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### Multiple Choice Questions

- Decide which of the choices best completes the statement or answers the question.
  - Locate that question number on the separate answer sheet provided.
  - Use the procedure described by your teacher to answer each question. For example, “fill in the circle that corresponds to your choice” or “make an X over the letter corresponding to your choice.”
1. A community plus the non-living factors with which it interacts is called a(n)
    - a. ecosystem.
    - b. biosphere.
    - c. biome.
    - d. population.
  2. “The fifty coyotes, *Canis latrans*, living in Waterton Lakes National Park in 2007” are defined, in ecological terms, as a(n)
    - a. ecosystem.
    - b. biosphere.
    - c. biome.
    - d. population.

*Use the following information to answer the next question.*

#### **Mule**

The mule is a cross between a donkey stallion (called a jack) and a horse mare. Hinnies are just the opposite. A stallion horse crossed to a donkey jennet can produce hinnies. Hinnies and mules are classified under the general term “mule.”

The mule is a sterile hybrid. The difference between the numbers of chromosomes in the cells of the donkey (62 chromosomes; 31 pairs) and the horse (64 chromosomes; 32 pairs) results in a mule or hinny with 63 chromosomes. This odd number is responsible for mule’s sterility—the donkey and horse chromosomes are unable to form matched pairs during the early stages of conception, resulting in the death of the reproductive cells.

Source: [http://www.ruralheritage.com/mule\\_paddock/mule\\_compare.htm](http://www.ruralheritage.com/mule_paddock/mule_compare.htm)

3. Which of the following statements best describes the relationship among horses, donkeys, and mules?
  - a. The horse and donkey are members of the same species because they can reproduce.
  - b. The horse and donkey are not members of the same species because their offspring are sterile (not fertile).
  - c. The horse and mule are members of the same species because they can reproduce.
  - d. The horse and mule are not members of the same species because their offspring are fertile.

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Use the following information to answer the next three questions.

### The Biosphere

All the ecosystems in the world and their interactions make up the biosphere. You can think of the biosphere as the largest possible ecosystem. The biosphere includes all parts of Earth that are inhabitable by some type of life.

Some ecologists organize the biosphere into different levels including

- 1 population
- 2 ecosystem
- 3 individual
- 4 community

### Numerical Response Question

- Record your answer on the answer sheet provided.
  - If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
1. The order in which these levels are organized from **smallest to largest** is \_\_\_\_, \_\_\_\_, \_\_\_\_, and \_\_\_\_\_. Record your **four-digit answer** in the numerical response section on the answer sheet

### Multiple Choice Questions

Use the following additional information to answer the next question.

### Purple loosestrife

Purple loosestrife (*Lythrum salicaria*) is a herbaceous wetland perennial that was introduced into North America from Europe in the early 1800s. It is believed that purple loosestrife arrived in the ballasts of cargo ships. Other possibilities include deliberate introduction as an herb, rootstalks brought over by horticulturalists, and seed transport via imported raw wool and sheep. Purple loosestrife has square, woody stalks growing to a height of 1-2 meters. It has smooth edged leaves that are 5-10 cm in length, attached directly to the stalk opposing one another (or occasionally, alternate). The plant forms 10-40 cm long pink/purple flowering spikes.

Purple Loosestrife invades native wetland communities, forming a single-species stand that no bird, mammal, or fish depends upon. Purple loosestrife germinates and grows faster than any native species. It soon forms dense, brush-like stands, usurping water and choking out native plants.

Source: [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/prm2593](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/prm2593)

4. If an ecologist was interested in the interactions of purple loosestrife with other native wetland species, the ecologist would most likely be studying
- a. individual species.
  - b. the community.
  - c. the biosphere.
  - d. individual populations.

