

- Which statement accurately compares cells in the human circulatory system to cells in the human nervous system?
 - Cells in the circulatory system carry out the same life function for the organism as cells in the nervous system.
 - Cells in the circulatory system are identical in structure to cells in the nervous system.
 - Cells in the nervous system are different in structure from cells in the circulatory system, and they carry out different specialized functions.
 - Cells in the nervous system act independently, but cells in the circulatory system function together.
- An iodine test of a tomato plant leaf revealed that starch was present at 5:00 p.m. on a sunny afternoon in July. When a similar leaf from the same tomato plant was tested with iodine at 6:00 a.m. the next morning, the test indicated that less starch was present. This reduction in starch content most likely occurred because starch was
 - changed directly into proteins
 - transported out of the leaves through the guard cells
 - transported downward toward the roots through tubes
 - changed into simple sugars
- Luciferin is a molecule that, when broken down in fireflies, produces heat and light. The rate at which luciferin is broken down in cells is controlled by
 - a carbohydrate
 - a simple sugar
 - an enzyme
 - a complex fat
- Communication between cells is affected if there is decreased ability to produce
 - digestive enzymes and gametes
 - antibodies and chloroplasts
 - hormones and nerve impulses
 - antibiotics and guard cells
- Tomato plants in a garden are not growing well. The gardener hypothesizes that the soil is too acidic. To test this hypothesis accurately, the gardener could
 - plant seeds of a different kind of plant
 - move the tomato plants to an area with less sunlight
 - change the pH of the soil
 - reduce the amount of water available to the plant
- When humans first domesticated dogs, there was relatively little diversity in the species. Today, there are many variations such as the German shepherd and the dalmation. This increase in diversity is most closely associated with
 - cloning of selected body cells
 - selective breeding
 - mitotic cell division
 - environmental influences on inherited traits

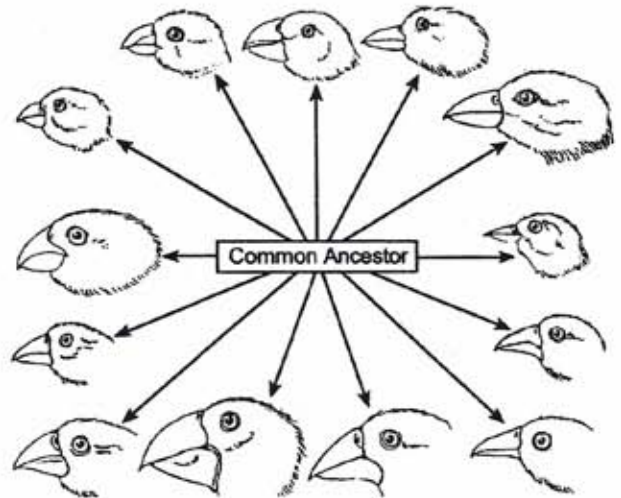
- A glucose-tolerance test was conducted to observe the effect of time on glucose concentration in the blood. An animal was fed 10 milliliters of glucose solution. At five different times after the ingestion of the solution, the blood glucose concentration was determined, and the results were recorded in the data table below.

Data Table

Time After Glucose Ingestion (minutes)	Glucose Concentration in Blood (mg/100 dL)
0	75
30	125
60	110
90	90
120	80
180	70

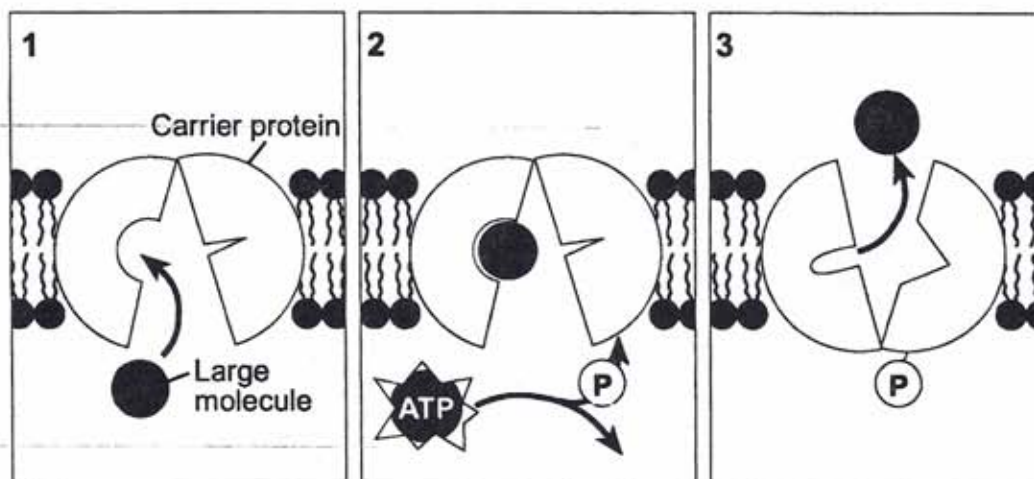
The change in glucose concentration in the blood between 0 and 30 minutes was probably due to

