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Introduction to Biology & Its Modern Trends

1. The term Biology is derived from the Greek words meaning:
A) Animal and discourse
B) Life and study
C) Plant and logic
D) Nature and science
Answer: Life and study

2. The scientific study of life is known as:
A) Ecology
B) Biology
C) Zoology
D) Physiology
Answer: Biology

3. Who first formally used the term "Biology"?
A) Aristotle
B) Theophrastus
C) Carl Linnaeus
D) Lamarck
Answer: Carl Linnaeus

4. The study of animals is called:
A) Botany
B) Microbiology
C) Zoology
D) Morphology
Answer: Zoology

5. The study of plants is called:
A) Zoology
B) Botany
C) Microbiology
D) Anatomy
Answer: Botany

6. The study of microorganisms is called:
A) Botany
B) Zoology
C) Microbiology
D) Histology
Answer: Microbiology

7. The study of the form and structure of organisms is:
A) Physiology
B) Anatomy
C) Morphology
D) Histology
Answer: Morphology

8. The study of internal structure is called:
A) Morphology
B) Histology
C) Anatomy
D) Physiology
Answer: Anatomy

9. The microscopic study of tissues is called:
A) Cytology
B) Anatomy
C) Histology
D) Morphology
Answer: Histology

10. The study of cell structure and function is called:
A) Histology
B) Cytology
C) Physiology
D) Embryology
Answer: Cytology

11. The study of the functions of body parts is:
A) Anatomy
B) Physiology
C) Morphology
D) Histology
Answer: Physiology

12. The study of heredity and variation is:
A) Ecology
B) Genetics
C) Embryology
D) Taxonomy
Answer: Genetics

13. The study of fossils is called:
A) Palaeontology
B) Taxonomy
C) Embryology
D) Ecology
Answer: Palaeontology

14. The naming and classification of organisms is:
A) Ecology
B) Genetics
C) Taxonomy
D) Physiology
Answer: Taxonomy

Cell Structure & Functions

1) Who first used the term "cell" to describe the microscopic compartments in cork?
A) Antonie van Leeuwenhoek
B) Matthias Schleiden
C) Robert Hooke
D) Rudolf Virchow
Answer: Robert Hooke

2) Which of the following is NOT a tenet of the modern cell theory?
A) All living organisms are composed of one or more cells.
B) The cell is the basic unit of structure and function in living things.
C) All cells contain a membrane-bound nucleus.
D) All cells arise from pre-existing cells.
Answer: All cells contain a membrane-bound nucleus.

3) Which of the following is considered a major exception to the cell theory?
A) Bacteria
B) Fungi
C) Viruses
D) Plant cells
Answer: Viruses

4) The maximum useful magnification of a standard compound light microscope is approximately:
A) 400x
B) 1000-1500x
C) 10,000x
D) 1,000,000x
Answer: 1000-1500x

5) The ability of a microscope to distinguish two closely spaced points as separate is called its:
A) Magnification
B) Resolution
C) Refraction
D) Illumination
Answer: Resolution

6) Which type of microscope uses a beam of electrons to visualize the internal ultrastructure of thinly sliced specimens?
A) Phase-contrast microscope
B) Scanning Electron Microscope (SEM)
C) Transmission Electron Microscope (TEM)
D) Dark-field microscope
Answer: Transmission Electron Microscope (TEM)

7) Cryo-electron microscopy is particularly valuable because it:
A) Uses heavy metal stains for high contrast
B) Allows visualization of specimens in a near-native, hydrated state
C) Is ideal for observing living, moving cells
D) Has a resolution limit equal to light microscopy
Answer: Allows visualization of specimens in a near-native, hydrated state

8) Cell fractionation, a technique to separate cellular components, primarily separates organelles based on their:
A) Color and electrical charge
B) Size and density
C) Magnetic properties
D) Enzymatic activity
Answer: Size and density

9) All cells, both prokaryotic and eukaryotic, are surrounded by:
A) A cell wall made of cellulose
B) A phospholipid bilayer plasma membrane
C) A capsule of glycoproteins
D) A nuclear envelope

Answer: A phospholipid bilayer plasma membrane

10) In a prokaryotic cell, the region where the genetic material is located is called the:
A) Nucleus
B) Nucleolus
C) Nucleoid
D) Nuclear pore
Answer: Nucleoid

11) A key structural difference between bacterial and archaeal cell membranes involves the type of linkage in their lipids:
A) Bacteria have ester linkages; Archaea have ether linkages.
B) Archaea have peptidoglycan in their membranes.
C) Bacteria have a true nucleus.
D) Archaea have 80S ribosomes.
Answer: Bacteria have ester linkages; Archaea have ether linkages.

12) The ribosomes found in the cytosol of eukaryotic cells are designated as:
A) 70S
B) 80S
C) 60S
D) 50S
Answer: 80S

13) Which cellular structure is the primary site for ribosomal RNA (rRNA) transcription and ribosomal subunit assembly?
A) Nucleus
B) Nucleolus
C) Rough Endoplasmic Reticulum
D) Golgi Apparatus
Answer: Nucleolus

14) Nuclear Pore Complexes (NPCs) primarily function to:
A) Synthesize DNA
B) Regulate active transport of macromolecules between nucleus and cytoplasm
C) Provide structural support to the nuclear envelope
D) Digest damaged organelles
Answer: Regulate active transport of macromolecules between nucleus and cytoplasm

15) Proteins destined for secretion from the cell are synthesized by ribosomes attached to the:
A) Free ribosomes in the cytosol
B) Rough Endoplasmic Reticulum
C) Smooth Endoplasmic Reticulum
D) Outer nuclear membrane
Answer: Rough Endoplasmic Reticulum

16) Which of the following is NOT a primary function of the Smooth Endoplasmic Reticulum (SER)?
A) Lipid and steroid hormone synthesis
B) Detoxification of drugs and poisons
C) Storage of calcium ions
D) Synthesis of secretory proteins
Answer: Synthesis of secretory proteins

17) In muscle cells, the specialized form of smooth ER that stores calcium ions is called the:
A) Golgi apparatus
B) Sarcoplasmic reticulum
C) Peroxisome
D) Lysosome
Answer: Sarcoplasmic reticulum

18) The side of the Golgi apparatus that receives transport vesicles from the ER is known as the:
A) trans face
B) maturing face
C) cis face
D) convex face
Answer: cis face

19) Lysosomes maintain their internal acidic pH primarily through the action of:
A) Sodium-potassium pumps
B) V-type H+ ATPase pumps
C) Simple diffusion of protons
D) Calcium ion channels
Answer: V-type H+ ATPase pumps

20) The process by which lysosomes digest a cell's own damaged organelles is called:
A) Phagocytosis
B) Autophagy
C) Pinocytosis
D) Exocytosis
Answer: Autophagy

21) Tay-Sachs disease is a lysosomal storage disorder resulting from a deficiency in which enzyme?
A) Glucocerebrosidase
B) Hexosaminidase A
C) Catalase
D) Cytochrome P450
Answer: Hexosaminidase A

22) The large central vacuole in plant cells is involved in all of the following EXCEPT:
A) Storage of ions and metabolites
B) Maintenance of turgor pressure
C) Photosynthesis
D) Waste sequestration
Answer: Photosynthesis

23) The infoldings of the inner mitochondrial membrane are called:
A) Cristae
B) Thylakoids
C) Cisternae
D) Grana
Answer: Cristae

24) According to the Endosymbiotic Theory, mitochondria are believed to have evolved from:
A) Cyanobacteria
B) Alpha-proteobacteria
C) Archaea
D) Early eukaryotic nuclei
Answer: Alpha-proteobacteria

25) Which organelle contains the enzyme catalase, responsible for breaking down hydrogen peroxide (H2O2)?
A) Peroxisome
B) Lysosome
C) Glyoxysome
D) Golgi apparatus
Answer: Peroxisome

26) Glyoxysomes, specialized peroxisomes found in germinating seeds, are primarily involved in:
A) The Calvin cycle
B) The glyoxylate cycle (converting fats to carbohydrates)
C) The Krebs cycle
D) Photorespiration
Answer: The glyoxylate cycle (converting fats to carbohydrates)

27) The thickest filaments of the cytoskeleton, composed of tubulin, are called:
A) Microfilaments
B) Intermediate filaments
C) Microtubules
D) Myosin filaments
Answer: Microtubules

28) Which motor protein typically moves cargo toward the minus end (center) of microtubules?
A) Kinesin
B) Myosin
C) Dynein
D) Actin
Answer: Dynein

29) The characteristic "9+2" arrangement of microtubules is found in the core structure (axoneme) of:
A) Centrioles
B) Microvilli
C) Cilia and flagella
D) The nuclear lamina
Answer: Cilia and flagella

30) The primary function of the centrosome in animal cells is to:
A) Synthesize ATP
B) Act as the Microtubule Organizing Center (MTOC)
C) Digest cellular waste
D) Store genetic material
Answer: Act as the Microtubule Organizing Center (MTOC)

31) According to the Fluid Mosaic Model, the plasma membrane is best described as:
A) A static bilayer of proteins with embedded lipids
B) A fluid bilayer of phospholipids with embedded proteins
C) A rigid layer of cellulose with protein channels
D) A single layer of phospholipids coated with carbohydrates
Answer: A fluid bilayer of phospholipids with embedded proteins

32) The role of cholesterol in the animal cell plasma membrane is to:
A) Act as a hormone receptor
B) Increase fluidity at low temperatures and decrease it at high temperatures
C) Facilitate active transport of ions
D) Synthesize steroid hormones
Answer: Increase fluidity at low temperatures and decrease it at high temperatures

33) The net movement of water across a selectively permeable membrane from an area of low solute concentration to high solute concentration is called:
A) Simple diffusion
B) Facilitated diffusion
C) Osmosis
D) Active transport
Answer: Osmosis

34) The Sodium-Potassium Pump (Na+/K+ ATPase) is a classic example of:
A) Simple diffusion
B) Facilitated diffusion
C) Primary active transport
D) Secondary active transport
Answer: Primary active transport

