Suggested Time: 120 minutes

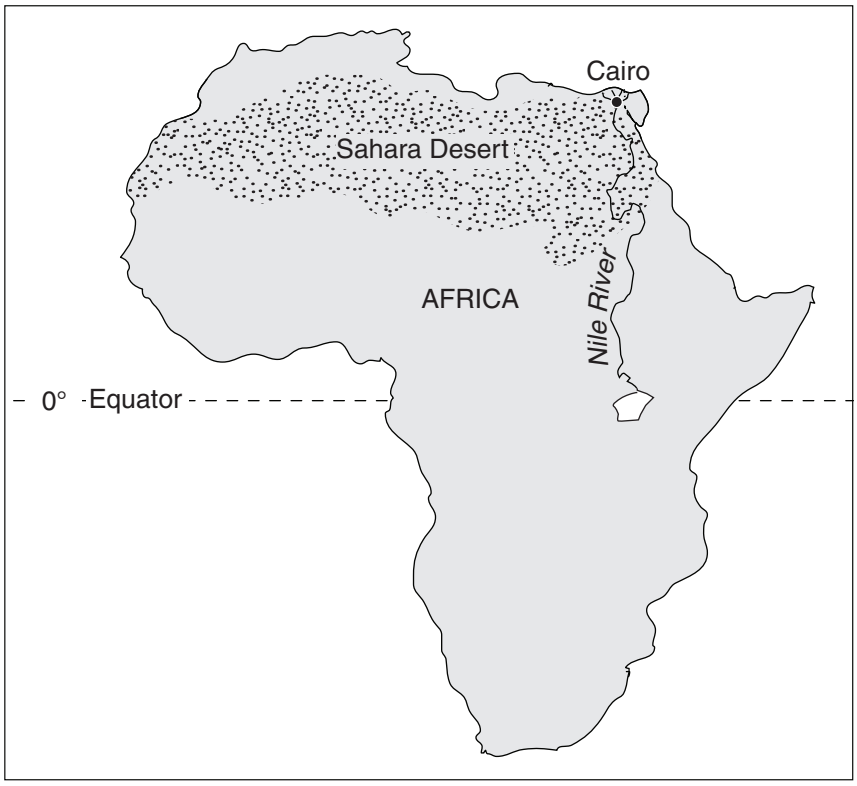
INSTRUCTIONS: For each question, select the best answer and record your choice on the **Answer Sheet** provided. Using a pencil, completely fill in the bubble that has the letter corresponding to your answer.

Refer to the data pages as necessary.

You have **Examination Booklet Form A**. In the box above #1 on your **Answer Sheet**, fill in the bubble as follows.

Exam Booklet Form/ Cahier d'examen	A	B	C	D	E	F	G	H
	●	○	○	○	○	○	○	○

Use the following diagram of Africa to answer question 1.



1. Which of the following is an example of a biome?

   A. the Equator
   B. the Nile River
   C. the city of Cairo
   D. the Sahara Desert

2. Which of the following is a characteristic of the boreal forest biome?

   A. coniferous trees
   B. a permafrost layer
   C. a constant temperature throughout the year
   D. annual rainfall of more than 250 cm per year

3. An ecologist wants to gather information about a stream along a mountainside. Which of the following is a biotic factor?