- the liver releasing glucose into the small intestine
 - glucose being absorbed from the digestive system
 - the synthesis of glucose from starch
 - glucose being used for cellular respiration
- As a result of sexual reproduction, an organism can pass a gene mutation to its offspring if the mutation occurs in
 - a body cell
 - a gamete
 - liver tissue
 - white blood cells
 - The diversity within the wild bird species in the diagram below can best be explained by which process?



- natural selection
- asexual reproduction
- ecological succession
- mitotic cell division

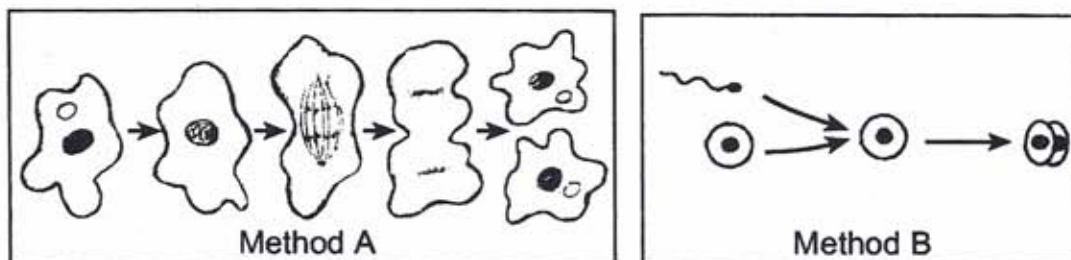
10. The diagram below represents movement of a large molecule across a membrane.



Which process is best represented in this diagram?

- (1) active transport (2) diffusion (3) protein building (4) gene manipulation

11. How does the type of reproduction shown in method *A* in the diagram below differ from the type of reproduction shown in method *B*?



- (1) Method *A* illustrates sexual reproduction, and method *B* illustrates asexual reproduction.
 (2) Offspring produced by method *B* will be genetically alike, but offspring produced by method *A* will be genetically different.
 (3) The two cells shown in the last step of method *A* are genetically alike, but the two cells shown in the last step of method *B* are genetically different.
 (4) Offspring produced by method *A* will be genetically like the parent, but offspring produced by method *B* will be genetically different from the parents.

12. Which statement best describes the result of some of the processes involved in genetic engineering?

- (1) They alter the arrangement of hereditary material.
 (2) They provide energy for mitosis and meiosis.
 (3) They are necessary for normal gamete formation.
 (4) They reduce variation in organisms that reproduce asexually.

13. A characteristic of mutations is that they usually

- (1) are caused only by the events of mitosis
 (2) do not occur at random
 (3) result in different genetic sequences
 (4) occur to meet the needs of a species

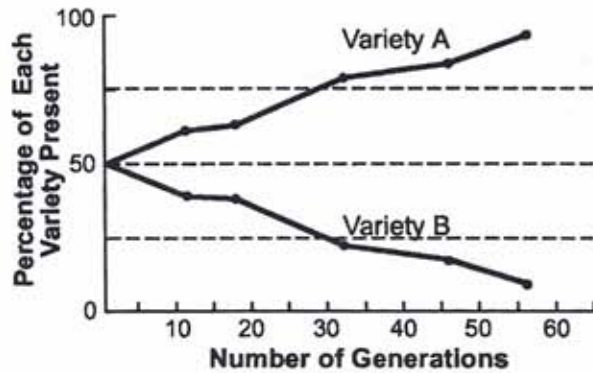
14. Regulation of sexual reproductive cycles of human males is related most directly to the presence of the hormone

- (1) estrogen (3) testosterone
 (2) progesterone (4) insulin

15. The nucleus is removed from a body cell of one organism and is placed in an egg cell that has had its nucleus removed. This process, which results in the production of organisms that are genetically alike, is known as

- (1) cloning (3) biological adaptation
 (2) fertilization (4) DNA production

16. What is the most probable reason for the increase in the percentage of variety *A* in the population of the species shown in the graph below?