35) Receptor-mediated endocytosis often involves the formation of specialized pits coated with the protein:
A) Actin
B) Clathrin
C) Tubulin
D) Keratin
Answer: Clathrin

36) The primary structural component of the plant cell wall is:
A) Chitin
B) Cellulose microfibrils
C) Peptidoglycan
D) Collagen
Answer: Cellulose microfibrils

37) Plasmodesmata in plant cells serve to:
A) Provide tensile strength
B) Connect the cytoplasm of adjacent cells for communication
C) Anchor the cell to the extracellular matrix
D) Seal cells into leak-proof sheets
Answer: Connect the cytoplasm of adjacent cells for communication

38) Which component of the animal extracellular matrix (ECM) provides great tensile strength?
A) Elastin
B) Proteoglycans
C) Collagen
D) Fibronectin
Answer: Collagen

39) Transmembrane proteins that link the extracellular matrix to the intracellular cytoskeleton are called:
A) Integrins
B) Cadherins
C) Connexins
D) Claudins
Answer: Integrins

40) Tight junctions in epithelial tissues primarily function to:
A) Allow passage of ions and small molecules
B) Provide strong mechanical adhesion
C) Create a seal preventing leakage between cells
D) Anchor cells to the basal lamina
Answer: Create a seal preventing leakage between cells

41) Gap junctions are composed of proteins called:
A) Integrins
B) Cadherins
C) Connexins
D) Keratins
Answer: Connexins

42) Stem cells that can give rise to all cell types in an organism, including extraembryonic tissues, are termed:
A) Pluripotent
B) Multipotent
C) Totipotent
D) Unipotent
Answer: Totipotent

43) Induced Pluripotent Stem Cells (iPSCs) are created by:
A) Fertilizing an egg cell
B) Reprogramming adult somatic cells
C) Isolating cells from the inner cell mass of a blastocyst
D) Fusing two different cell types
Answer: Reprogramming adult somatic cells

44) A major disadvantage associated with the use of iPSCs is:
A) They are ethically controversial to obtain.
B) They cannot differentiate into many cell types.
C) They carry a risk of tumor formation due to the reprogramming process.
D) They are extremely difficult to culture in the lab.
Answer: They carry a risk of tumor formation due to the reprogramming process.

45) A key structural difference between plant and animal cells is that plant cells possess:
A) Centrioles
B) A cell wall and chloroplasts
C) Lysosomes
D) Numerous small vacuoles
Answer: A cell wall and chloroplasts

46) The main carbohydrate storage molecule in plant cells is:
A) Glycogen
B) Starch
C) Cellulose
D) Chitin
Answer: Starch

47) The main carbohydrate storage molecule in animal cells is:
A) Glycogen
B) Starch

C) Cellulose
D) Sucrose
Answer: Glycogen

48) Cytokinesis in plant cells occurs through the formation of a:
A) Cleavage furrow
B) Contractile ring of actin and myosin
C) Cell plate
D) Septum
Answer: Cell plate

49) Which of the following organelles is typically absent in plant cells?
A) Mitochondria
B) Centrioles
C) Peroxisomes
D) Ribosomes
Answer: Centrioles

50) The resolution limit of the naked human eye is approximately:
A) 0.1 mm
B) 1 µm
C) 0.2 nm
D) 10 nm
Answer: 0.1 mm

51) The Svedberg unit (S) is a measure of a particle's:
A) Mass
B) Electrical charge
C) Sedimentation rate during centrifugation
D) Density
Answer: Sedimentation rate during centrifugation

52) In a typical prokaryotic cell, the genetic material consists of:
A) Multiple linear chromosomes with histones
B) A single circular chromosome, often with additional plasmids
C) DNA packaged within a double-membrane nucleus
D) RNA as the primary genetic material
Answer: A single circular chromosome, often with additional plasmids

53) Binary fission is the primary method of cell division for:
A) Animal cells
B) Plant cells
C) Prokaryotic cells
D) Fungal cells
Answer: Prokaryotic cells

54) The outer mitochondrial membrane contains large channel-forming proteins called:
A) ATP synthases
B) Porins
C) Cytochromes
D) Integrins
Answer: Porins

55) Which of the following is NOT found within the mitochondrial matrix?
A) Circular mitochondrial DNA (mtDNA)
B) 70S ribosomes
C) Enzymes for the Krebs cycle
D) Thylakoid membranes
Answer: Thylakoid membranes

56) Stacks of thylakoid membranes (grana) are characteristic of which organelle?
A) Mitochondrion
B) Chloroplast
C) Peroxisome
D) Lysosome
Answer: Chloroplast

57) The light-independent reactions of photosynthesis (Calvin cycle) take place in the:
A) Thylakoid lumen
B) Stroma of the chloroplast
C) Mitochondrial matrix

D) Cytosol
Answer: Stroma of the chloroplast

58) Which type of plastid is responsible for photosynthesis?
A) Chromoplast
B) Leucoplast
C) Chloroplast
D) Amyloplast
Answer: Chloroplast

59) Microfilaments (actin filaments) are primarily involved in:
A) Organizing the mitotic spindle
B) Intracellular transport along microtubules
C) Cell shape changes, muscle contraction, and cytokinesis
D) Providing permanent mechanical strength to the nucleus
Answer: Cell shape changes, muscle contraction, and cytokinesis

60) The drug Cytochalasin D affects cells by:
A) Stabilizing microtubules
B) Depolymerizing microfilaments (actin)
C) Disrupting intermediate filaments
D) Inhibiting dynein motor proteins
Answer: Depolymerizing microfilaments (actin)

61) The drug Taxol (paclitaxel) acts by:
A) Depolymerizing microtubules
B) Stabilizing microtubules, preventing their disassembly
C) Blocking actin polymerization
D) Inhibiting myosin ATPase activity
Answer: Stabilizing microtubules, preventing their disassembly

62) The nuclear lamina, which provides structural support to the nucleus, is composed of:
A) Microtubules
B) Actin filaments
C) Intermediate filament proteins called lamins
D) Collagen fibers
Answer: Intermediate filament proteins called lamins

63) Highly condensed, transcriptionally inactive chromatin is known as:
A) Euchromatin
B) Heterochromatin
C) Nucleosome
D) Chromosome
Answer: Heterochromatin

64) Which of the following is NOT considered part of the endomembrane system?
A) The nuclear envelope
B) Mitochondria
C) The Golgi apparatus
D) Lysosomes
Answer: Mitochondria

65) N-linked glycosylation of proteins begins in the:
A) Golgi apparatus
B) Smooth ER
C) Rough ER
D) Cytosol
Answer: Rough ER

66) The cisternal maturation model describes the movement and modification of cargo through the:
A) Nucleus
B) Mitochondria
C) Golgi apparatus
D) Peroxisomes
Answer: Golgi apparatus

67) Primary lysosomes are formed by budding from the:
A) Rough ER
B) Smooth ER
C) trans-Golgi network

D) Plasma membrane
Answer: trans-Golgi network

68) Contractile vacuoles in freshwater protists primarily function in:
A) Intracellular digestion
B) Photosynthesis
C) Osmoregulation (water balance)
D) Lipid synthesis
Answer: Osmoregulation (water balance)

69) The tonoplast is the membrane that surrounds the:
A) Nucleus
B) Chloroplast
C) Central vacuole in plant cells
D) Lysosome
Answer: Central vacuole in plant cells

70) The F0F1 complex (ATP synthase) is located in the:
A) Outer mitochondrial membrane
B) Inner mitochondrial membrane
C) Mitochondrial matrix
D) Intermembrane space
Answer: Inner mitochondrial membrane

71) The initial steps in the beta-oxidation of very long-chain fatty acids occur in:
A) Mitochondria only
B) Peroxisomes only
C) Both mitochondria and peroxisomes
D) The smooth endoplasmic reticulum
Answer: Both mitochondria and peroxisomes

72) Which cytoskeletal element is non-polar and primarily provides high tensile strength?
A) Microtubules
B) Microfilaments
C) Intermediate filaments
D) All of the above
Answer: Intermediate filaments

73) The basal body of a cilium has a microtubule arrangement of:
A) 9+2
B) 9+0
C) 9+1
D) 8+2
Answer: 9+0

74) The bending movement of cilia and flagella is caused by:
A) Contraction of the basal body
B) Dynein arms walking along adjacent microtubule doublets, causing sliding
C) Depolymerization of the axoneme at the tip
D) Action of myosin motor proteins
Answer: Dynein arms walking along adjacent microtubule doublets, causing sliding

75) Pinocytosis refers to the process of:
A) Cellular "eating" of large particles
B) Cellular "drinking" of extracellular fluid and dissolved solutes
C) Receptor-mediated uptake of specific ligands
D) Export of materials via vesicles
Answer: Cellular "drinking" of extracellular fluid and dissolved solutes

76) Secondary active transport uses energy stored in:
A) ATP hydrolysis directly
B) Light energy
C) An electrochemical gradient of another ion (e.g., Na+)
D) GTP hydrolysis
Answer: An electrochemical gradient of another ion (e.g., Na+)

77) Aquaporins are specialized channel proteins that facilitate the transport of:
A) Sodium ions
B) Glucose
C) Water

D) Potassium ions
Answer: Water

78) The middle lamella of plant cell walls is rich in:
A) Cellulose
B) Lignin
C) Pectin
D) Chitin
Answer: Pectin

79) Lignin, which provides rigidity and strength, is deposited in the:
A) Primary cell wall
B) Secondary cell wall
C) Plasma membrane
D) Middle lamella
Answer: Secondary cell wall

80) Hemidesmosomes function to:
A) Seal adjacent epithelial cells tightly together
B) Anchor epithelial cells to the underlying basal lamina (ECM)
C) Provide cytoplasmic channels for communication
D) Facilitate cell-cell adhesion via cadherins
Answer: Anchor epithelial cells to the underlying basal lamina (ECM)

