

Packet # 8

Base your answers to questions 43 through 46 on the information below and on your knowledge of biology.

**For Teacher
Use Only**

Three students each added equal volumes of pond water to four beakers and placed each beaker in a different water bath. Each student maintained the water baths at temperatures shown in the data table. The students then added an equal number of water fleas to each of their four beakers. After one hour, the students used microscopes to determine the average heart rate of the water fleas. The procedure was repeated for a total of three trials at each temperature. The results of the investigation are summarized in the data table.

Water Flea Heart Rate

Water Temperature (°C)	Average Water Flea Heart Rate (beats/minute)
5	40
15	119
25	205
35	280

Directions (1-2): Using the information in the data table, construct a line graph on the grid provided, following the directions below.

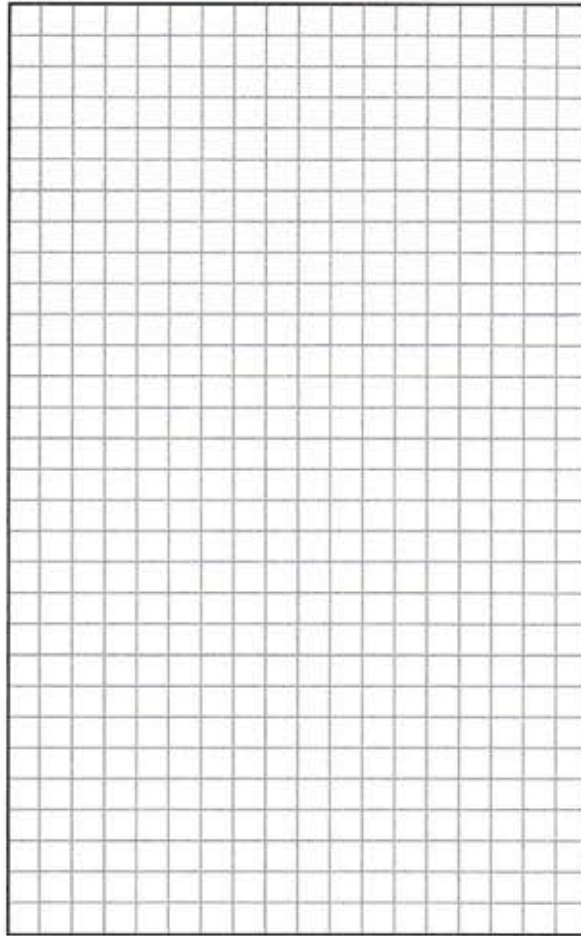
1. Mark an appropriate scale on each labeled axis. [1]
2. Plot the data for the average heart rate on the grid. Surround each point with a small circle and connect the points. [1]

Example:



**The Effect of Temperature on
Water Flea Heart Rate**

Average Water Flea Heart Rate (beats/min)



Water Temperature (°C)

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3. The independent variable in this investigation is the

- (1) number of trials
- (2) number of water fleas
- (3) temperature of the water
- (4) average heart rate

4. State the relationship between temperature and heart rate in water fleas. [1]

Part D

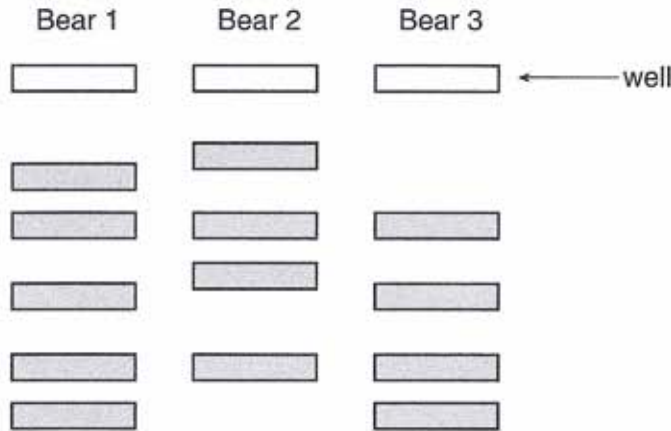
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Answer all questions in this part. [13]

Directions (16 - 19): For those questions that are followed by four choices, circle the number of the choice that best completes the statement or answers the question. For all other questions in this part, follow the directions given in the question.

