EST II – Individual Subject Test

Student's Name _____

National ID _____

Test Center: _____

Subject: Biology

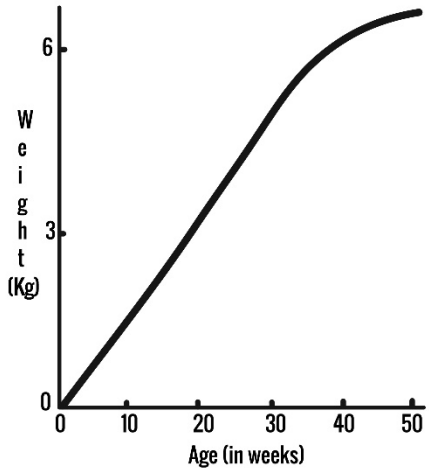
Duration: 60 minutes

80 Multiple Choice Questions

Instructions:

- Place your answer on the answer sheet. Mark only one answer for each of the multiple choice questions.
- Avoid guessing. Your answers should reflect your overall understanding of the subject matter.
- Calculator is not allowed.

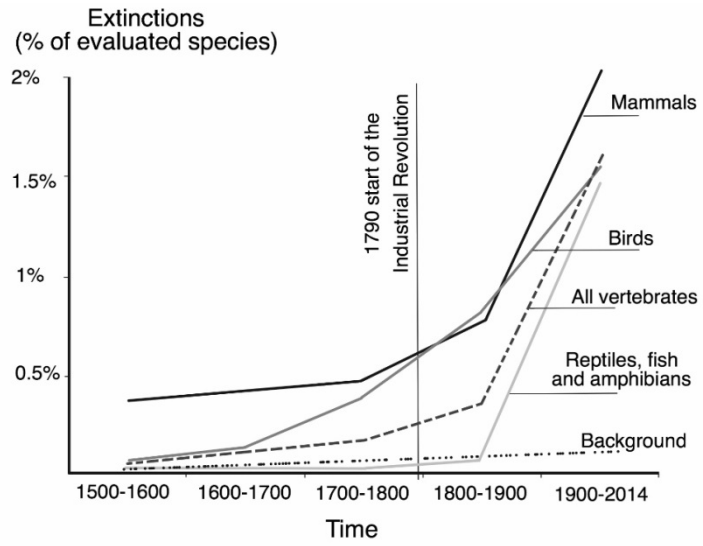
1. The graph below represents a characteristic of life. Which one is it?



A. adaptation
B. growth
C. homeostasis
D. evolution
E. reproduction

Questions 2-3: Refer to the given below

The graph below represents the extinction (in%) of evaluated species over a period of time.



2. What was the effect of the industrial revolution on the cumulative extinction rates of the animals?

A. the industrial revolution significantly increased the background extinction that threatened the survival of many animals
B. reptiles, fish and amphibians were the most affected by industrial revolution
C. the background extinction is as dangerous and significant as the cumulative extinction rates of all vertebrates
D. The total number of vertebrates is much lower than the number of reptiles, fish and amphibians compared to the number of mammals
E. the most significant change that occurred to the number of animals getting extinct was recorded within mammals

3. Which one of these could NOT be the case for the increased numbers of mass extinctions after the industrial revolution?

A. destruction of a natural habitat due to the invasion of human beings
B. the alarming contribution of the background extinction that happens due to natural disasters
C. negatively affecting the biotic and abiotic components of many ecosystems, thus jeopardizing the lives of many of the inhabitants
D. causing severe changes to the climate, thus changing the characteristics of ecosystems and making it hard for certain animals to survive
E. habitat fragmentation due to constructing new roads and bridges

4. In butterflies, branched veins on wings is dominant over parallel veins, and orange color is dominant over yellow. If two heterozygous butterflies for these traits mate, what is the probability of having yellow offspring with branched veins on wings?

A. 9/16
B. 3/16
C. 16/16
D. 1/16
E. 1/2

5. All of the following are true about B cells EXCEPT:

A. mature in the thymus
B. produce antibodies
C. involved in cell-mediated immunity
D. bind with the antigen on the surface of the microbe
E. A and C

6. The upland chorus frog and the European frog can interbreed but never do, since the upland chorus frog mates during winter time while the European frog mates during summer. What type of an evolutionary process does this example represent?

A. geographic isolation
B. habitat isolation
C. behavioral isolation
D. reproductive isolation
E. temporal isolation

Questions 7-10: Each set of lettered choices below refers to the numbered questions or statements immediately following it. Select the one lettered choice that best answers each question and fill in the corresponding space on the answer sheet. A choice may be used once, more than once, or not at all in each set.

A. DNA polymerase
B. RNA polymerase
C. helicase
D. ligase
E. restriction enzyme

7. is responsible for unwinding the strands of DNA during replication

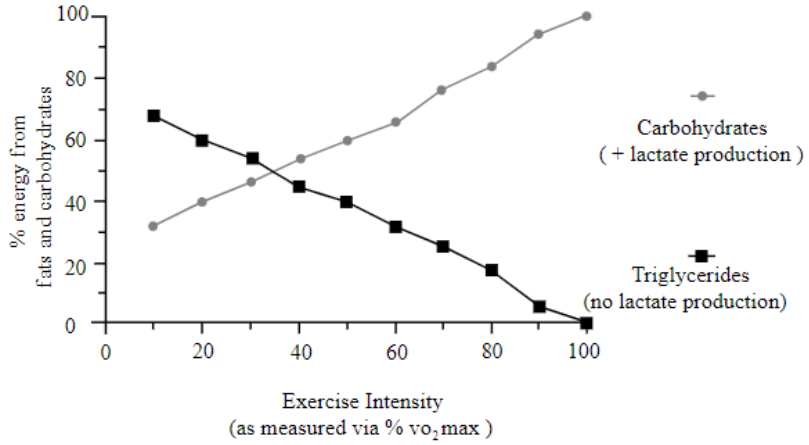
8. plays a major role during transcription

9. a protein that cleaves DNA at specific sites

10. is responsible for linking the two sections of DNA during replication

Questions 11-12: Refer to the given below

The graph below shows the effect of exercise intensity on sugar and fat consumption and lactic acid production.