81) Desmosomes are linked intracellularly to the:
A) Microtubule network
B) Microfilament (actin) network
C) Intermediate filament network (e.g., keratin)
D) Nuclear lamina
Answer: Intermediate filament network (e.g., keratin)

82) A primary function of the glycocalyx (cell coat) is:
A) ATP synthesis
B) Cell recognition and adhesion
C) DNA replication
D) Protein synthesis
Answer: Cell recognition and adhesion

83) Integrins are involved in:
A) Mechanotransduction and outside-in signaling
B) Forming tight seals between epithelial cells
C) Creating pores for intercellular communication
D) Digesting extracellular debris
Answer: Mechanotransduction and outside-in signaling

84) Mature human red blood cells are considered an exception to cell theory because they:
A) Are surrounded by a cell wall
B) Have multiple nuclei
C) Lack a nucleus and cannot divide
D) Contain chloroplasts
Answer: Lack a nucleus and cannot divide

85) In an electron microscope, image formation depends on differences in:
A) Light absorption
B) Electron scattering by the specimen
C) Refractive index
D) Fluorescence emission
Answer: Electron scattering by the specimen

86) Super-resolution microscopy techniques (e.g., STED, PALM) can achieve resolutions down to approximately:
A) 200 nm
B) 10-20 nm
C) 2 µm
D) 0.2 nm
Answer: 10-20 nm

87) The bacterial flagellum is powered by:
A) ATP hydrolysis
B) A proton (H+) gradient and a rotary motor
C) Dynein motor proteins
D) Myosin-actin interactions

Answer: A proton (H+) gradient and a rotary motor

88) The cell wall of fungi is primarily composed of:
A) Cellulose
B) Chitin
C) Peptidoglycan
D) Silica
Answer: Chitin

89) Which of the following is NOT a function of the plasma membrane?
A) Selective barrier for transport
B) Cell signaling via receptors
C) Synthesis of ribosomal RNA
D) Cell adhesion and recognition
Answer: Synthesis of ribosomal RNA

90) According to the Fluid Mosaic Model, integral membrane proteins are:
A) Static and immobile
B) Able to drift laterally in the fluid lipid bilayer
C) Only located on the external surface
D) Covalently bound to phospholipid heads
Answer: Able to drift laterally in the fluid lipid bilayer

91) Facilitated diffusion differs from simple diffusion in that it:
A) Requires energy from ATP
B) Moves molecules against their concentration gradient
C) Uses specific transport proteins (channels or carriers)
D) Is only for non-polar molecules
Answer: Uses specific transport proteins (channels or carriers)

92) The Sodium-Glucose Symporter in intestinal cells is an example of:
A) Simple diffusion
B) Facilitated diffusion
C) Primary active transport
D) Secondary active transport
Answer: Secondary active transport

93) Exocytosis is the process by which cells:
A) Take in large particles
B) Secrete macromolecules by vesicle fusion with the plasma membrane
C) Import fluids and solutes
D) Degrade internal organelles
Answer: Secrete macromolecules by vesicle fusion with the plasma membrane

94) Polysomes (or polyribosomes) are:
A) Multiple ribosomes translating a single mRNA molecule simultaneously
B) Aggregates of ribosomal RNA in the nucleolus
C) Vesicles containing multiple enzymes
D) Structures within the Golgi apparatus
Answer: Multiple ribosomes translating a single mRNA molecule simultaneously

95) The cell theory was primarily formulated by:
A) Hooke, Leeuwenhoek, and Pasteur
B) Schleiden, Schwann, and Virchow
C) Brown, Palade, and de Duve
D) Singer, Nicolson, and Mitchell
Answer: Schleiden, Schwann, and Virchow

96) Louis Pasteur's swan-neck flask experiment provided evidence against:
A) Cell theory
B) The germ theory of disease
C) Spontaneous generation of microorganisms
D) The theory of evolution
Answer: Spontaneous generation of microorganisms

97) Confocal microscopy improves image clarity by:
A) Using a laser and pinhole to eliminate out-of-focus light
B) Employing electrons with very short

wavelengths
C) Staining with heavy metals
D) Converting phase differences to contrast
Answer: Using a laser and pinhole to eliminate out-of-focus light

98) Scanning Electron Microscopy (SEM) is best used to produce images of:
A) Two-dimensional internal cross-sections
B) Three-dimensional topographical views of surfaces
C) Living, moving cells
D) Fluorescently tagged proteins
Answer: Three-dimensional topographical views of surfaces

99) Which organelle is often termed the "powerhouse" of the eukaryotic cell?
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Lysosome
Answer: Mitochondrion

100) The internal fluid-filled space of a chloroplast is called the:
A) Matrix
B) Stroma
C) Thylakoid lumen
D) Cristae
Answer: Stroma

101) The presence of cristae significantly increases the surface area of the:
A) Outer mitochondrial membrane
B) Inner mitochondrial membrane
C) Thylakoid membrane
D) Nuclear envelope
Answer: Inner mitochondrial membrane

102) Which organelle is considered semi-autonomous due to possessing its own DNA and ribosomes?
A) Lysosome
B) Peroxisome
C) Golgi apparatus
D) Mitochondrion
Answer: Mitochondrion

103) The primary cilium in many animal cells functions mainly as a:
A) Motile structure for fluid movement
B) Sensory "antenna" for signal reception
C) Site of protein synthesis
D) Digestive compartment
Answer: Sensory "antenna" for signal reception

104) According to the signal hypothesis, proteins destined for secretion have a signal sequence that targets them to the:
A) Mitochondria
B) Cytosol
C) Endoplasmic Reticulum (ER)
D) Nucleus
Answer: Endoplasmic Reticulum (ER)

105) The addition and modification of carbohydrate chains on proteins (e.g., sulfation) primarily occurs in the:
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosomes
Answer: Golgi apparatus

106) The molecular tag mannose-6-phosphate directs proteins from the Golgi to:
A) The nucleus
B) Lysosomes
C) Mitochondria
D) The plasma membrane for secretion
Answer: Lysosomes

107) The complete self-digestion of a cell by its own lysosomal enzymes is called:
A) Autophagy
B) Apoptosis

C) Autolysis
D) Phagocytosis
Answer: Autolysis

108) Which of the following processes does NOT occur within peroxisomes?
A) Detoxification of hydrogen peroxide (H2O2)
B) Beta-oxidation of very long-chain fatty acids
C) The Krebs (TCA) cycle
D) Photorespiration (in plant cells)
Answer: The Krebs (TCA) cycle

109) Which of the following is a component of the cytoskeleton?
A) Ribosome
B) Peroxisome
C) Microtubule
D) Nucleolus
Answer: Microtubule

110) The motor protein kinesin typically moves cargo along microtubules toward the:
A) Minus end (center)
B) Plus end (periphery)
C) Both directions equally
D) It moves on microfilaments, not microtubules
Answer: Plus end (periphery)

111) The motor protein myosin is primarily associated with which cytoskeletal element?
A) Microtubules
B) Microfilaments (actin)
C) Intermediate filaments
D) Nuclear lamina
Answer: Microfilaments (actin)

112) Cytoplasmic streaming (cyclosis) in plant cells is driven by the interaction of:
A) Microtubules and kinesin
B) Actin and myosin
C) Intermediate filaments and dynein
D) Tubulin and dynein
Answer: Actin and myosin

113) The mitotic spindle is primarily composed of:
A) Microfilaments
B) Intermediate filaments
C) Microtubules
D) Collagen fibers
Answer: Microtubules

114) The drug colchicine disrupts cell division by:
A) Stabilizing microtubules
B) Inhibiting microtubule polymerization
C) Depolymerizing microfilaments
D) Blocking myosin activity
Answer: Inhibiting microtubule polymerization

115) Which type of cell junction forms a direct cytoplasmic channel between adjacent animal cells?
A) Tight junction
B) Adherens junction
C) Desmosome
D) Gap junction
Answer: Gap junction

116) Adherens junctions are linked intracellularly to the:
A) Intermediate filament network
B) Microfilament (actin) network via linker proteins like catenins
C) Microtubule network
D) Nuclear lamina
Answer: Microfilament (actin) network via linker proteins like catenins

117) The extracellular matrix (ECM) of animal cells resists compression largely due to:
A) Collagen fibers
B) Elastin
C) Proteoglycans

D) Fibronectin
Answer: Proteoglycans

118) A plant cell placed in a hypertonic solution will likely undergo:
A) Swelling and bursting
B) Shrinking and plasmolysis
C) No net change
D) Rapid division
Answer: Shrinking and plasmolysis

119) Oxygen and carbon dioxide cross the plasma membrane via:
A) Simple diffusion
B) Facilitated diffusion
C) Active transport
D) Endocytosis
Answer: Simple diffusion

120) The GLUT transporters that move glucose into cells are examples of:
A) Channel proteins
B) Carrier proteins for facilitated diffusion
C) Active transport pumps
D) Symporters
Answer: Carrier proteins for facilitated diffusion

121) Vesicles budding from the Golgi apparatus are targeted to their correct destination based on:
A) Their lipid composition alone
B) Molecular "zip codes" or protein tags
C) Their size alone
D) Random diffusion
Answer: Molecular "zip codes" or protein tags

122) Which organelle is the primary site for the synthesis of phospholipids for cellular membranes?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondrion
Answer: Smooth ER

123) The enzymes of the electron transport chain are embedded in the:
A) Outer mitochondrial membrane
B) Inner mitochondrial membrane
C) Mitochondrial matrix
D) Intermembrane space
Answer: Inner mitochondrial membrane

124) The Calvin cycle uses ATP and NADPH produced in the:
A) Light-dependent reactions in the thylakoids
B) Krebs cycle in the mitochondrial matrix
C) Glyoxylate cycle in glyoxysomes
D) Electron transport chain in the inner mitochondrial membrane
Answer: Light-dependent reactions in the thylakoids

