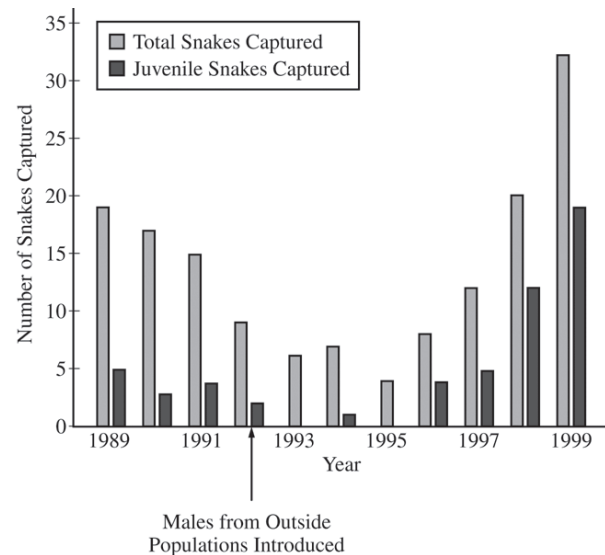


6. In an attempt to rescue a small isolated population of snakes from decline, a few male snakes from several larger populations of the same species were introduced into the population in 1992. The snakes reproduce sexually, and there are abundant resources in the environment.

The figure below shows the results of a study of the snake population both before and after the introduction of the outside males. In the study, the numbers of captured snakes indicate the overall population size.



- (a) **Describe** ONE characteristic of the original population that may have led to the population's decline in size between 1989 and 1993.
- (b) **Propose** ONE reason that the introduction of the outside males rescued the snake population from decline.
- (c) **Describe** how the data support the statement that there are abundant resources in the environment.

**BIOLOGY****Section II****8 Questions****Planning Time—10 minutes****Writing Time—80 minutes**

**Directions:** Questions 1 and 2 are long free-response questions that require about 22 minutes each to answer and are worth 10 points each. Questions 3–8 are short free-response questions that require about 6 minutes each to answer. Questions 3–5 are worth 4 points each and questions 6–8 are worth 3 points each.

Read each question carefully and completely. Write your response in the space provided for each question. Only material written in the space provided will be scored. Answers must be written out in paragraph form. Outlines, bulleted lists, or diagrams alone are not acceptable.

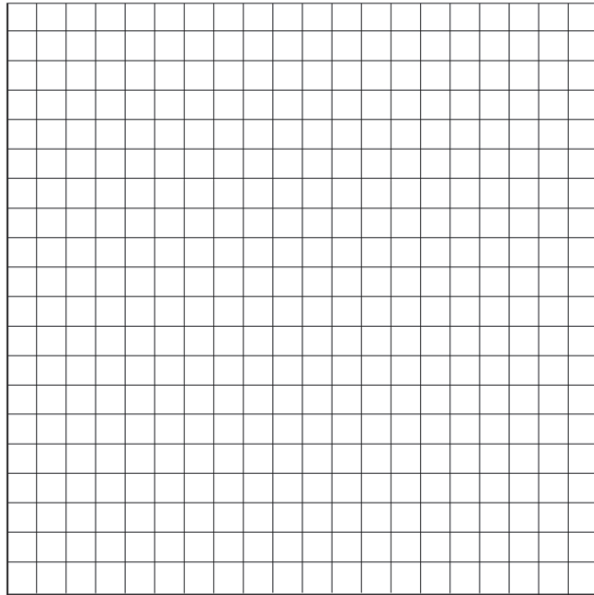
1. Trichomes are hairlike outgrowths of the epidermis of plants that are thought to provide protection against being eaten by herbivores (herbivory). In a certain plant species, stem trichome density is genetically determined.

To investigate variation in stem trichome density within the plant species, a student counted the number of trichomes on the stems of six plants in each of three different populations. The student used the data to calculate the mean trichome density (numbers of hairs per square centimeter) for each population. The results are provided in the table below.

TRICHOME DENSITY IN THREE PLANT POPULATIONS (number of trichomes/cm<sup>2</sup>)

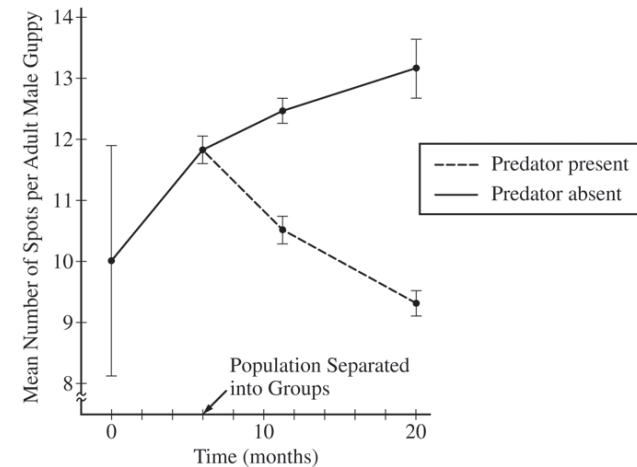
| Population | Plant 1 | Plant 2 | Plant 3 | Plant 4 | Plant 5 | Plant 6 | Mean | Standard Error of the Mean (SEM) |
|------------|---------|---------|---------|---------|---------|---------|------|----------------------------------|
| I          | 8       | 11      | 9       | 10      | 8       | 6       | 9    | 1                                |
| II         | 12      | 6       | 15      | 9       | 13      | 8       | 11   | 1                                |
| III        | 13      | 17      | 9       | 14      | 12      | 16      | 14   | 1                                |

- (a) On the axes provided, **create** an appropriately labeled graph to illustrate the sample means of the three populations to within 95% confidence (i.e., sample mean  $\pm$  2 SEM).
- (b) Based on the sample means and standard errors of the means, **identify** the two populations that are most likely to have statistically significant differences in the mean stem trichome densities. **Justify** your response.
- (c) **Describe** the independent and dependent variables and a control treatment for an experiment to test the hypothesis that higher trichome density in plants is selected for in the presence of herbivores. **Identify** an appropriate duration of the experiment to ensure that natural selection is measured, and **predict** the experimental results that would support the hypothesis.



4. Adult male guppies (*Poecilia reticulata*) exhibit genetically determined spots, while juvenile and adult female guppies lack spots. In a study of selection, male and female guppies from genetically diverse populations were collected from different mountain streams and placed together in an isolated environment containing no predators.

The study population was maintained for several generations in the isolated area before being separated into two groups. One group was moved to an artificial pond containing a fish predator, while a second group was moved to an artificial pond containing no predators. The two groups went through several generations in their new environments. At different times during the experiment, the mean number of spots per adult male guppy was determined as shown in the figure below. Vertical bars in the figure represent two standard errors of the mean (SEM).



- (a) **Describe** the change in genetic variation in the population between 0 and 6 months and **provide** reasoning for your description based on the means and SEM.
- (b) **Propose** ONE type of mating behavior that could have resulted in the observed change in the number of spots per adult male guppy between 6 and 20 months in the absence of the predator.
- (c) **Propose** an evolutionary mechanism that explains the change in average number of spots between 6 and 20 months in the presence of the predator.