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5. If an ecologist was interested in the interactions of all populations in this wetland together with the abiotic factors that surround and affect the wetland, the ecologist would most likely be studying
  - a. individual species.
  - b. the community.
  - c. the ecosystem.
  - d. individual populations.
6. Which of the following would be a biotic factor that could help shape an ecosystem?
  - a. The centimetres of precipitation that a region receives each year.
  - b. The intensity of sunlight reaching the forest floor.
  - c. The amount of phosphorous in the soil.
  - d. The number of large carnivores in a community.
7. The following statements discuss ecological principles. Identify the INCORRECT statement.
  - a. Populations are randomly scattered throughout the biosphere.
  - b. As populations in a community interact with one another, they can modify the environment so that it becomes suitable for other species.
  - c. Interactions that might influence the structure of a community include competition between individuals of the same species in different populations.
  - d. A population is a group of individuals of the same species living in a specific area at the same time.
8. The practice of classifying living things is called
  - a. biology.
  - b. genetics.
  - c. taxonomy.
  - d. gradualism.

Use the following information to answer the next question.

### Snowshoe Hare

The snowshoe hare, *Lepus americanus*, one of the most common boreal forest mammals, is found only in North America. It is shy and secretive, often undetected in summer, but its distinctive tracks and well-used trails (“runways” or “leads”) become conspicuous with the first snowfall.

9. Identify the row below that identifies the categories in the modern classification system of the scientific name for the snowshoe hare.

Row	<i>Lepus</i>	<i>americanus</i>
a.	kingdom	phylum
b.	class	order
c.	family	genus
d.	genus	species

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10. Which two domains contain the unicellular prokaryotes?

- Protista and Fungi
- Bacteria and Archaea
- Plantae and Animalia
- Fungi and Plantae

*Use the following information to answer the next question.*

### Six Kingdoms of Life

#### Description

- A** Organisms in this kingdom are very diverse and can exist in a wide range of habitats.
- B** Organisms in this kingdom were once thought to be plants. However, they obtain their food by secreting digestive enzymes onto a food source and then absorbing the molecules that are released by the enzymes.
- C** All of the organisms in this kingdom utilize the process of photosynthesis to make their own food.
- D** Organisms in this kingdom are specialized to live in extreme environments such as salt lakes, hot springs, and underwater thermal hot vents.
- E** Organisms in this kingdom include both unicellular and multicellular organisms. Some representatives are autotrophs while others are heterotrophs.
- F** Organisms in this kingdom ingest their food, and most are motile. All of the organisms have complex and specialized cells.

#### Kingdoms

- Archaea
- Bacteria
- Protista
- Fungi
- Plantae
- Animalia

### Numerical Response Question

2. Using the numbers above, match four Kingdoms to their respective descriptions. Record your **four-digit answer** on the numerical response section on the answer sheet.

**Kingdom:**

**Description:**

A

C

D

F

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## Multiple Choice Questions

Use the following information to answer the next question.

## Western Rattlesnake

The western rattlesnake, also called the prairie rattlesnake, is a brownish-green-coloured rattlesnake found across most of the United States west of Texas and the Dakotas. Western rattlesnakes are also found in northern Mexico and southwest Canada, mostly in grasslands and in brush. There are nine subspecies, one of which is found in southeastern Alberta.

The western rattlesnake eats small mammals, ground-nesting birds, amphibians, and reptiles, including other snakes. It locates its prey by using its tongue to sense airborne chemicals given off by the prey. Once the prey has been located, the rattlesnake rapidly strikes out with its fangs, then releases its prey quickly. Venom is released from the fangs when the snake strikes, immobilizing the prey, which the snake then tracks and eats. The venom also works to destroy tissue and help with the digestion of bulkier prey.

11. Which of the following statements about the western rattlesnake is NOT true?
- Venom enables the western rattlesnake to immobilize and ingest its prey immediately.
  - Populations share their habitat with animals such as small mammals and amphibians.
  - Its range includes parts of North and Central America.
  - Venom helps to destroy the tissue of the rattlesnake's prey.

Use the following additional information to answer the next two questions.

