Past-paper walk-through

Natural Disruptions to Ecosystems ▪ 2.5

eXercise

Questions in this set

- 2026 Q1
- 2025 Set 1 Q1
- 2014 Q3

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 1

2026 ▪ Q1

The following information applies to parts A, B, C, D, and E.

Climate change can affect both terrestrial and marine organisms. Researchers studying the effect of climate change on bird distribution mapped elevation zones at which five bird species lived within a tropical mountain range. Birds are distributed in part according to climate-related adaptations. Researchers modeled where the birds would most likely live in the future based on climate change predictions.

The results of this study are shown in the following diagram. Each unique shape in the diagram represents a different bird species, labeled A through E. Current distribution is shown on the left side of the figure, and predicted future distribution is shown on the right.

Bird Species Distribution

Question 1

[Diagram: a pyramid-shaped chart titled “Bird Species Distribution,” split into a “Current Distribution” half (left) and “Predicted Future Distribution” half (right), divided by a vertical center line. The pyramid is divided into four horizontal elevation bands, from top (narrowest) to bottom (widest): “High Elevations,” “Mid-High Elevations,” “Mid-Low Elevations,” and “Low Elevations,” separated by dashed lines. Each band shows bird-shape icons above the letters A, B, C, D, E (Current side) and A, B, C, D, E (Predicted Future side), indicating which species is present at that elevation. A legend defines a black bird silhouette = “Species present at elevation” and a gray bird silhouette = “Extinct species.”
Current Distribution:

- High Elevations: Species A and Species C present.
- Mid-High Elevations: Species A present.

Question 1

- Mid-Low Elevations: Species B and Species D present.
- Low Elevations: Species B, Species C, Species D, and Species E present.

Predicted Future Distribution:

- High Elevations: Species A present; Species E shown extinct (gray icon).
- Mid-High Elevations: Species B and Species D present.
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The following information applies to parts F, G, and H.
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- Tank 1: 27°C and no sediment
- Tank 2: 32°C and no sediment

Question 1

- Tank 3: 37°C and no sediment

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- Tank 1: 27°C and no sediment
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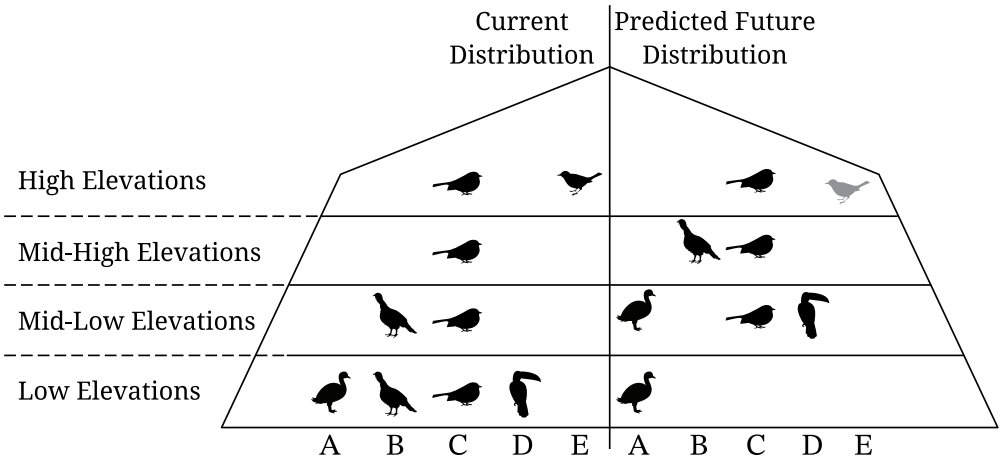
- Tank 3: 27°C and high sediment

1. Respond to parts A, B, C, D, E, F, G, H, I, and J.

(a) Based on the information in the diagram, **identify** the elevation zone that has the highest species richness for the current distribution.

Question 1


Current Distribution
Predicted Future Distribution
High Elevations
Mid-High Elevations
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A B C D E
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2026 ▪ Q1

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Question 1

- Mid-High Elevations: Species B and Species D present.
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Question 1

1. Respond to parts A, B, C, D, E, F, G, H, I, and J.

(b) Describe a climate condition at high elevations that is different than it is at low elevations.

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(c) A predator at low elevations currently feeds on Species C and D. Based on the information in the diagram, **describe** what could happen to the predator species in the future in response to the predicted changes in the prey community.