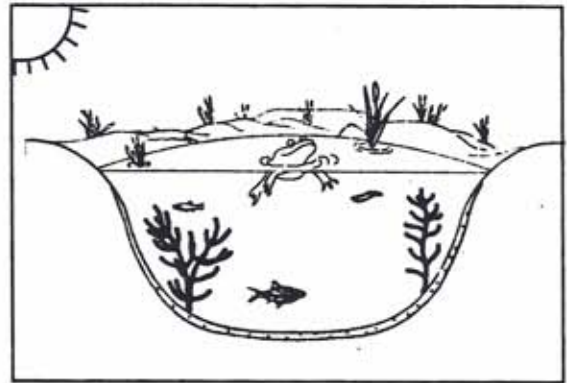


- (1) There is no chance for variety *A* to mate with variety *B*.
 (2) There is no genetic difference between variety *A* and variety *B*.
 (3) Variety *A* is less fit to survive than variety *B* is.
 (4) Variety *A* has some adaptive advantage that variety *B* does not have.
17. The type of molecule represented below is found in organisms.



Which statement correctly describes the sequence of bases found in this type of molecule?

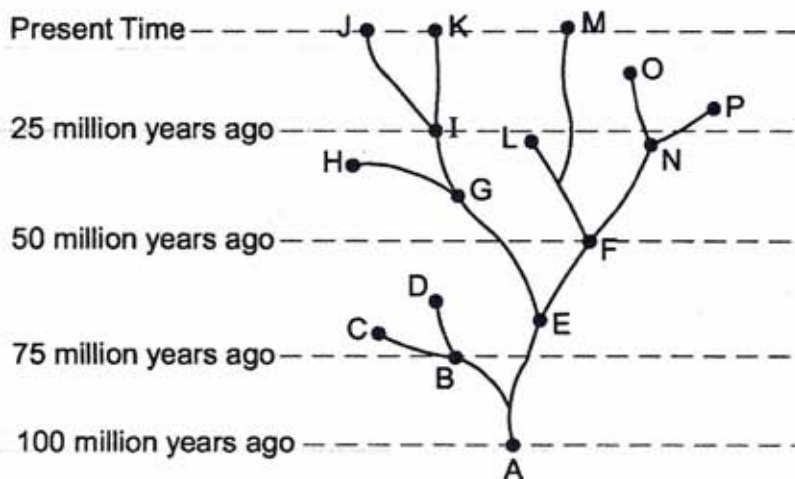
- (1) It changes every time it replicates.
 (2) It determines the characteristics that will be inherited.
 (3) It is exactly the same in all organisms.
 (4) It directly controls the synthesis of starch within a cell.
18. Most cells in the body of a fruit fly contain eight chromosomes. In some cells, only four chromosomes are present, a condition which is a direct result of
- (1) mitotic cell division (3) embryonic differentiation
 (2) meiotic cell division (4) internal fertilization
19. People with AIDS are unable to fight multiple infections because the virus that causes AIDS
- (1) weakens their immune systems
 (2) produces antibodies in their blood
 (3) attacks muscle tissue
 (4) kills pathogens
20. Feedback mechanisms are best described as processes that help
- (1) reduce hormone levels to below normal in the blood
 (2) destroy hormones in the blood
 (3) directly control muscle contraction in the leg
 (4) keep body conditions near a normal, steady state
21. A pond ecosystem is represented in the diagram below.



Energy for this ecosystem originally comes from

- (1) water (3) sunlight
 (2) consumers (4) plants
22. Heavy cigarette smoking and the use of alcohol throughout pregnancy usually increase the likelihood of
- (1) the birth of twins
 (2) the birth of a male baby
 (3) a baby being born with a viral infection
 (4) a baby being born with medical problems
23. The mass of some corn plants at the end of their growth period was 6 tons per acre. Most of this mass was produced from
- (1) water and organic compounds absorbed from the soil
 (2) minerals from the soil and oxygen from the air
 (3) minerals and organic materials absorbed from the soil
 (4) water from the soil and carbon dioxide from the air
24. The gene for the production of human insulin is inserted into certain bacterial cells. The offspring of these bacterial cells will most likely be able to
- (1) destroy pathogens (3) synthesize this hormone
 (2) reproduce sexually (4) form human tissue

25. The diagram below illustrates a proposed evolutionary path of certain organisms, based on the theory of evolution.



Which statement could best be inferred from the information in this diagram?

- (1) Evolution does not involve gradual change. (2) Evolutionary changes can result in extinction.
 (3) Evolution begins with plants. (4) Evolution produces organisms that all fill the same niche.