125) Coenocytic organisms have bodies that are:
A) Made of a single cell
B) Not divided into separate cells (multinucleate)
C) Prokaryotic in nature
D) Lacking a nucleus
Answer: Not divided into separate cells (multinucleate)

126) The "cell sap" found in the central vacuole of plant cells primarily contains:
A) Hydrolytic enzymes
B) Chlorophyll
C) Water, ions, sugars, and pigments
D) Digestive enzymes for autophagy
Answer: Water, ions, sugars, and pigments

127) A process that occurs in both mitochondria and chloroplasts is:
A) The Calvin cycle
B) The Krebs cycle
C) Chemiosmotic ATP synthesis

D) Beta-oxidation of fatty acids
Answer: Chemiosmotic ATP synthesis

128) An important piece of evidence supporting the endosymbiotic origin of mitochondria and chloroplasts is that they:
A) Have single membranes like the ER
B) Lack their own DNA
C) Have their own circular DNA and 70S ribosomes
D) Are produced by the Golgi apparatus
Answer: Have their own circular DNA and 70S ribosomes

129) The outer membrane of the nuclear envelope is continuous with the membrane of the:
A) Golgi apparatus
B) Rough Endoplasmic Reticulum
C) Mitochondrion
D) Plasma membrane
Answer: Rough Endoplasmic Reticulum

130) In prokaryotic cells, transcription and translation are:
A) Separated by the nuclear envelope
B) Coupled (occur simultaneously in the cytoplasm)
C) Restricted to the nucleoid region only
D) Regulated by spliceosomes
Answer: Coupled (occur simultaneously in the cytoplasm)

131) The basal lamina is a specialized type of:
A) Cell junction
B) Extracellular matrix (ECM)
C) Cytoskeletal element
D) Organelle
Answer: Extracellular matrix (ECM)

132) A key structural difference between prokaryotic and eukaryotic flagella is:
A) Prokaryotic flagella are made of tubulin; eukaryotic are made of flagellin.
B) Prokaryotic flagella rotate; eukaryotic flagella bend using dynein motors.
C) Eukaryotic flagella are powered by a proton gradient; prokaryotic by ATP.
D) Only eukaryotic flagella are used for motility.
Answer: Prokaryotic flagella rotate; eukaryotic flagella bend using dynein motors.

133) Which of the following is NOT a typical function of plasma membrane proteins?
A) Enzymatic activity
B) Signal transduction
C) Synthesis of ribosomal RNA
D) Cell-cell recognition
Answer: Synthesis of ribosomal RNA

134) The process by which a cell engulfs a large solid particle is called:
A) Pinocytosis
B) Phagocytosis
C) Receptor-mediated endocytosis
D) Exocytosis
Answer: Phagocytosis

135) In the plasma membrane, the hydrophilic heads of phospholipids face:
A) The interior of the bilayer
B) The extracellular fluid and the cytosol
C) Only the extracellular fluid
D) Only the cytosol
Answer: The extracellular fluid and the cytosol

136) The energy for primary active transport comes directly from:
A) The electrochemical gradient of Na+
B) The hydrolysis of ATP
C) Light energy
D) The proton motive force
Answer: The hydrolysis of ATP

137) For every ATP hydrolyzed, the Na+/K+ pump transports:
A) 3 Na+ out, 2 K+ in

B) 2 Na+ out, 3 K+ in
C) 3 Na+ in, 2 K+ out
D) 2 Na+ in, 3 K+ out
Answer: 3 Na+ out, 2 K+ in

138) Osmosis is best described as a special case of:
A) Facilitated diffusion
B) Active transport
C) Simple diffusion of water
D) Bulk transport
Answer: Simple diffusion of water

139) A plant cell with a cell wall placed in a hypotonic solution will become:
A) Flaccid
B) Plasmolyzed
C) Turgid
D) Lysed (burst)
Answer: Turgid

140) Which molecule would diffuse most readily across a pure phospholipid bilayer?
A) Sodium ion (Na+)
B) Glucose
C) Oxygen (O2)
D) Potassium ion (K+)
Answer: Oxygen (O2)

141) Voltage-gated and ligand-gated channels are specific types of:
A) Carrier proteins
B) Channel proteins
C) ATP-powered pumps
D) Receptors not involved in transport
Answer: Channel proteins

142) The release of neurotransmitters at a synapse is accomplished by:
A) Phagocytosis
B) Pinocytosis
C) Exocytosis
D) Receptor-mediated endocytosis
Answer: Exocytosis

143) A key advantage of small cell size is a high surface area-to-volume ratio, which allows for:
A) More efficient waste removal and nutrient uptake
B) Greater capacity for DNA storage
C) Increased structural strength
D) A slower metabolic rate
Answer: More efficient waste removal and nutrient uptake

144) In cell fractionation, the pellet formed after the highest-speed centrifugation would be richest in:
A) Nuclei
B) Mitochondria
C) Ribosomes
D) Microsomes (membrane fragments)
Answer: Ribosomes

145) Which technique is best for studying the dynamic movement of a specific protein in a living cell?
A) Transmission Electron Microscopy (TEM)
B) Scanning Electron Microscopy (SEM)
C) Fluorescence microscopy with GFP tagging
D) Bright-field microscopy on stained, fixed cells
Answer: Fluorescence microscopy with GFP tagging

146) The stacking of thylakoids into grana in chloroplasts serves to:
A) Increase surface area for light-dependent reactions
B) Provide structure for the Calvin cycle
C) Store starch
D) House enzymes for the Krebs cycle
Answer: Increase surface area for light-dependent reactions

147) A function shared by both Smooth ER and peroxisomes is:

A) Protein synthesis
B) Detoxification of harmful substances
C) ATP synthesis
D) RNA synthesis
Answer: Detoxification of harmful substances

148) Which of the following is NOT a component of the cytoskeleton?
A) Microtubule
B) Microfilament
C) Intermediate filament
D) Microvillus
Answer: Microvillus

149) The formation of a cleavage furrow during animal cell cytokinesis is driven by a contractile ring composed of:
A) Tubulin and kinesin
B) Actin and myosin
C) Intermediate filaments
D) Microtubules and dynein
Answer: Actin and myosin

150) Which organelle(s) contain the enzyme catalase to break down hydrogen peroxide?
A) Lysosome only
B) Peroxisome only
C) Glyoxysome only
D) Peroxisomes and glyoxysomes
Answer: Peroxisomes and glyoxysomes

151) The flexibility and biconcave shape of red blood cells is provided by a network of cytoskeletal proteins primarily composed of:
A) Tubulin
B) Spectrin and actin
C) Keratin
D) Lamin
Answer: Spectrin and actin

152) Cytoplasmic streaming in plant cells, which moves chloroplasts, is facilitated by:
A) Microtubules and kinesin
B) Actin filaments and myosin
C) Intermediate filaments and dynein
D) Microvilli and integrins
Answer: Actin filaments and myosin

153) A characteristic feature of apoptosis (programmed cell death) is:
A) Cell swelling and bursting (lysis)
B) Release of lysosomal enzymes causing inflammation
C) Orderly cell shrinkage and fragmentation, often involving mitochondria
D) Always being caused by external physical damage
Answer: Orderly cell shrinkage and fragmentation, often involving mitochondria

154) The main function of the nucleoplasm is to:
A) Synthesize ribosomal subunits
B) Provide a medium for chromatin and nucleoli
C) Control molecular traffic via nuclear pores
D) Store calcium ions
Answer: Provide a medium for chromatin and nucleoli

155) The ABO blood group antigens on red blood cells are an example of cell recognition mediated by:
A) Phospholipids
B) Glycolipids and glycoproteins of the glycocalyx
C) Cholesterol molecules
D) Integral channel proteins
Answer: Glycolipids and glycoproteins of the glycocalyx

156) A symporter and an antiporter are both types of:
A) Ion channels
B) Carrier proteins used in secondary active transport
C) Primary active transport pumps
D) Phospholipids

Answer: Carrier proteins used in secondary active transport

157) Which structure is unique to the cell walls of bacteria?
A) Cellulose
B) Chitin
C) Peptidoglycan (murein)
D) Lignin
Answer: Peptidoglycan (murein)

158) The main role of the extracellular matrix (ECM) in animal tissues is to:
A) Carry out photosynthesis
B) Provide structural support, adhesion, and signaling
C) Synthesize proteins for secretion
D) Generate ATP for cellular work
Answer: Provide structural support, adhesion, and signaling

159) The Krebs (TCA) cycle takes place in the:
A) Mitochondrial matrix
B) Mitochondrial intermembrane space
C) Inner mitochondrial membrane
D) Cytosol
Answer: Mitochondrial matrix

160) The light-dependent reactions of photosynthesis occur in the:
A) Stroma
B) Thylakoid membranes
C) Mitochondrial cristae
D) Cytosol
Answer: Thylakoid membranes

161) Intermediate filaments are particularly important for:
A) Chromosome movement during mitosis
B) Beating of cilia
C) Providing mechanical strength and anchoring organelles
D) Muscle contraction
Answer: Providing mechanical strength and anchoring organelles

162) A Nuclear Localization Signal (NLS) on a protein directs it to the:
A) Mitochondria
B) Endoplasmic reticulum
C) Nucleus
D) Peroxisome
Answer: Nucleus

163) The process by which cells take in droplets of extracellular fluid and its dissolved contents is:
A) Phagocytosis
B) Pinocytosis
C) Autophagy
D) Exocytosis
Answer: Pinocytosis

164) The main function of the Golgi apparatus is:
A) Protein synthesis
B) Modification, sorting, and packaging of proteins and lipids
C) Cellular respiration
D) Detoxification of drugs
Answer: Modification, sorting, and packaging of proteins and lipids

165) Which organelle is most abundant in liver cells for detoxification functions?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosome
Answer: Smooth ER

166) Plasmodesmata are structures that connect the cytoplasm of adjacent:
A) Animal cells
B) Plant cells
C) Bacterial cells