Base your answers to questions 61 through 64 on the information and diagram below and on your knowledge of biology.

The diagram below shows the results of a test that was done using DNA samples from three bears of different species. Each DNA sample was cut into fragments using a specific enzyme and placed in the wells as indicated below. The DNA fragments were then separated using gel electrophoresis.



6. Which *two* bears are most closely related? Support your answer with data from the test results. [2]

7. Identify one additional way to determine the evolutionary relationship of these bears. [1]

8. Gel electrophoresis is used to separate DNA fragments on the basis of their

- (1) size
- (2) color
- (3) functions
- (4) chromosomes

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9. Identify one procedure, other than electrophoresis, that is used in the laboratory to separate the different types of molecules in a liquid mixture. [1]

10. On a television talk show, a guest claims that people who exercise vigorously for 15 minutes or more every day are able to solve math problems more rapidly than people who have no vigorous exercise in their daily routine.

Describe a controlled experiment that could be conducted to test this claim. In your description be sure to:

- state the purpose of the experiment [1]
- state why the sample to be used should be large [1]
- describe how the experimental group will be treated and how the control group will be treated [2]
- state the specific data to be collected during the experiment [1]
- state one way to determine if the results support the claim [1]

Base your answers to questions // through //4 on the information and data table below and on your knowledge of biology.

**For Teacher
Use Only**

A student counted the total number of leaves in a group of duckweed plants (*Lemna gibba*) over a 5-day period. The data collected are shown in the table below.

Growth of Duckweed Leaves

Time in Days	Number of Leaves
0	15
1	20
2	25
3	40
4	60
5	80

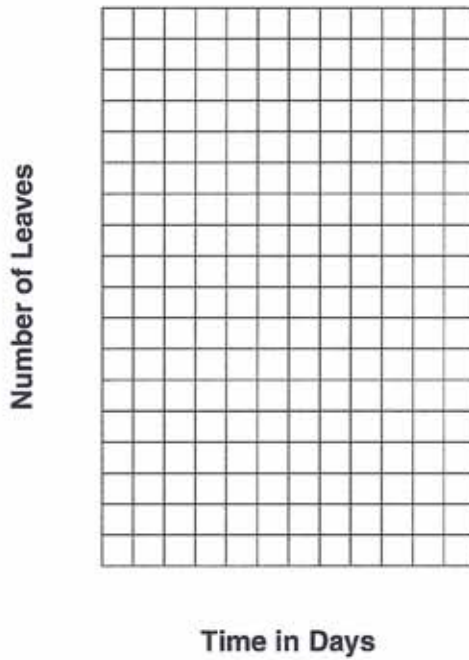
Directions (-): Using the information in the data table, construct a line graph on the grid provided on the next page following the directions below.

// Mark an appropriate scale on each labeled axis. [1]

//2 Plot the data from the data table. Surround each point with a small circle and connect the points. [1]

Example: 

Growth of Duckweed Leaves



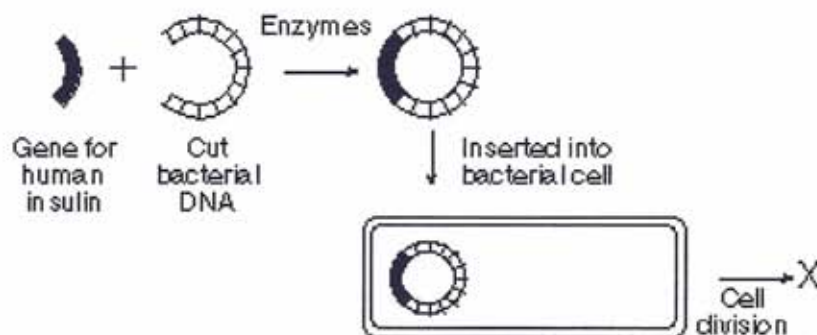
**For Teacher
Use Only**

13. The time it takes for the number of leaves to increase from 15 to 30 is approximately

- (1) 2.0 days
- (2) 2.3 days
- (3) 2.9 days
- (4) 3.2 days

14. State what would most likely happen to the production of oxygen by duckweed plants if the intensity and duration of exposure to light were increased. [1]