11. What conclusion can be made from the graph regarding carbohydrate and fat consumption compared to increasing exercise intensity?

A. only carbohydrates are consumed in anaerobic respiration
B. the rate of anaerobic respiration decreases with the increasing intensity of exercises in both organic compounds
C. aerobic respiration is more dominant in triglycerides compared to carbohydrates
D. lactic acid production increases as the cell receives more oxygen due to exercising
E. carbohydrates and fats are consumed at the same rate to ensure maximum production of lactic acid

12. Which of the following molecules is most probably involved in the reaction occurring in the graph?

A. fatty acid
B. oxygen
C. amino acid
D. glycerol
E. glucose

13. What is the highest level of organization in ecology?

A. population
B. ecosystem
C. biosphere
D. species
E. community

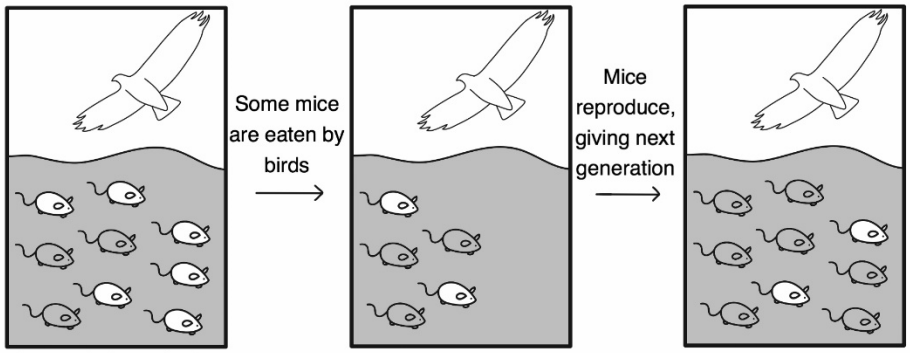
14. Which of the following is NOT a symptom of the inflammatory response in the human immune system?

A. redness
B. production of antibodies
C. soreness
D. increased warmth
E. swelling

15. Blood leaves the left ventricle, travels to all the cells in the body and returns back to the right atrium of the heart before it is pushed down to the right ventricle. Blood leaving the left ventricle:

A. is oxygenated compared to the blood coming back to the heart
B. has more pressure compared to the blood coming back to the heart
C. is deoxygenated compared to the blood coming back to the heart
D. A and B
E. B and C

Questions 16-17 : Refer to the figure below



16. The figure above represents which of the following principles of evolution?

I. natural selection
II. survival of the fittest
III. variations within species

A. I only
B. I and III only
C. II and III only
D. I, II and III
E. III only

17. What principle of natural selection is demonstrated in the example shown in the figure?

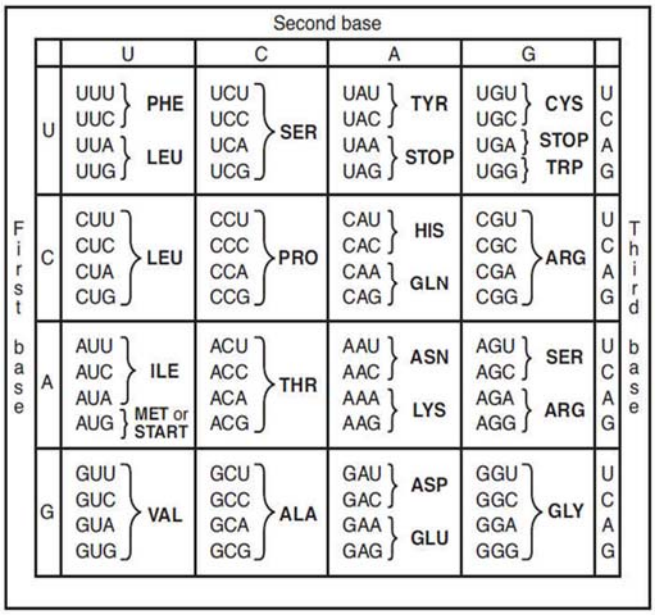
A. disruptive selection
B. diversifying selection
C. directional selection
D. stabilizing selection
E. speciation

18. What type of mutation is shown in the amino acid sequence of the mutated DNA compared to the normal sequence of amino acids in the table below?

normal DNA	TAC TTG AAT CGT
normal mRNA	AUG AAC UUA GCA
normal amino acid	met – asn – leu – ala

mutated DNA	TAC TTG **ATT** CGT
mRNA	?
amino acid	?

Genetic code chart



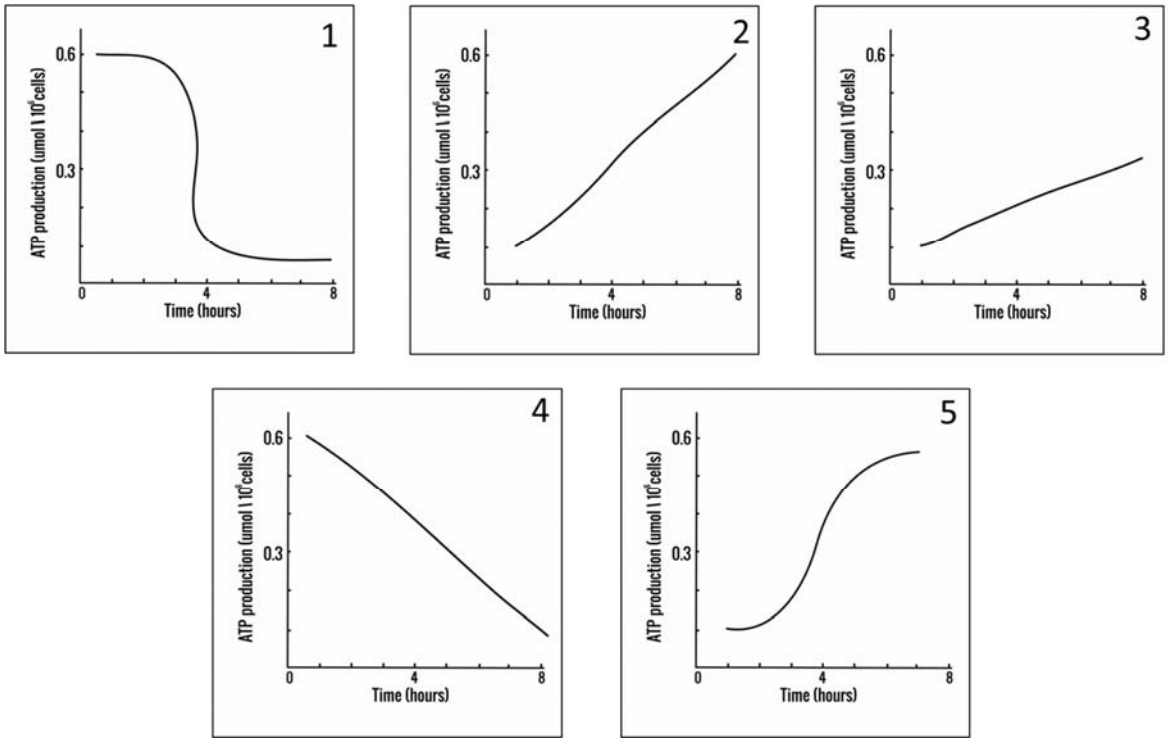
A. silent mutation
B. missense mutation
C. nonsense mutation
D. deletion
E. insertion

