EDUCATIONAL ASSESSMENT AND EXAMINATIONS SERVICE (EAES)
ETHIOPIAN SECONDARY SCHOOL LEAVING CERTIFICATE EXAMINATION (ESSLCE)

Biology Exam Booklet - Code 661

Hamle 2018 E.C. / July 2026 G.C.

NUMBER OF ITEMS: 100	**SUBJECT CODE: 06**
BOOKLET CODE: 661	**TIME ALLOWED: 2:30 HOURS**

BIOLOGY (QUESTIONS 1 - 100)

Directions: *Solve each of the problems given in questions 1 - 100 and select the correct answer from the given four alternatives. Then, blacken the letter of your choice on the separate answer sheet provided.*

1. Which ions should enter the presynaptic and postsynaptic nerve cells in order for a nerve impulse to cross the synaptic cleft, respectively?

A. Calcium and sodium ions
B. Sodium and potassium ions
C. Sodium and calcium ions
D. Calcium and potassium ions

2. While cooking a pancake, a girl accidentally touched the hot part of the plate and immediately withdrew her hand. Which one of the following impulse pathways shows the correct sequence of events during response to this stimulus?

A. Receptor → motor neuron → sensory neuron → brain → effector
B. Receptor → interneuron → spinal cord → motor neuron → effector
C. Receptor → interneuron → brain → motor neuron → effector
D. Receptor → sensory neuron → spinal cord → motor neuron → effector

3. Which of the following is the main functions of hypodermis? It

A. protects entry of pathogenic microorganisms.
B. serves as an insulation and energy storage.
C. produces skin pigment known as melanin.
D. provides a waterproof barrier and produces keratin.

4. Which of the following eye structure and its function is correctly matched?

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A. Pupil - controls the iris muscles to adjust the light into the eyes

B. Iris - controls the diameter of the lens by attaching to its opposite ends

C. Sclera - physically supports the internal structures of the eyes

D. Cornea - provides nourishment to the inner parts of the eyes

5. If you are spinning in a chair and instantly stop, you feel a sensation of imbalance. What does this explain?

A. Fluid in the ampullae continues to move but the sensory hairs signaling stops.

B. Fluids in the semicircular canals stop moving, but the sensory hairs continue signaling.

C. Fluids in the semicircular canals continues to moving and the sensory hairs also bend for signaling.

D. Fluids in the sacculus and utriculus move irregularly leading to false motion.

6. Which of the following is necessarily correct about trophic levels in an ecosystem?

A. Omnivores do not eat each other and trophic level doesn't work.

B. Carnivores in the third trophic level do not eat each other.

C. Cattles are herbivores positioned in the second trophic level.

D. Herbivores are in the highest trophic levels in the ecosystem.

7. Which of the following is the correct order of energy flow in an ecosystem?

A. Sun → grass → sheep → decomposers

B. Sun → decomposers → grass → sheep

C. Producer → herbivore → carnivore → sun

D. Producer → sun → carnivore → herbivore

8. In an ecosystem, organism 'A' is eaten by organism 'B', organism 'B' is eaten by organism 'C', and organism 'C' is eaten by organism 'D'. Based on this hypothetical food chain, which of the following is correct about organism 'B'? It is a/an

A. omnivore B. herbivore

C. producer D. carnivore

9. Which one of the following processes are involved in water cycle?

A. Evaporation, transpiration, condensation, precipitation and runoff

B. Transpiration, combustion, percolation, precipitation and feeding

C. Transpiration, oxidation, condensation, sedimentation and weathering

D. Evaporation, combustion, assimilation, sedimentation and leaching

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10. Global warming is mainly related to which of the following cycles?

A. Water
B. Phosphorus
C. Nitrogen
D. Carbon

11. It is hoped that students gained a knowledge and skill after learning how to demonstrate water transport in plants using a simple experiment. Through which of the following the knowledge and skill be applied in a real life?

A. Cutting stems diagonally to increase the surface area for water flow
B. Removing broader leaves of a plant to increase transpiration rate
C. Regularly watering household plants during high humid day
D. Putting garden plants under shade to reduce transpiration

12. Suppose you have a potted growing seedling in your house and you want it to be straight both its shoot and root while it is growing. This can be achieved by:

A. placing it in a shady area near the window inside a rotating instrument, and water it from all sides.
B. placing it away from the window where there is bright light, add water to all sides and putting it in a rotating instrument.
C. adding water to all sides of it, place it near the window where there is adequate shade putting it inside a rotating instrument.
D. adding water to one side of it, and place it away from the window where there is bright light.

13. Which one of the following molecules is organic?

A. Enzymes
B. Water
C. Hydrogen sulfide
D. Sodium chloride

14. Which one of the following nutrients is correctly matched with its primary role to the human body?

A. Protein - immediate energy source
B. Carbohydrate - body building
C. Nucleic acid - maintain body temperature
D. Lipids - body heat reserve

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15. Which one of the following statements is correct about phospholipid? It is:

A. unique to human, animal and plant cells.

B. a component of the nucleic acids, hormone and enzyme.

C. a structural component of the cell membrane.

D. the primary source of energy for most organisms.

16. The transport of gases and water through the cell membrane based on concentration gradient is possible because of:

A. diffusion and osmosis

B. carrier and channel proteins

C. active transport

D. facilitated diffusion

17. The process of taking-in food to generate energy needed for body's different activities is:

A. excretion

B. absorption

C. nutrition

D. homeostasis

18. The general term used when an elementary school child get sick because of shortage of enough amount of one particular nutrient is:

A. degeneracy disease

B. hereditary disease

C. deficiency disease

D. infectious disease

19. A sick person who lost his appetite has lost much of his body weight. Which of the following more accurately explains this condition?

A. Since there is no food intake, his body muscle starts to respire anaerobically.

B. Due to shortage of nutrients, the body is utilizing its fat or protein reserves.

C. The person could unable to do heavy physical exercises to strengthen his muscles.

D. The person's body is expending its nutrients for immune responses to defend itself.

20. Which one of the following ecological levels includes all the rest?

A. Biosphere

B. Biome

C. Community

D. Ecosystem

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21. If you are asked to write the taxonomic hierarchy of modern human being from the kingdom downwards, what will be the correct sequence the taxon?