15. The diagram below illustrates some key steps of a procedure in one area of biotechnology.



The letter X most likely represents

- 1 bacterial cells that are unable to synthesize insulin
- 2 human cells that are able to synthesize antibodies
- 3 bacterial cells that are able to synthesize insulin
- 4 human cells that are unable to resist antibiotics

16. Which statement about the rates of evolution for different species is in agreement with the theory of evolution?

- 1 They are identical, since the species live on the same planet.
- 2 They are identical, since each species is at risk of becoming extinct.
- 3 They are different, since each species has different adaptations that function within a changing environment.
- 4 They are different, since each species has access to unlimited resources within its environment.

17. Which concept is not a part of the theory of evolution?

- 1 Present-day species developed from earlier species.
- 2 Some species die out when environmental changes occur.
- 3 Complex organisms develop from simple organisms over time.
- 4 Change occurs according to the needs of an individual organism to survive.

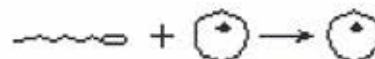
18. Warts result when certain viruses cause skin cells to reproduce at a high rate. This rapid reproduction of skin cells is due to the viruses stimulating

- | | |
|-------------------------|-------------------------|
| 1 cellular digestion | 3 synthesis processes |
| 2 mitotic cell division | 4 meiotic cell division |

19. Even though the environment changes, a population that occupies a given geographic area will most likely continue to be found in this area if the

- 1 variations in the population decrease over time
- 2 members of the population decrease in number
- 3 members of the population exceed the carrying capacity
- 4 population passes on those genes that result in favorable adaptations

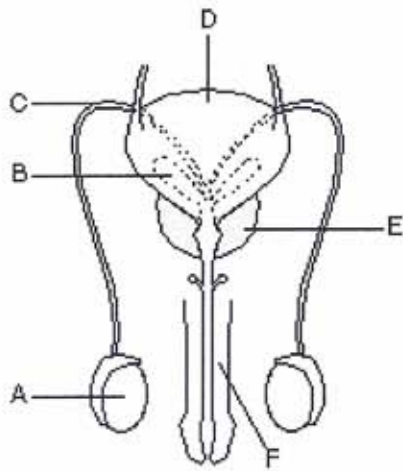
20. The diagram below represents a reproductive process that takes place in humans.



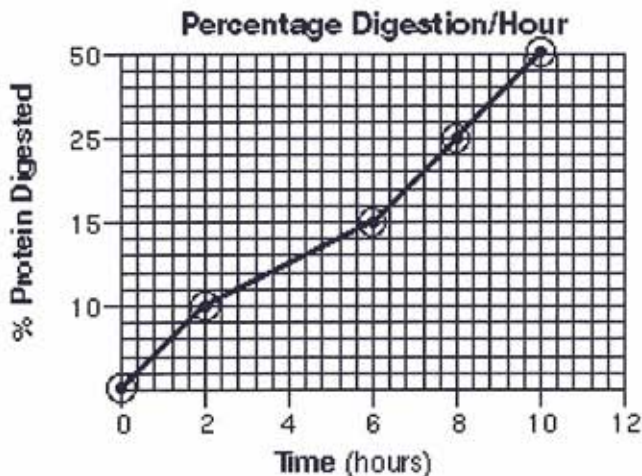
Which statement does *not* correctly describe this process?

- 1 The normal species chromosome number is restored.
- 2 Males and females each contribute DNA to the offspring.
- 3 The zygote will develop to become identical to the dominant parent.
- 4 The sex of the zygote is determined by DNA in the gametes.

Base your answers to questions 21 through 23 on the diagram below and on your knowledge of biology.