Questions 19-21 : Refer to the given below

The flu virus is known to affect the process of cellular respiration and ATP production. The table below shows the amount of ATP produced in control cells and in cells infected by the flu virus.

	ATP production (µmol\10^6 cells)	
Time (hours)	control cells	virus infected cells
1	0.1	0.1
2	0.2	0.15
3	0.3	0.2
4	0.4	0.3
5	0.5	0.4
6	0.6	0.45
7	0.7	0.5
8	0.8	0.6

19. Which of the following graphs most probably represents the data regarding infected cells shown in the table above?



A. 1
B. 2
C. 3
D. 4
E. 5

20. What is the final percent change in the ATP production in virus infected cells compared to control cells?

A. 75% decrease
B. 25% decrease
C. 75% increase
D. 25% increase
E. cannot be determined from the table

21. All of these can be true about the effect of the virus on cellular respiration EXCEPT:

A. most of the body functions that require energy will have compromised performance
B. the virus can cause fatigue in the body
C. the virus can enhance the function of ATP synthase during cellular respiration
D. the reaction that is most likely to be the most affected by the virus is the Krebs cycle
E. the decrease in ATP production can compromise the body's immune response against the virus

Questions 22-23: Refer to the given below

A scientist discovered a new species and was unsure how to classify it, so she decided to undergo thorough observation accompanied by some experiments to have a clear idea of the species. The results of her observations and her experiments are found in the table below.

Observation/experimentation	**Result**
Symmetry	bilateral symmetry
circulatory system	closed circulatory system
excrete wastes through	nephridia
body segmentation	present

22. In which of the following phyla could this living organism be placed in?

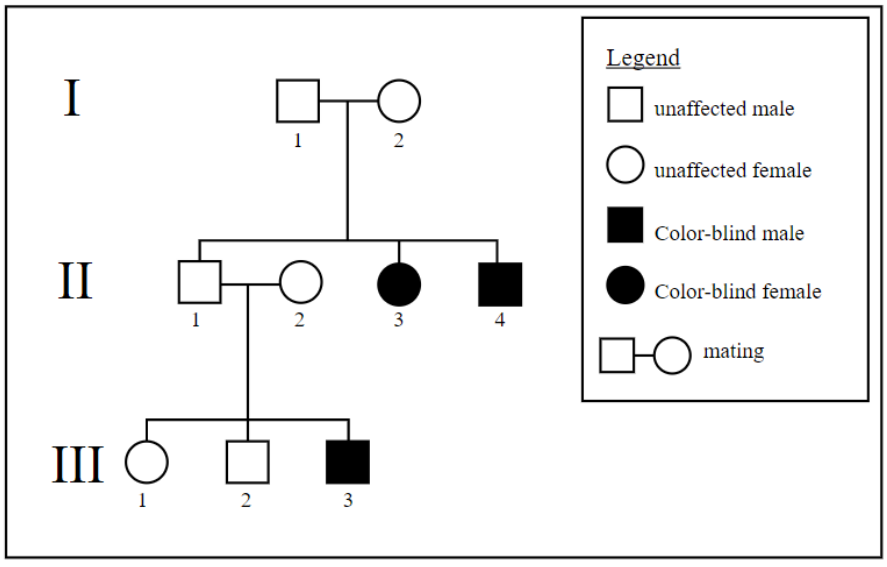
A. Porifera
B. Cnidarian
C. Annelida
D. Mollusk
E. Arthropod

23. A cross section was taken from the unknown species which is shown below. What type of body cavity is found in this living organism?

A. pseudocoelomate
B. coelomate
C. acoelomate
D. gastrula
E. blastula

Questions 24-25: Refer to the given below

Color-blindness is a sex-linked recessive disease. The following pedigree shows the inheritance of color-blindness in a family.



24. How can the female in II-3 be color-blind knowing that her parents have normal vision?

A. she has Turner's syndrome
B. she received a defected X chromosome from her father
C. she had a genetic mutation after birth
D. she was wrongly diagnosed with color-blindness
E. she received a defected X from her grandmother (father's mother)