A. Animalia → Hominidae → Mammalia → Primata → Homo → Chordata → Homo sapiens

B. Animalia → Mammalia → Chordata → Hominidae → Primata → Homo → Homo sapiens

C. Animalia → Chordata → Mammalia → Primata → Hominidae → Homo → Homo sapiens

D. Animalia → Primata → Mammalia → Chordata → Hominidae → Homo → Homo sapiens

22. Which one of the following statements correctly presents the importance of biological classification? It:

A. allows biologists to study the relationship between organisms.

B. avoids confusion by giving names based on local languages.

C. is an ancient science with limited practical relevance today.

D. increases energy and time to study the evolution of organisms.

23. Which of the following is INCORRECT about an organism classified under the Kingdom Protista? It is:

A. morphologically simple or complex.

B. an autotroph or a heterotroph.

C. animal or plant like.

D. an archaeon or a bacterium.

24. All of the following are organelles located in the cytoplasm of a eukaryotic cell EXCEPT:

A. nucleus B. plasma membrane

C. endoplasmic reticulum D. ribosome

25. Which one of the following subcellular structures is found in both animal and plant cells?

A. Cell wall B. Chloroplast

C. Ribosome D. Plastid

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26. Which one of the following procedures demonstrate the correct sequence of events that happen during replication a bacteriophage?

A. Synthesis of new molecules → attachment → entry of virions → assembly → release

B. Entry of virions → attachment → assembly → synthesis of new molecules → release

C. Attachment → entry of virions → synthesis of new molecules → assembly → release

D. Synthesis of new molecules → attachment → entry of virions → assembly → release

27. A student sterilized culture media, hospital needles for disposal and blood serum using different sterilization techniques. At the end of the experiment, she confirmed that all of the sterilized materials were germ free. Which sterilization techniques were used by the student, respectively?

A. Hot air oven, intermittent sterilization and flaming

B. Low temperature pasteurization, hot air oven and disinfection

C. Moist heat sterilization, incineration and intermittent sterilization

D. Tyndallization, dry heat sterilization and incineration

28. Which one of the following is correct regarding anabolic and catabolic pathways? Anabolic pathways:

A. needs energy to synthesize macromolecules whereas catabolic pathways release energy from breakdown of molecules.

B. occur in mitochondria whereas the catabolic pathways occur in the chloroplasts.

C. provide raw materials for catabolic reactions whereas catabolic pathways use it to make larger molecules.

D. involve enzymes for chemical reactions whereas catabolic pathways use chemical catalysts.

29. Which one of the following statements correctly describes the reduction stage of the calvin cycle?

A. Combination of 3-phosphoglyceric acid with carbon dioxide

B. Combination of carbon dioxide to ribulose-1,5-bisphosphate

C. Formation of the ribulose-1,5-bisphosphate acceptor

D. Formation of glucose from glyceraldehyde-3-phosphate

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30. If a plant is placed in a highly controlled environment where light is available but very limited CO_2, what will happen to the light-dependent and light-independent reactions of the photosynthesis?

A. The light dependent reaction produces ATP and NADPH while the light independent reaction will consume ATP.

B. The light independent reactions will continue while light dependent reaction will cease.

C. Light dependent reaction will stop producing oxygen, but light independent reaction will continue producing glucose.

D. Both the light-independent and light-dependent reaction will stop immediately.

31. Which one the following end products of digestion move initially into the lacteals for absorption?

A. Glucose and amino acids

B. Water and vitamins

C. Medicines and alcohol

D. Fatty acids and glycerol

32. Pulmonary circulation differs from systemic circulation in that it is a circulation that:

A. pumps blood to the wall of lungs via coronary artery.

B. carries deoxygenated blood via pulmonary vein.

C. takes place between the heart and the lungs.

D. supplies oxygenated blood to the rest body parts.

33. Which of the following is a common and universal practice regarding blood transfusion?

A. Blood group compatibility has to be confirmed before transfusion.

B. The genetic background of the donor must be checked against the recipients.

C. The donors must be a close relative of the recipient to avoid any potential serious reactions.

D. Analyzing the donor's family background and nutritional status so far.

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34. Which one of the following statements is correct about Rh incompatibility? It refers to the:

A. agglutination of blood from two sources with regard to the 'A' and 'B' antigens on erythrocytes.

B. Rh^- mother's antibodies attack the red blood cells of an Rh^+ fetus.

C. absence of an agglutination when 'O' blood type is donated to all other blood types.

D. condition when an erythrocyte has neither the 'A' nor the 'B' antigen.

35. Which one of the following shows a correct match between the component and function of the human lymphatic system?

A. Lymph nodes - produces and transport red blood cells

B. Lymph - transport white blood cells

C. Lymphatic vessels - transport fluid to the body tissues

D. Lymphatic trunk - collects and fight pathogens

36. When an individual underwent medical checkup, his overall condition is judged normal except that he is extremely cold-sensitive and has abnormally dry skin. To which of the following macromolecules the problem most likely related while keeping all other factors normal?

A. Nucleic acids B. Lipids

C. Glycogen D. Carbohydrates

37. A sequence of events that take place in a parent cell as a means of distributing genetic material to form daughter cells is:

A. cell movement B. cell cycle

C. cell signal D. cell aging

38. What is the role of the microvilli in the wall of the small intestine? Because it:

A. produces the gastric juices involved during digestion.

B. secretes bile to facilitate fat digestion and absorption.

C. specifically adapted to transport lipid digestive end products.

D. increases the surface area for absorption of nutrients.

39. Which of the following shows a pair of "pure" and its "applied" sub-fields of biology?

A. Zoology - forestry B. Botany - plant breeding

C. Anatomy - poultry D. Microbiology - horticulture

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40. This item is based on the table below that compares meiosis and mitosis.

No.	Meiosis	Mitosis
1.	Occurs during sexual reproduction to produce genetically unique daughter cells.	Occurs during asexual reproduction to produce genetically identical daughter cells.
2.	Ends with four daughter cells that maintains parental chromosome.	Ends with two daughter cell reducing parental chromosome by half.
3.	The process starts with replication of DNA at interphase stage.	The process starts with replication of DNA at interphase phase.
4.	Serve as a means to provide evidence for evolution.	Serve as means of reproduction, repair and growth.

From the above table, which rows correctly compare the process of meiosis and mitosis?