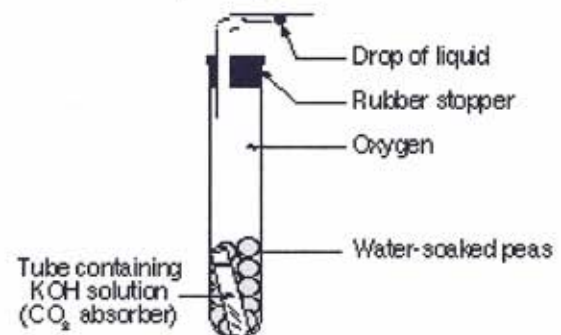
21. Which letter indicates a structure that secretes a hormone that promotes maturation of gametes? [1]
22. Which letter indicates a structure that is *not* involved in the production or delivery of gametes? [1]
23. Structures B and E provide nutrients and fluid for the gametes. Why are these substances necessary for fertilization? [1]
- _____
24. Describe *one* error that was made in the preparation of the graph shown below. [1]



Base your answers to questions 25 through 27 on the diagram below and on your knowledge of biology.



25. State *one* reason that algae form the base of this pyramid. [1]
26. Which term best describes the mosquito larvae?
 1 producer 3 carnivore
 2 parasite 4 consumer
27. Explain why each level of the pyramid *decreases* in area from bottom to top. [1]
- _____
28. Describe the role of scavengers in an ecosystem. [1]
29. Explain how carbohydrates provide energy for life functions. [1]
30. In the demonstration shown below, which process performed by the peas when they start to grow causes the drop of liquid to move to the left?

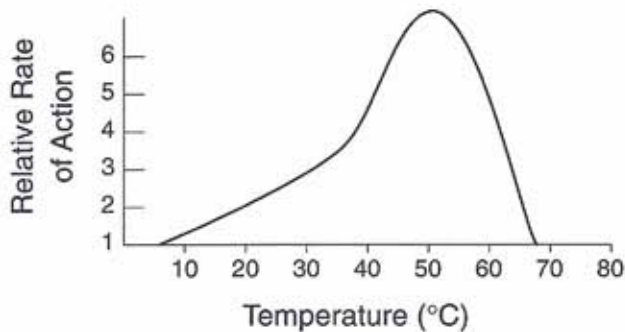


- 1 protein synthesis 3 digestion
 2 photosynthesis 4 cellular respiration

31. Which activity is *not* a function of white blood cells in response to an invasion of the body by bacteria?

- (1) engulfing these bacteria
- (2) producing antibodies to act against this type of bacteria
- (3) preparing for future invasions of this type of bacteria
- (4) speeding transmissions of nerve impulses to detect these bacteria

32. The graph below shows the effect of temperature on the relative rate of action of enzyme X on a protein.



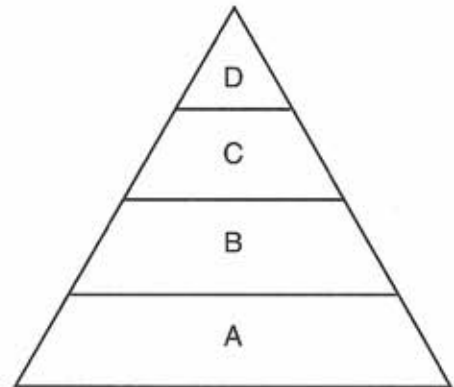
Which change would *not* affect the relative rate of action of enzyme X?

- (1) the addition of cold water when the reaction is at 50°C
- (2) an increase in temperature from 70°C to 80°C
- (3) the removal of the protein when the reaction is at 30°C
- (4) a decrease in temperature from 40°C to 10°C

33. When organisms break the bonds of organic compounds, the organisms can

- (1) use the smaller molecules to plug the gaps in the cell membrane to slow diffusion
- (2) use the energy obtained to digest molecules produced by respiration that uses oxygen
- (3) obtain energy or reassemble the resulting materials to form different compounds
- (4) excrete smaller amounts of solid waste materials during vigorous exercise

34. Which statement about the pyramid of energy shown below is correct?



- (1) The amount of energy needed to sustain the pyramid enters at level D.
- (2) The total amount of energy decreases with each successive feeding level from D to A.
- (3) The amount of energy is identical in each level of the pyramid.
- (4) The total amount of energy at level D is less than the total amount of energy at level B.