D) Fungal cells
Answer: Plant cells

167) Which of the following is NOT a function of lysosomes?
A) Autophagy
B) Phagocytosis of foreign particles
C) Synthesis of steroid hormones
D) Autolysis
Answer: Synthesis of steroid hormones

168) Simple diffusion and facilitated diffusion are both types of:
A) Active transport
B) Passive transport
C) Endocytosis
D) Osmosis
Answer: Passive transport

169) A characteristic of carrier proteins in facilitated diffusion is that they:
A) Hydrolyze ATP for energy
B) Change conformation to move the solute across the membrane
C) Form a permanent hydrophilic pore
D) Move solutes against their concentration gradient
Answer: Change conformation to move the solute across the membrane

170) The primary function of microvilli on intestinal epithelial cells is to:
A) Increase surface area for absorption
B) Propel mucus along the surface
C) Provide mechanical strength
D) Serve as sensory receptors
Answer: Increase surface area for absorption

171) Which cell type would be expected to have the most extensive network of Smooth ER?
A) Pancreatic cell secreting digestive enzymes
B) Liver cell detoxifying alcohol
C) Skeletal muscle cell contracting
D) Red blood cell transporting oxygen
Answer: Liver cell detoxifying alcohol

172) Transport through the nuclear pore complex is:
A) Free and non-selective for all molecules
B) Selective, involving both passive diffusion and active transport
C) Restricted to only mRNA exiting the nucleus
D) Limited to only ribosomal proteins entering the nucleus
Answer: Selective, involving both passive diffusion and active transport

173) In a muscle cell, calcium ions are stored at high concentration in the:
A) Nucleus
B) Mitochondrion
C) Sarcoplasmic reticulum (specialized SER)
D) Golgi apparatus
Answer: Sarcoplasmic reticulum (specialized SER)

174) A key difference between eukaryotic and prokaryotic mRNA is that eukaryotic mRNA:
A) Is not processed after transcription
B) Undergoes processing (capping, polyadenylation, splicing)
C) Is transcribed in the cytoplasm
D) Is translated simultaneously with transcription
Answer: Undergoes processing (capping, polyadenylation, splicing)

175) The term "semi-autonomous" applied to mitochondria and chloroplasts refers to their ability to:
A) Survive independently outside the cell
B) Synthesize some of their own proteins using their own genetic system
C) Control cell division
D) Communicate directly with the nucleus via vesicles

Answer: Synthesize some of their own proteins using their own genetic system

176) Which organelle is involved in the synthesis of carbohydrates for the plant cell wall?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondrion
Answer: Golgi apparatus

177) Both mitochondria and chloroplasts contain:
A) A single circular DNA molecule and 70S ribosomes
B) Multiple linear chromosomes and 80S ribosomes
C) No DNA of their own
D) Thylakoid membranes
Answer: A single circular DNA molecule and 70S ribosomes

178) The movement of chromosomes during cell division is orchestrated by the:
A) Microfilament network
B) Intermediate filament network
C) Microtubule-based spindle apparatus
D) Endoplasmic reticulum
Answer: Microtubule-based spindle apparatus

179) Peroxisomes and glyoxysomes are both:
A) Surrounded by a double membrane
B) Involved in lipid metabolism and detoxification
C) Sites of protein synthesis
D) Derived from the Golgi apparatus
Answer: Involved in lipid metabolism and detoxification

180) Proteins destined for use within the cytoplasm are typically synthesized on:
A) Free ribosomes in the cytosol
B) Ribosomes bound to the Rough ER
C) Ribosomes inside mitochondria
D) Ribosomes on the nuclear envelope
Answer: Free ribosomes in the cytosol

181) The extensive network of membranes involved in protein and lipid synthesis is the:
A) Golgi apparatus
B) Endoplasmic reticulum
C) Lysosomal system
D) Peroxisomal network
Answer: Endoplasmic reticulum

182) The formation of the mitotic spindle is organized by the:
A) Centrioles in the centrosome (in animal cells)
B) Nucleolus
C) Ribosomes
D) Peroxisomes
Answer: Centrioles in the centrosome (in animal cells)

183) Which of the following can be classified as a non-membrane bound organelle?
A) Peroxisome
B) Lysosome
C) Glyoxysome
D) Ribosome
Answer: Ribosome

184) Which substance can cross the lipid bilayer of the plasma membrane most easily?
A) Sodium ion (Na+)
B) Glucose
C) A small, nonpolar molecule like oxygen
D) A large, polar amino acid
Answer: A small, nonpolar molecule like oxygen

185) Which of the following is found in both prokaryotic and eukaryotic cells?
A) Centriole
B) Mitochondria
C) Endoplasmic reticulum

D) Ribosomes
Answer: Ribosomes

186) Membrane-bound organelles are absent in which type of organism?
A) Saccharomyces (yeast)
B) Plants
C) Animals
D) Streptococcus (bacteria)
Answer: Streptococcus (bacteria)

187) Which statement about plastids is true?
A) They are surrounded by a single membrane.
B) They are the "powerhouse" of the plant cell.
C) They are found in all eukaryotic organisms.
D) They contain their own DNA and ribosomes.
Answer: They contain their own DNA and ribosomes.

188) Who is credited with the discovery and naming of lysosomes?
A) George Palade
B) Christian de Duve
C) Camillo Golgi
D) Rudolf Virchow
Answer: Christian de Duve

189) The electron transport chain and oxidative phosphorylation occur on the:
A) Outer mitochondrial membrane
B) Inner mitochondrial membrane
C) Mitochondrial matrix
D) Intermembrane space
Answer: Inner mitochondrial membrane

190) The component of the plasma membrane that helps regulate its fluidity across a range of temperatures is:
A) Integral proteins
B) Phospholipids
C) Glycoproteins
D) Cholesterol
Answer: Cholesterol

191) Each centriole is composed of how many microtubule triplets arranged in a circle?
A) 9
B) 27 (9 triplets)
C) 6
D) 18
Answer: 9

192) The dark-independent reactions of photosynthesis (Calvin cycle) fix carbon dioxide in the:
A) Thylakoid lumen
B) Stroma of the chloroplast
C) Mitochondrial matrix
D) Cytosol
Answer: Stroma of the chloroplast

193) Out of the following, which set of structures is found only in plant cells?
A) Vacuole, Chloroplast, Ribosomes
B) Chloroplast, Cell Wall, Large Central Vacuole
C) Chloroplast, Microtubules, Peroxisomes
D) Chloroplast, Cell Wall, Mitochondria
Answer: Chloroplast, Cell Wall, Large Central Vacuole

194) Which of the following is NOT a function of the cell membrane?
A) Providing a large surface area for reactions
B) Separating various organelles within the cell
C) Producing lipids and proteins
D) Separating the cell from its external environment
Answer: Producing lipids and proteins

195) Neurotransmitters are released from the presynaptic neuron into the synaptic cleft via:
A) Simple Diffusion
B) Osmosis
C) Active Transport
D) Exocytosis
Answer: Exocytosis

196) The principle "Omnis cellula e cellula" (all cells come from cells) is attributed to:
A) Louis Pasteur
B) Rudolf Virchow
C) Theodor Schwann
D) August Weismann
Answer: Rudolf Virchow

197) Which microscopy technique is best for viewing unstained, living cells by converting refractive index differences into contrast?
A) Bright-field microscopy
B) Dark-field microscopy
C) Phase-contrast microscopy
D) Fluorescence microscopy
Answer: Phase-contrast microscopy

198) The proteins within a biological membrane that determine most of its specific functions are:
A) Phospholipids
B) Cholesterol
C) Carbohydrates
D) Proteins
Answer: Proteins

199) The movement of a substance against its concentration gradient, requiring energy, is called:
A) Diffusion
B) Facilitated diffusion
C) Active transport
D) Osmosis
Answer: Active transport

200) Which organelle is primarily responsible for the synthesis of steroid hormones?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondria
Answer: Smooth ER

201) The cellular structure that gives red blood cells their flexible, biconcave shape is the:
A) Cell wall
B) Spectrin-based cytoskeleton network
C) Central vacuole
D) Cholesterol-rich membrane
Answer: Spectrin-based cytoskeleton network

202) Which of the following are sites for protein synthesis?
A) Nucleolus and Ribosomes
B) Ribosomes only
C) Golgi apparatus and Ribosomes
D) Smooth ER and Ribosomes
Answer: Ribosomes only

203) The function of the nucleolus is to synthesize and assemble:
A) DNA
B) Ribosomal subunits
C) ATP
D) Phospholipids
Answer: Ribosomal subunits

204) Which of the following organelles has a double membrane and is involved in cellular respiration?
A) Lysosome
B) Peroxisome
C) Mitochondrion
D) Vacuole
Answer: Mitochondrion

205) The process by which lysosomes digest worn-out organelles is known as:
A) Phagocytosis
B) Autophagy
C) Pinocytosis
D) Exocytosis
Answer: Autophagy

206) Which of the following is a characteristic of prokaryotic cells?

