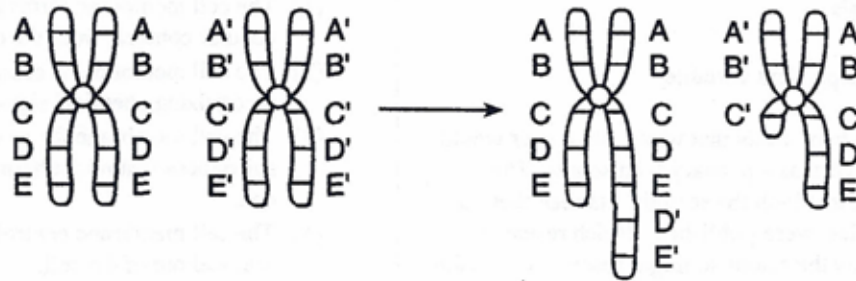


1. Diagrams, tables, and graphs are used by scientists mainly to
 - (1) design a research plan for an experiment
 - (2) test a hypothesis
 - (3) organize data
 - (4) predict the independent variable
2. A scientist tested a hypothesis that white-tailed deer would prefer apples over corn as a primary food source. The findings of the test, in which the scientist claimed that the deer preferred apples, were published. Which research technique, if used by the scientist, might result in this claim being questioned?
 - (1) The scientist observed four deer in different locations at various times of the day.
 - (2) The scientist observed a total of 500 deer in 20 different locations at various times of the day.
 - (3) The scientist observed 200 deer in various natural settings, but none in captivity.
 - (4) The scientist observed 300 deer in various locations in captivity, but none in natural settings.
3. What happens to certain nutrient molecules after they pass into muscle cells?
 - (1) They are replicated in the nucleus.
 - (2) They are acted on by enzymes and release the energy they contain.
 - (3) They are changed into tissues and organs in the cytoplasm.
 - (4) They enter chloroplasts, where they can absorb light energy.
4. A medical test indicates that a patient has a defective protein. This condition is most likely due to a change in the directions coded in the
 - (1) number of hydrogen atoms in starch molecules
 - (2) sequence of inorganic molecules
 - (3) number of carbon atoms in sugar molecules
 - (4) sequence of subunits in DNA
5. If a human system fails to function properly, what is the most likely result?
 - (1) a stable rate of metabolism
 - (2) a disturbance in homeostasis
 - (3) a change in the method of cellular respiration
 - (4) a change in the function of DNA
6. In multicellular organisms, cells must be able to communicate with each other. Structures that enable most cells to communicate with each other are known as
 - (1) pathogenic agents
 - (2) chloroplasts
 - (3) antibiotics
 - (4) receptor molecules
7. Which statement regarding the functioning of the cell membrane of all organisms is *not* correct?
 - (1) The cell membrane forms a boundary that separates the cellular contents from the outside environment.
 - (2) The cell membrane is capable of receiving and recognizing chemical signals.
 - (3) The cell membrane forms a barrier that keeps all substances that might harm the cell from entering the cell.
 - (4) The cell membrane controls the movement of molecules into and out of the cell.
8. Every single-celled organism is able to survive because it carries out
 - (1) metabolic activities
 - (2) autotrophic nutrition
 - (3) heterotrophic nutrition
 - (4) sexual reproduction
9. The shape of a protein molecule is influenced by
 - (1) whether it is organic or inorganic
 - (2) the sequence of amino acids in it
 - (3) the number of genes found in the nucleus
 - (4) the number of chromosomes in the cell
10. A small amount of DNA was taken from a fossil of a mammoth found frozen in glacial ice. Genetic technology can be used to produce a large quantity of identical DNA from this mammoth's DNA. In this technology, the original DNA sample is used to
 - (1) stimulate differentiation in other mammoth cells
 - (2) provide fragments to replace certain human body chemicals
 - (3) act as a template for repeated replication
 - (4) trigger mitosis to obtain new base sequences
11. Which situation would most directly affect future generations naturally produced by a maple tree?
 - (1) Ultraviolet radiation changes the DNA sequence within some leaves of the tree.
 - (2) Ultraviolet radiation changes the DNA sequence within the gametes of some flowers of the tree.
 - (3) An increase in temperature reduces the number of cell divisions in the roots.
 - (4) Rapidly growing cells just under the bark are exposed to radiation, causing changes in genetic material.
12. The first life-forms to appear on Earth were most likely
 - (1) complex single-celled organisms
 - (2) complex multicellular organisms
 - (3) simple single-celled organisms
 - (4) simple multicellular organisms

13. The diagram below represents a change that occurred in a pair of chromosomes during the formation of an egg cell. The letters represent genes on the pair of chromosomes.