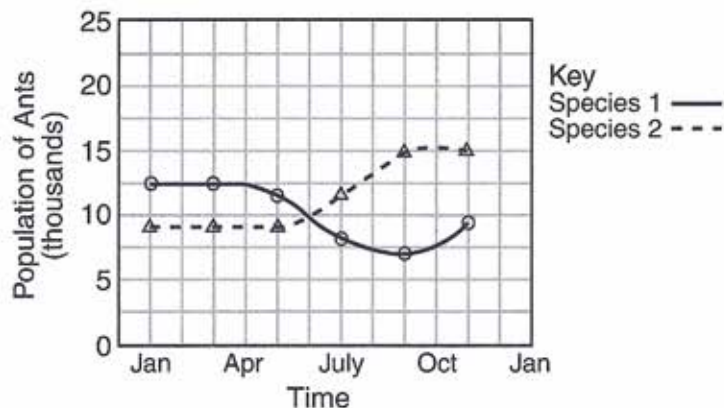
35. Some organizations are buying up sections of forest land. Once purchased, these sections of forest will never be cut down. The main reason for protecting these sections of forest is to

- (1) cause the extinction of undesirable animal species
- (2) prevent these trees from reproducing too fast
- (3) maintain the diversity of the living environment
- (4) provide more land for agricultural purposes

36. The rapid destruction of tropical rain forests may be harmful because

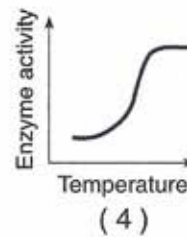
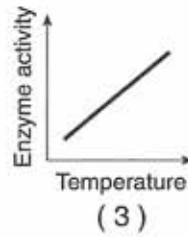
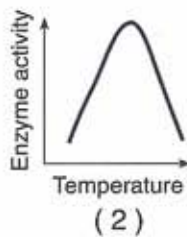
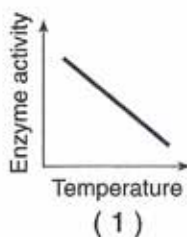
- (1) removing trees will prevent scientists from studying ecological succession
- (2) genetic material that may be useful for future medical discoveries will be lost
- (3) energy cycling in the environment will stop
- (4) the removal of trees will limit the construction of factories that will pollute the environment

37. The graph below shows the populations of two species of ants. Ants of species 2 have a thicker outer covering than the ants of species 1. The outer covering of an insect helps prevent excessive evaporation of water.



Which statement would best explain the population changes shown in the graph?

- (1) The food sources for species 1 increased while the food sources for species 2 decreased from January through November.
 - (2) Disease killed off species 1 beginning in May.
 - (3) The weather was hotter and dryer than normal from April through September.
 - (4) Mutations occurred from April through September in both species, resulting in both species becoming better adapted to the environment.
38. Enzymes have an optimum temperature at which they work best. Temperatures above and below this optimum will decrease enzyme activity. Which graph best illustrates the effect of temperature on enzyme activity?



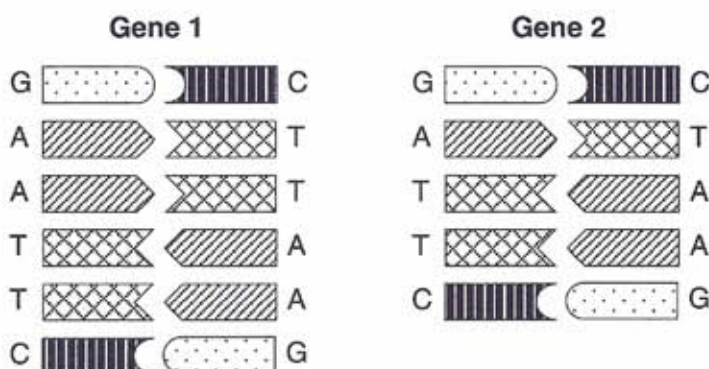
39. A word equation is shown below.