Western Rattlesnake ( <i>Crotalus viridis</i> )		Western Garter Snake ( <i>Thamnophis sirtalis</i> )	
domain	Eukarya	domain	Eukarya
kingdom	Animalia	kingdom	Animalia
phylum	Chordata	phylum	Chordata
class	Reptilia	class	Reptilia
order	Squamata	order	Squamata
family	Viperidae	family	Colubridae
genus	<i>Crotalus</i>	genus	<i>Thamnophis</i>
species	<i>viridis</i>	species	<i>sirtalis</i>

12. The rattlesnake and garter snake are structurally similar. Which of the following is the lowest level at which these similarities can be described?
- class
  - order
  - genus
  - species

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13. Predict the classification level that would first differentiate these snakes from a frog or a toad (amphibians).
- class
  - phylum
  - order
  - genus

*Use the following information to answer the next question.*

#### **Bull Trout**

At the turn of the century, bull trout were the predominant trout species in Alberta. They were found throughout rivers and streams in the prairie and parkland region of the province. In Central Alberta, bull trout were found in the Red Deer River drainage area and as far east as Edmonton in the North Saskatchewan River drainage area. In the Oldman and Bow River watersheds, bull trout occurred well downstream of Calgary and Lethbridge. This population still occurs, though it is seriously in decline.

Source: <http://www.flyfishalberta.com/trout/bulltrout.htm>

14. The information provided above is defining
- the ecological niche of the bull trout at the turn of the century.
  - the range of the bull trout at the turn of the century.
  - the ecosystem of the bull trout at the turn of the century.
  - the biodiversity of the bull trout at the turn of the century.

*Use the following information to answer the next question.*

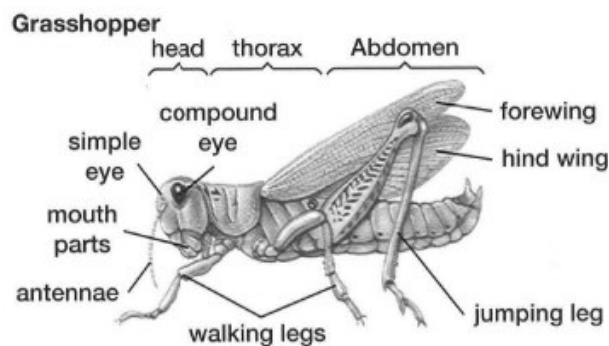
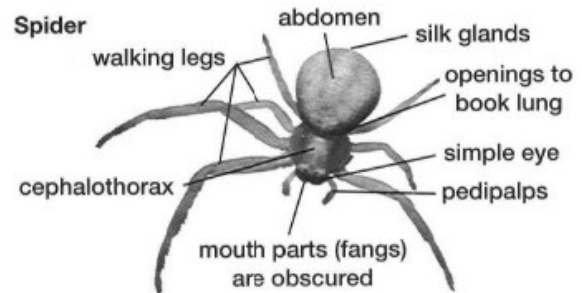
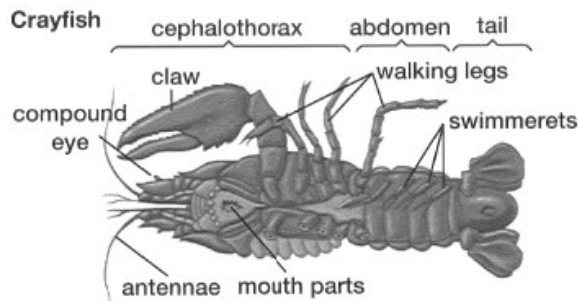
#### **Bald Eagle**

Bald eagles are found in coastal areas, rivers, large lakes, and mountainous areas. Bald eagles are found in Alaska, Canada, and along the coast of the southern United States. Bald eagles are diurnal (active during the day). Even though they are fish eaters, they will take ducks, birds, rodents, or whatever prey is available and easiest to obtain. Bald eagles are also known as scavengers because they will feed on carrion (dead and decaying flesh).

15. The information above includes a partial description of the bald eagle's
- ecological niche.
  - population.
  - biotic limiting factors.
  - abiotic limiting factors.

