

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/cm²)

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.