This reaction is most directly involved in the process of

- (1) reproduction
- (2) protein synthesis
- (3) replication
- (4) heterotrophic nutrition

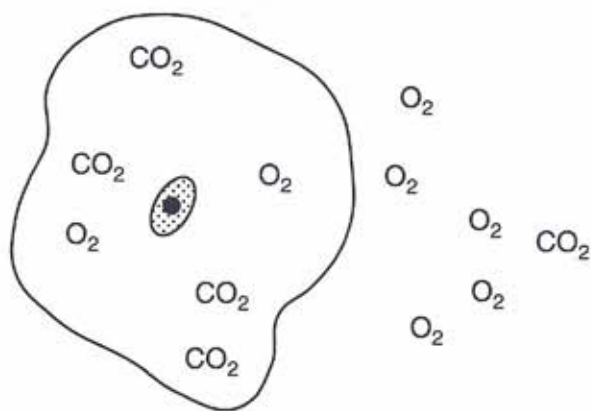
40. The diagrams below represent portions of the genes that code for wing structure in two organisms of the same species. Gene 1 was taken from the cells of a female with normal wings, and gene 2 was taken from the cells of a female with abnormal wings.



The abnormal wing structure was most likely due to

- | | |
|--------------------|------------------------|
| (1) an insertion | (3) a deletion |
| (2) a substitution | (4) normal replication |

41. The diagram below represents a cell in water. Formulas of molecules that can move freely across the cell membrane are shown. Some molecules are located inside the cell and others are in the water outside the cell.



Based on the distribution of these molecules, what would most likely happen after a period of time?

- (1) The concentration of O_2 will increase inside the cell.
- (2) The concentration of CO_2 will remain the same inside the cell.
- (3) The concentration of O_2 will remain the same outside the cell.
- (4) The concentration of CO_2 will decrease outside the cell.

42. During the warm temperatures of summer, the arctic fox produces enzymes that cause its fur to become reddish brown. During the cold temperatures of winter, these enzymes do not function. As a result, the fox has a white coat that blends into the snowy background. This change in fur color shows that

- (1) the genes of a fox are made of unstable DNA
- (2) mutations can be caused by temperature extremes
- (3) random alteration of DNA can occur on certain chromosomes
- (4) the expression of certain genes is affected by temperature

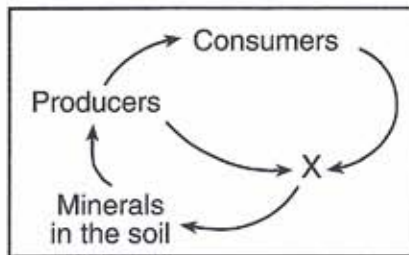
43. Which phrases best identify characteristics of asexual reproduction?

- (1) one parent, union of gametes, offspring similar to but not genetically identical to the parent
- (2) one parent, no union of gametes, offspring genetically identical to parents
- (3) two parents, union of gametes, offspring similar to but not genetically identical to parents
- (4) two parents, no union of gametes, offspring genetically identical to parents

Answer all questions in this part.

Directions (44-52): For each statement or question, write on your separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

44. In the diagram below, what does X most likely represent?



- (1) autotrophs (3) decomposers
(2) herbivores (4) carnivores

45. Two closely related species of birds live in the same tree. Species A feeds on ants and termites, while species B feeds on caterpillars. The two species coexist successfully because

- (1) each occupies a different niche
(2) they interbreed
(3) they use different methods of reproduction
(4) birds compete for food