A. 1, 2 and 4
B. 2, 3 and 4
C. 1, 2 and 3
D. 1, 3 and 4

41. Which one of the following statements is correct about the process of digestion in humans? It involves:

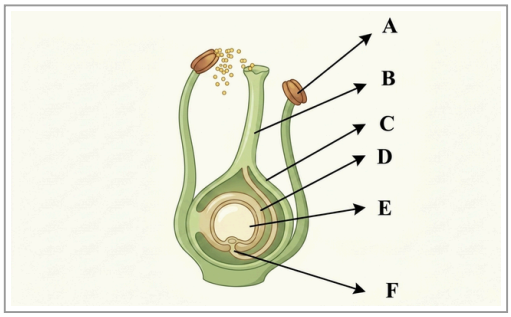
A. breaks down of large food molecules into absorbable end products.
B. mechanical breakdown of carbohydrates into maltose in the small intestine.
C. enzyme and secretions that best works at common optimum pH.
D. mechanical breakdown of larger molecules in the duodenum.

42. Which of the following clearly shows the differences between flowering and non-flowering plants? Flowering plants have:

A. vascular bundle while non-flowering plants do not have.
B. true roots, stem and leaves, but non-flowering plants do not have.
C. fruits, but non-flowering plants do not have.
D. seeds while non-flowering plants do not have.

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43. This item is based on the following diagram of parts of a flower.



In the above diagram, which part of a flower is represented by letter D?

A. Pollen tube
B. Ovule
C. Sepal
D. Anther

44. From which structure does the seed embryo obtains food until it forms leaf and manufacture its own food?

A. Seedcoat and hypocotyl
B. Cotyledon and endosperm
C. Plumule and epicotyl
D. Radicle and plumule

45. Which one of the following statements is INCORRECT about seed dispersal?

A. The mechanism of seed dispersal is related to the structural adaptations and overall nature of seeds.

B. Seed dispersal is necessary to avoid overcrowding and biological competitions between growing seedlings.

C. Water is the main seed dispersal agent for seeds that are covered with hard seed coats.

D. Different seed dispersal mechanisms ensure plant distribution across wide areas because plants are sessile.

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46. Which one of the following options contains a pair of innate and acquired animal behaviors?

A. Web making in spiders and honeybees dancing

B. Opening of mouth in chicks and honeybees dancing

C. Insight learning in monkeys and sensitization in sea slug

D. Nest-building in birds and habituation in prairie dogs

47. How is the process of osmoregulation linked to sugar regulation or vice versa in humans?

A. When there is excess water in the body, osmoregulation removes it irrespective of blood sugar level.

B. When the kidneys malfunction, both osmoregulation and sugar regulation are affected.

C. If hormonal problems affect blood sugar level, intake of more electrolytes and water solve the problem.

D. Both osmoregulation and sugar regulation are dependent on external condition.

48. Which one of the following statements correctly describes how enzymes speed up the rate of chemical reactions? By:

A. lowering the energy of reactants required to react more easily

B. decreasing the collision between substrate and enzyme

C. increasing the concentrations of reactants and speeding the reaction

D. being part of the reactants and product in a reaction

49. Assume that a protein has many binds and twists due to interaction between the side chain groups of amino acids to gain maximum stability. To which structure this protein belongs?

A. Secondary structure B. Quaternary structure

C. Tertiary structure D. Primary structure

50. What happens following a successful enzyme-substrate binding?

A. The activation energy of the reaction will be raised.

B. Loss of the molecular structure of the active site.

C. Formation of an enzyme-substrate complex.

D. The substrate will become more stable.

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51. Two modern food processing companies use microorganisms in different ways:

Company I - produces high quality yogurt using *Lactobacillus*
Company II - produces bread by adding yeast to the dough

Which biotechnological role is shared by both companies?

A. Preserving the products without refrigerator

B. Preventing spoilage completely in all condition

C. Increasing the yield but decreasing quality of the products

D. Improving taste and texture through fermentation

52. Which of the following sets of benefits can be gained from transgenic organisms?

A. Increased genetic diversity, improved carcass composition and susceptibility to diseases

B. High quality fiber, increased growth rate and improved milk composition

C. Increased feed utilization, decreased prolificacy and increased meat quality

D. High quality hair, increased susceptibility to disease and increased reproductive performance

53. Which one of the following is correct about bioremediation? It is the use of:

A. fungi to eliminate insects that devastate food crops.

B. microbes to detoxify pollutants from the environments.

C. genetically modified microbes to extract minerals from their ores.

D. transgenic bacterium to improve growth rate and yield of crop.

54. Which of the following is the correct sequences of events of bacterial reproduction by binary fission?

A. Replication of DNA → invagination of cell wall and membrane → formation of cross wall → two identical cells

B. Replication of DNA → invagination of cell wall and membrane → formation of cross wall → two different cells

C. Invagination of cell wall and membrane → Replication of DNA → formation of cross wall → two different cells

D. Invagination of cell wall and membrane → Replication of DNA → formation of cross wall → two identical cells

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55. A student placed a piece of bread in moist environment and after a few days he observed the growth of a fuzzy organism on the bread. How did the organism obtain nutrients required for its growth? By:

A. synthesizing organic molecules using light energy

B. decomposing the nutrient extracellularly and absorbing it

C. hydrolyzing organic matter intracellularly and transporting it

D. directly ingesting the organic matter using phagocytosis

56. The ministry of Agriculture provided selected fish species for the farmers to introduce into two different ponds. Pond I, had limited resources available, while pond II had unlimited resources. What types of growth patterns would be expected in the two ponds after a year?

A. Pond I would exhibit logistic growth while pond II an exponential growth.

B. The growth rate curve for pond I would be J-shaped while for pond II it would be S-shaped.

C. The growth curves in both pond I and pond II would be J-shaped.

D. Pond I would exhibit exponential growth while pond II a logistic growth.

57. Which one of the following options correctly differentiates renewable and non-renewable resources?

A. Renewable resources can be exhausted after continuous utilization while non-renewable resources can't.

B. The rate of consumption of renewable resources exceeds its rate of recovery while non-renewable resources is lower.

C. Non-renewable resources are not susceptible to depletion due to over used while renewable resources can be depleted.

D. The quantity of renewable resources is not affected by human consumption while non-renewable resources is affected.

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58. Which one of the following is correct about the conservation mechanism of wild life?

A. Indigenous practices rely on the use of taboos for conservation of plants.

B. Modern practices rely on growing invasive plants in mountainous area in order to prevent soil erosion.

C. Controlled wildlife hunting areas can't be considered one of the conservation mechanisms.

D. Wild life conservation is selective protection of a species with economic significances and eliminating less valued species.