A) Presence of a nuclear envelope
B) 80S ribosomes
C) Division by mitosis
D) Presence of a nucleoid region
Answer: Presence of a nucleoid region

207) The folds of the inner mitochondrial membrane are called cristae and their function is to:
A) Increase surface area for ATP production
B) Store calcium ions
C) Synthesize proteins
D) Package enzymes for export
Answer: Increase surface area for ATP production

208) The structure that forms during cytokinesis in plant cells, eventually developing into the new cell wall, is the:
A) Cleavage furrow
B) Cell plate
C) Phragmoplast
D) Contractile ring
Answer: Cell plate

209) Which organelle is responsible for breaking down hydrogen peroxide into water and oxygen?
A) Lysosome
B) Peroxisome
C) Glyoxysome
D) Both B and C
Answer: Both B and C

210) The term "fluid" in the Fluid Mosaic Model of the membrane refers to the:
A) Movement of phospholipids and proteins within the bilayer
B) Aqueous environment inside and outside the cell
C) Flow of ions through channels
D) Movement of the entire membrane
Answer: Movement of phospholipids and proteins within the bilayer

211) The main function of the Rough Endoplasmic Reticulum is:
A) Lipid synthesis
B) Protein synthesis and initial modification
C) Detoxification
D) Calcium storage
Answer: Protein synthesis and initial modification

212) The model that describes the plasma membrane as a phospholipid bilayer with embedded proteins is the:
A) Unit Membrane Model
B) Fluid Mosaic Model
C) Sandwich Model
D) Induced Fit Model
Answer: Fluid Mosaic Model

213) Which organelle is known as the "suicidal bag" of the cell?
A) Golgi apparatus
B) Lysosome
C) Peroxisome
D) Vacuole
Answer: Lysosome

214) The organelle that modifies, sorts, and packages proteins for secretion is the:
A) Nucleus
B) Rough ER
C) Golgi apparatus
D) Lysosome
Answer: Golgi apparatus

215) Which of the following is a double-membraned organelle?
A) Ribosome
B) Lysosome
C) Peroxisome
D) Chloroplast
Answer: Chloroplast

216) The movement of water from a dilute solution to a concentrated solution across a semipermeable membrane is:
A) Diffusion
B) Active transport
C) Osmosis
D) Facilitated diffusion
Answer: Osmosis

217) Which of the following is a function of the cytoskeleton?
A) Storage of genetic material
B) Maintenance of cell shape and intracellular transport
C) Site of protein synthesis
D) ATP production
Answer: Maintenance of cell shape and intracellular transport

218) The organelle responsible for photosynthesis in plant cells is the:
A) Mitochondrion
B) Chloroplast
C) Peroxisome
D) Leucoplast
Answer: Chloroplast

219) Which of the following organelles contains its own DNA?
A) Lysosome
B) Golgi apparatus
C) Peroxisome
D) Mitochondrion
Answer: Mitochondrion

220) The structure that separates the nucleus from the cytoplasm is the:
A) Plasma membrane
B) Nuclear envelope
C) Cell wall
D) Endoplasmic reticulum
Answer: Nuclear envelope

221) Which cellular structure is composed of rRNA and proteins and is the site of protein synthesis?
A) Nucleolus
B) Ribosome
C) Golgi apparatus
D) Lysosome
Answer: Ribosome

222) The organelle involved in lipid synthesis and detoxification in liver cells is the:
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosome
Answer: Smooth ER

223) The structure that provides mechanical support and shape to plant cells is the:
A) Plasma membrane
B) Cell wall
C) Cytoskeleton
D) Extracellular matrix
Answer: Cell wall

224) The organelle responsible for ATP production through oxidative phosphorylation is the:
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Peroxisome
Answer: Mitochondrion

225) Which organelle is involved in the breakdown of fatty acids and detoxification of hydrogen peroxide?
A) Lysosome
B) Peroxisome
C) Glyoxysome
D) Golgi apparatus
Answer: Peroxisome

226) The structure that facilitates cell movement and is composed of microtubules in a 9+2 arrangement is the:
A) Cilium
B) Microvillus
C) Desmosome
D) Tight junction
Answer: Cilium

227) The storage carbohydrate in animal cells is:
A) Cellulose
B) Starch
C) Glycogen
D) Sucrose
Answer: Glycogen

228) Which of the following is present in both animal and plant cells?
A) Centrioles
B) Cell wall
C) Large central vacuole
D) Mitochondria
Answer: Mitochondria

229) The process by which cells engulf large particles is called:
A) Pinocytosis
B) Phagocytosis
C) Exocytosis
D) Osmosis
Answer: Phagocytosis

230) Which of the following is a characteristic of facilitated diffusion?
A) Requires ATP
B) Moves molecules against their concentration gradient
C) Uses carrier or channel proteins
D) Is only for lipid-soluble molecules
Answer: Uses carrier or channel proteins

231) The organelle that contains digestive enzymes and breaks down cellular waste is the:
A) Vacuole
B) Peroxisome
C) Lysosome
D) Glyoxysome
Answer: Lysosome

232) Which cellular structure is involved in cell division and organization of microtubules?
A) Centriole
B) Nucleolus
C) Ribosome
D) Peroxisome
Answer: Centriole

233) The structure that stores calcium ions in muscle cells is the:
A) Golgi apparatus
B) Sarcoplasmic reticulum
C) Lysosome
D) Peroxisome
Answer: Sarcoplasmic reticulum

234) Which organelle is responsible for the synthesis of secretory proteins?
A) Smooth ER
B) Rough ER
C) Golgi apparatus
D) Lysosome
Answer: Rough ER

235) The structure that connects adjacent plant cells and allows communication is the:
A) Desmosome
B) Gap junction
C) Plasmodesma
D) Tight junction
Answer: Plasmodesma

236) Which cellular structure is involved in the modification, sorting, and packaging of proteins for secretion?
A) Nucleus

B) Rough ER
C) Golgi apparatus
D) Lysosome
Answer: Golgi apparatus

237) The structure that provides tensile strength and anchors the nucleus is the:
A) Microtubule
B) Microfilament
C) Intermediate filament
D) Actin filament
Answer: Intermediate filament

238) Which organelle contains enzymes for the Krebs cycle and electron transport chain?
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Peroxisome
Answer: Mitochondrion

239) The structure that forms a selective barrier controlling the movement of substances in and out of the cell is the:
A) Cell wall
B) Plasma membrane
C) Nuclear envelope
D) Endoplasmic reticulum
Answer: Plasma membrane

240) Which cellular component is involved in the synthesis of ribosomal RNA?
A) Nucleus
B) Nucleolus
C) Ribosome
D) Golgi apparatus
Answer: Nucleolus

241) The structure that stores pigments, ions, and waste in plant cells is the:
A) Chloroplast
B) Central vacuole
C) Nucleus
D) Peroxisome
Answer: Central vacuole

242) Which organelle is involved in the synthesis of steroid hormones?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondrion
Answer: Smooth ER

243) The structure that provides a pathway for the transport of materials within the cell is the:
A) Cytoskeleton
B) Endoplasmic reticulum
C) Golgi apparatus
D) Lysosome
Answer: Endoplasmic reticulum

244) Which cellular structure is involved in the breakdown of damaged organelles through autophagy?
A) Peroxisome
B) Lysosome
C) Glyoxysome
D) Golgi apparatus
Answer: Lysosome

245) The structure that contains cristae and a matrix is the:
A) Chloroplast
B) Mitochondrion
C) Nucleus
D) Peroxisome
Answer: Mitochondrion

246) Which organelle is involved in the conversion of light energy into chemical energy?
A) Mitochondrion
B) Chloroplast
C) Peroxisome

D) Lysosome
Answer: Chloroplast

247) The structure that contains thylakoids and stroma is the:
A) Mitochondrion
B) Chloroplast
C) Nucleus
D) Peroxisome
Answer: Chloroplast

248) Which cellular component is involved in the synthesis of membrane phospholipids?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosome
Answer: Smooth ER

249) The structure that contains hydrolytic enzymes and an acidic interior is the:
A) Peroxisome
B) Lysosome
C) Glyoxysome
D) Golgi apparatus
Answer: Lysosome

250) Which organelle is involved in the detoxification of drugs and poisons in liver cells?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondrion
Answer: Smooth ER

251) The structure that contains catalase and is involved in beta-oxidation of fatty acids is the:
A) Lysosome
B) Peroxisome
C) Glyoxysome
D) Golgi apparatus
Answer: Peroxisome

252) Which cellular structure is involved in the synthesis of proteins for export?
A) Free ribosomes
B) Bound ribosomes on Rough ER
C) Smooth ER
D) Golgi apparatus
Answer: Bound ribosomes on Rough ER

253) The structure that contains chlorophyll and carries out the light-dependent reactions of photosynthesis is the:
A) Stroma
B) Thylakoid membrane
C) Cristae
D) Matrix
Answer: Thylakoid membrane

254) Which organelle is involved in the storage and release of calcium ions in cells?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosome
Answer: Smooth ER

255) The structure that contains the enzymes for the Calvin cycle is the:
A) Thylakoid lumen
B) Stroma of chloroplast
C) Mitochondrial matrix
D) Cytosol
Answer: Stroma of chloroplast

256) Which cellular component is involved in the assembly of ribosomal subunits?
A) Nucleus
B) Nucleolus
C) Ribosome
D) Golgi apparatus
Answer: Nucleolus

257) The structure that contains pores for the exchange of materials between nucleus and cytoplasm is the:

A) Nuclear envelope
B) Plasma membrane
C) Cell wall
D) Endoplasmic reticulum
Answer: Nuclear envelope

258) Which organelle is involved in the synthesis of carbohydrates for the plant cell wall?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Mitochondrion
Answer: Golgi apparatus

259) The structure that contains a circular DNA molecule and 70S ribosomes is the:
A) Nucleus
B) Mitochondrion
C) Chloroplast
D) Both B and C
Answer: Both B and C

260) Which cellular structure is involved in the movement of chromosomes during cell division?
A) Microtubules
B) Microfilaments
C) Intermediate filaments
D) Actin filaments
Answer: Microtubules

261) The structure that contains a double membrane and is involved in lipid metabolism is the:
A) Peroxisome
B) Glyoxysome
C) Both A and B
D) Lysosome
Answer: Both A and B

262) Which organelle is involved in the synthesis of proteins for use within the cytoplasm?
A) Free ribosomes
B) Bound ribosomes on Rough ER
C) Smooth ER
D) Golgi apparatus
Answer: Free ribosomes

263) The structure that contains a network of membranes and is involved in protein synthesis and modification is the:
A) Golgi apparatus
B) Endoplasmic reticulum
C) Lysosome
D) Peroxisome
Answer: Endoplasmic reticulum

264) Which cellular component is involved in the formation of the mitotic spindle?
A) Centrioles
B) Nucleolus
C) Ribosomes
D) Peroxisomes
Answer: Centrioles