   A. water flow rate
   B. mineral deposits
   C. water temperature
   D. variety of life forms

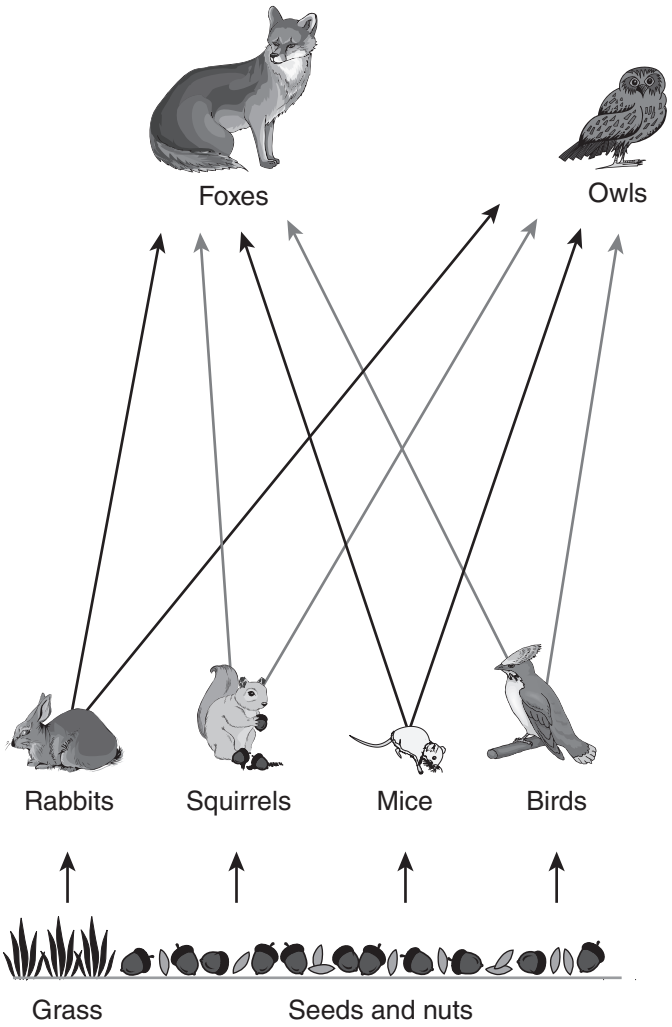
Use the following image of a honeybee pollinating a flower as it gathers food to answer question 4.

From "America's Beekeepers: Hives," May 1993, *National Geographic* magazine

4. What relationship exists between the honeybee and the flower?

   A. predation
   B. parasitism
   C. mutualism
   D. commensalism

Use the following illustration to answer question 5.



5. Which of the following is likely to occur if a large number of squirrels are removed from the area?

   A. an increase in the fox population
   B. an increase in the owl population
   C. a decrease in the plant population
   D. a decrease in the rabbit population

6. Which of the following contain the greatest carbon stores in gigatonnes of carbon?

   A. marine life
   B. oil and gas deposits
   C. organic matter in soil
   D. marine sediments and sedimentary rocks

7. Which of the following elements have these three characteristics in common?

   - dissolved in water
   - stored in sediments
   - present in the atmosphere

   A. carbon and nitrogen
   B. carbon and phosphorus
   C. nitrogen and phosphorus
   D. carbon, nitrogen and phosphorus

8. Which of the following do nitrogen fixation and the decomposition of organic wastes have in common?

   A. Both enrich the soil.
   B. Both are part of the carbon cycle.
   C. Both decrease levels of nitrogen in the soil.
   D. Both are responsible for increased levels of carbon dioxide in the atmosphere.

9. Which of the following best explains the distribution of temperate rainforests?

   A. warm, moist air near the equator
   B. intense solar radiation causing arid conditions
   C. presence of large numbers of small herbivores
   D. presence of coastal mountains causing high annual precipitation

10. In which of the following locations is the annual precipitation the greatest?

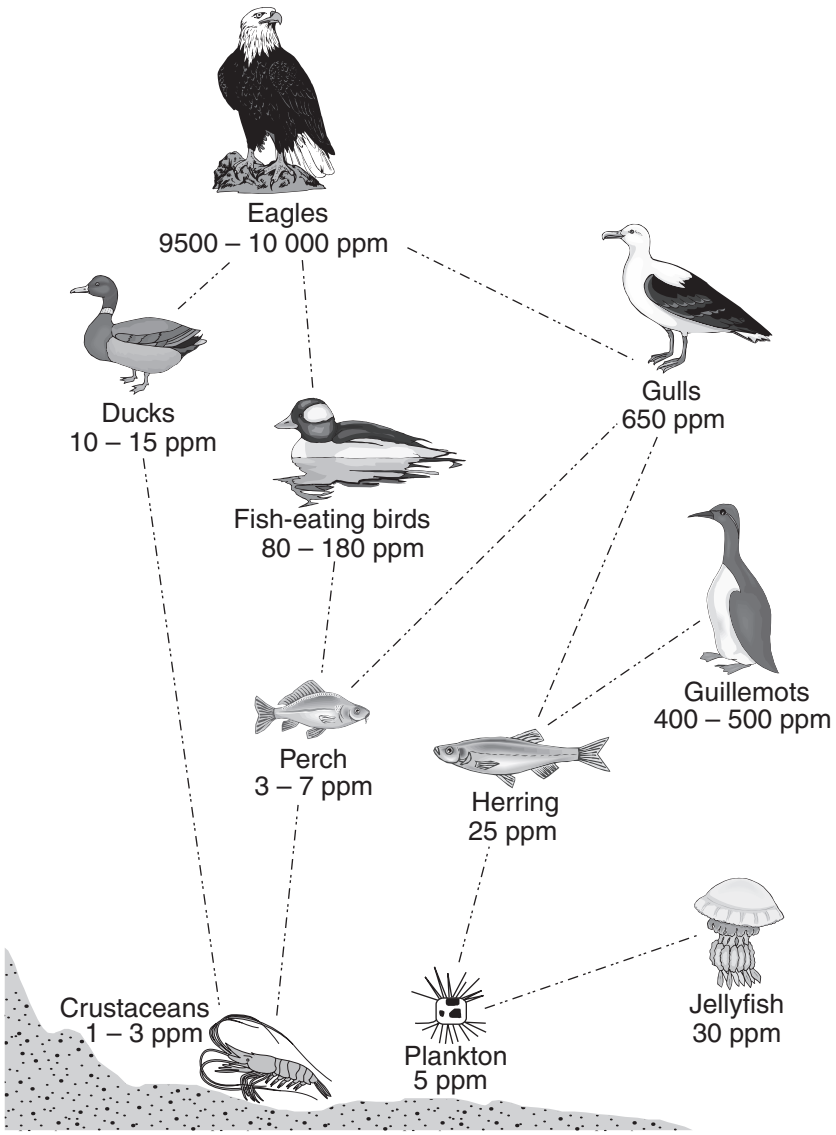
A. (A)