26. A characteristic of hormones and enzymes that allows them to work effectively with other organic molecules is their

- (1) specific shape
 (2) small size
 (3) concentration of carbon and hydrogen atoms
 (4) high-energy bonds

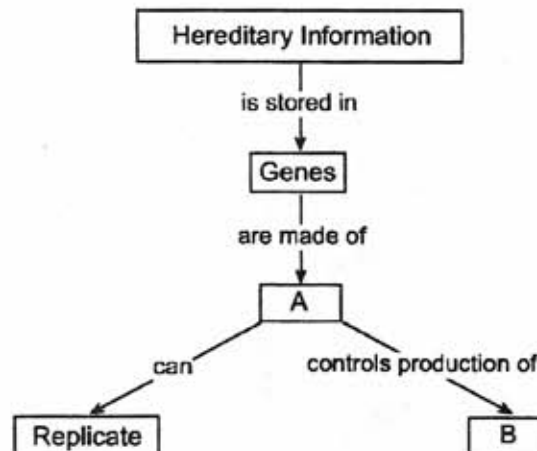
27. Both a deer and a tree react to changes in their external surroundings, helping them to maintain a constant internal environment. This statement describes

- (1) predation (2) homeostasis
 (3) antibiotic resistance (4) autotrophic nutrition

28. In an investigation to determine the change in heart rate with increased activity, a biology teacher asked students to take their pulses immediately before and immediately after exercising for 2 minutes. The data showed an average heart rate of 72 beats per minute before exercising and 90 beats per minute after exercising. If a valid conclusion is to be made from the results of this investigation, which assumption must be made?

- (1) In most students, the average heart rate is not affected by exercise
 (2) Exercise causes the heart rate to slow down.
 (3) Each student exercised with the same intensity.
 (4) The heart rate of each student goes up 18 beats after jogging for 2 minutes.

Base your answers to questions 29 and 30 on the diagram below, which provides information related to heredity.



The type of molecule in box A serves as a template. Explain what this means.

29. Which molecules are represented by box B?

- (1) bases (2) proteins
 (3) amino acids (4) simple sugars

31. A student designed an investigation to determine the effect of temperature on the rate of seed germination. The student placed moist filter paper in each of four culture dishes. Ten bean seeds were placed on the filter paper in each dish. The four dishes were numbered and placed in the dark at different temperatures as follows: Dish 1: 10°C, Dish 2: 15°C, Dish 3: 20°C, Dish 4: 25°C. The total number of germinated seeds in each culture dish was counted each day for two weeks.

Which data table is best for recording the results of this investigation?

(1)

Petri Dish	Day	Temperature	Amount of Light
1			
2			
3			
4			

(3)

Day	Temperature			
	Dish 1	Dish 2	Dish 3	Dish 4

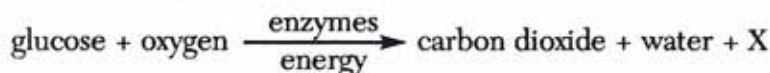
(2)

Petri Dish	Amount of Water	Number of Germinated Seeds	Amount of Light
1			
2			
3			
4			

(4)

Day	Number of Germinated Seeds			
	10°C	15°C	20°C	25°C

Base your answers to questions 32 and 33 on the word equation below.



32. Name the process represented by the equation.

33. Name the molecule represented by letter X.

(1) **ATP or adenosine triphosphate.**

34. To test the effect of hormones on plant growth, six potted plant seedlings of the same species were measured and then sprayed with auxin (a growth hormone). After four weeks of growth under ideal conditions, the plants were measured again. To set up a proper control for this experiment, the investigator should

- (1) spray the same plants with different amounts of auxin
- (2) spray auxin on six plant seedlings of the same species and grow them in the dark for four weeks
- (3) wash the auxin off three of the plants after two weeks
- (4) grow another six plant seedlings of the same species under the same conditions, spraying them with distilled water only

35. A student wanted to determine if slugs preferred green leaf lettuce leaves over purple cabbage leaves for food. Pieces of both leaves were cut. One piece of each type of leaf and one slug were placed in each of ten containers. After three days, the surface area of each leaf section was measured and the results were recorded in a data table. State *one* reason that the results of this experiment might be considered invalid.

Base your answers to questions 36 and 37 on the data table below. The data table shows the amount of oxygen that will dissolve in freshwater and sea-water at different temperatures. The amount of oxygen is expressed in parts per million (ppm).