25. What is the probability for individual III-1 to be born color-blind?

A. 0%
B. 25%
C. 75%
D. 100%
E. cannot be determined from the pedigree

26. Double fertilization occurs in:

I. angiosperms
II. gymnosperms
III. ferns
IV. mosses

A. I only
B. I and II only
C. II and III only
D. I and III only
E. I, II, III and IV

27. The Cambrian explosion marked the start of which of the following eras?

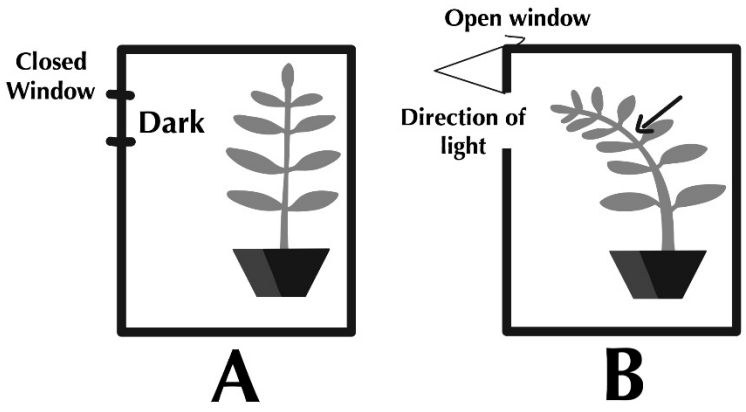
A. Paleozoic era
B. Mesozoic era
C. Cenozoic era
D. Precambrian times
E. Phanerozoic eon

28. All of these are characteristics of primates EXCEPT:

A. have opposable thumbs
B. possess binocular vision
C. have fewer offspring
D. presence of claws
E. have larger brains compared to body size

Questions 29-30: Refer to the given below

Sally wanted to examine an important phenomenon in plants, so she constructed the following setup as shown in the figure below.



29. Which phenomenon in plant was Sally trying to demonstrate?

A. geotropism
B. thigmotropism
C. hydrotropism
D. phototropism
E. chemotropism

30. What type of hormone is found in larger concentrations (compared to the rest of the plant) in the area where the arrow is pointing in plant B?

A. auxin
B. abscisic acid
C. ethylene
D. gibberelins
E. cytokinins

31. The plasma membrane has a hydrophilic head and a hydrophobic tail. Which of the following can be maintained due to this unique structure of the plasma membrane?

A. large water-soluble substances will find it difficult to penetrate the plasma membrane to the inside of the cell
B. water-insoluble substances can easily pass through the polar head but will be stuck in the middle of the bilayer
C. the cell maintains its structure because of the way a phospholipid bilayer is formed
D. polar molecules find it easy to penetrate the plasma membrane
E. the plasma membrane maintains a very stiff structure due to the fluid mosaic model of the plasma membrane.

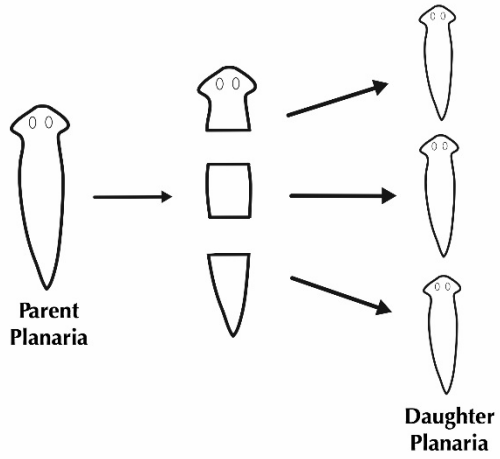
32. A cell undergoing mitosis was shown to have 16 chromosomes at metaphase. How many chromosomes will each of the daughter cells have at the end of mitosis?

A. 4
B. 8
C. 16
D. 32
E. it depends on the species

33. A man with an unknown blood type needs an urgent blood transfusion. What is the safest choice of blood type that could be given to this man?

A. A^+
B. A^-
C. O^+
D. O^-
E. AB^-

34. What type of reproduction is shown in the figure below?

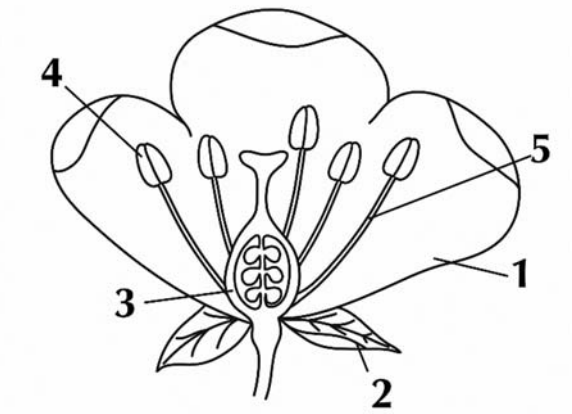


A. budding
B. fragmentation
C. sexual reproduction
D. binary fission
E. parthenogenesis

35. Which of the following organic compounds is capable of performing the following functions: transport substances, make hormones and speed up reactions?

A. carbohydrates
B. proteins
C. lipids
D. nucleic acids
E. A and B

Questions 36-37: Refer to the figure below



36. The presence of this structure attract the pollinators

A. 1
B. 2
C. 3
D. 4
E. 5

37. The male gamete is formed in this structure:

A. 1
B. 2
C. 3
D. 4
E. 5

38. Which of the following organelles/structures would you expect to find abundantly in a sperm?

A. nucleus
B. acrosome
C. flagella
D. mitochondria
E. ribosomes

39. A population of randomly-mating beetles contains 36% brown beetles. Brown coloring is recessive and can be presented by the genotype "bb". Calculate the percentage of heterozygous individuals according to the Hardy Weinberg equation.

A. 36%
B. 46%
C. 48%
D. 54%
E. 72%

40. Which of these relationships is NOT correct?

A. pepsin: sucrose
B. lipase: fats
C. amylase: starch
D. trypsin: protein
E. maltase: maltose

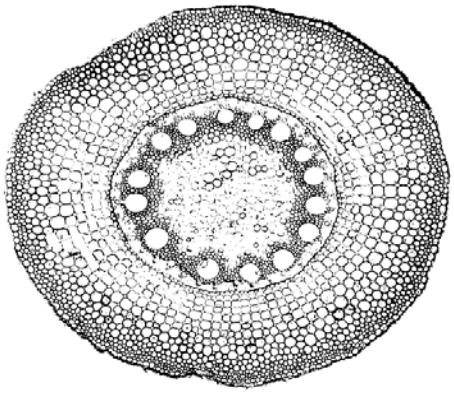
41. Freshwater fish have to make many adaptations in order to survive in an environment with less concentration of salt in their surroundings. All of the following are characteristics of freshwater fish EXCEPT:

A. they need to have an internal salt concentration higher than that of freshwater
B. they can eat more to replenish the lost salt from their bodies
C. they need to urinate large amounts with little salt
D. They do not need to drink at all
E. Their kidneys should be able to expel maximum amount of salt to the outside

42. Photosynthesis and cellular respiration are known to be complementary to one another. All of the following are true about photosynthesis and cellular respiration EXCEPT:

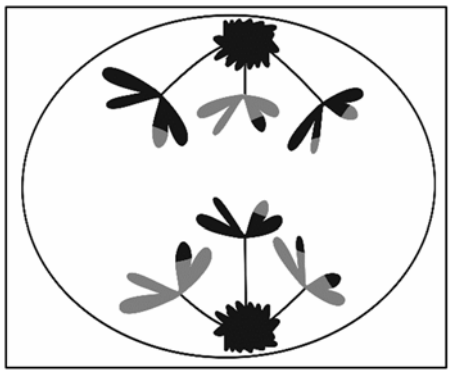
A. the products of one process are the reactants of the other process
B. glucose produced during photosynthesis turns back into carbon dioxide by cellular respiration to be used again in photosynthesis
C. these two processes are the main contributors and influencers of the carbon cycle
D. the oxygen released in photosynthesis can be used in the electron transport chain of the cellular respiration
E. water acts as a reactant in cellular respiration and a product in photosynthesis

43. What is shown in the figure below?



A. monocot stem
B. dicot stem
C. monocot root
D. dicot root
E. monocot leaf

Questions 44-45: Refer to the figure below

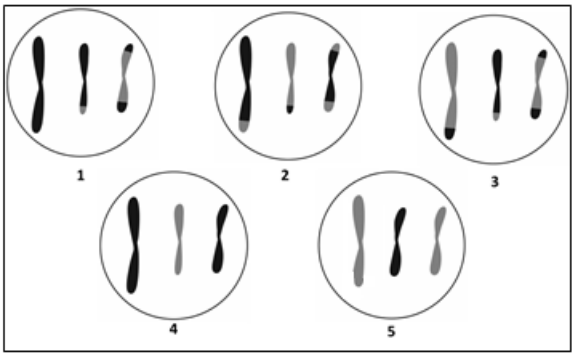


A

44. Which stage of meiosis is represented in figure A?

A. metaphase I
B. metaphase II
C. anaphase I
D. anaphase II
E. telophase I

45. Which of the following CANNOT be a gamete produced by the cell in figure A?

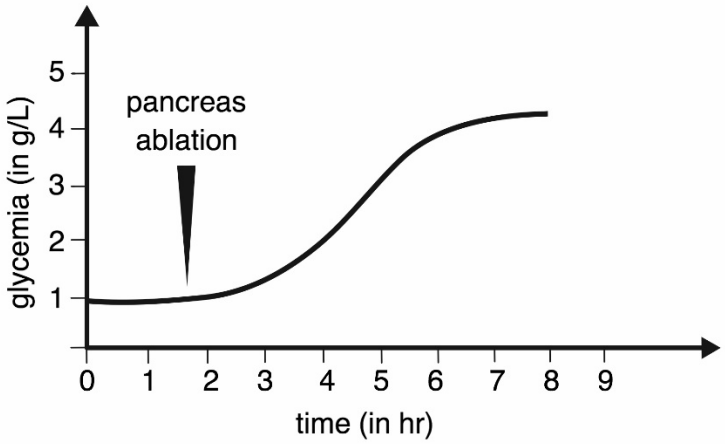


A. 1
B. 2
C. 3
D. 4
E. 5

Questions 46-47 : Refer to the given below

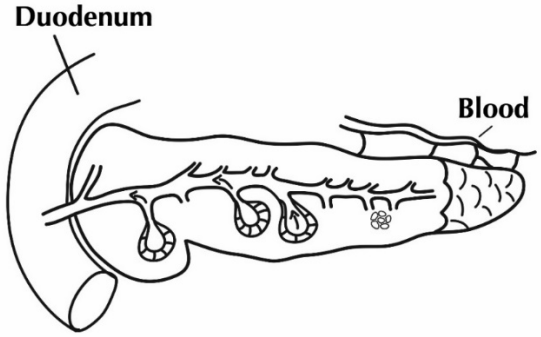
In 1852 a scientist conducted an experiment on a rabbit to understand the function of the pancreas. He completely removed the pancreas and observed the blood glucose level (glycemia), which is shown in the graph. Later, he also noticed the presence of fat in the stool which is an indication of poor digestion.

46. In the following graph, the time of the greatest increase in the blood sugar levels occurs:



A. during the first 2 hours
B. between the 2nd and the 4th hour
C. between the 4th and the 6th hour
D. between the 6th and the 7th hour
E. between the 7th and the 8th hour

47. Dissection of the pancreas showed that it contains a duct that collects a liquid produced by pancreatic cells and the gland is also connected to many blood vessels. What can be concluded regarding the type of gland the pancreas is?



A. the pancreas acts as an endocrine gland
B. the pancreas acts as an exocrine gland
C. the pancreas acts as an endocrine and an exocrine gland
D. the pancreas can alternate between being an endocrine gland and an exocrine gland, but never both at the same time
E. the type of gland that the pancreas represents depends on body temperature

48. A forest with several different species of rabbits had a huge fire that killed most of the different populations of rabbits allowing only a small, random assortment of survivors to escape to a different area. This is an example of which one of these terms?

A. genetic drift
B. founder's effect
C. bottleneck effect
D. A and B
E. A and C

Questions 49-50: Refer to the given below

A scientist conducted a series of experiments on a specimen to identify whether it is a living or non-living organism. The results of the experiments are found in the table below:

is capable of reproduction when put in a host
is incapable of growth after some time
possesses DNA
is capable of adapting to changing environments
is incapable of utilizing energy

49. Based on the results, what conclusion can the scientist make?

A. the fact that it can adapt to changing environments makes this specimen a living organism regardless of other characteristics
B. any specimen possessing any form of nucleic acid such as DNA will be considered a living organism
C. it is a non-living structure since it is incapable of growing and developing
D. it is living since being able to reproduce on its own is not necessary to conclude that a specimen is not living
E. the table does not show enough evidence to make any assumptions on the viability of the specimen

50. Which of the following is most likely to be the specimen in the experiment?

A. virus
B. bacteria
C. protozoan
D. amoeba
E. zooplankton

51. A student wanted to study the effect of exercise on his heart rate. This student does not have any cardiac or respiratory problems. The results of his experiment are shown in the table below. Predict what could the heart rate most probably be after he rested for 7 minutes?