265) The structure that contains a single membrane and is involved in the breakdown of hydrogen peroxide is the:
A) Lysosome
B) Peroxisome
C) Glyoxysome
D) Both B and C
Answer: Both B and C

266) Which organelle is involved in the synthesis of proteins for lysosomes?
A) Free ribosomes
B) Bound ribosomes on Rough ER
C) Smooth ER
D) Golgi apparatus
Answer: Bound ribosomes on Rough ER

267) The structure that contains a phospholipid bilayer and embedded proteins is the:
A) Cell wall

B) Plasma membrane
C) Nuclear envelope
D) Endoplasmic reticulum
Answer: Plasma membrane

268) Which cellular structure is involved in the transport of vesicles along microtubules?
A) Kinesin and dynein
B) Myosin and actin
C) Tubulin and actin
D) Keratin and vimentin
Answer: Kinesin and dynein

269) The structure that contains a rigid layer of cellulose and provides support to plant cells is the:
A) Plasma membrane
B) Cell wall
C) Extracellular matrix
D) Cytoskeleton
Answer: Cell wall

270) Which organelle is involved in the synthesis of ATP through photophosphorylation?
A) Mitochondrion
B) Chloroplast
C) Peroxisome
D) Lysosome
Answer: Chloroplast

271) The structure that contains a double membrane and is involved in the storage of genetic material is the:
A) Nucleus
B) Mitochondrion
C) Chloroplast
D) All of the above
Answer: Nucleus

272) Which cellular component is involved in the synthesis of RNA?
A) Nucleus
B) Nucleolus
C) Ribosome
D) Golgi apparatus
Answer: Nucleus

273) The structure that contains a network of microfilaments and is involved in cell motility is the:
A) Cytoskeleton
B) Endoplasmic reticulum
C) Golgi apparatus
D) Lysosome
Answer: Cytoskeleton

274) Which organelle is involved in the synthesis of proteins for the plasma membrane?
A) Free ribosomes
B) Bound ribosomes on Rough ER
C) Smooth ER
D) Golgi apparatus
Answer: Bound ribosomes on Rough ER

275) The structure that contains a membrane and is involved in the storage of starch in plant cells is the:
A) Chloroplast
B) Amyloplast
C) Central vacuole
D) Peroxisome
Answer: Amyloplast

276) Which cellular structure is involved in the synthesis of ribosomal proteins?
A) Nucleus
B) Nucleolus
C) Ribosome
D) Golgi apparatus
Answer: Ribosome

277) The structure that contains a double membrane and is involved in the synthesis of ATP through oxidative phosphorylation is the:
A) Nucleus

B) Chloroplast
C) Mitochondrion
D) Peroxisome
Answer: Mitochondrion

278) Which of the following is a function of the cytoskeleton?
A) Storage of genetic material
B) Intracellular transport and cell shape maintenance
C) Site of protein synthesis
D) ATP production
Answer: Intracellular transport and cell shape maintenance

279) The site of cellular respiration in eukaryotic cells is the:
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Lysosome
Answer: Mitochondrion

280) Which organelle is involved in packaging and modifying proteins for secretion?
A) Nucleus
B) Rough ER
C) Golgi apparatus
D) Peroxisome
Answer: Golgi apparatus

281) The structure that contains digestive enzymes and breaks down cellular waste is the:
A) Vacuole
B) Peroxisome
C) Lysosome
D) Glyoxysome
Answer: Lysosome

282) Which cellular structure is responsible for maintaining turgor pressure in plant cells?
A) Cell wall
B) Chloroplast
C) Central vacuole
D) Nucleus
Answer: Central vacuole

283) The organelle that contains chlorophyll and carries out photosynthesis is the:
A) Mitochondrion
B) Chloroplast
C) Peroxisome
D) Leucoplast
Answer: Chloroplast

284) Which structure is involved in the synthesis of lipids and detoxification?
A) Rough ER
B) Smooth ER
C) Golgi apparatus
D) Lysosome
Answer: Smooth ER

285) The structure that provides mechanical support and shape to plant cells is the:
A) Plasma membrane
B) Cell wall
C) Cytoskeleton
D) Extracellular matrix
Answer: Cell wall

286) Which organelle is responsible for the synthesis of ATP through oxidative phosphorylation?
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Peroxisome
Answer: Mitochondrion

287) The structure that separates the contents of the nucleus from the cytoplasm is the:
A) Plasma membrane
B) Nuclear envelope
C) Cell wall

D) Endoplasmic reticulum
Answer: Nuclear envelope

288) Which cellular component is composed of rRNA and proteins and is the site of protein synthesis?
A) Nucleolus
B) Ribosome
C) Golgi apparatus
D) Lysosome
Answer: Ribosome

289) The structure that contains the cell's genetic material is the:
A) Nucleus
B) Mitochondrion
C) Chloroplast
D) Ribosome
Answer: Nucleus

290) Which organelle is involved in the breakdown of fatty acids and detoxification of hydrogen peroxide?
A) Lysosome
B) Peroxisome
C) Glyoxysome
D) Golgi apparatus
Answer: Peroxisome

291) The structure that facilitates cell movement and is composed of microtubules in a 9+2 arrangement is the:
A) Cilium
B) Microvillus
C) Desmosome
D) Tight junction
Answer: Cilium

292) Which cellular structure is involved in cell division and organization of microtubules?
A) Centriole
B) Nucleolus
C) Ribosome
D) Peroxisome
Answer: Centriole

293) The structure that stores calcium ions in muscle cells is the:
A) Golgi apparatus
B) Sarcoplasmic reticulum
C) Lysosome
D) Peroxisome
Answer: Sarcoplasmic reticulum

294) Which organelle is responsible for the synthesis of secretory proteins?
A) Smooth ER
B) Rough ER
C) Golgi apparatus
D) Lysosome
Answer: Rough ER

295) The structure that connects adjacent plant cells and allows communication is the:
A) Desmosome
B) Gap junction
C) Plasmodesma
D) Tight junction
Answer: Plasmodesma

296) Which cellular structure is involved in the modification, sorting, and packaging of proteins for secretion?
A) Nucleus
B) Rough ER
C) Golgi apparatus
D) Lysosome
Answer: Golgi apparatus

297) The structure that provides tensile strength and anchors the nucleus is the:
A) Microtubule
B) Microfilament
C) Intermediate filament
D) Actin filament
Answer: Intermediate filament

298) Which organelle contains enzymes for the Krebs cycle and electron transport chain?
A) Nucleus
B) Chloroplast
C) Mitochondrion
D) Peroxisome
Answer: Mitochondrion

299) The structure that forms a selective barrier controlling the movement of substances in and out of the cell is the:
A) Cell wall
B) Plasma membrane
C) Nuclear envelope
D) Endoplasmic reticulum
Answer: Plasma membrane

300) Which cellular component is involved in the synthesis of ribosomal RNA?
A) Nucleus
B) Nucleolus
C) Ribosome
D) Golgi apparatus
Answer: Nucleolus

Biological Membranes

1. Which component of the plasma membrane is primarily responsible for its selective permeability barrier?
A) Cholesterol
B) Integral proteins
C) Phospholipid bilayer
D) Carbohydrate chains
Answer: Phospholipid bilayer

2. According to the fluid mosaic model, membrane proteins are:
A) Stationary within the bilayer
B) Embedded and able to move laterally
C) Only present on the cytoplasmic side
D) Covalently bound to phospholipids
Answer: Embedded and able to move laterally

3. What property of phospholipid tails increases membrane fluidity at lower temperatures?
A) Saturation
B) Longer length
C) Unsaturation (kinks)
D) Positive charge
Answer: Unsaturation (kinks)

4. Cholesterol in animal cell membranes acts primarily to:
A) Increase fluidity at high temperatures
B) Decrease fluidity at all temperatures
C) Buffer membrane fluidity against temperature changes
D) Facilitate active transport
Answer: Buffer membrane fluidity against temperature changes

5. Which type of membrane protein extends completely through the lipid bilayer?
A) Peripheral protein
B) Glycoprotein
C) Transmembrane protein
D) Lipid-anchored protein
Answer: Transmembrane protein

6. The asymmetric distribution of proteins and lipids in membrane leaflets is established during:
A) Translation
B) Membrane synthesis in the ER and Golgi
C) Phospholipid flip-flop
D) Facilitated diffusion
Answer: Membrane synthesis in the ER and Golgi

7. Which membrane protein function involves relaying a message to the cell interior after binding a signaling molecule?
A) Transport
B) Enzymatic activity
C) Signal transduction
D) Cell-cell recognition
Answer: Signal transduction

8. The movement of a substance across a membrane down its concentration gradient without energy expenditure is:
A) Active transport
B) Facilitated diffusion
C) Osmosis
D) Both B and C
Answer: Both B and C

9. Small, nonpolar molecules like O2 and CO2 cross the membrane via:
A) Channel proteins
B) Carrier proteins
C) Simple diffusion through the lipid bilayer
D) Active transport
Answer: Simple diffusion through the lipid bilayer

10. What is the net movement of water across a selectively permeable membrane from a region of low solute concentration to high solute concentration called?
A) Active transport
B) Facilitated diffusion
C) Osmosis
D) Plasmolysis
Answer: Osmosis

11. A cell placed in a hypertonic solution will:
A) Swell and possibly lyse
B) Shrink and shrivel
C) Show no net water movement
D) Become turgid
Answer: Shrink and shrivel

12. Facilitated diffusion differs from simple diffusion in that it:
A) Requires energy from ATP
B) Moves substances against their gradient

Cell Cycle

1. What is the series of events a eukaryotic cell undergoes from its formation until it divides into two daughter cells called?
A) Mitosis
B) Interphase
C) Cell Cycle
D) Cytokinesis
Answer: Cell Cycle

2. Who proposed the principle that all cells arise from pre-existing cells?
A) Walther Flemming
B) Rudolf Virchow
C) Edouard van Beneden
D) Oscar Hertwig
Answer: Rudolf Virchow