B. (B)

C. (C)

D. (D)

Use the following diagram of PCB levels in a community to answer question 11.



11. Which statement best explains the relatively high level of PCBs in eagles compared to those of guillemots?

    A. Both species are carnivores.
    B. Guillemots eat more herring than eagles do.
    C. Levels of PCBs are higher in marine environments.
    D. Eagles occupy a higher trophic level than guillemots.

Use the following article to answer question 12.

"Sorry, no eel pie today"

Eel pie, jellied eels, eel Florentine. The eels used in these dishes used to be abundant in Europe's ponds and streams but they may soon disappear.

The problem is that it only takes small amounts of polychlorinated biphenyls (PCBs), a common chemical pollutant, to kill eel embryos. Most European eels already have enough PCBs in them to stop them from reproducing.

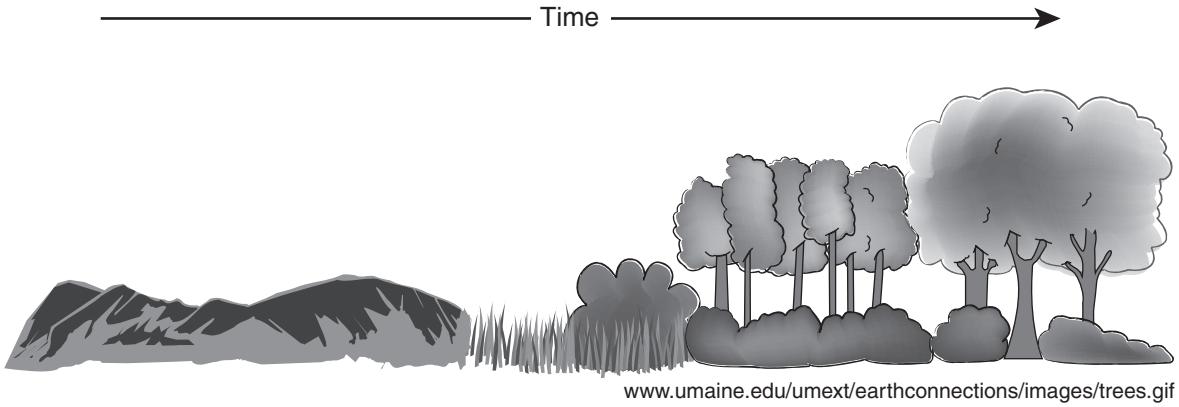
Overfishing was previously thought to have been the cause of the crash in the eel population. However, now that spawning has been observed in captivity, it has been found that a mother eel transfers PCBs from her body fat to her eggs. As a result, eel embryos die even when their mothers have PCB levels considered safe for human consumption.

Adapted from *New Scientist Print Edition,* March 11, 2006.

12. Which of the following is responsible for the observed decrease in the European eel population?

A. overfishing
B. loss of spawning grounds
C. PCB concentrations in eel eggs
D. increased predation on eel eggs

Use the following diagram of change over time to answer question 13.

