NEW JERSEY CENTER
FOR TEACHING & LEARNING

Biology Diagnostic Assessment

This diagnostic assessment is solely to help guide your decisions about which courses you should study to increase the likelihood of a successful outcome on your credentialing exam. The results of this assessment will not be used for any other purpose.

These questions represent our best judgment regarding what is assessed on this exam and the last course in the sequence of NJCTL courses in which that topic is taught. Hence, if you do well on the questions from an early course, you can better focus your efforts on later courses.

To make this effective, you must **not guess** on questions since if you get them correct by chance, you may mislead yourself. Similarly, if you find you struggle or take an excessive amount of time to do a problem, you may be better served by leaving it blank since it would probably be worth learning that topic more thoroughly.

Since this assessment cannot thoroughly probe each aspect of a topic given its limited length, taking the above instructions to heart would give you a more informative result than trying your best to maximize your score.

1. What kinds of bond involves the transferring of electrons between atoms?
    a. ionic
    b. covalent
    c. hydrogen
    d. metallic

2. The bond between a hydrogen atom and an oxygen atom within a water molecule is an example of _____.
    a. ionic
    b. covalent
    c. hydrogen
    d. metallic

3. In a molecule of methane (CH4), how many covalent bonds does each carbon atom form?
    a. 1
    b. 2
    c. 3
    d. 4

4. Which of the following best describes the concept of entropy in thermodynamics?
    a. The total amount of energy in a system.
    b. The measure of disorder or randomness in a system.
    c. The energy transferred between objects due to a temperature difference.
    d. The potential energy stored in chemical bonds.

5. According to the laws of thermodynamics, which of the following statements is true?
    a. Energy can be created from nothing.
    b. Energy can be destroyed completely.
    c. Energy can change forms, but the total amount of energy in a closed system remains constant.
    d. Energy transfer is always 100% efficient.

6. Which of the following processes represents an increase in entropy?
    a. Melting of ice to form liquid water.
    b. Condensation of water vapor to form a cloud.
    c. Freezing of liquid water to form ice.
    d. Dissolving sugar in water to form a solution.

7. The Miller-Urey experiment aimed to simulate conditions considered present on early Earth to _____.
    a. prove the existence of extraterrestrial life
    b. create the first self-replicating molecules
    c. investigate the formation of minerals
    d. generate complex organic molecules from simple compounds

8. The lipid-rich structures that have been proposed as a possible precursor to cellular life due to their ability to form simple membranes are called _____.
    a. amino acids
    b. ribozymes
    c. protocells
    d. isotopes

9. The RNA world hypothesis suggests that early life forms might have primarily utilized RNA for both genetic information storage and catalytic functions because _____.
    a. RNA is a more stable molecule than DNA
    b. DNA was not available at that time
    c. RNA has the ability to self-replicate and perform enzymatic activities
    d. RNA was abundant in the atmosphere

10. Which of the following biomolecules is the main source of energy for cellular processes and provides extra structural support to cell membranes?
    a. proteins
    b. nucleic acids
    c. carbohydrates
    d. lipids

11. Enzymes are essential biological molecules that function as _____.
    a. genetic information carriers
    b. structural components of cells
    c. energy storage molecules
    d. catalysts for chemical reactions

12. _____ are the building blocks of proteins.
    a. nucleotides
    b. monosaccharides
    c. amino acids
    d. fatty acids

13. The phospholipid bilayer of the cell membrane has a hydrophilic ("water-loving") head and a hydrophobic ("water-fearing") tail. What kind of arrangement does this result in?
    a. A strong barrier preventing any substances from entering or leaving the cell.
    b. A flexible and dynamic structure that allows selective transport and maintains cellular integrity.
    c. A rigid structure that maintains the shape of the cell.
    d. A passive diffusion of all molecules across the membrane.

14. Which processes involve engulfing large particles or even other cells by the cell membrane to form a vesicle?
    a. osmosis
    b. diffusion
    c. phagocytosis
    d. active transport

15. Which of the following membrane proteins acts as a channel, allowing the passage of specific ions or molecules across the cell membrane?
    a. receptor proteins
    b. enzymatic proteins
    c. integral proteins
    d. peripheral proteins

16. Enzymes are biological catalysts that enhance chemical reactions in living organisms by _____.
    a. providing energy to the reactions.
    b. changing the equilibrium constant of reactions.
    c. increasing the activation energy required for reactions.
    d. lowering the activation energy required for reactions.

17. Factors such as temperature and pH can influence enzyme activity. What happens to an enzyme when it is subjected to extreme temperatures or pH levels?
    a. The enzyme becomes more active and efficient.
    b. The enzyme's structure remains unchanged.
    c. The enzyme denatures and loses its functionality.
    d. The enzyme's substrate specificity increases.