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*Use the following information to answer the next three questions.*



**Key to Selected Classes of the Phylum Arthropoda**

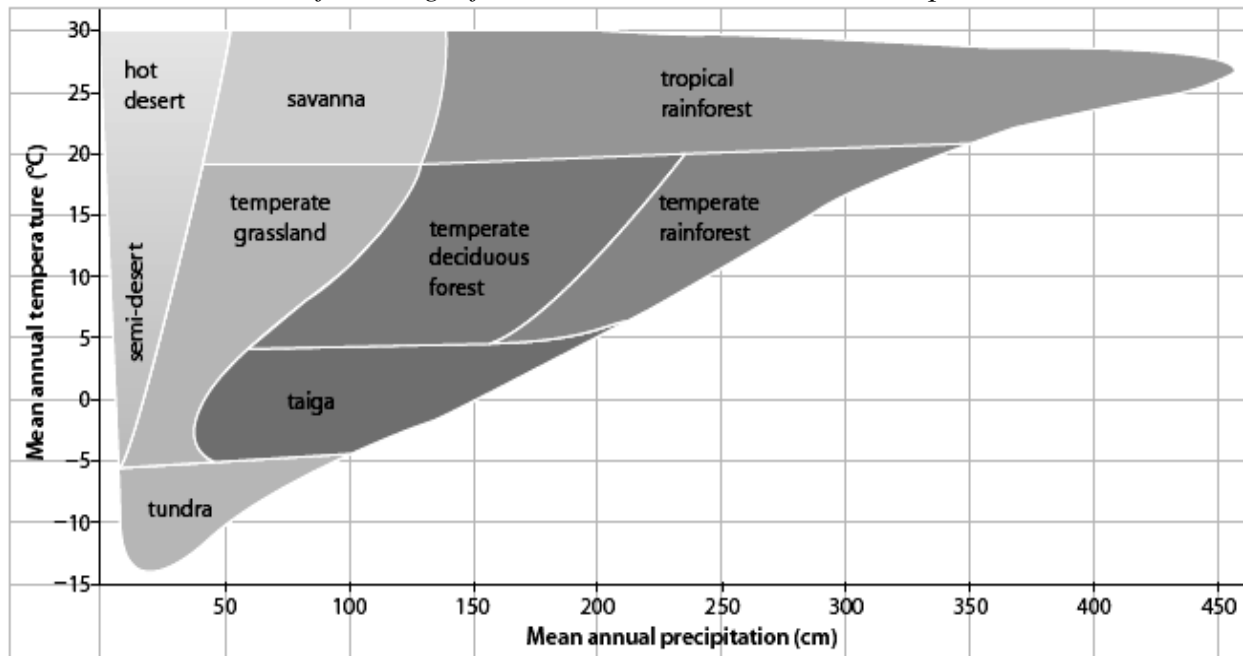
- 1 a. Walking legs, more than five pairs..... go to 2
- 1 b. Walking legs, 5 or fewer pairs ..... go to 3
- 2 a. Legs, 1 pair for each body segment ..... Class Chilipoda
- 2 b. Legs, 2 pairs for each body segment ..... Class Diplopoda
- 3 a. Antennae present ..... go to 4
- 3 b. Antennae absent ..... Class Archnida
- 4 a. Wings present..... Class Insecta
- 4 b. Wings absent..... Class Crustacea

16. Based on the key, the grasshopper would be classified in the
- a. Class Crustacea.
  - b. Class Archnida.
  - c. Class Diplopoda.
  - d. Class Insecta.
17. Based on the key, the steps that you would use to classify the crayfish are
- a. Step 1 b → Step 3 a → Step 4 b.
  - b. Step 1 a → Step 2 b.
  - c. Step 1 b → Step 3 b.
  - d. Step 1 b → Step 3 a → Step 4 a.

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18. The type of key used to classify the arthropods above is called
- a binomial key.
  - a dichotomous key.
  - a family key.
  - a kingdom key.

*Use the following information to answer the next three questions.*



**Terrestrial Biomes**

19. Identify the factor that most likely determines if an area is going to develop into a temperate grassland, a temperate deciduous forest, or a temperate rainforest.
- the temperature in the area.
  - the amount of precipitation the area receives.
  - the latitude of the area.
  - the amount of sunlight the area receives.
20. Identify the factor that most likely determines if an area is going to develop into a tundra region or a desert.
- The tundra receives more precipitation than the desert.
  - The tundra is located in a more southerly latitude.
  - The tundra receives less direct sunlight.
  - The tundra soil supports an abundance of producers.



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21. Which of the following statements is INCORRECT?