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(d) Species C is considered a generalist, while Species E is considered a specialist. **Explain** why Species C and E are predicted to respond differently to climate change.

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(e) Based on the information in the diagram, **explain** why the bird community at low elevations in the future would be less likely to recover from natural disruptions than the current low-elevation bird community.

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1. Respond to parts A, B, C, D, E, F, G, H, I, and J.

(f) Identify the independent variable in Experiment 1.

Question 1

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(g) Identify a likely scientific question for Experiment 1.

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(h) In Experiment 2 the temperature of the tanks was held constant, while the amount of sediment was varied. **Explain** how this modification could affect the results of this experiment.

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(i) Changes in climate also affect Arctic ecosystems. One impact of climate change is the loss of ice and snow in polar regions. **Describe** a positive feedback loop that results from the loss of ice and snow in polar regions.

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The results of this study are shown in the following diagram. Each unique shape in the diagram represents a different bird species, labeled A through E. Current distribution is shown on the left side of the figure, and predicted future distribution is shown on the right.

Bird Species Distribution

[Diagram: a pyramid-shaped chart titled "Bird Species Distribution," split into a "Current Distribution" half (left) and "Predicted Future Distribution" half (right), divided by a vertical center line. The pyramid is divided into four horizontal elevation bands, from top (narrowest)

Question 1

to bottom (widest): “High Elevations,” “Mid-High Elevations,” “Mid-Low Elevations,” and “Low Elevations,” separated by dashed lines. Each band shows bird-shape icons above the letters A, B, C, D, E (Current side) and A, B, C, D, E (Predicted Future side), indicating which species is present at that elevation. A legend defines a black bird silhouette = “Species present at elevation” and a gray bird silhouette = “Extinct species.”
Current Distribution:

- High Elevations: Species A and Species C present.
- Mid-High Elevations: Species A present.
- Mid-Low Elevations: Species B and Species D present.
- Low Elevations: Species B, Species C, Species D, and Species E present.

Predicted Future Distribution:

- High Elevations: Species A present; Species E shown extinct (gray icon).

Question 1

- Mid-High Elevations: Species B and Species D present.
- Mid-Low Elevations: Species A, Species C, and Species D present.
- Low Elevations: Species A present.]

The following information applies to parts F, G, and H.
Some organisms such as birds can move in response to environmental changes, while other organisms such as corals cannot. Researchers studying the effect of climate change on marine organisms conducted two experiments involving photosynthetic algae that have a symbiotic relationship with corals.
In Experiment 1, the researchers placed photosynthetic algal colonies living in corals in three different saltwater tanks. The temperature of Tank 1 was set to 27°C, the average temperature at which most corals live. Water circulation in each tank mimicked natural ocean currents. After 30 days, the researchers counted the number of bleached corals. The tank setups are shown in the following list.

Question 1

- Tank 1: 27°C and no sediment
- Tank 2: 32°C and no sediment
- Tank 3: 37°C and no sediment

In Experiment 2, the researchers used the same photosynthetic algae living in corals but modified the conditions of the tanks as shown in the following list. Water circulation kept the sediment in the tanks suspended. After 30 days, the researchers counted the number of bleached corals.

- Tank 1: 27°C and no sediment
- Tank 2: 27°C and moderate sediment
- Tank 3: 27°C and high sediment

Question 1

1. Respond to parts A, B, C, D, E, F, G, H, I, and J.

(j) Describe one problem that Arctic species, such as polar bears or ringed seals, face because of warming in polar regions.

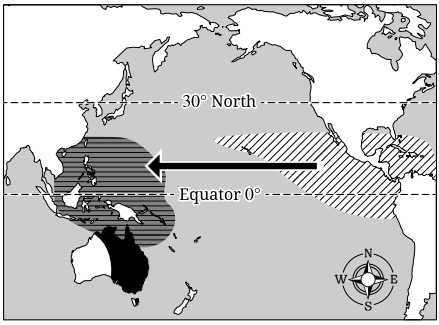
Question 1

2025 Set 1 ▪ Q1

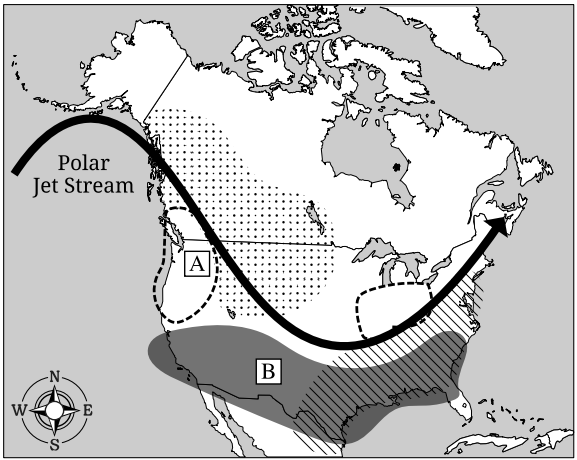
Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(a) Describe one reproductive strategy used by a K-selected species such as the chickadee.