The alteration that occurred will most likely

- (1) be passed on to every cell that develops from the egg cell
 (2) change the chromosome number of the body cells that
 (3) convert sex cells into body cells
 (4) trigger the production of pathogens

14. Within which structure in the human body does specialization of parts of the developing baby take place?

- (1) ovary (3) testis
 (2) uterus (4) pancreas

15. Which statement best explains the significance of meiosis in the process of evolution within a species?

- (1) The gametes produced by meiosis ensure the continuation of any particular species by asexual reproduction.
 (2) Equal numbers of eggs and sperm are produced by meiosis.
 (3) Meiosis produces eggs and sperm that are alike.
 (4) Meiosis provides for variation in the gametes produced by an organism.

16. During the last months of pregnancy, the brain of a human embryo undergoes an essential "growth spurt." Which action by the mother would most likely pose the greatest threat to the normal development of the nervous system of the embryo at this time?

- (1) spraying pesticides in the garden
 (2) taking prescribed vitamins on a daily basis
 (3) maintaining a diet high in fiber and low in fat
 (4) not exercising

17. Which phrase best describes cellular respiration, a process that occurs continuously in the cells of organisms?

- (1) removal of oxygen from the cells of an organism
 (2) conversion of light energy into the chemical bond energy of organic molecules
 (3) transport of materials within cells and throughout the bodies of multicellular organisms
 (4) changing of stored chemical energy in food molecules to a form usable by organisms

18. The diagram below represents chromosomes in a zygote.



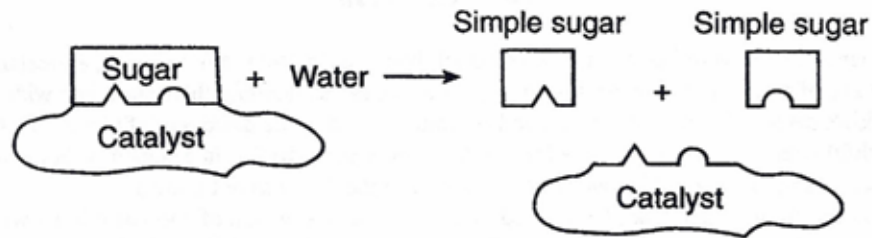
Which diagrams best illustrate the daughter cells that result from normal mitotic cell division of this zygote?

- (1) +
 (2) +
 (3) +
 (4) +

19. Eating a sweet potato provides energy for human metabolic processes. The original source of this energy is the energy

- (1) in protein molecules stored within the potato
 (2) from starch molecules absorbed by the potato plant
 (3) made available by photosynthesis
 (4) in vitamins and minerals found in the soil

20. The diagram below illustrates a biochemical process that occurs in organisms.



The substance labeled "catalyst" is also known as

- (1) a hormone (2) an enzyme (3) an antibody (4) an inorganic compound

21. Which statement does *not* identify a characteristic of antibodies?
- (1) They are produced by the body in response to the presence of foreign substances.
 - (2) They may be produced in response to an antigen.
 - (3) They are nonspecific, acting against any foreign substance in the body.
 - (4) They may be produced by white blood cells.
22. The blood of newborn babies is tested to determine whether a certain substance is present. This substance indicates the presence of the disorder known as PKU, which may result in mental retardation. Babies with this disorder are put on a special diet to prevent mental retardation. In this situation, which action is usually taken first?
- (1) treating the expression of the disorder
 - (2) preventing the expression of the disorder
 - (3) controlling the disorder
 - (4) diagnosing the disorder
23. An increase in the level of insulin in the blood would most directly result in
- (1) a decrease in the amount of glucose in the blood
 - (2) a decrease in the amount of protein in the blood
 - (3) an increase in the amount of fat in cells
 - (4) an increase in the amount of carbon dioxide in cells

Base your answers to questions 24 through 27 on the passage below and on your knowledge of biology.