- The unequal heating of the atmosphere set up conditions that produce global air and water currents that interact with physical features to produce various patterns of rainfall.
- The pattern of precipitation influences the types of soil that form in different regions that, when combined with other factors, determines the types and abundance of plants that can survive.
- An increase in mean annual temperature and mean annual precipitation will usually result in a decrease in the biodiversity of an area.
- Each terrestrial biome is characterized by communities of species with similar adaptations to that particular combination of physical conditions.

*Use the following information to answer the next question.*

### **Richardson's Ground Squirrels**

At home in the short-grass prairie of North America, the range of Richardson's ground squirrels includes portions of Alberta, Saskatchewan, Manitoba, Montana, North Dakota, South Dakota, and Minnesota.

Richardson's ground squirrels prefer open terrain with high visibility to detect approaching predators. They fare well in human-modified areas such as city parks, over-grazed pastures, the edges of cultivated fields, and perennial crop fields.

Source: [http://people.uleth.ca/~michener/habitat\\_range.htm](http://people.uleth.ca/~michener/habitat_range.htm)

22. The range of the Richardson's ground squirrel does not include

- open terrain.
- human-modified areas.
- cultivated fields.
- short grass prairie of North America.

*Use the following information to answer the next two questions.*

### **Dissolved Oxygen**

The amount of oxygen dissolved in the water of a lake or a river depends on several factors including

- temperature
- flow of the water (slow or turbulent)

The colder the water, the more oxygen can be dissolved in the water. Therefore, dissolved concentrations at one location are usually higher in the winter than in the summer.

In fast-moving streams, rushing water is aerated by bubbles as it churns over rocks and falls down hundreds of tiny waterfalls. These streams, if unpolluted, are usually saturated with oxygen. In slow, stagnant waters, oxygen only enters the top layer of water, and deeper water is often low in dissolved oxygen concentration.

Source: <http://bcn.boulder.co.us/basin/data/BACT/info/DO.html>

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23. Trout require dissolved oxygen levels to stay above 6 mg/L. Should dissolved oxygen levels drop below this level, trout will be under stress and/or die. In the case of trout, the dissolved oxygen level in water is an example of
- a biotic limiting factor.
  - competition.
  - predation.
  - an abiotic limiting factor.

*Use the additional information to answer the next question.*

Dams slow water down, and therefore can affect the dissolved oxygen concentration of water downstream. If water is released from the top of the reservoir, it can be warmer because the dam has slowed the water, giving it more time to warm up and lose oxygen. If dams release water from the bottom of a reservoir, this water will be cooler but may be low in dissolved oxygen due to decomposition of organic matter by decomposers.

24. In this case, the decomposition of organic matter by decomposers causes lower dissolved oxygen levels. The result is the death of many fish. This is an example of
- a biotic factor affecting an abiotic limiting factor.
  - competition affecting a biotic limiting factor.
  - predation affecting an abiotic limiting factor.
  - an abiotic factor limiting affecting a biotic factor.

*Use the following information to answer the next two questions.*

### **Moose and Winter Ticks**

Significant mortality of moose (*Alces alces*) occurred throughout broad regions of northern and western Alberta in early 1999. Occurrences\* involving moose were recorded at local Alberta Natural Resources Service (NRS) district offices. A total of 1130 occurrence reports involving moose throughout Alberta between January 1 and April 30, 1999 were submitted to the author for review. Although there was considerable inherent bias in the sample, some general patterns emerged. Most moose (92 percent) had evidence of hairloss and 28 percent of them were dead. In the overall sample, 35 percent were calves; however in the subsample of dead moose with hairloss, 43 percent were calves. It is assumed that the hairloss was a result of infestation with winter tick, *Dermacentor albipictus*. Most occurrences (96 percent) were within the boreal habitats of northern and western Alberta and half of them were recorded in March (50 percent). It is apparent that excessive mortality of moose, particularly calves, occurred in late winter. The outbreak is considered a direct result of the interactions among moose, ticks, habitat, and weather. Weather appears to have been the ultimate force driving the interactions. Late winter snow cover, and moose densities may provide clues for potential management actions in the subsequent fall period.

\* Occurrences include situations in which officers or biologists directly handle an animal, receive phone calls from the public or industry regarding animals in distress or found dead, and situations in which wildlife become a nuisance or a concern for public safety.