Question 1


30° North
Equator 0°
N
W
E
S
Ocean water cooler than average
Ocean water warmer than average
Increased chance of precipitation
Stronger than normal trade winds

Question 1



Question 1

Site	Species A	Species B	Species C	Species D	Species E	Species F
Urban park	X			X	X	
Grassland	X	X	X	X		X

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(b) Based on the information provided, explain how a decrease in spider populations could affect a lower trophic level.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(c) Based on the data in Figure 1, identify the number of spiders per sample at 25% nonnative plants.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(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.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(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.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(f) Insect biodiversity is important to maintain ecosystem health. A group of students was interested in learning about factors that affect ant biodiversity. They located two study sites near their school: a frequently mowed urban park and an unmowed grassland. The students used traps designed to collect ants. They loaded 10 of these traps with the same food and placed them randomly at different locations within each site. Students collected the traps after 24 hours and counted the number of different ant species in each trap to determine species richness.

(f)(i) Identify a likely scientific question for the students' investigation of ant diversity.

(f)(ii) Identify the dependent variable in the students' investigation.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(g) The data from the student investigation of ant diversity are shown in the following table. An "X" in the table indicates that the species was present at that site.

Ant Species Present in an Urban Park and Unmowed Grassland

Site	**Species A**	**Species B**	**Species C**	**Species D**	**Species E**	**Species F**
Urban park	X			X	X	
Grassland	X	X	X	X		X

Question 1

(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.

(g)(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.

Question 1

2025 Set 1 ▪ Q1

Respond to parts A, B, C, D, E, F, G, and H, and all subparts.

(h) Habitat fragmentation has impacts on a variety of species. Paved roads can lead to habitat fragmentation.

Describe one effect that a paved road in a forest can have on animal species such as deer or bears.

Solution 1

(a)

Mark scheme

- Describe one reproductive strategy of a K-selected species (e.g., chickadee). Any one of: provides considerable parental care for offspring; has few offspring; parents expend significant energy per offspring; individuals reproduce more than once in their lifetime (iteroparity); has a long gestation period/reaches reproductive maturity later.

Solution 1

(b)

Mark scheme

- Explain how a decrease in spider populations affects a lower trophic level: insects/insect populations would increase because they are no longer being preyed on/eaten as much by spiders; consequently plant populations would decrease because more insects are now eating the plants (a trophic cascade down through insects to plants).

Solution 1

(c)

Mark scheme

- From Figure 1, the number of spiders per sample at 25% nonnative plants is 2.0 (accept 2).

Solution 1

(d)

Mark scheme

- Trend in Figure 1: as the percentage of nonnative plants increases, the number of insects per sample decreases (equivalently, as nonnative plant percentage decreases, insects increase) — an inverse/negative relationship between nonnative plant percentage and insect abundance.

Solution 1

(e)

Mark scheme

- One way Figure 2 supports the hypothesis that chickadee populations are stable or growing below 25% nonnative plants: below this threshold, the population growth rate shown is at or above replacement level (positive growth), meaning enough reproduction is occurring to replace or grow the population.

Solution 1

(f)

Mark scheme

- This is background/stem text introducing the student investigation of ant biodiversity (10 baited traps placed randomly at a frequently mowed urban park and an unmowed grassland, collected after 24 hours, species counted). It is context for parts (i) and (ii) and carries no scoring point of its own.

Solution 1

(f)(i)

Mark scheme

- A likely scientific question for the investigation: "Does the number of species/species richness/biodiversity differ between an urban park and a grassland?" or "Does mowing affect the number of species/species richness/biodiversity?"

Solution 1

(f)(ii)

Mark scheme

- The dependent variable is the number of ant species / ant species richness / the presence-absence of different ant species observed at each site.