18. What is the primary function of stomata in plant leaves?
    a. Absorption of sunlight for photosynthesis
    b. Storage of water and nutrients
    c. Exchange of gases, such as oxygen and carbon dioxide
    d. Production of pollen for reproduction

19. The process by which plants convert light energy into chemical energy stored in glucose molecules is known as _____.
    a. transpiration
    b. respiration
    c. mitosis
    d. photosynthesis

20. Soil plays a crucial role in providing essential nutrients to plants. Which of the following soil layers is most important for plant growth as it contains a high concentration of organic matter and nutrients?
    a. bedrock
    b. subsoil
    c. topsoil
    d. parent material

21. Prokaryotic cells lack which of the following cellular structures that are commonly found in eukaryotic cells?
    a. cytoplasm
    b. ribosomes
    c. cell membrane
    d. nucleus

22. Which of the following is a distinctive feature of prokaryotic cells that aids in their classification and identification?
    a. mitochondria
    b. chloroplasts
    c. cell wall
    d. flagella

23. The presence of _____ characterizes eukaryotic cells.
    a. cell walls made of peptidoglycan
    b. membrane-bound organelles
    c. circular DNA molecules
    d. single, continuous chromosome

24. Which organelles are responsible for producing energy in eukaryotic cells through aerobic respiration?
    a. golgi apparatus
    b. lysosome
    c. mitochondrion
    d. nucleus

25. During cellular respiration, which molecule is broken down to release energy that can be used by the cell?
    a. glucose
    b. ribose
    c. DNA
    d. amino acids

26. _____ is the primary pigment responsible for capturing light energy during photosynthesis.
    a. Chlorophyll
    b. Carotene
    c. Melanin
    d. Xanthophyll

27. Which of the following processes occurs in the cell's cytoplasm and involves the breakdown of glucose to produce a small amount of ATP without using oxygen?
    a. photosynthesis
    b. glycolysis
    c. citric acid cycle
    d. electron transport chain

28. Which process involves the conversion of genetic information from DNA into RNA?
    a. transcription
    b. translation
    c. replication
    d. mutation

29. What is the role of transfer RNA (tRNA) in protein synthesis?
    a. It carries genetic information from DNA to the ribosome.
    b. It carries amino acids to the ribosome for protein assembly.
    c. It acts as a template for complementary base pairing during transcription.
    d. It synthesizes proteins directly in the cytoplasm.

30. The _____ is a sequence of three nucleotides on a messenger RNA (mRNA) molecule corresponding to a specific amino acid.
    a. codon
    b. anticodon
    c. ribosome
    d. peptide bond

31. Which type of cell division produces two genetically identical daughter cells, each with the same number of chromosomes as the parent cell?
    a. meiosis
    b. cytokinesis
    c. mitosis
    d. replication

32. During which phase of meiosis does crossing-over occur, resulting in the exchange of genetic material between homologous chromosomes?
    a. prophase I
    b. metaphase I
    c. anaphase I
    d. telophase I

33. At the end of meiosis II, how many haploid daughter cells are produced from a single diploid parent cell?
    a. 1
    b. 2
    c. 3
    d. 4

34. A _____ trait is expressed only when two identical alleles are present (either two dominant alleles or two recessive alleles).
    a. heterozygous
    b. hybrid
    c. codominant
    d. homozygous

35. In a monohybrid cross between two heterozygous individuals (Aa), what is the expected phenotypic ratio of their offspring?
    a. 1:1
    b. 3:1
    c. 2:1
    d. 4:0

36. Which genetic disorder is caused by the absence or dysfunction of a blood-clotting protein, leading to prolonged bleeding even after minor injuries?
    a. Sickle cell anemia
    b. Cystic fibrosis
    c. Hemophilia
    d. Down syndrome

37. A carrier of a genetic disorder _____.
    a. exhibits the disorder's symptoms
    b. is always homozygous for the disorder
    c. does not transmit the disorder to their offspring
    d. carries one copy of the normal allele and one copy of the mutated allele

38. Which of the following is responsible for pumping oxygen-rich blood to the rest of the body?
    a. aorta
    b. pulmonary artery
    c. pulmonary vein
    d. coronary artery

39. The process by which oxygen moves from the lungs into the bloodstream and carbon dioxide moves from the bloodstream into the lungs is called _____.
    a. osmosis
    b. diffusion
    c. active transport
    d. endocytosis

40. Which of the following body systems is responsible for producing hormones that regulate various physiological processes in the body?
    a. skeletal system
    b. nervous system
    c. digestive system
    d. endocrine system

41. Which scientist is credited with proposing the theory of natural selection as a mechanism for evolution?
    a. Gregor Mendel
    b. Charles Darwin
    c. Louis Pasteur
    d. Alfred Wegener