Source: <http://www.srd.gov.ab.ca/fw/diseases/pdf/moosetick.pdf>

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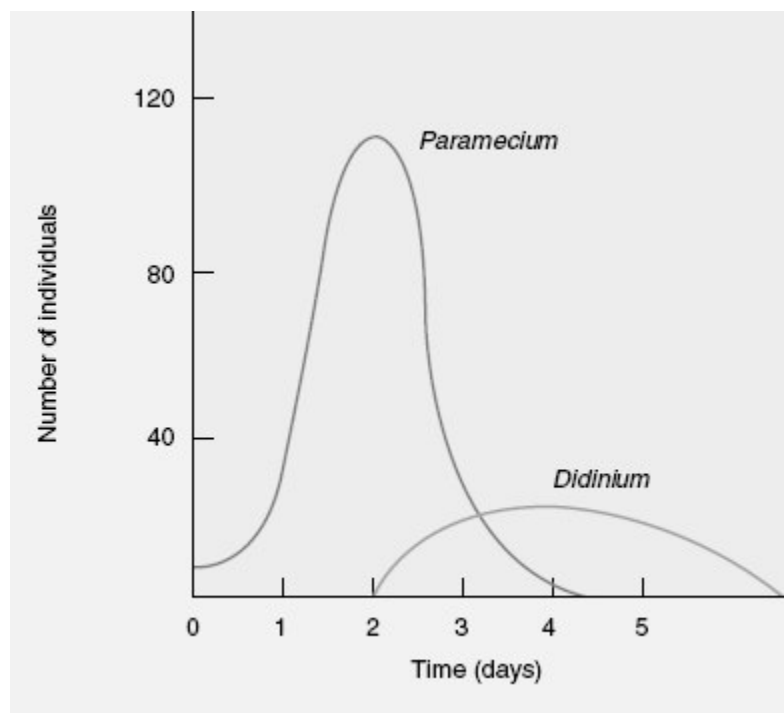
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25. The biotic limiting factor that played a role in the mortality of the moose population in northern Alberta in 1999 was most likely
- the late winter snow.
  - a parasitic infestation of the winter tick.
  - intraspecific competition as members of the moose population competed for food.
  - interspecific competition as members of the moose population competed for food.
26. Predict which of the following would be a result of the loss of so many moose in 1999.
- There would be more hosts for the winter ticks.
  - The population of wolves and other large carnivores would increase.
  - The vegetation normally eaten by the moose would be rejuvenated.
  - The vegetation normally eaten by the moose would die off because of increased competition.

Use the following information to answer the next three questions.

### Paramecium and Didinium

In the 1930s a Russian biologist named G. F. Gause used two species of microscopic protozoans, *Paramecium sp.* and *Didinium sp.*, to examine predator-prey relationships. Gause conducted an experiment using two flasks. In flask 1, he put some *Paramecium sp.* and their food. In flask 2, Gause put *Paramecium sp.*, their food, and some *Didinium sp.*. *Didinium sp.* is a predator of *Paramecium sp.* Gause observed the growth of the *Paramecium sp.* in these two flasks for several weeks. He took daily samples to see how the population was changing. The results from flask 2 are shown in this graph:



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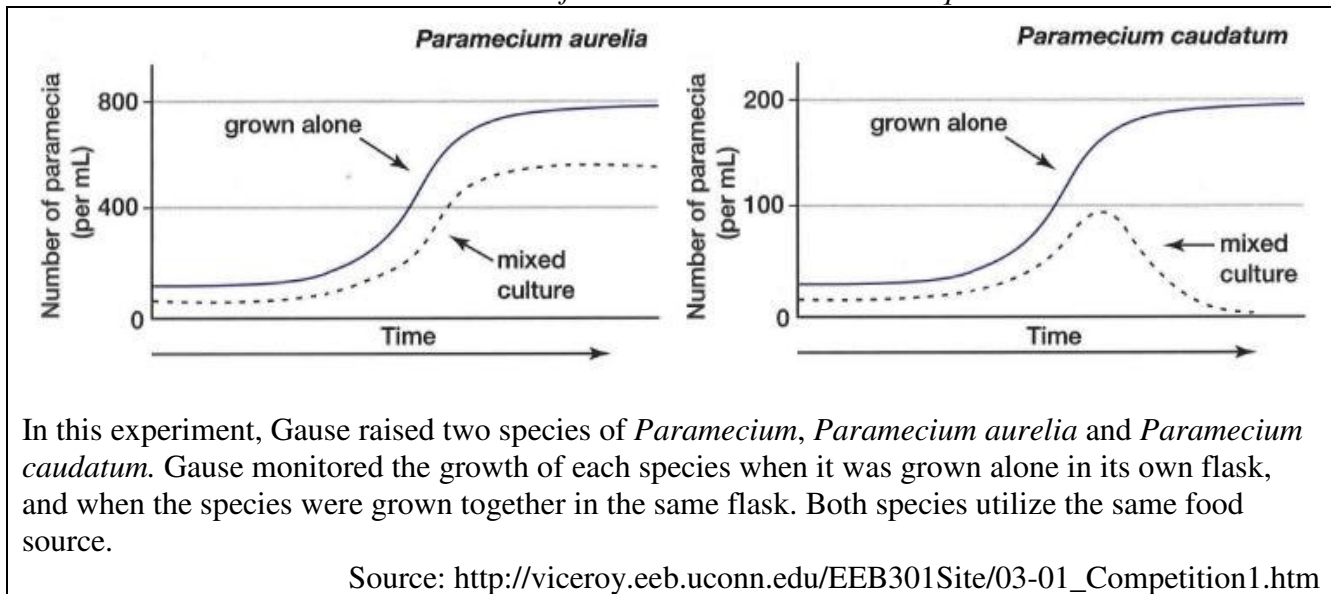
27. Which row below best explains the results of adding the *Didinium* to the *Paramecium* culture in flask 2?

Row	Impact on the <i>Paramecium</i> Population	Impact on the <i>Didinium</i> Population
a.	no impact	no impact
b.	population increased continuously	population increased at first then decreased
c.	population increased continuously	population increased continuously
d.	population decreased	population increased at first then decreased

28. This relationship is best defined as

- a biotic interaction; prey-predator.
- an abiotic interaction; prey-predator.
- a biotic interaction; interspecific competition.
- an abiotic interaction; intraspecific competition.

Use this additional information to answer the next question.



29. The relationship above is best defined as

- a biotic interaction; prey-predator.
- an abiotic interaction; prey-predator.
- a biotic interaction; interspecific competition.
- an abiotic interaction; intraspecific competition.

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30. Which of the following statements is INCORRECT?

- The most common way to determine the size of a population is to count or estimate the number of individuals in a number of samples.
- A transect consists of a long triangle and a line of a certain length. The occurrence of any individual within a certain distance of the line is recorded.
- Ecologists tend to use quadrats to sample a stationary population.
- The density of a population is determined by determining the size of the quadrat and then dividing this by the average number of individuals in the quadrat.

### Written Response Questions

*Use the following information to answer the following questions.*

#### **Canada Lynx – Snowshoe Hare**

In 1992, the Canada lynx were at the lowest point in their 10-year population cycle. The population of their main prey, the snowshoe hare, had crashed from a high of seven to nine hares per hectare in 1990 to one hare or less per hectare in 1991. The winter after that crash, the lynx had dropped from a high of 30 lynx per 100 square kilometres to three lynx per 100 square kilometres.

The 10-year cycle of life and death between populations of snowshoe hare and Canada lynx is an old story first recorded in the fur returns of early Hudson's Bay Company traders. The cycle is based on the lynx's preference for hare flesh above all other. Lynx will eat grouse, ptarmigan, mice, voles, red squirrels, carrion, and almost any other flesh. Yet when hares are plentiful, they eat almost nothing else. And when hares are scarce, although many lynx starve to death and few kittens that are born survive, some plump and healthy lynx have been found.