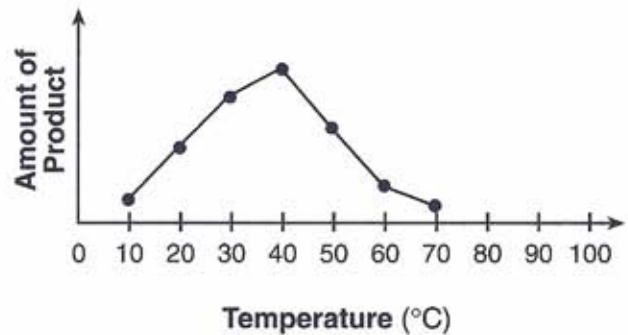
46. After a hormone enters the bloodstream, it is transported throughout the body, but the hormone affects only certain cells. The reason only certain cells are affected is that the membranes of these cells have specific

- (1) receptors (3) antibodies
(2) tissues (4) carbohydrates

47. A characteristic of a DNA molecule that is *not* characteristic of a protein molecule is that the DNA molecule

- (1) can replicate itself
(2) can be very large
(3) is found in nuclei
(4) is composed of subunits

48. The graph below illustrates the relative amounts of product formed by the action of an enzyme in a solution with a pH of 6 at seven different temperatures.



Which statement best expresses the amount of product that will be formed at each temperature if the experiment is repeated at a pH of 4?

- (1) The amount of product formed will be equal to that produced at pH 6.
(2) The amount of product formed will be greater than that produced at pH 6.
(3) The amount of product formed will be less than that produced at pH 6.
(4) The amount of product formed can *not* be accurately predicted.

49. Which statement best explains the fact that some identical twins appear different from one another?

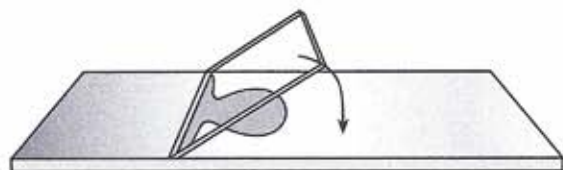
- (1) Their DNA is essentially the same and the environment plays little or no role in the expression of their genes.
(2) Their DNA is very different and the environment plays a significant role in the expression of their genes.
(3) Their DNA is very different and the environment plays little or no role in the expression of their genes.
(4) Their DNA is essentially the same and the environment plays a significant role in the expression of their genes.

Part B-1

Answer all questions in this part. [8]

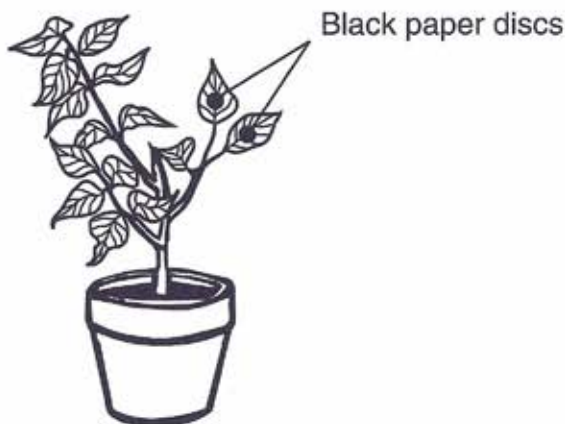
Directions: For each statement or question, write on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

50. The diagram below shows how a coverslip should be lowered onto some single-celled organisms during the preparation of a wet mount.



Why is this a preferred procedure?

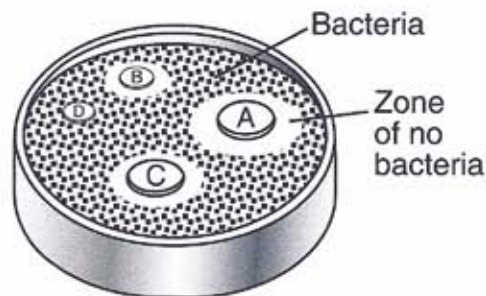
- (1) The coverslip will prevent the slide from breaking.
 - (2) The organisms will be more evenly distributed.
 - (3) The possibility of breaking the coverslip is reduced.
 - (4) The possibility of trapping air bubbles is reduced.
51. The diagram below represents the setup for an experiment. Two black paper discs are opposite each other on both sides of each of two leaves.