42. The process by which certain traits become more or less common in a population due to their advantageous or disadvantageous effects on survival and reproduction is known as _____.
    a. genetic drift
    b. mutation
    c. speciation
    d. natural selection

43. _____ is the similarity in structure between the forelimbs of mammals like humans, bats, and whales.
    a. Homologous structures
    b. Analogous structures
    c. Vestigial structures
    d. Convergent evolution

44. Which taxonomic category includes organisms that are more closely related than those in the same family but less closely related than those in the same genus?
    a. class
    b. phylum
    c. order
    d. domain

45. _____ is the system of classification that groups organisms based on their evolutionary history and common ancestors.
    a. Binomial nomenclature
    b. Phylogenetics
    c. Linnaean taxonomy
    d. Taxonomic hierarchy

46. Phylogenetic trees depict evolutionary relationships among organisms. In a phylogenetic tree, what do the branching points (nodes) represent?
    a. extinct species
    b. convergent evolution
    c. common ancestors
    d. mutation events

47. Which level of ecological organization includes all living organisms in a particular area interacting with each other and their physical environment?
    a. ecosystem
    b. population

c. community
d. species

48. The Earth's biosphere refers to the _____.
    a. collective genetic material of all living organisms
    b. sum of all ecosystems on the planet
    c. atmosphere surrounding the Earth
    d. zone of deep ocean trenches

49. Which ecological level of organization is defined as a group of individuals of the same species living in the same area and potentially interbreeding?
    a. ecosystem
    b. community
    c. population
    d. biome

50. _____ is the role and position a species has in its environment, including its interactions with other species and its use of resources.
    a. Biodiversity
    b. Habitat
    c. Niche
    d. Keystone

51. A relationship in which one organism benefits and the other is neither helped nor harmed is known as _____.
    a. predation
    b. commensalism
    c. mutualism
    d. parasitism

52. What is the term for the maximum number of individuals of a particular species that a particular environment can support?
    a. carrying capacity
    b. niche
    c. biodiversity
    d. symbiosis

53. Which of the following air pollutants is a primary contributor to smog formation and can cause respiratory problems in humans?
    a. carbon dioxide (CO_2)
    b. nitrogen dioxide (NO_2)
    c. methane (CH_4)
    d. oxygen (O_2)

54. Acid rain is primarily caused by the emission of which air pollutant into the atmosphere?
    a. carbon monoxide (CO)
    b. sulfur dioxide (SO_2)
    c. particulate matter (PM)

d. hydrocarbons (HC)

55. Particulate matter (PM) is a type of air pollutant that consists of tiny solid particles and liquid droplets suspended in the air. Which of the following health problems could be associated with exposure to high levels of particulate matter?
    a. skin rashes
    b. vitamin D deficiency
    c. respiratory and cardiovascular diseases
    d. color blindness

56. Which of the following pollutants is a common source of nutrient pollution in water bodies, leading to excessive growth of algae and oxygen depletion?
    a. carbon dioxide (CO_2)
    b. nitrogen oxides (NO_x)
    c. sulfur dioxide (SO_2)
    d. phosphates (PO_4)

57. Thermal pollution occurs when water bodies are heated by human activities, such as industrial discharges or power plant cooling. What effect can thermal pollution have on aquatic ecosystems?
    a. decreased algal growth
    b. increased dissolved oxygen levels
    c. enhanced biodiversity
    d. reduced oxygen availability for aquatic organisms

58. What term describes the contamination of water bodies from various sources, such as industrial waste, agricultural runoff, and sewage, resulting in the impairment of water quality and ecosystem health?
    a. thermal pollution
    b. water pollution
    c. water scarcity
    d. acid rain

59. Which of the following waste management methods involves reducing the amount of waste produced by using fewer resources and generating less disposable materials?
    a. incineration
    b. landfilling
    c. recycling
    d. source reduction

60. Composting is a waste management practice that involves _____.
    a. burning waste materials to generate energy
    b. burying waste in designated landfills
    c. separating recyclable materials from non-recyclables
    d. decomposing organic waste into nutrient-rich soil amendments

61. What is the primary goal of scientific inquiry?

a. To prove pre-existing beliefs.
b. To validate personal opinions.
c. To generate hypotheses without testing.
d. To explain natural phenomena through evidence-based reasoning.

62. What is a controlled experiment in scientific inquiry?
    a. An experiment that is conducted in a laboratory setting only.
    b. An experiment that includes multiple variables to observe their combined effects.
    c. An experiment in which only the independent variable is manipulated while keeping all other variables constant.
    d. An experiment that involves studying natural phenomena without manipulation.

63. The purpose of forming a hypothesis in the scientific method is to _____.
    a. prove a theory
    b. establish facts
    c. provide a final conclusion
    d. make a testable prediction based on observations

64. Why is peer review an important step in the scientific process?
    a. It helps to keep research findings confidential.
    b. It ensures that research results are immediately accepted as facts.
    c. It allows for scientific findings to be communicated and evaluated by other experts.
    d. It prevents new discoveries from being published.