59. Why are the chlorofluorocarbons considered to be the major cause of ozone layer depletion? Because they:

A. prevent the formation of catalytic cycle of chlorine to form ozone layer.

B. increase the ozone's ultraviolet radiation-absorbing capacity.

C. cause chemical reactions that break down ozone molecules.

D. react with hydrogen ions to form hydrochloric acids in the ozone layer.

60. This item is based on the following given list of conservation method of plants:

1. Relying on taboos for using some plant species
2. Establishing botanical gardens to maintain endangered species
3. Use of sacred places for protection of plants
4. Traditional agroforestry system practices
5. Use of preserving seeds in a genes bank

Based on the above information, which alternatives contains only indigenous knowledge?

A. 2, 3 and 4 B. 1, 2 and 5

C. 2, 3 and 5 D. 1, 3 and 4

61. In mice, the allele for black fur is dominant (B) over the allele for white fur (b), and the allele for short tail is dominant (S) over the allele for long tail (s). If the heterozygous genotypes of the two traits were crossed with each other and produced a total of 160 offsprings, how many offsprings with white fur long tail would be obtained?

A. 40 B. 30

C. 90 D. 10

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62. Which one of the following human genetic disorders is correctly matched with its example?

A. X-linked recessive disorders - haemophilia

B. Chromosomal disorders - cystic fibrosis

C. Autosomal recessive disorder - down syndrome

D. Autosomal-dominant disorder - albinism

63. Which one of the following components of the human musculoskeletal systems and its functions is correctly paired?

A. Tendon - keeps bones in a place and enables movements

B. Ligament - connects muscles to bones

C. Connective tissues - favor positions and movements

D. Joint and cartilage - connect tissues to tissues

64. Suppose the skeletal muscle was stimulated during a laboratory exercise and the following features were recorded:

I. Calcium ions bind to troponin
II. The nerve impulse reaches neuromuscular junction
III. Calcium ions reabsorbed into sarcoplasmic reticulum
IV. Myosin cross bridge with actin using ATP

In which of the following sequences do the muscles contract?

A. II, IV, I, III

B. II, I, IV, III

C. I, II, III, IV

D. I, II, IV, III

65. Two women visited health a center to get information about the types of contraceptives and to choose the long lasting and reversable contraceptive methods, but with different mechanisms of actions. Woman I preferred the method that inhibits ovulation, while woman II preferred the one that prevents implantation. Based on this information, which of the following contraceptive were selected by woman I and II, respectively?

A. Pills and diaphragm

B. Tubal ligation and spermicides

C. Depo-Provera and tubal ligation

D. Depo-Provera and intrauterine device

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66. Which of the following correctly describes the process of Kreb's cycle? It begins with combination of acetyl-CoA with:

A. pyruvate and ends with regeneration of oxaloacetate.

B. pyruvate and ends with generation of citric acids.

C. oxaloacetate and ends with regeneration of oxaloacetate.

D. oxaloacetate and ends with generation of citric acids.

67. How many net ATP molecules are produced from two glucose molecules assuming that only glycolysis is occurred due to shortage of oxygen?

A. 36 B. 34

C. 2 D. 4

68. This item is based on the following table that shows complete oxidation of one glucose molecule in eukaryotic cells.

No.	Substrate level phosphorylation	Oxidative phosphorylation
I.	Takes place in the cytoplasm	Takes place in the matrix of mitochondria
II.	Produces a total of 4 ATP molecules	Produces a total of 36 ATP molecules
III.	Happens in the presence as well as absence of oxygen	Happens only in the presence of oxygen
IV.	ATP generation depends on high energy molecules	ATP generation depend on proton gradient

Which alternative contains the numbers corresponding to the correct comparison between the substrate level and oxidative phosphorylation?

A. I and II B. II and III

C. I and IV D. III and IV

69. Which one of the following statements explains how comparative anatomy provides evidence for evolution? Organisms having:

A. the same structures but different functions had evolved from different ancestors.

B. analogous structure had shared a common ancestor.

C. different vestigial organs had evolved from the same ancestor.

D. pentadactyl limbs had evolved from a common ancestor.

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70. Four groups of students debated on the theories of the origin of life as indicated below.

Group I - Explained the idea that the source of life on Earth was resistant spores from other planets.
Group II - Supported the idea that life started on earth as a result of divine intervention.
Group III - Supported the idea that life has no beginning or an end.
Group IV - Explained that life on earth began through chemical reactions.

Based on the above information, which theories were presented and debated on by group I, II, III and IV students, respectively?

A. Biochemical origin, special creationism, cosmozoan and eternity of life

B. Cosmozoan, special creationism, eternity of life and biochemical origin

C. Eternity of life, biochemical origin, abiogenesis and spontaneous generation

D. Abiogenesis, special creationism, cosmozoan and eternity of life

71. Which one of the following is the correct sequence of sperm formation in human?

A. Germ cells → spermatogonia → primary spermatocyte → secondary spermatocyte → spermatids → spermatozoa

B. Germ cells → spermatogonia → spermatozoa → primary spermatocyte → secondary spermatocyte → spermatids

C. Primordial germ cells → primary spermatocyte → secondary spermatocyte spermatogonia → spermatozoa → spermatids

D. Primordial germ cells → spermatogonia → primary spermatocyte → secondary spermatocyte → spermatozoa → spermatids

72. Which one of the following causes of infertility in female when she decided not to have any more children?

A. Fibroid growth around womb

B. Sterilization of reproductive organ

C. Use of blood pressure medications

D. Pelvic surgery complications

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73. Which one of the following factors impairs safe decision making and contribute directly to the increased spread of sexually transmitted diseases (STI)?

A. Having no prior history of STI
B. Inconsistent use of latex condoms
C. Misuse of recreational drugs
D. Having multiple sexual partners

74. A 19 years old girl who had unwanted sexual contact and harassed, became very emotional and mentally stressed. Which type of harmful traditional practice did the girl face?

A. Early marriage
B. Gender based violences
C. Kidnapping or abduction
D. Genital mutilation

75. Which of the following are the most commonly damaged organs as a result of chronic alcohol consumption?

A. Kidney and pancreases
B. Stomach and small intestine
C. Brain and liver
D. Large intestine and sex organs

76. Which one of the following systems is responsible for protecting the body from infection?

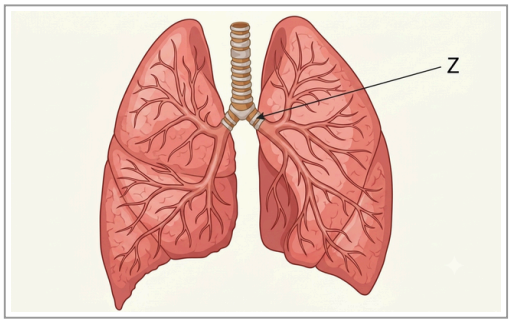
A. Immune system
B. Digestive system
C. Reproductive system
D. Respiratory system

77. When does the direct link between the human breathing and circulatory systems is demonstrated? It is when:

A. the tidal volume of the lungs equals to the volume of blood pumped into the pulmonary artery at a time.
B. the average breathing rate of an adult is equals the average heart beat per minute.
C. the breathing system releases out water vapour and the circulatory system fights off infections.
D. the breathing system exchanges gases and circulatory systems transports those gases.