This experimental setup would most likely be used to show that

- (1) glucose is necessary for photosynthesis
- (2) protein is a product of photosynthesis
- (3) light is necessary for photosynthesis
- (4) carbon dioxide is a product of photosynthesis

52. An experiment was carried out to determine which mouthwash was most effective against bacteria commonly found in the mouth. Four paper discs were each dipped into a different brand of mouthwash. The discs were then placed onto the surface of a culture plate that contained food, moisture, and bacteria commonly found in the mouth. The diagram below shows the growth of bacteria on the plate after 24 hours.



Which change in procedure would have improved the experiment?

- (1) using a smaller plate with less food and moisture
- (2) using bacteria from many habitats other than the mouth
- (3) using the same size paper discs for each mouthwash
- (4) using the same type of mouthwash on each disc

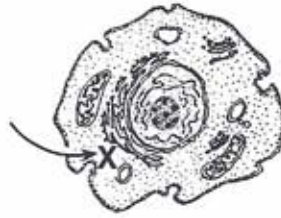
Answer all questions in this part.

Directions (53-55) For those questions that are followed by four choices, circle the number of the choice that best completes the statement or answers the question. For all other questions in this part, follow the directions given in the question and record your answers in the spaces provided.

Base your answers to questions 37 through 39 on the two different cells shown below. Only cell A produces substance X. Both cells A and B use substance X.



Cell A



Cell B

53. Identify substance X. [1]

54. Identify the type of organelle in cell A that produces substance X. [1]

55. Identify the type of organelle found in both cell A and cell B that uses substance X. [1]

Base your answers to questions 56 through 60 on the information and data table below and on your knowledge of biology.

**For Teacher
Use Only**

The rate of respiration of a freshwater sunfish was determined at different temperatures. The rate of respiration was determined by counting the number of times the gill covers of the fish opened and closed during 1-minute intervals at the various temperatures. The following data were collected.

Data Table

Temperature (°C)	Gill Cover Opening and Closing Per Minute
10	15
15	25
18	30
20	38
23	60
25	57
27	25

Directions (56-58): Using the information in the data table, construct a line graph on the grid provided on the next page, following the directions below.

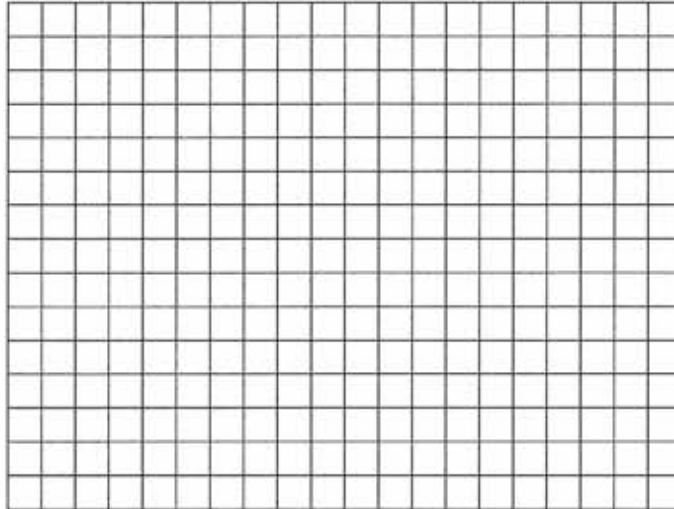
56 Label the x-axis and indicate the units. [1]

57 Mark an appropriate scale on each axis. [1]

58 Plot the data from the data table. Surround each point with a small circle and connect the points. [1]

Example: 

Number of Times Gill Covers
Opened and Closed per Minute



40

41

42

59. According to the data, as the temperature increases, the rate of respiration of the sunfish

- (1) increases steadily
- (2) decreases steadily
- (3) increases, then decreases
- (4) decreases, then increases

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60. Which title is appropriate for this graph?

- (1) The Effect of Temperature on Rate of Respiration in Sunfish
- (2) The Effect of Gill Movement on Rate of Respiration in Sunfish
- (3) The Relationship Between Temperature and Dissolved Oxygen
- (4) The Relationship Between Sunfish Population and Temperature Change in Freshwater Habitats

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