To Tan or Not To Tan

Around 1870, scientists discovered that sunshine could kill bacteria. In 1903, Niels Finsen, an Icelandic researcher, won the Nobel Prize for the use of sunlight therapy against infectious diseases. Sunbathing then came into wide use as a treatment for tuberculosis, Hodgkin's disease (a form of cancer), and common wounds. The discovery of vitamin D, the "sunshine vitamin," reinforced the healthful image of the Sun. People learned that it was better to live in a sun-filled home than in a dark dwelling. At that time, the relationship between skin cancer and exposure to the Sun was not known.

In the early twentieth century, many people believed that a deep tan was a sign of good health. However, in the 1940s, the rate of skin cancer began to increase and reached significant proportions by the 1970s. At this time, scientists began to realize how damaging those deep tans could really be.

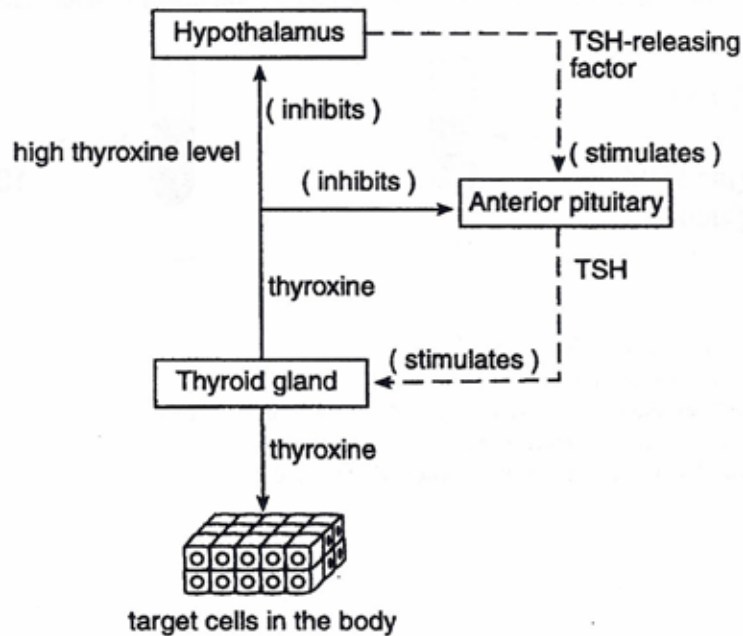
Tanning occurs when ultraviolet radiation is absorbed by the skin, causing an increase in the activity of melanocytes, cells that produce the pigment melanin. As the melanin is produced, it is absorbed by cells in the upper region of the skin, resulting in the formation of a tan. In reality, the skin is building up protection against damage caused by the ultraviolet radiation. Exposure to more sunlight means more damage to the cells of the skin. Research has shown that, although people usually do not get skin cancer as children, each time a child is exposed to the Sun without protection, the chance of that child getting skin cancer as an adult increases.

Knowledge connecting the Sun to skin cancer has greatly increased since the late 1800s. Currently, it is estimated that ultraviolet radiation is responsible for more than 90% of skin cancers. Yet, even with this knowledge, about two million Americans use tanning parlors. A recent survey showed that at least 10% of these people would continue to do so even if they knew for certain that it would give them skin cancer.

Many of the deaths due to this type of cancer can be prevented. The cure rate for skin cancer is almost 100% when treated early. Reducing exposure to harmful ultraviolet radiation helps to prevent it. During the past 15 years, scientists have tried to undo the tanning myth. If the word "healthy" is separated from the word "tan," maybe the occurrence of skin cancer will be reduced.