65. The following cell signaling mechanism directly transfers molecules between adjacent cells through protein channels.
    a. autocrine signaling
    b. endocrine signaling
    c. paracrine signaling
    d. gap junction signaling

66. In the process of signal transduction, what is the role of second messengers?
    a. To initiate the signal cascade by directly binding to target proteins
    b. To amplify the signal strength through a series of enzyme activations
    c. To directly bind to the receptor on the cell membrane
    d. To facilitate DNA replication in response to external signals

67. Which type of cell signaling involves a molecule released into the bloodstream to affect distant target cells?
    a. autocrine signaling
    b. endocrine signaling
    c. paracrine signaling
    d. juxtacrine signaling

68. Which of the following nitrogenous bases is found in RNA but not in DNA?

a. uracil (U)
b. thymine (T)
c. guanine (G)
d. adenine (A)

69. The backbone of DNA and RNA molecules is composed of which two components?
    a. amino acids and fatty acids
    b. nucleotides and carbohydrates
    c. phosphates and sugars
    d. peptides and lipids

70. What type of chemical bond is formed between complementary nitrogenous bases in a DNA or RNA molecule?
    a. covalent bond
    b. ionic bond
    c. hydrogen bond
    d. peptide bond

71. The central dogma of molecular biology describes the flow of genetic information in cells. Which of the following statements accurately represents this concept?
    a. DNA is directly translated into proteins.
    b. RNA is directly transcribed into proteins.
    c. DNA is transcribed into RNA, which is then translated into proteins.
    d. Proteins are transcribed into RNA, which is then translated into DNA.

72. During transcription, which enzyme is responsible for synthesizing RNA molecules complementary to a DNA template?
    a. DNA polymerase
    b. RNA polymerase
    c. Ribonuclease
    d. Reverse transcriptase

73. In the context of the central dogma, what is the process by which the information stored in a messenger RNA (mRNA) molecule is used to assemble amino acids into a protein?
    a. translation
    b. transcription
    c. replication
    d. reverse transcription

74. Which of the following regulatory mechanisms involves binding regulatory proteins to specific DNA sequences near the promoter region of a gene, either enhancing or inhibiting transcription?
    a. transcriptional regulation
    b. RNA splicing
    c. DNA methylation
    d. DNA replication

75. What is the role of microRNAs (miRNAs) in gene expression regulation?
    a. They code for specific proteins.
    b. They initiate DNA replication.
    c. They bind to target mRNA molecules, leading to their degradation or inhibition of translation.
    d. They promote RNA splicing.

76. The process of removing introns and joining exons in a pre-mRNA molecule to produce a mature mRNA is called _____.
    a. transcription
    b. translation
    c. replication
    d. RNA splicing

77. Which of the following is an example of post-translational regulation of gene expression?
    a. Altering the sequence of DNA bases.
    b. Splicing introns from pre-mRNA.
    c. Adding a methyl group to DNA.
    d. Modifying a protein by adding a phosphate group.

78. The purpose of PCR (polymerase chain reaction) in biotechnology is to _____.
    a. amplify DNA sequences
    b. insert foreign DNA into a host organism
    c. transcribe DNA into RNA
    d. cut DNA molecules at specific sites

79. What is the role of restriction enzymes in genetic engineering?
    a. They synthesize DNA molecules.
    b. They insert genes into host cells.
    c. They cut DNA at specific recognition sequences.
    d. They reverse transcription of RNA into DNA.

80. What is a transgenic organism?
    a. An organism that can only reproduce asexually.
    b. An organism that is genetically identical to its parent.
    c. An organism that contains genes from another species.
    d. An organism that lacks genetic material.

Answer Key

BIOL 6841 1. A 2. B 3. D 4. B 5. C 6. A 7. D 8. C 9. C 10. C 11. D 12. C 13. B 14. C 15. C 16. D 17. C 18. C 19. D 20. C	_____/20 Percent Correct: _____
BIOL 6842 21. D 22. C 23. B 24. C 25. A 26. A 27. B 28. A 29. B 30. A 31. C 32. A 33. D 34. D 35. B 36. C 37. D 38. A 39. B 40. D	_____/20 Percent Correct: _____
BIOL 6843 41. B 42. D 43. A 44. C 45. B 46. C 47. C 48. B 49. C 50. C 51. B 52. A 53. B 54. B 55. C 56. D 57. D 58. B 59. D 60. D	_____/20 Percent Correct: _____
BIOL 6846 61. D 62. C 63. D 64. C 65. D 66. B 67. B 68. A 69. C 70. C 71. C 72. B 73. A 74. A 75. C 76. D 77. D 78. A 79. C 80. C	_____/20 Percent Correct: _____