The hare population increases until the winter's "browse" is eaten bare. If you fell an aspen and leave it where it falls, bunnies descend on it like fuzzy piranhas and nibble it bare. In response to intensive browsing by hares, most vegetation produces secondary compounds—chemicals which make browsable plants less palatable and nutritious. The increase of these chemicals occurs in cycles, and this too plays a role in triggering hare population crashes. As the food supply disappears, hares, like the lynx, will cannibalize their dead. A hare's fat reserves are very slight. Weakened by hunger and cold, hares soon begin to starve. Lynx and other predators gorge on hares and continue to breed, producing young at a peak rate until they run out of prey.

After a spike in hare mortality, plant growth slowly recovers, and the number of predators declines. With fewer predators present, the hare population begins to rebuild as forage improves. As a result, surviving adult lynx, finding more bunnies to eat, will begin to produce young again, and so the cycle continues as it has from time immemorial.

Source: The Lynx and the Hare, based on the feature article by Sid Marty, appearing in Canadian Geographic Magazine: <http://lynx.uio.no/jon/lynx/cglynx1a.htm>

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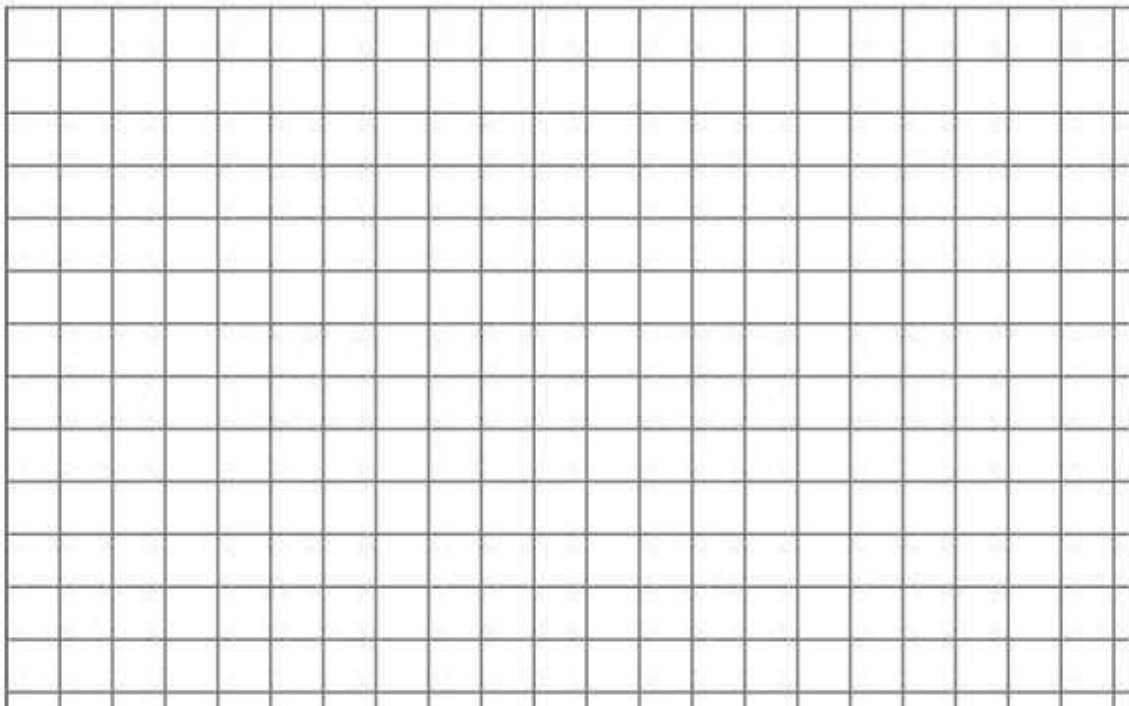
1. a) **Identify** the relationship exhibited by the Canada lynx and the snowshoe hare. (1 mark)

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- b) **Sketch a graph** illustrating the 10 year population cycles of the Canada lynx and snowshoe hare. You do not have to use actual population data to draw this graph. (5 marks)



- c) **Explain**, in terms of limiting factors, why the snowshoe hare population increases for a number of years and then decreases rapidly. (4 marks)

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d) **Explain**, in terms of limiting factors, why the Canada lynx population increases for a number of years and then decreases rapidly. (4 marks)

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e) **Predict** how human activities could disrupt the relationship between the Canada lynx and the snowshoe hare. (3 marks)

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