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78. Consider the following diagram of the lung.



In the above diagram, which part of the lung is indicated by letter Z?

A. Alveoli
B. Bronchioles
C. Trachea
D. Bronchi

79. Which one is directly related to the water-conserving role of the kidneys?

A. Their location in the body in relation to other organ-systems and their fat cover.
B. Their internal structures specialized for absorption and reabsorption sequentially.
C. Their feature having endocrine glands on the top of the kidneys.
D. Their unique external shape, size, color and overall appearance.

80. During the field visit to a forest a student noticed that the population of beetles having short, medium, and long antennae were equally distributed previously. But over several generation, the beetles having medium antenna were significantly reduced and the allele frequencies of the other two groups increased. Which type of natural selection occurred in this beetle population?

A. Directional selection
B. Disruptive selection
C. Normalizing selection
D. Stabilizing selection

81. Suppose the frequency of the dominant allele in a given population is 0.8. What will be the frequency of the heterozygous genotype considering the condition of the Hardy-Weinberg Equilibrium?

A. 0.16
B. 0.32
C. 0.10
D. 0.60

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82. This item is based on the following events of the process of urine formation.

1. Descending loop of Henle allows water to pass from the filtrate into the intestinal fluid.
2. Collecting duct reabsorbs solutes and water from the filtrate.
3. Glomerulus filters small solutes from the blood.
4. Ascending loop of Henle reabsorbs Na and Cl from the filtrate into the intestinal fluid.
5. Proximal convoluted tubule reabsorbs ions, water and nutrients, remove toxins and adjust filtrate pH.
6. Distal tubule selectively secretes and absorbs different ions to maintain blood pH and electrolyte balance.

Which one of the following options show the correct sequence of events mentioned above in the process of urine formation?

A. 3-5-1-4-6-2
B. 3-4-2-6-5-1
C. 3-6-2-4-1-5
D. 3-1-5-2-4-6

83. An archeological survey conducted in four different sites revealed fossils of different members of the human family as indicated below:

Site I - *Homo habilis*
Site II - *Australopithecus africanus*
Site III - *Homo sapiens*
Site IV - *Homo erectus*

From the above information, which sequence shows the human family from the most primitive to the advanced?

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

84. Suppose you have given a codon with base sequences of "CAA" which is responsible coding for an amino acid "glutamine". After exposure to a mutagenic agent its base sequence is changed to "CAG" but this still coding for the same amino acid "glutamine". What type of mutation has occurred in the base sequence?

A. Nonsense
B. Missense
C. Deletion
D. Silent

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85. Which one of the following descriptions is correct about the structures of the nerve system?

A. The central nerve system is composed of brain and parasympathetic nerves.

B. The sensory neurons and the spinal cord constitute the peripheral nerve system.

C. Nerve system located in the spinal cord and sense organs are part of the peripheral nerve system.

D. Nerves in the brain and the spinal cord responsible for motor outputs are part of the central nerve system.

86. During an experiment a student noticed that doubling the substrate concentration initially increases the rate of reaction, however, the rate remains the same up on addition of extra substrates. Why did this happen? Because the:

A. enzymes were partially denatured.

B. active site of the enzyme was saturated.

C. enzyme's activation energy was lowered.

D. reaction rate didn't attain the maximum rate.

87. What is the main purpose of malting in alcoholic production? To:

A. remove the fibers in the grain to that interferes with clarification.

B. activate enzymes that hydrolyze starch into monosaccharides.

C. kill spoilage microorganisms that can affect the flavor of the product.

D. initiate fermentation of sugars before application of the yeasts.

88. A teacher demonstrated two permanent microscopic glass slides of onion epidermal cells at different stages of cell division.

Slide X - was with paired homologous chromosomes arranged at the equator.
Slide Y - contained two haploid daughter cells with non-separated sister chromatids.

Based on the above information, to which phases and types of cell division do slides X and Y corresponded, respectively?

A. Metaphase II of meiosis and telophase II of meiosis

B. Metaphase I of meiosis and telophase II of meiosis

C. Metaphase I of meiosis and telophase I of meiosis

D. Metaphase of mitosis and telophase of mitosis

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89. Which of the following is the main role of mRNA during protein synthesis?

A. Translating DNA and relocate the information to the cytoplasm.

B. Bringing the transcribed information from the nucleus to the cytoplasm.

C. Assembling the synthesized amino acids into functional proteins.

D. Bringing the free amino acids located in the cytoplasm to the ribosome.

90. In a test cross, the genotype of unknown organism cross with:

A. heterozygous genotype

B. homozygous dominant genotype

C. unknown codominant genotype

D. homozygous recessive genotype

91. This item is based on the following table that shows the functions of hormones produced by different endocrine glands.

No.	Pituitary Gland	Parathyroid Gland	Adrenal Gland
I.	Increases water reabsorption from kidney tubules	Stimulates reabsorption of calcium in kidneys	Responsible for vasoconstriction in skin
II.	Enhances the absorption of glucose into liver cells	Responsible for the absorption of vitamin D	Promotes contraction of myometrium
III.	Promotes the release of milk	Responsible for the release of calcium ions from bones	Promotes generation of glucose during fasting

Which alternative contains the numbers with the correct functions of the hormones in the above table?

A. II

B. II and III

C. I and III

D. I and II

92. In a hot summer, a person's body temperature rises above the normal level. Which pair of physiological thermoregulatory mechanisms adjust the body to the normal state?

A. Shivering and vasodilation

B. Sweating and vasodilation

C. Shivering and vasoconstriction

D. Sweating and vasoconstriction

@NextGen_17

93. Which one of the following statements defines climate change? It refers to:

A. a short-term change in the temperature of an environment.

B. the daily weather change of a specific environment.

C. a systematic change in the atmosphere over a long period.

D. the static weather change of an environment in a year.

94. An environmental impact assessment study was conducted in three countries to determine the contribution of human activities to the greenhouse effects.