Solution 1

(g)

Mark scheme

- This presents the data table of ant species present (X) at the urban park vs. the unmowed grassland (species A-F). It is context for parts (i) and (ii) and carries no scoring point of its own.

Solution 1

(g)(i)

Mark scheme

- The unmowed grassland's ant community would more likely recover from a disturbance because, with a larger number of species, the grassland is more likely to have some species/individuals with adaptations that allow them to survive the disturbance; the grassland is more diverse, so the loss of any one species is less likely to cause collapse of the whole community/ecosystem.

Solution 1

(g)(ii)

Mark scheme

- If biodiversity had been measured at a paved playground instead of the grassland, the playground would show fewer species than the grassland/urban park, because the paved area is not suitable habitat for many ant species, and/or because humans could trample the ants/ant habitat there.

Solution 1

(h)

Mark scheme

- One effect of a paved road through a forest on animals such as deer or bears: animals can be hit by cars when trying to cross the road while hunting/migrating (roadkill); fragmentation can isolate individuals and reduce genetic diversity; noise pollution can damage hearing, cause stress, or mask sounds used to communicate/hunt; the road/noise can alter migratory routes or prevent movement to access resources; species that thrive in edge habitats might increase. Any one of these earns the point.

Question 3

2014 ▪ Q3

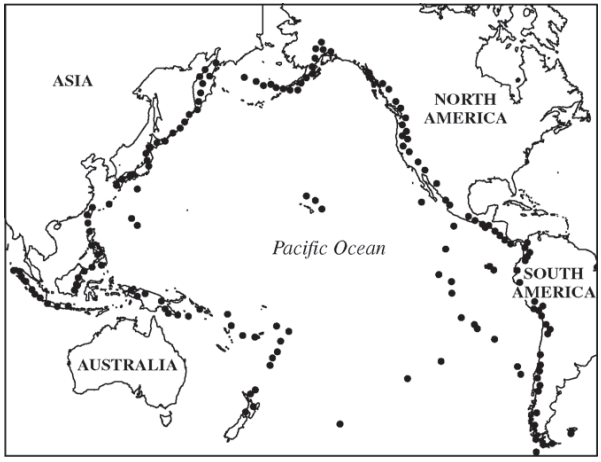
[Map of the Pacific Ocean basin showing the continents of Asia, North America, South America, and Australia surrounding the Pacific Ocean; a curved line of dots traces the "Ring of Fire" around the Pacific margin — from Asia's eastern coast, along the Aleutian chain, down the western coast of North America, through Central America, down the western coast of South America, across through Indonesia/the Philippines/Papua New Guinea, and down to New Zealand — each dot representing a volcano or an earthquake.]

Plate-tectonic theory states that the Earth's lithosphere is broken into very slowly moving pieces or plates. Plate movements over vast stretches of time have led to the current orientation of our continents and oceans. Individual events along plate boundaries, such as earthquakes and volcanic eruptions, pose periodic threats to human activity and ecosystems. The "Ring of Fire" is a term that describes the

Question 3

location of increased seismic and volcanic activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.
(a)(i) Japan, Indonesia, and the Philippines are examples of volcanic island chains that have formed along subduction zones between plates in the western Pacific.
Describe what happens when two tectonic plates collide along a subduction zone.
(a)(ii) Explain how subduction leads to volcanic activity.

Question 3



Question 3

2014 ▪ Q3

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Question 3

activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.

(b)(i) Although the landscape following a volcanic eruption may appear unable to support ecological communities, over time the area can be transformed through succession.

What is primary succession?

(b)(ii) Explain how primary succession can lead to soil formation on a newly formed volcanic landscape.

Question 3

2014 ▪ Q3

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Question 3

activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.

(c)(i) In addition to volcanic activity, highly destructive tsunamis are generated along Pacific Plate subduction zones.

Explain how a tsunami is generated along a subduction zone.

(c)(ii) Describe one negative ecological impact that tsunamis have on coastal environments.

Question 3

2014 ▪ Q3

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Question 3

activity around the margins of the Pacific Ocean basin. On the map above, each dot represents a volcano or an earthquake.

(d)(i) Southern California experiences periodic devastating earthquakes along the San Andreas Fault, which is a transform boundary located along the eastern edge of the Pacific Plate.

Describe what happens to the tectonic plates along a transform boundary at the moment when an earthquake occurs.

(d)(ii) Describe what happens to the tectonic plates along a transform boundary during the time between earthquakes.