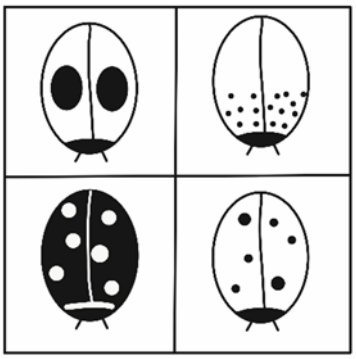
Effect of Exercise on Heart Rate	
Pulse taken	Heart rate
At rest	72
Immediately after exercise	112
1 minute after exercise	96
7 minute after exercise	?

A. 75
B. 52
C. 65
D. 115
E. 98

52. Which of the following is an example of the theory of endosymbiosis?

A. a parasitic relationship of a mosquito biting a human and transmitting disease
B. when all the body systems work together ensuring a balanced relationship between the different body parts
C. the second line of defense of the human immune system characterized by the nonspecific attack against invaders
D. the formation of head and sensory apparatus in advanced animals
E. when large eukaryotic cells engulfed smaller prokaryotic cells and both had a mutualistic relationship

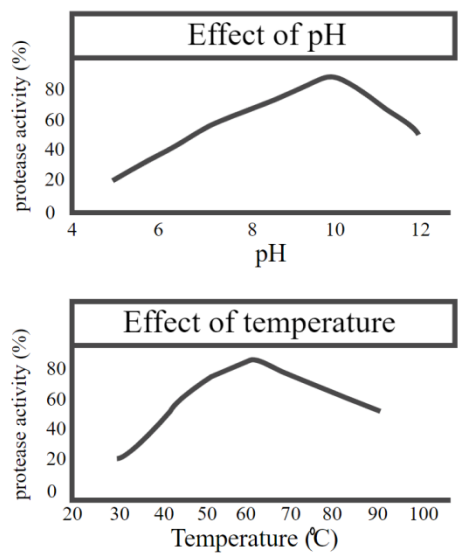
53. What do the ladybugs in the image below represent?



A. species diversity
B. ecosystem diversity
C. genetic diversity
D. community diversity
E. species richness

54. Protein proteases are enzymes found in laundry detergents that help in breaking down stains such as blood, sweat and eggs. The graphs below show the effect of temperature and pH on the activity of these enzymes. Based on the graphs, the label on the detergent box would most probably state the following:

"This detergent is_____ and works best at a temperature range of _____."



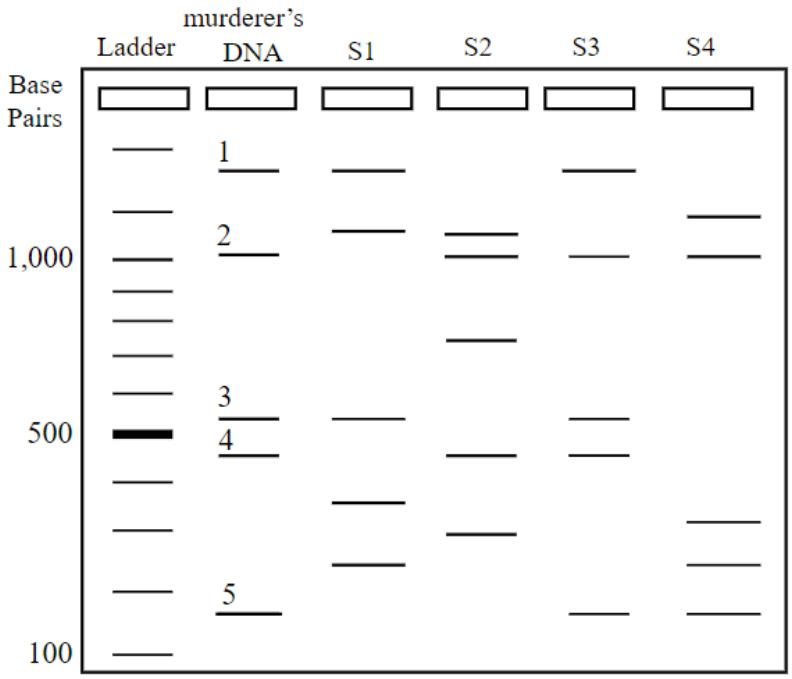
A. acidic, 30°C-50°C
B. acidic, 55°C-65°C
C. basic, 40°C-55°C
D. basic, 55°C-65°C
E. neutral, 70°C-90°C

55. The change in a population from high birth and death rates to low birth and death rates is known as:

A. age structure
B. net population growth
C. zero population growth
D. demographic transition
E. B and C

Questions 56-57: Refer to the given below

DNA fingerprinting uses gel electrophoresis technology to show the genetic make-up of a living organism, it is mostly used in solving crimes or paternity cases. The figure below shows gel electrophoresis representing DNA samples from four suspects of a murder case (S1-S4), along with DNA found from hair sample that belongs to the murderer.



