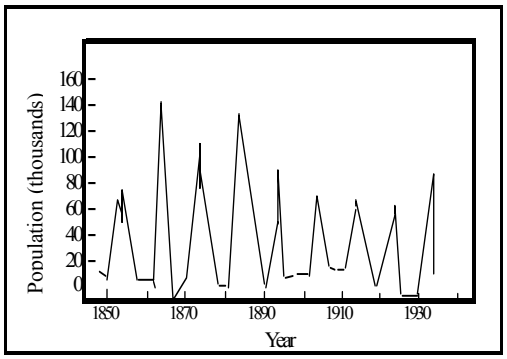
MAJOR FIELD TEST IN BIOLOGY
SAMPLE QUESTIONS

The following questions illustrate the range of the test in terms of the abilities measured, the disciplines covered, and the difficulty of the questions posed. They should not, however, be considered representative of the entire scope of the test in either content or difficulty. An answer key follows the questions.



1. The curve in the graph above represents the population size of the snowshoe hare, a prey species in northern Canada and Alaska. If one assumes that the predator and prey have mutual density dependent effects on one another, the curve drawn for the simultaneous population size of the lynx, a predator on the snowshoe hare, would most likely

   (A) have peaks simultaneously with the peaks for the prey
   (B) have peaks halfway between the peaks for the prey
   (C) have peaks slightly before the peaks for the prey
   (D) have peaks slightly after the peaks for the prey
   (E) be essentially a horizontal line

2. Cytoplasmic streaming in cells is a phenomenon that

   (A) depends on intracellular microfilaments
   (B) depends on extracellular collagen
   (C) is caused by cilia and flagella
   (D) occurs only in prokaryotes
   (E) is absent in green plants

3. A circadian rhythm is best exemplified by the

   (A) emergence patterns of 17-year cicadas
   (B) annual migration patterns of monarch butterflies
   (C) daily activity patterns of a rat
   (D) scheduled mealtimes of a school child
   (E) menstrual cycle of an adult human female

4. Flame cells, green glands, and Malpighian tubules are all specialized structures involved in

   (A) digestion
   (B) excretion
   (C) respiration
   (D) energy transfer
   (E) reproduction

5. All of the following occur in the light reactions of photosynthesis EXCEPT the

   (A) transfer of electrons to ferredoxin
   (B) oxidation of water molecules
   (C) formation of ADP molecules
   (D) utilization of photons
   (E) formation of O_2 molecules

6. Compared to a eutrophic lake, an oligotrophic lake tends to have a greater

   (A) supply of oxygen in the deep waters
   (B) number of blue-green algae
   (C) biological oxygen demand
   (D) amount of hydrogen sulfide
   (E) amount of degradable organic matter

7. Higher plants have a polar main axis with definite stem and root ends. This polarity is first established

   (A) when the seedling first grows into the light
   (B) when germination first starts in the soil
   (C) in the embryo of the seed
   (D) at the time the plant is old enough to produce leaves
   (E) just before the flower forms on the parent plant

8. The membranes of mitochondria, chloroplasts, and bacteria do all of the following EXCEPT

   (A) generate ATP
   (B) generate chemical gradients
   (C) generate electrical potentials
   (D) pump ions against concentration gradients
   (E) catalyze the reaction of the Krebs cycle

9. Which of the following is released by the placenta and acts to assist in the maintenance of pregnancy?

   (A) Chorionic gonadotropin
   (B) Vasopressin
   (C) Thyroxine
   (D) Luteinizing hormone
   (E) Oxytocin

10. The evolutionary process most likely to account for the fixation of neutral or even nonadaptive genes or gene combinations in small populations is called

    (A) recombination
    (B) Lamarckian selection
    (C) Darwinian selection
    (D) Genetic drift
    (E) Mutation

11. Low species diversity would be expected in which of the following communities?

    (A) Those with greater primary than secondary productivity
    (B) Those under constant conditions
    (C) Those in unpredictable or severe environments
    (D) Those in the tropics
    (E) Those inhabiting land masses with vast areas

Questions 12 and 13

Directions: The following questions consist of five lettered headings followed by a list of numbered words, phrases, sentences, or figures. For each numbered word, phrase, sentence, or figure, select the one heading that is most closely related to it and fill in the corresponding oval on the answer sheet. One heading may be used once, more than once, or not at all in each group.

(A) Differentiation
(B) Determination
(C) Pattern formation
(D) Induction
(E) Plasticity

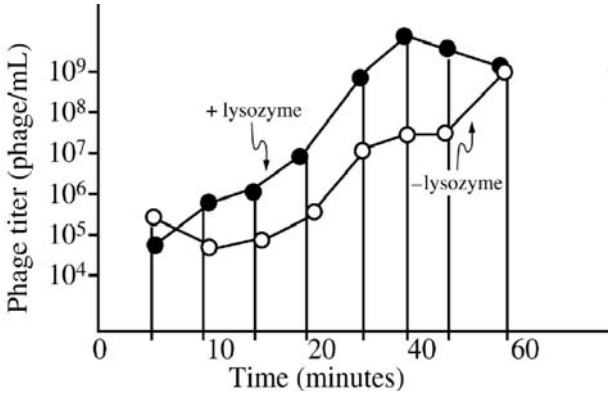
12. A group of unspecialized embryonic cells is transplanted from a leg bud to a wing bud in the chick embryo, and develops into toes.

13. The lens of the vertebrate eye develops only after the head ectoderm comes in contact with the optic cup.

Questions 14 and 15

Directions: The following questions concern a laboratory or experimental situation. In each case, first study the description of the situation. Then choose the one best answer to each question following it and fill in the corresponding oval on the answer sheet.

Questions 14-15 are based on the following diagram and information.



The one-step growth curve of bacteriophage T4 was constructed as follows:

A 0.1 mL sample of T4 phage suspension (10^9 phage / mL) was mixed with 100 mL of cultured E. coli (10^7 bacteria/mL) and incubated at 37° C. At regular intervals the culture was shaken and duplicate samples of the infected bacteria were collected. Each sample was mixed with chloroform to kill the bacteria. One sample was treated with lysozyme to break open the bacteria and the other was not treated. Neither chloroform nor lysozyme kills T4. The titer of the phage in all samples was measured and the data were plotted in the diagram above.

14. The data from this experiment indicate that

(A) *E. coli* cells cannot contain multiple copies of the phage at one time.
(B) Lysozyme accelerates the rate of replication of T4 phage.
(C) The absence of lysozyme affects young phages more adversely than it does older phages.
(D) The population of T4 phage almost doubled within the first hour of incubation.
(E) Replicated phages are present within the bacterial cells 10-20 minutes before they are released from the cells.

15. What was the initial concentration of T4 phage after adding it to the bacterial culture?

(A) 10^5 phage/mL
(B) 10^6 phage/mL
(C) 10^7 phage/mL
(D) 10^8 phage/mL
(E) 10^9 phage/mL

ANSWER KEY

1. D	9. A
2. A	10. D
3. C	11. C
4. B	12. B
5. C	13. D
6. A	14. E
7. C	15. B
8. E	