Country I - Extensive use of industrial fertilizers for agriculture
Country II - Large scale use of rice paddies for agriculture
Country III - Huge amount of fossil fuel combustion for electricity

Based on the above information, which types of greenhouse gases were produced by country I, II, and III, respectively?

A. Methane, carbon dioxide and nitrous oxide

B. Nitrous oxide, methane and carbon dioxide

C. Sulfur hexafluoride, methane and nitrous oxide

D. Hydrofluorocarbon, carbon dioxide and methane

95. Which one of the following statements explains the United Nations Framework Convention on Climate Change. It is an agreement that:

A. provides permission for the developed countries to invest low carbon projects in the poorer countries.

B. forces developing countries to reduce their greenhouse gas emissions by 5%.

C. prohibits dangerous human interference with climate system.

D. obliges the industrialized nations to reduce their greenhouse gas emissions by half.

96. An organism having the following characteristics can be grouped under animals:

A. Prokaryotic cell, cell wall and respiration

B. Eukaryotic cell, multicellular and breathing

C. Chemoautotrophs, adaptability and reproduction

D. Autotroph, movement and response to stimuli

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97. What does the development of new devices by imitating biological structures indicate?

A. Most biological structures are based on the shape of technological innovations.

B. Close observations of biological structures can inform technological innovations.

C. The function of a technological product imitated from a biological structure is unrelated latter.

D. The design biological structures to technological tools for their intended function are ineligible.

98. Which one of the following characteristics correctly compares invertebrates and vertebrates? Invertebrates:

A. are symmetrical, but vertebrates are necessarily asymmetrical.

B. are aquatic animals while vertebrates are terrestrial.

C. have closed, but vertebrates have open circulatory system.

D. do not regulate their body temperature while vertebrates do.

99. Which of the following descriptions is correct about the reproductive characteristics of rats, birds, frogs, and crocodiles?

A. Rats are mammals giving birth to a young child and are breast feeding.

B. Crocodiles lay eggs following an external fertilization in waterbodies.

C. The young hatching from a frog egg possesses the same permanent adult structures.

D. Birds are similar to frogs in that both lay eggs following an external fertilization.

100. Which of the following is an example of the economic importance of insects in agriculture and food production? Their role as:

A. pollinators and sources of nutrients

B. pests and sources of medicine

C. biting nuisances and aesthetics

D. vectors and biological controls

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THE END

ESSLCE BIOLOGY

Official Answer Key - Booklet Code: 661

Exam Solutions & Answers (1 - 100)

1. A	2. D	3. B	4. C	5. C	6. C	7. A	8. B	9. A	10. D
11. D	12. B	13. A	14. D	15. C	16. A	17. C	18. C	19. B	20. A
21. C	22. A	23. D	24. B	25. C	26. C	27. C	28. A	29. D	30. D
31. D	32. C	33. A	34. B	35. D	36. B	37. B	38. D	39. B	40. D
41. A	42. C	43. B	44. B	45. C	46. D	47. B	48. A	49. C	50. C
51. D	52. B	53. B	54. A	55. B	56. A	57. D	58. A	59. C	60. D
61. D	62. A	63. A	64. B	65. D	66. C	67. D	68. D	69. D	70. B
71. A	72. B	73. C	74. B	75. C	76. A	77. D	78. B	79. B	80. B
81. B	82. A	83. A	84. D	85. D	86. B	87. B	88. C	89. B	90. D
91. C	92. B	93. C	94. B	95. C	96. B	97. B	98. D	99. A	100. A

@Neetgenius

Detailed Explanations: Biology (1 - 33)

Q1 (A): Nerve impulse transmission at the synapse requires calcium ions to enter the presynaptic terminal, triggering neurotransmitter release. Subsequently, sodium ions enter the postsynaptic cell to depolarize its membrane and propagate the action potential.

Q2 (D): The immediate withdrawal of a hand after touching a hot object is a reflex arc: Receptor → sensory neuron → spinal cord (interneuron) → motor neuron → effector (muscle).

Q3 (B): The hypodermis (subcutaneous layer) contains adipose tissue, which acts as thermal insulation, cushions the body, and stores energy.

Q4 (C): The sclera is the tough, fibrous outer layer of the eye that provides physical protection and maintains structural integrity.

Q5 (C): Spinning causes the endolymph fluid in the semicircular canals to move. When you suddenly stop, inertia keeps the fluid moving for a short time, continuing to bend the sensory hair cells and signaling false motion to the brain.

Q6 (C): Cattles are primary consumers (herbivores) that feed on producers (first trophic level) and are positioned at the second trophic level.

Q7 (A): Energy flows from the sun to producers (grass), then to primary consumers (sheep), and eventually to decomposers.

Q8 (B): Organism 'A' is the producer. 'B' eats 'A', making B a primary consumer or herbivore.

Q9 (A): The water cycle involves evaporation, transpiration from plants, condensation to form clouds, precipitation as rain, and surface runoff.

Q10 (D): Global warming is caused by the accumulation of greenhouse gases, primarily carbon dioxide, which is linked directly to the carbon cycle.

Q11 (D): Removing leaves or placing plants under shade lowers the rate of transpiration by reducing exposure to heat and light.

Q12 (B): Seedlings exhibit phototropism (growing toward light) and gravitropism. To keep them straight, they must be placed in a rotating instrument (clinostat) under uniform light conditions so that gravity and light are evenly distributed on all sides.

Q13 (A): Organic molecules must contain carbon and hydrogen backbones. Enzymes, being proteins, are organic.

Q14 (D): Lipids (fats) act as a primary heat and energy reserve in the human body.

Q15 (C): Phospholipids form the foundational lipid bilayer of cell membranes in all living organisms.

Q16 (A): Simple diffusion (for gases) and osmosis (for water) allow passive transport down a concentration gradient directly across the lipid bilayer.

Q17 (C): Nutrition is the physiological process of acquiring and utilizing nutrients for energy, growth, and cellular repair.

Q18 (C): Sickness caused by the direct lack of a specific essential nutrient (like vitamins or minerals) is termed a deficiency disease.

Q19 (B): During starvation, the body catabolizes stored energy reserves: first glycogen, then lipids (fats), and finally structural proteins (muscles) to generate ATP.

Q20 (A): The biosphere is the highest and most inclusive level of ecological organization, encompassing all biomes, ecosystems, communities, and populations.

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Q21 (C): The correct downward taxonomic sequence for modern humans is: Kingdom (Animalia) → Phylum (Chordata) → Class (Mammalia) → Order (Primates) → Family (Hominidae) → Genus (Homo) → Species (Homo sapiens).