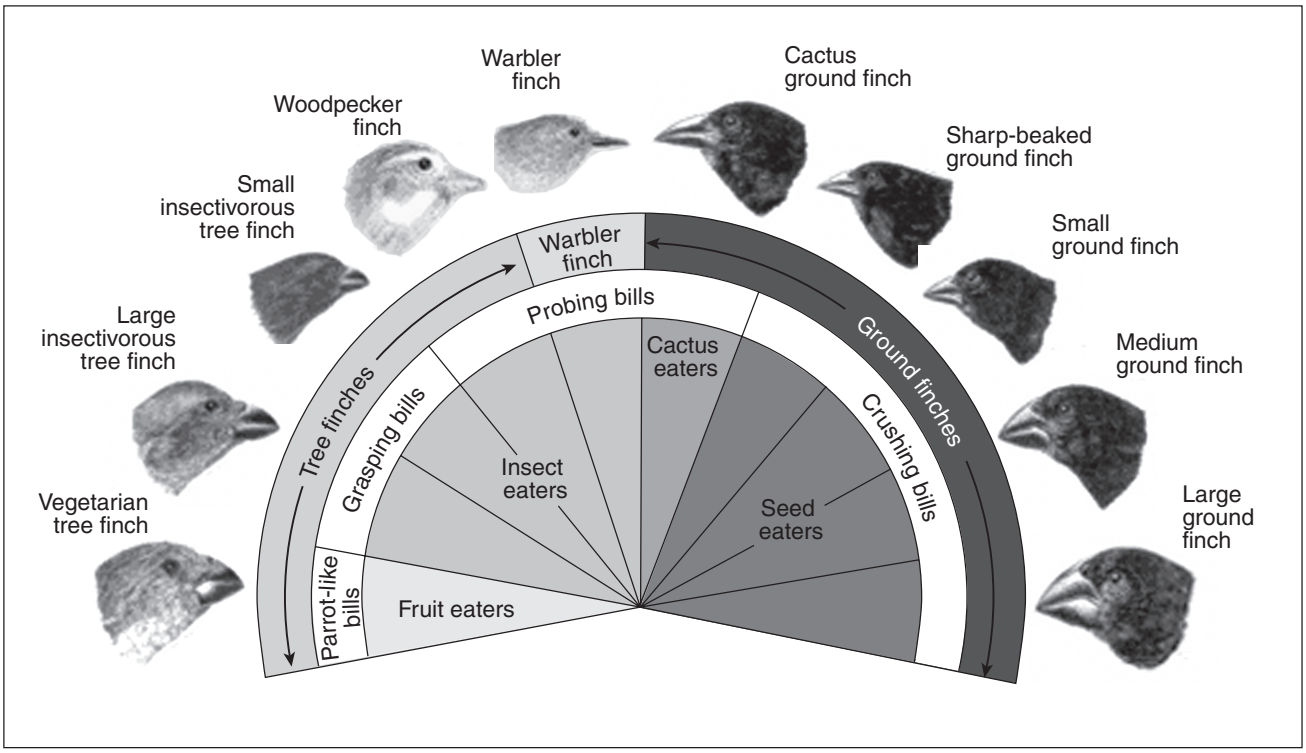


www.umaine.edu/umext/earthconnections/images/trees.gif

13. The diagram illustrates which of the following?

    A. biodegradation
    B. natural selection
    C. adaptive radiation
    D. ecological succession

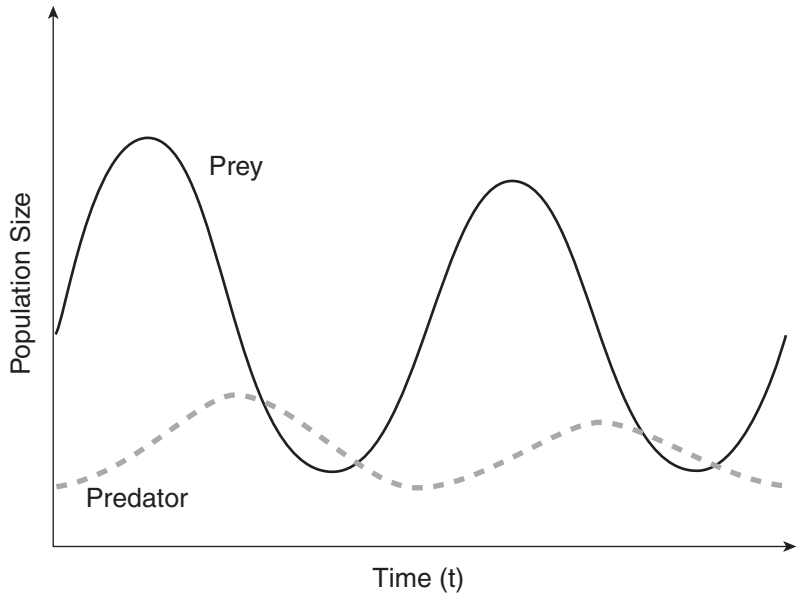
Use the following diagram to answer question 14.