56. Which one of these numbers represents the largest DNA fragment?

A. 1
B. 2
C. 3
D. 4
E. 5

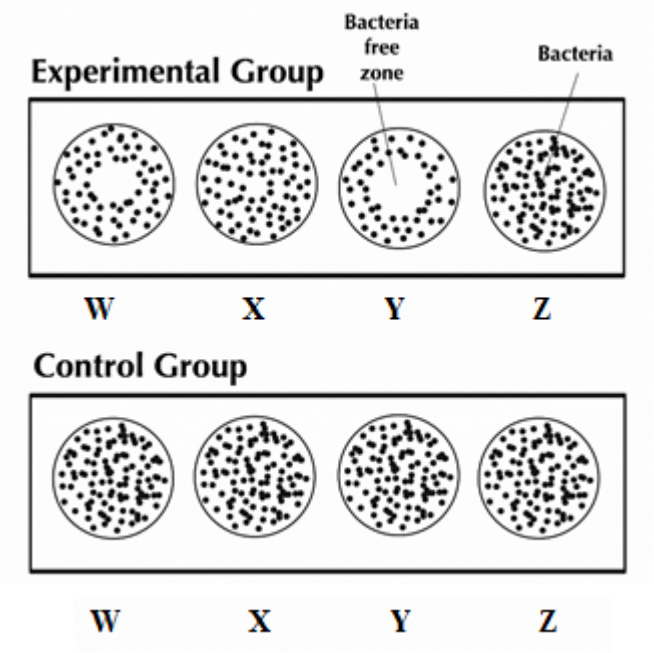
57. Which one of these suspects is most likely to be the murderer?

A. suspect 1
B. suspect 2
C. suspect 3
D. suspect 4
E. more tests are needed

58. All of the following are examples of homeostasis in the human body EXCEPT:

A. insulin is released after eating a sugary snack to maintain a constant blood glucose level
B. carbon dioxide is exhaled from lungs to ensure a stable pH of blood
C. on hot days, sweating makes sure body temperature remains at 37°C
D. being able to run and throw objects with high precision ensures we can protect ourselves from predators
E. urinating will remove unnecessary excess water from the body

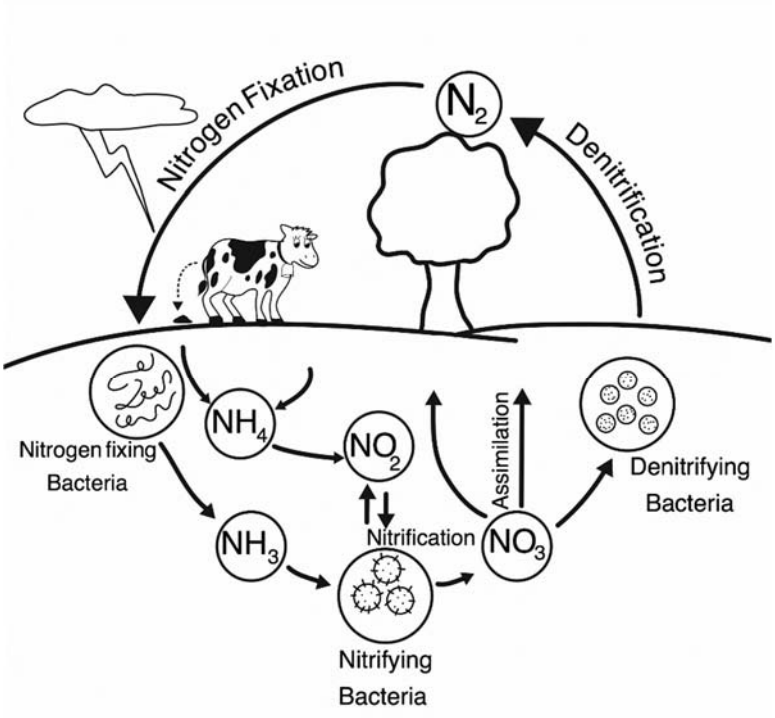
59. A scientist conducted an experiment to study the effect of antibiotic X on the survival of four different types of bacteria (W, X, Y and Z). She prepared 8 petri dishes (1 type of bacteria in 2 dishes) inoculating the same count of bacterial cells in each dish. After 24 hours, she added 20µg of antibiotic X in the center of the four experimental dishes. After 3 hours at 37°C she observed the following results:



Which one of these is the independent factor?

A. having a constant temperature
B. the different types of bacteria
C. the addition of antibiotic X
D. the death rate of the bacteria
E. the survival rate of the bacteria

Questions 60-61: Refer to the nitrogen cycle in the diagram below:



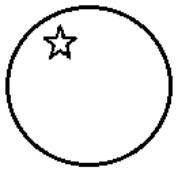
60. Which living organism is responsible for moving nitrogen from the biotic part to the abiotic part of the nitrogen cycle and vice versa?

A. nitrogen-fixing bacteria
B. denitrifying bacteria
C. green plants
D. nitrifying bacteria
E. there is more than one way for this process to occur

61. Which of these statements is NOT a similarity between the nitrogen cycle and the carbon cycle?

A. both cycles can transform either carbon or nitrogen from the ocean to the atmosphere or vice versa
B. both undergo chemical changes that transform the form of the molecules containing them
C. carbon and nitrogen are present in all living things
D. both cycles involve releasing the element in a molecular form into the atmosphere
E. both have short-term and long-term parts in their cycles

62. Looking through a compound light microscope, the following circle, which represents the field of vision, is seen. The star represents a structure you want to see more clearly in the center. How should you move the slide to bring the star to the center?



A. to the right and up
B. to the left and up
C. to the right and down
D. to the left and down
E. you need to follow the manual of the microscope

63. A man was having painful cramps along with other symptoms. The doctor told him that he is having problems in digesting fat. Which of these organs is the LEAST involved in causing this condition?

A. liver
B. gall bladder
C. small intestine
D. stomach
E. pancreas

Questions 64-66: Each set of lettered choices below refers to the numbered questions of statements immediately following it. Select the one lettered choice that best answers each question and fill in the corresponding space on the answer sheet. A choice may be used once, more than once, or not at all in each set.