Data Table

Temperature (°C)	Freshwater Oxygen Content (ppm)	Seawater Oxygen Content (ppm)
1	14.24	11.15
10	11.29	9.00
15	10.10	8.09
20	9.11	7.36
25	8.27	6.75
30	7.56	6.19

Write a statement comparing the oxygen-holding ability of
 36. freshwater with the oxygen-holding ability of seawater in the temperature range shown.

37. State how the oxygen-holding ability of freshwater varies with changes in temperature.

Base your answers to questions 38 and 39 on the information below.

A student completed a series of experiments and found that a protein-digesting enzyme (intestinal protease) functions best when the pH is 8.0 and the temperature is 37°C. During an experiment, the student used some of the procedures listed below.

Procedures

- (A) Adding more protease
- (B) Adding more protein
- (C) Decreasing the pH to 6.0
- (D) Increasing the temperature to 45°C
- (E) Decreasing the amount of light

38. Which procedure would have the *least* effect on the rate of protein digestion?

- (1) A
- (2) E
- (3) C
- (4) D

39. Which two procedures would most likely cause a decrease in the rate of protein digestion?

- (1) A and D
- (2) B and C
- (3) C and D
- (4) A and E

40. Vaccinations play a major role in medicine today. Explain the role of vaccines in the prevention of disease. Your answer must include at least:
 a a description of the contents of a vaccine
 b a description of how a vaccine protects the body from disease
 c one specific reason certain vaccinations are required for students to attend public schools

Base your answers to questions 41 through 43 on the information below and on your knowledge of biology.

Telomere Tales

The number of times a human body cell reproduces is dependent on the length of its special chromosome tips. These tips, which are known as telomeres, act as cell division clocks. With each division, the length of the telomere shortens until a critical length is reached, signaling cell reproduction to stop. Knowledge of telomeres could be used in cancer diagnosis, in understanding diseases of aging, and in providing information that would lead to the survival of transplanted organs.

As most body cells divide, their telomeres shorten and, in turn, the overall chromosome length is reduced. However, tissues such as bone marrow and most cancer cells lengthen their shrinking chromosome tips with the help of an enzyme, telomerase. As a result, the chromosomes of these rapidly dividing cells never reach critical length, and the cells continue to reproduce.

Transplantation speeds up the aging process in donor cells. The telomeres of transplanted cells are shorter than those in normal bone marrow cells. If telomerase is inserted into donor cells, the donor tissues may live longer. This procedure would greatly benefit organ transplants and the treatment of patients who have HIV (the virus that causes AIDS). For example, blood-forming cells could be removed from these patients early in the disease, cultured with telomerase to extend their telomeres, and then returned to the bodies of the patients as their blood cell counts fall.

41. State the relationship between the presence of telomerase, telomere length, and the number of cell divisions.

42. Explain how the knowledge of telomerase may lead to an effective treatment for cancer.

43. State one way telomerase could be used to treat patients who have HIV.

Base your answers to questions 44 and 45 on the information and data table below and on your knowledge of biology.

You are the head of the research division of the Leafy Lettuce Company. Your company is experimenting with hydroponic technology. Hydroponic technology involves growing plants in containers of growth solution in a greenhouse. No soil is used. Your first experiment used five groups of five plants of the same size and species. Each group was grown in a different growth solution for the same period of time. The results of the experiment are shown in the table below.

Group	Growth Solution	Average Growth in Height (cm)	Average Surface Area of Leaves (cm ²)
1	H ₂ O	4.4	7.6
2	H ₂ O + N	5.1	10.0
3	H ₂ O + N + P	11.5	37.5
4	H ₂ O + N + P + Mg	13.0	125.0
5	H ₂ O + N + P + Mg + K	20.3	306.5

Key
N = Nitrogen
P = Phosphorus
Mg = Magnesium
K = Potassium

44. Prepare a brief report to the president of the Leafy Lettuce Company summarizing the results of your experiment and identifying another possible variable that could be investigated to improve the growth of the lettuce. In your report, be sure to include:
- a a recommendation of the best growth solution to use for hydroponic lettuce [Support your recommendation.]
 - b another possible variable (besides the growth solution) that might be investigated to improve the growth of the hydroponic lettuce
 - c a recommendation for an extension of this investigation to make it more valid

45. Could the results of this investigation be used to select the best growth solution for other species of plants? Justify your answer.

46. Just like complex organisms, cells are able to survive by coordinating various activities. Complex organisms have a variety of systems, and cells have a variety of organelles that work together for survival. Describe the roles of two organelles. In your answer be sure to include:

- a the names of two organelles and the function of each
- b an explanation of how these two organelles work together
- c the name of an organelle and the name of a system in the human body that have similar functions