14. The finches on the Galapagos Islands are different from island to island because of which of the following?

    A. different ages
    B. different sizes
    C. different predators
    D. different food sources

Use the following graph showing the relationship between predator and prey to answer questions 15 and 16.



15. The increase in the predator population size lags behind the increase in the prey population size.

    A. The statement is supported by the graph.
    B. The statement is refuted by the graph.
    C. The statement is neither supported nor refuted by the graph.

16. Which of the following situations contributes to the shape of the graph?

I	When the prey population is small, the predators have more difficulty capturing food and their population starts to decline.
II	In response to predator decline, the prey population starts to increase.
III	Both predator and prey populations increase until the increased number of predators causes the prey population to decline.
IV	As the predator population increases and eats more prey, the reduced prey population will lead to starvation among predators.

    A. I and II only
    B. I and IV only
    C. II and III only
    D. I, II, III and IV

Use the following article to answer question 17.

Were Volcanoes the Crucible of Life?

New research by scientists shows that volcanoes produce large quantities of biologically available nitrogen.

Some bacteria and fungi have evolved the ability to fix nitrogen themselves, and these biological processes, along with mankind's activities (such as the burning of fossil fuels), are the major sources of fixed nitrogen in present-day ecosystems.

Where did the nitrogen that enabled life to evolve come from in the first place? Previously, lightning and asteroid impacts have been suggested as the major fixed nitrogen sources in the Earth's atmosphere of about three billion years ago; volcanism had not previously been thought of as an important process.

New work shows that the high temperatures associated with volcanic activity might also have played an important role in helping to fix nitrogen. Higher levels of fixed nitrogen were found in volcanic plumes than in the surrounding air.

This shows that the heat from volcanoes allows the nitrogen and oxygen in the atmosphere to react together to form fixed nitrogen. The results suggest that volcanism may have been at least as important as lightning and asteroid impacts in converting atmospheric nitrogen into fixed nitrogen on the early Earth.

Adapted from http://131.111.150.52/news/press/dpp/2004100402, *4 October 2004*.
Photo: http://www.arenal.net/costa-rica-screensaver/arenal-volcano-screensaver.jpg

17. Which of the following describes nitrogen fixation in an active volcanic environment?

A. Heat from the volcano provides the energy to fix nitrogen.
B. Plants growing on cooling ashflows have the ability to fix nitrogen.
C. The burning of organic material on the slopes of volcanoes fixes nitrogen.
D. Bacteria and fungi on the flanks of the volcano have the ability to fix nitrogen.

18. Which of the following natural phenomena is most likely to cause widespread disease in human populations?

    A. fire
    B. El Niño
    C. flooding
    D. timber pest infestation

19. Which of the following explains why foreign species may be successful in a new ecosystem?

    A. Predators of the foreign species are absent.
    B. The foreign species prevents natural selection.
    C. A native species becomes a parasite on the foreign species.
    D. The foreign species causes adaptive radiation of native populations.

Use the following article to answer questions 20 and 21.

In March of 1989, the *Exxon Valdez* oil tanker spilled millions of litres of crude oil into the waters of Prince William Sound in Alaska. The spill killed many organisms, including an estimated 250 000 seabirds, 2800 sea otters, 300 harbour seals, 250 bald eagles and as many as 22 killer whales. Billions of salmon and herring eggs, as well as tidal plants and animals, were also smothered in oil.

Most of the fish and wildlife species that were affected have not fully recovered. Of the many species affected by the spill, only the river otter and bald eagle have returned to previous levels.

Killer whales, harbour seals and common loons have shown little sign of recovery in the area. Several other species, including sea otters and Pacific herring have made significant progress toward recovery, but are still not at the levels seen before the incident.

20. Which of the following organisms recovered most quickly after the oil spill?

A. harbour seals and salmon
B. river otters and bald eagles
C. killer whales and bald eagles
D. sea otters and Pacific herring

21. Which of the following describes the initial impact of the oil spill on the ecosystem?

A. Several animal species became extinct.
B. Adaptive radiation occurred in the seashore community.
C. There was an increase in the rate of ecological succession.
D. There was a reduction in the population of certain organisms.