A. nucleic acid
B. ribosomes
C. cell wall
D. plasma membrane
E. mitochondria

64. this can only be found in eukaryotic cells

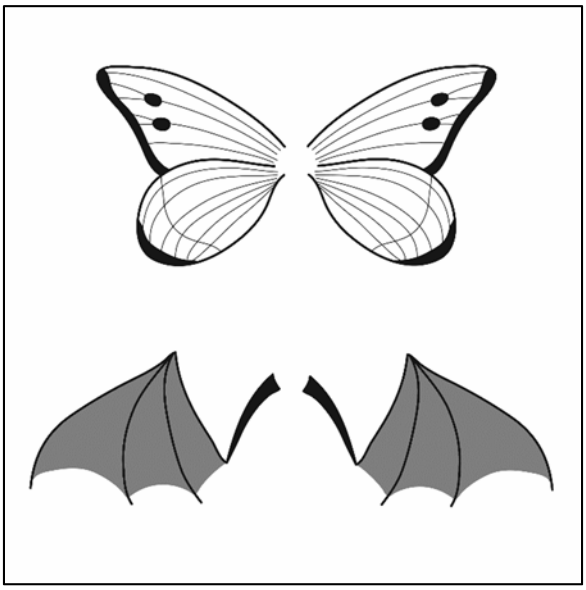
65. this is absent from animal cells

66. can bind to tRNA

67. Kangaroos, mice, koalas, Tasmanian wolves and Marsupial rats all emerged from an ancestral mammal and varied in terms of the survival traits they possessed. Which one of these patterns of evolution applies to this example?

A. divergent evolution
B. convergent evolution
C. parallel evolution
D. coevolution
E. adaptive radiation

68. The figure below shows an example of which of the following evidences of evolution?



A. analogous structures
B. homologous structures
C. vestigial structures
D. fossil records
E. molecular biology

69. Which one of these vitamins is soluble in water?

A. vitamin A
B. vitamin B
C. vitamin D
D. vitamin E
E. vitamin K

70. Life started on Earth about 3.8 billion years ago under harsh environmental conditions. Which type of cell was most probably the first cell ever to form on Earth?

A. prokaryotic and autotroph
B. prokaryotic and heterotroph
C. eukaryotic and photosynthetic
D. eukaryotic and autotrophic
E. prokaryotic and photosynthetic

71. Which one of these represents an ecosystem?

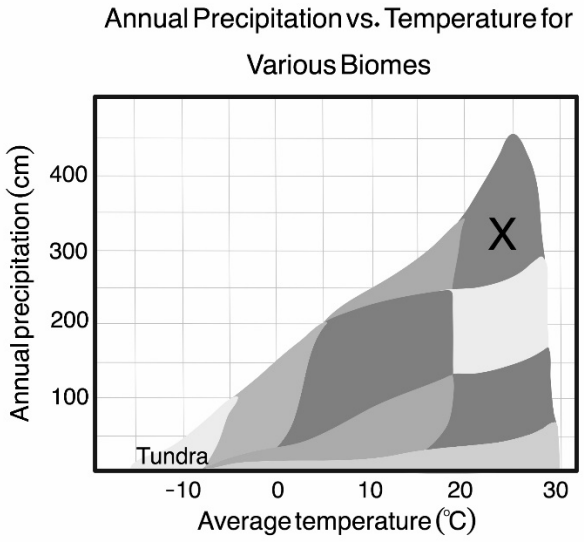
A. populations of birds and squirrels inhabiting a tree
B. the biotic and abiotic components of a tropical rain forest
C. the phytoplankton and zooplankton in the ocean
D. plant and animal species in cold and warm areas combined
E. bacteria populations found in an infected person's throat

72. Which of the following animals has only cells without proper tissues?

A. hydra
B. earthworm
C. sponge
D. jellyfish
E. roundworm

Questions 73-74: Refer to the given below

The graph below represents the annual precipitation and the temperature for the various biomes in the world.



73. Which of the following biomes could be represented by the letter X on the graph?

A. tropical rainforest
B. desert
C. boreal forest
D. temperate grassland
E. tropical savanna

74. In a tundra, which of the following biotic factors is most probably not present?

A. polar bears
B. birds
C. shrubs
D. oak trees
E. insects

75. Overgrazing in a green field turned the floor from green to almost brown. Scientists studying the effect of overgrazing in that area discovered that a lizard population inhabiting that area changed from being green to being almost brown. Which of the following would best explain the color change that occurred in the lizard population?

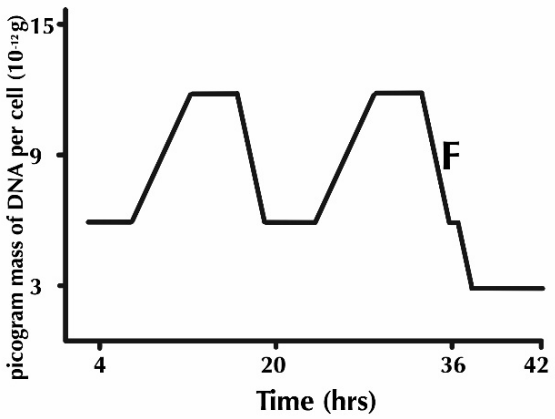
A. overgrazing changed the color of grass into brown thus allowing lizards to camouflage into that color
B. the lizards developed brown pigments to be able to blend in with the color of the field
C. first the lizards became brown which caused the field to develop dark colored grass
D. a mutation caused the formation of new brown pigments in lizards that dominated the green color
E. the brown lizards in the population were the only ones that survived predators since they stopped standing out from the environment around them

76. In mitosis, chromosomes condense and become visible during:

A. telophase
B. anaphase
C. metaphase
D. prophase
E. interphase

Questions 77-78: Refer to the given below

The following graph shows the intracellular DNA mass over a period of time.



77. Based on the graph, which of the following cells is most probably represented?

A. skin cell
B. liver cell
C. sperm cell
D. spermatogonium cell
E. red blood cell

78. Which of the following phases is represented by letter F?

A. G1 phase
B. S phase
C. metaphase I
D. telophase I
E. metaphase II

79. Vampire bats regularly regurgitate blood and donate it to other members of their group who have failed to feed that night, ensuring they do not starve. What type of social behavior is this?

A. agonistic behavior
B. dominance hierarchies
C. territoriality
D. altruism
E. habituation

80. Proper observation is crucial for scientific discoveries. Which one of these statements is considered an observation?

A. Bats use ultrasound waves to detect objects around them
B. A lynx has scent glands in its claws; it leaves its scent after scratching a tree
C. Sea turtles may use the Earth's magnetic field for navigation
D. Many animals leave pheromones behind to mark their territory
E. Elephants can reach to a size of 3.9 meters