Q22 (A): Biological classification groups organisms based on evolutionary and structural relationships, allowing scientists to study evolutionary pathways and connections.

Q23 (D): Archaea and bacteria are prokaryotic organisms belonging to Monera/Archaea/Bacteria kingdoms, whereas protists are eukaryotic.

Q24 (B): The plasma membrane is the boundary of the cell rather than an internal cytoplasmic organelle.

Q25 (C): Ribosomes are universal structures found in all cell types (both prokaryotes and eukaryotes, plant and animal cells).

Q26 (C): Lytic cycle sequence of bacteriophages: Attachment → entry of viral genome → synthesis of viral components → assembly → release.

Q27 (C): Media are typically sterilized via autoclaving (moist heat), needles are incinerated, and heat-sensitive serum is sterilized or treated with pasteurization/intermittent sterilization (Tyndallization).

Q28 (A): Anabolism is an endergonic process that synthesizes complex macromolecules from simpler precursors using energy. Catabolism is an exergonic process that breaks down complex molecules to release energy.

Q29 (D): The reduction phase of the Calvin cycle utilizes ATP and NADPH to reduce 3-phosphoglycerate (3-PGA) into G3P (glyceraldehyde-3-phosphate), which is used to synthesize glucose.

Q30 (D): If carbon dioxide is absent, the light-independent reactions stop immediately. Since the light-dependent reactions depend on the recycled ADP and NADP+ from the light-independent cycle, the light reactions will also cease rapidly.

Q31 (D): Fatty acids and glycerol are reassembled into chylomicrons in the intestinal cells and absorbed into the lymphatic lacteals rather than blood capillaries.

Q32 (C): Pulmonary circulation Specifically refers to the pathway that carries blood between the heart and the lungs for gas exchange.

Q33 (A): Verifying ABO and Rh blood group compatibility between donor and recipient is a mandatory universal protocol to prevent fatal agglutination reactions.

Detailed Explanations: Biology (34 - 66)

Q34 (B): Rh incompatibility (erythroblastosis fetalis) occurs when an Rh-negative mother is sensitized to Rh-positive fetal red blood cells, producing anti-Rh antibodies that target the red blood cells of a subsequent Rh-positive fetus.

Q35 (D): The lymphatic trunk collects lymph from various vessels and transports it toward the subclavian veins, filtering pathogens through lymph nodes.

Q36 (B): Dry skin and cold sensitivity are related to thyroid/metabolic issues or a severe lack of lipids, which provide essential structural insulation and subcutaneous fat barriers.

Q37 (B): The cell cycle represents the highly regulated sequence of growth, DNA replication, and division (mitosis/meiosis) in eukaryotic cells.

Q38 (D): Microvilli are tiny, finger-like projections on the surface of the intestinal epithelial cells that dramatically increase surface area to maximize nutrient absorption.

Q39 (B): Botany is a pure biological science (the study of plants), and plant breeding is its direct practical or applied application.

Q40 (D): Row 2 is incorrect because meiosis results in haploid cells (half the chromosome number), and mitosis maintains the diploid chromosome number. Thus, rows 1, 3, and 4 are correct.

Q41 (A): Human digestion is the physiological breakdown of large, insoluble macromolecules into smaller, soluble molecules that can be absorbed.

Q42 (C): Flowering plants (angiosperms) produce seeds enclosed in fruits, whereas non-flowering seed plants (gymnosperms) produce naked seeds on cones, and non-flowering non-seed plants (ferns, mosses) do not produce seeds.

Q43 (B): Inside the ovary wall (C), letter D points to the ovule, which eventually matures into a seed after fertilization.

Q44 (B): In angiosperm seeds, the developing embryo depends on the stored food reserves in the cotyledons or endosperm until it germinates and begins photosynthesis.

Q45 (C): Different seed dispersal mechanisms indeed ensure wider distribution because plants are sessile, but C is incorrect because wind, animals, and explosive mechanisms are also major dispersal agents for hard seeds, whereas water is only the primary agent for specialized floating seeds (like coconuts).

Q46 (D): Nest-building in birds is an innate (instinctive) behavior, whereas habituation in prairie dogs (learning to ignore non-threatening stimuli) is an acquired behavior.

Q47 (B): Kidneys play a vital role in both osmoregulation (water/salt balance) and filtering waste. Malfunction of the kidneys or surrounding hormones impacts the body's homeostatic balance, including metabolic pathways.

Q48 (A): Enzymes accelerate biochemical reactions by lowering the activation energy barrier required for reactants to transition into products.

Q49 (C): The tertiary structure of a protein is stabilized by intramolecular interactions between the R-groups (side chains) of amino acids, including disulfide bonds, hydrogen bonds, hydrophobic interactions, and ionic bonds.

Q50 (C): The immediate result of a substrate binding to the active site of an enzyme is the formation of a temporary enzyme-substrate (ES) complex.

Q51 (D): Lactobacillus (used in yogurt) and yeast (used in bread) both perform fermentation, which improves the flavor, texture, and digestability of the food products.

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Q52 (B): Transgenic livestock can be engineered to produce high-quality fibers, have increased growth rates, or express modified therapeutic proteins in their milk.

Q53 (B): Bioremediation is the environmental biotechnology technique of using living microorganisms to clean up, break down, or neutralize pollutants from contaminated soil or water.

Q54 (A): Binary fission sequence in bacteria: DNA replication → invagination of the cell membrane and cell wall → cross wall formation → division into two identical daughter cells.

Q55 (B): Fungi (the fuzzy organisms on bread) are saprophytic; they secrete digestive enzymes extracellularly to break down complex nutrients and then absorb the soluble compounds.

Q56 (A): Under limited resources (Pond I), populations exhibit a logistic growth curve (S-shaped) as they approach carrying capacity. Under unlimited resources (Pond II), populations grow exponentially (J-shaped).

Q57 (D): Renewable resources are naturally replenished over short periods, so their sustainable use is not depleted by human consumption, unlike non-renewable resources which have fixed quantities.

Q58 (A): Many traditional or indigenous cultures utilize sacred taboos (e.g., prohibiting the cutting of certain trees or hunting in sacred forests) to conserve biodiversity.

Q59 (C): CFCs release chlorine free radicals under UV light, which catalytically react with and decompose ozone (O_3) molecules into oxygen molecules.

Q60 (D): Items 1 (taboos), 3 (sacred places), and 4 (traditional agroforestry) represent indigenous, traditional conservation knowledge.