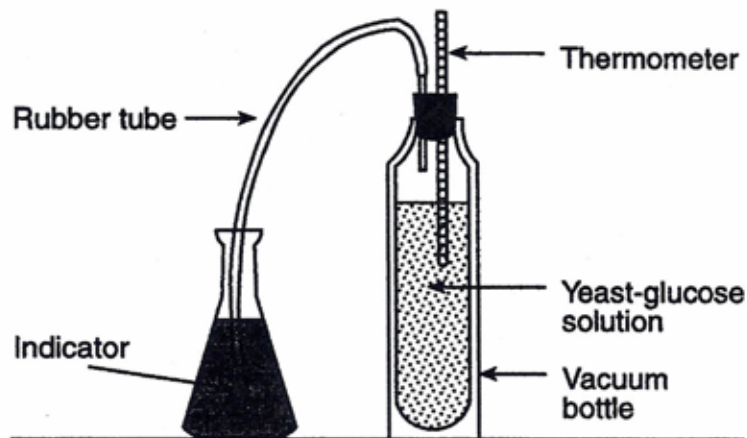
24. State one known benefit of daily exposure to the Sun.
25. Explain what is meant by the phrase "the tanning myth."
26. Which statement concerning tanning is correct?
- (1) Tanning causes a decrease in the ability of the skin to regulate body temperature.
 - (2) Radiation from the Sun is the only radiation that causes tanning.
 - (3) The production of melanin, which causes tanning, increases when skin cells are exposed to the Sun.
 - (4) Melanocytes decrease their activity as exposure to the Sun increases, causing a protective coloration on the skin.
27. Which statement concerning ultraviolet radiation is not correct?
- (1) It may damage the skin.
 - (2) It stimulates the skin to produce antibodies.
 - (3) It is absorbed by the skin.
 - (4) It may stimulate the skin to produce excess pigment.
-
28. Although human muscle cells and nerve cells have the same genetic information, they perform different functions. Explain how this is possible.
-
29. Explain why people with AIDS often develop many other infectious diseases.
-
30. An unknown microorganism was observed with a compound light microscope. Identify the structure that, if observed in the organism, would indicate that it is an autotroph.
-

31. The diagram below represents a function of the thyroid gland.



State *one* effect of an increasing level of TSH-releasing factor.

32. A student placed a solution of glucose and yeast in a vacuum bottle and sealed it with a two-hole stopper as shown in the diagram below. The temperature of the yeast glucose solution increased gradually with time, and the color of the indicator was observed and recorded throughout a 2-day period.



The purpose of the investigation was most likely to

- (1) study the relationship between temperature and pressure
- (2) demonstrate the release of energy by a chemical process
- (3) show that proteins are produced by yeast
- (4) study autotrophic nutrition in yeast

33. The diagram below shows two setups that were used to study bacterial growth. Each setup initially contained an equal number of the bacterium *E. coli* in different carbohydrate solutions. After one hour, a 1-milliliter sample was drawn from each tube and analyzed. The number of bacteria found in the sample from test tube 1 was higher than the number in test tube 2.



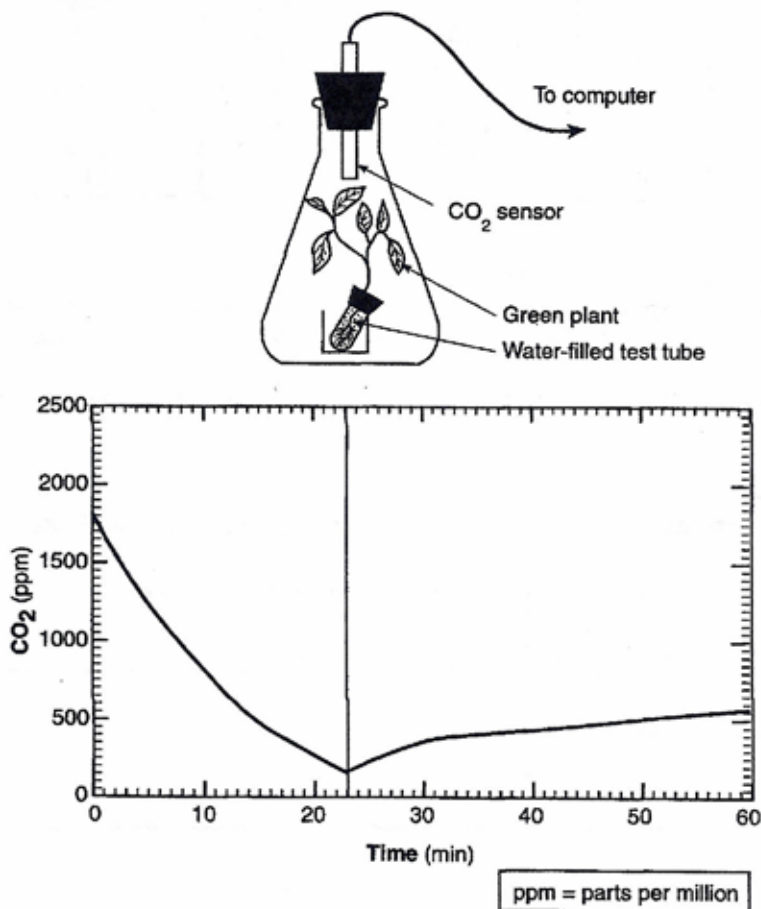
Which conclusion regarding this investigation is not valid?

