a Solution (Doing Calculations)

10 points

A	**Identify** an anthropogenic source of particulate matter, other than from motor vehicles.	**Point 01**

Examples of acceptable responses may include the following:

- Coal/fossil fuel combustion
- Industrial exhaust
- Construction/demolition
- Waste incineration
- Mining
- Burning of biomass
- Anthropogenically caused wildfires
- Unpaved roads
- Agricultural fields

B	One way to reduce pollutants associated with motor vehicles is to use a vapor recovery nozzle. **Describe** one way a vapor recovery nozzle is used to reduce atmospheric pollution.	**Point 02**

Acceptable description point:

- It prevents fumes/vapors from escaping into the atmosphere when gassing/fueling (a motor vehicle).

C	**Explain** how a decrease in the number of people commuting to work in their personal vehicles could lead to a reduction in acid rain.	**Point 03**

Examples of acceptable responses may include the following:

- (A decrease in commuting) would result in lower nitrogen oxide/sulfur oxide emissions from cars/vehicles.
- (A decrease in commuting) would lead to less nitric acid/sulfuric acid in the atmosphere.

D	**Calculate** the percent change in gas mileage between the gasoline-powered SUV and the hybrid SUV based on the data provided. **Show** your work.	**Point 04**

One point for the correct setup to calculate the percent change in gas mileage.

Examples of acceptable responses may include the following:

- (36 mpg – 22 mpg) / 22 mpg x 100
- (36 – 22) / 22 x 100

	One point for the correct calculation of the percent change in gas mileage.	**Point 05**

Examples of acceptable responses may include the following:

- 63.6% increase
- 63.6%
- 63.6
- 64%
- 64

E	**Calculate** how many more miles the owner can drive in the hybrid SUV in the city than they could have driven in the gasoline-powered SUV. **Show** your work.	**Point 06**

One point for the correct setup to calculate how many more miles the hybrid SUV can drive than the gasoline-powered SUV.

Examples of acceptable responses may include the following:

- (14 gallon x 36 mpg) – (14 gallon x 22 mpg)
- (14 x 36) – (14 x 22)
- 14*(36-22)

	One point for the correct calculation of how many more miles the hybrid SUV can drive than the gasoline-powered SUV.	**Point 07**

Examples of acceptable responses may include the following:

- 196
- 200

F	**Propose** a realistic solution that schools could implement to decrease energy use for heating and cooling, other than a reduction in the amount of time the school building is occupied.	**Point 08**

Examples of acceptable responses may include the following:

- Implement green building design features
- Open windows to reduce use of air conditioning
- Use energy-efficient heating and cooling equipment
- Adjust the thermostat to reduce use of heat and air conditioning
- Install conservation landscaping

G **Calculate** the energy use in the school building in kilowatts per year using LED light bulbs. **Point 09**
Show your work.

One point for the correct setup to calculate the energy use in the school building in kWh/year using LED light bulbs.

Examples of acceptable responses may include the following:

- $(2.8 \times 10^4$ bulbs) x 0.0085 kilowatt x 2,340 hours
- $(2.8 \times 10\text{^}4)$ x 0.0085 x 2,340

One point for the correct calculation of the energy use in the school building in kWh/year **Point 10** using LED light bulbs.

Examples of acceptable responses may include the following (if units are included in the response, kWh/year or kW/year are accepted):

- 556,920
- 5.6 x 10^5
- 5.6E5