Q61 (D): A dihybrid cross of two double-heterozygotes (BbSs × BbSs) yields a classic 9:3:3:1 phenotypic ratio. White fur with a long tail (bbss) is the double-recessive phenotype, occurring in 1/16 of the offspring. Total offspring = 160 × (1/16) = 10.

Q62 (A): Haemophilia is a classic X-linked recessive genetic disorder. Down syndrome is a chromosomal numerical disorder (Trisomy 21), cystic fibrosis is autosomal recessive, and albinism is autosomal recessive.

Q63 (A): Tendons connect muscles to bones to enable skeletal movement, while ligaments connect bones to other bones to stabilize joints.

Q64 (B): Muscle contraction sequence: Nerve impulse reaches the neuromuscular junction (II) → calcium ions are released and bind to troponin (I) → myosin cross-bridges bind with actin using ATP (IV) → calcium is reabsorbed into the sarcoplasmic reticulum to relax (III).

Q65 (D): Depo-Provera is a hormonal injection that inhibits ovulation. An intrauterine device (IUD) is placed in the uterus to prevent the implantation of a fertilized egg.

Q66 (C): The Krebs cycle begins when acetyl-CoA combines with the 4-carbon oxaloacetate to form 6-carbon citric acid, and concludes with the regeneration of oxaloacetate.

Detailed Explanations: Biology (67 - 100)

Q67 (D): One glucose molecule produces a net of 2 ATP during glycolysis. Under anaerobic conditions, only glycolysis occurs. Therefore, two glucose molecules yield 2 × 2 = 4 net ATP.

Q68 (D): Substrate-level phosphorylation happens in both aerobic and anaerobic conditions, while oxidative phosphorylation depends strictly on a proton gradient across the inner membrane of the mitochondria in the presence of oxygen.

Q69 (D): Pentadactyl limbs of vertebrates are homologous structures (similar ancestral origin but modified for different functions), proving they share a common ancestor.

Q70 (B): Group I describes the Cosmozoan/Panspermia theory. Group II describes Special Creation. Group III describes the Steady-State theory (Eternity of life). Group IV describes the Biochemical Evolution theory (Oparin-Haldane).

Q71 (A): Sperm spermatogenesis sequence: Germ cells → spermatogonia → primary spermatocyte → secondary spermatocyte → spermatids → spermatozoa.

Q72 (B): Voluntary sterilization (tubal ligation) is a surgical method used to permanently prevent further pregnancies.

Q73 (C): Recreational drugs and alcohol impair cognitive judgment and self-control, leading to risky sexual behaviors and an increased spread of STIs.

Q74 (B): Unwanted sexual contact, harassment, and assault are classifications of gender-based violence.

Q75 (C): Chronic alcohol abuse primarily damages the brain (neurological damage) and the liver (cirrhosis).

Q76 (A): The immune system is the specialized bodily system responsible for identifying and neutralizing foreign pathogens to protect against infection.

Q77 (D): The respiratory system is responsible for the exchange of gases (oxygen and carbon dioxide), while the circulatory system physically transports these dissolved gases throughout the body.

Q78 (B): Letter Z points to the bronchioles, which are the small, branched airways leading from the bronchi to the alveoli.

Q79 (B): The kidney's nephrons are highly specialized tubular structures consisting of the proximal tubule, loop of Henle, and distal tubule, which sequentially perform selective reabsorption to conserve water.

Q80 (B): Natural selection that favors both extreme phenotypes (short and long antennae) while selecting against the intermediate phenotype (medium antennae) is called disruptive selection.

Q81 (B): Hardy-Weinberg: p = 0.8 &implies; q = 1 - 0.8 = 0.2. Heterozygous frequency 2pq = 2 × 0.8 × 0.2 = 0.32.

Q82 (A): The path of filtrate during urine formation: Glomerulus filtration (3) → proximal convoluted tubule (5) → descending loop (1) → ascending loop (4) → distal tubule (6) → collecting duct (2).

Q83 (A): Human evolutionary timeline: Australopithecus africanus (II) → Homo habilis (I) → Homo erectus (IV) → Homo sapiens (III).

Q84 (D): A base substitution that alters the codon sequence but still codes for the exact same amino acid is a silent mutation.

Q85 (D): The central nervous system is composed strictly of the brain and the spinal cord. Motor and sensory outputs are executed by nerves residing inside the CNS.

Q86 (B): At very high substrate concentrations, all active sites on the enzymes are continuously occupied (saturated), so the reaction rate reaches a maximum plateau.

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Q87 (B): Malting germinates the barley grain, activating amylase enzymes that hydrolyze stored starches into fermentable sugars.

Q88 (C): Paired homologous chromosomes lining up at the equator is Metaphase I of meiosis. Two haploid daughter cells with intact sister chromatids corresponds to Telophase I of meiosis.

Q89 (B): mRNA (messenger RNA) copies the genetic code from DNA in the nucleus during transcription and transports it to the cytoplasm for translation.

Q90 (D): To determine an unknown genotype, a test cross is performed by crossing the individual with a homozygous recessive partner.

Q91 (C): ADH from the pituitary increases water reabsorption. Parathyroid hormone (PTH) stimulates calcium release from bones and reabsorption in kidneys.

Q92 (B): When body temperature rises, the hypothalamus triggers sweating (evaporative cooling) and vasodilation (bringing warm blood to the skin surface to radiate heat).

Q93 (C): Climate change refers to long-term, systematic alterations in the global atmospheric patterns over decades or centuries.

Q94 (B): Agricultural fertilizers produce nitrous oxide (N_2O). Rice paddies produce methane (CH_4). Fossil fuel combustion releases carbon dioxide (CO_2).

Q95 (C): The UNFCCC is an international environmental treaty aimed at stabilizing greenhouse gas concentrations in the atmosphere to prevent dangerous anthropogenic interference with the climate system.

Q96 (B): Animals are characterized as eukaryotic, multicellular, heterotrophic organisms that lack cell walls.

Q97 (B): Biomimicry (imitating biological systems) demonstrates that close observation of nature's designs can directly inspire and inform technological innovations.

Q98 (D): Invertebrates are ectothermic (cannot regulate their internal body temperature through metabolic means), whereas most birds and mammals (vertebrates) are endothermic.

Q99 (A): Rats are mammals that exhibit viviparity (giving birth to live young) and nourish their offspring using mammary glands.

Q100 (A): Insects are of immense economic value because they serve as primary pollinators for crops and can be processed as nutrient-rich food/feed sources.