- (1) All bacteria grow best in a solution of glucose.
- (2) *E. coli* grows better in a 10% solution of glucose than in a 10% solution of sucrose.
- (3) The type of sugar solution will make a difference in the rate of growth of *E. coli*.
- (4) The rate of growth of *E. coli* depends on the type of carbohydrate present.

Base your answers to questions 34 and 35 on the information below and on your knowledge of biology.

A small green plant was placed in a flask as shown below. A sensor that measures the CO_2 content of the air in the flask was inserted, and then the flask was sealed with a rubber stopper. The other end of the sensor was connected to a computer to monitor and record CO_2 levels in the flask over a period of time.

For part of the time the flask was placed in bright light and for part of the time it was placed in total darkness. The graph below shows data that were recorded by the sensor over a period of time.



34. Which condition most likely produced the effect on CO_2 level over the first 23 minutes?

- (1) The light was on for the entire 23 minutes.
- (2) The light was off for the entire 23 minutes.
- (3) The light was off at the start and turned on after 10 minutes.
- (4) The light could have been either on or off because it would have had no effect on the CO_2 level.

35. Which process most likely caused the change in CO_2 level in the flask over the last 37 minutes?

- (1) photosynthesis
- (2) respiration
- (3) active transport
- (4) circulation

36. The data table below contains information on the growth of eight white pine trees, planted in eight different locations, after a period of time.

Data Table

Tree Number	Trunk Diameter 1.2 Meters Above Soil Surface (m)	Soil pH	Elevation Above Sea Level (ft)
1	0.54	4.0	1,200
2	0.79	6.5	1,650
3	0.64	4.5	1,400
4	1.04	5.0	1,350
5	0.96	5.0	1,350
6	0.82	4.5	1,250
7	0.80	5.5	1,400
8	0.52	5.0	1,600

Which statement is best supported by the data in the table?

- (1) White pines grow best at higher elevations.
- (2) White pines are not found at elevations below 1,000 feet.
- (3) White pines have a long life span.
- (4) White pines can grow in acidic soil.

37. In the table below, identify *two* body activities that would change in response to an increase in muscle activity *and* describe how each would change.

Activity	Change in Response to Muscle Activity
1. _____ _____	1. _____ _____
2. _____ _____	2. _____ _____

Base your answers to questions 38 through 40 on the information below and on your knowledge of biology.

The planning board of a community held a public hearing in response to complaints by residents concerning a waste-recycling plant. These residents claim that the waste-hauling trucks were polluting air, land, and water and that the garbage has brought an increase in rats, mice, and pathogenic bacteria to the area. The residents were insistent that the waste-recycling plant be closed permanently.

Other residents recognized the health risks but felt that the benefits of waste recycling outweighed the health issues.

38. Identify *two* specific health problems that could result from living near the waste recycling plant.

39. State *one* cause of a health problem that can be associated with the presence of the wasterecycling plant.

40. State *one* ecological benefit of recycling wastes.

41. Base your answer to the following question on the information 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 growing lettuce using hydroponic technology. Hydroponic technology involves growing plants in containers of growth solution in a greenhouse. No soil is used. The growth solution that the company uses contains water, nitrogen, and phosphorus. The company wants to know if adding iron to this formula will improve lettuce growth.

Briefly describe how to test the effect of the formula with iron added. In your description, be sure to:

- state a hypothesis to be tested in the new experiment
- state how the control group will be treated differently from the experimental group
- identify two factors that must be kept the same in both the experimental and control groups
- state what type of data should be collected to support or refute the hypothesis

Base your answers to questions 42 through 44 on the information below and on your knowledge of biology.

Children must be vaccinated against certain diseases before they can enter school. Some parents feel that vaccinations are dangerous.

42. Explain to these parents what a vaccine is and what it does in the body.

43. State *one* way a child could develop an immunity to a certain disease without being vaccinated.

44. Identify *one* part of a research plan that must be followed when developing a new vaccine.