3. Which phase of the cell cycle is characterized by high metabolic activity and preparation for division but no visible division?
A) M Phase
B) Cytokinesis
C) Interphase
D) G0 Phase
Answer: Interphase

4. Approximately what percentage of the total cell cycle time is occupied by interphase in a typical mammalian cell?
A) 50%
B) 75%
C) 90%
D) 10%
Answer: 90%

5. During which sub-phase of interphase does the cell grow, synthesize proteins and organelles, and produce enzymes for DNA replication?
A) S Phase
B) G2 Phase
C) G1 Phase
D) M Phase
Answer: G1 Phase

6. DNA replication occurs during which specific phase of the cell cycle?
A) G1 Phase
B) G2 Phase
C) S Phase
D) Prophase
Answer: S Phase

7. The result of DNA replication in the S phase is that each chromosome consists of two identical:
A) Homologous chromosomes
B) Sister chromatids
C) Centromeres
D) Kinetochores
Answer: Sister chromatids

8. During which gap phase does the cell synthesize proteins necessary for cell division, such as tubulin for spindle fibers?
A) G1 Phase
B) S Phase
C) G2 Phase
D) G0 Phase
Answer: G2 Phase

9. A temporary or permanent non-dividing state that cells may enter from the G1 phase is called:
A) S Phase
B) G2 Phase
C) G0 Phase
D) Metaphase
Answer: G0 Phase

10. Which of the following cell types typically enters the G0 phase permanently?
A) Skin epithelial cells
B) Intestinal lining cells
C) Neurons
D) Red blood cell precursors
Answer: Neurons

11. The type of cell division that ensures the daughter cells have the same number of chromosomes as the parent cell is:
A) Meiosis
B) Binary Fission
C) Mitosis
D) Apoptosis
Answer: Mitosis

12. Mitosis occurs in which type of cells in a multicellular organism?
A) Germ-line cells
B) Gametes
C) Somatic cells

Cell Communication

1. What are the three main stages of cell signaling according to Sutherland's research on epinephrine?
A) Signal initiation, propagation, termination
B) Signal release, diffusion, reception
C) Signal reception, transduction, response
D) Signal amplification, relay, integration
Answer: Signal reception, transduction, response

2. In bacterial quorum sensing, what behavior is coordinated when cells reach a critical density?
A) Sporulation
B) Biofilm formation
C) Binary fission
D) Flagellar rotation
Answer: Biofilm formation

3. Which type of signaling involves a nerve cell releasing neurotransmitters into a synapse?
A) Paracrine signaling
B) Autocrine signaling
C) Endocrine signaling
D) Synaptic signaling
Answer: Synaptic signaling

4. What is the term for a molecule that specifically binds to a receptor protein?
A) Substrate
B) Ligand
C) Kinase
D) Second messenger
Answer: Ligand

5. G protein-coupled receptors (GPCRs) typically have how many transmembrane alpha helices?
A) One
B) Three
C) Five
D) Seven
Answer: Seven

6. What is the immediate result when a signaling molecule binds to a receptor tyrosine kinase (RTK)?
A) Activation of adenylyl cyclase
B) Dimerization and autophosphorylation
C) Opening of an ion channel
D) Direct gene activation
Answer: Dimerization and autophosphorylation

7. Which second messenger is produced directly from ATP by the enzyme adenylyl cyclase?
A) IP3
B) DAG
C) cAMP
D) Ca2+
Answer: cAMP

8. What is the primary role of protein phosphatases in signal transduction pathways?
A) To amplify the signal
B) To terminate the signal by dephosphorylation
C) To act as transcription factors
D) To synthesize second messengers
Answer: To terminate the signal by dephosphorylation

9. Where are the receptors for steroid hormones such as cortisol typically located?
A) On the plasma membrane
B) In the cytosol or nucleus
C) In the mitochondrial membrane
D) On the endoplasmic reticulum
Answer: In the cytosol or nucleus

10. What is the function of the Ras protein in signal transduction?
A) It is a second messenger
B) It acts as a molecular switch (G protein) linking RTKs to MAPK cascade
C) It phosphorylates tyrosine residues
D) It hydrolyzes cAMP to AMP
Answer: It acts as a molecular switch (G protein) linking RTKs to MAPK cascade

11. Which enzyme is responsible for inactivating cyclic AMP (cAMP)?
A) Adenylyl cyclase
B) Phospholipase C
C) Protein kinase A
D) Phosphodiesterase
Answer: Phosphodiesterase

12. In the context of cell signaling, what does IP3 (inositol trisphosphate) trigger the release of?

Biological Molecules

1. What is the branch of biology that deals with the study of biological molecules and their reactions?
A) Physiology
B) Biochemistry
C) Molecular biology
D) Genetics
Answer: Biochemistry

2. Water is an excellent solvent for polar substances because of its:
A) High specific heat
B) Cohesion
C) Polarity
D) Hydrogen bonding
Answer: Polarity

3. The property of water that allows it to resist changes in temperature is due to its:
A) High specific heat capacity
B) High heat of vaporization
C) Cohesion
D) Adhesion
Answer: High specific heat capacity

4. When water molecules stick to each other, it is called:
A) Cohesion
B) Adhesion
C) Surface tension
D) Capillary action
Answer: Cohesion

5. When water molecules stick to other surfaces, it is called:
A) Cohesion
B) Adhesion
C) Surface tension
D) Capillary action
Answer: Adhesion

6. Ice floats on water because:
A) Ice is denser than water
B) Ice is less dense than water
C) Ice has a higher specific heat
D) Ice has a lower heat of vaporization
Answer: Ice is less dense than water

7. Hydrophobic exclusion refers to:
A) The attraction between water and nonpolar molecules
B) The repulsion between water and nonpolar molecules
C) The ionization of water
D) The formation of hydrogen bonds
Answer: The repulsion between water and nonpolar molecules

8. The high specific heat of water is due to:
A) Hydrogen bonding
B) Covalent bonding
C) Ionic bonding
D) van der Waals forces
Answer: Hydrogen bonding

9. Water is a polar molecule because:
A) It has a linear shape
B) The oxygen atom is more electronegative than hydrogen
C) It has a tetrahedral shape
D) It can form hydrogen bonds
Answer: The oxygen atom is more electronegative than hydrogen

10. The cohesion of water molecules is responsible for:
A) High specific heat
B) High heat of vaporization
C) Surface tension
D) Low density of ice
Answer: Surface tension

11. Adhesion of water molecules to cell walls helps in:
A) Temperature regulation
B) Capillary action
C) Floating of ice
D) Solvent properties
Answer: Capillary action

12. Hydrophobic exclusion is important for:
A) Formation of lipid bilayers
B) Solubility of salts in water
C) High specific heat
D) Ionization of water
Answer: Formation of lipid bilayers

13. Water's high surface tension is primarily a result of:
A) Covalent bonding
B) Ionic bonding
C) Hydrogen bonding
D) Van der Waals forces
Answer: Hydrogen bonding

14. Capillary action in plants is possible due to water's properties of:
A) High specific heat and heat of vaporization
B) Cohesion and adhesion
C) Universal solvent nature and polarity
D) Low density as ice
Answer: Cohesion and adhesion

15. Water's high heat of vaporization is a result of:
A) Low boiling point
B) Breaking of hydrogen bonds to change from liquid to vapor
C) High density
D) Low specific heat
Answer: Breaking of hydrogen bonds to change from liquid to vapor

16. Carbon's ability to form four stable covalent bonds is termed:
A) Catenation
B) Tetravalency
C) Isomerism
D) Electronegativity
Answer: Tetravalency

17. The immense structural diversity of organic molecules is primarily due to carbon's:
A) High electronegativity
B) Ability to form long chains and rings (catenation)
C) Small atomic radius
D) Formation of ionic bonds
Answer: Ability to form long chains and rings (catenation)

18. Molecules with the same molecular formula but different structural arrangements are called:
A) Isotopes
B) Polymers
C) Isomers
D) Enantiomers
Answer: Isomers

19. In biochemistry, which functional group is characteristic of an alcohol?
A) -COOH
B) $-NH_2$
C) -OH
D) -SH
Answer: -OH

20. The general formula for monosaccharides is:
A) $(CH_2O)_n$
B) $(CHO)_n$
C) $(CH_3O)_n$
D) $(C_2H_5O)_n$
Answer: $(CH_2O)_n$

21. Which of the following is a monosaccharide with the empirical formula $C_6H_{12}O_6$?

A) Ribose
B) Glucose
C) Sucrose
D) Maltose
Answer: Glucose

22. Monosaccharides with a carbonyl group at the end of the carbon chain are called:
A) Ketoses
B) Aldoses
C) Trioses
D) Pentoses
Answer: Aldoses

23. Which of the following is a ketose sugar?
A) Glucose
B) Fructose
C) Galactose
D) Ribose
Answer: Fructose

24. The sugar found in RNA is:
A) Deoxyribose
B) Ribose
C) Glucose
D) Fructose
Answer: Ribose

25. The sugar found in DNA is:
A) Deoxyribose
B) Ribose
C) Glucose
D) Fructose
Answer: Deoxyribose

26. Which of the following is a pentose sugar?
A) Glucose
B) Fructose
C) Ribose
D) Galactose
Answer: Ribose

27. The bond formed between two monosaccharides is called:
A) Peptide bond
B) Glycosidic bond
C) Ester bond
D) Phosphodiester bond
Answer: Glycosidic bond

28. Sucrose is composed of:
A) Glucose and glucose
B) Glucose and fructose
C) Glucose and galactose
D) Fructose and galactose
Answer: Glucose and fructose

29. Lactose is composed of:
A) Glucose and glucose
B) Glucose and fructose
C) Glucose and galactose
D) Fructose and galactose
Answer: Glucose and galactose

30. Maltose is composed of:
A) Glucose and glucose
B) Glucose and fructose
C) Glucose and galactose
D) Fructose and galactose
Answer: Glucose and glucose

31. Which of the following is a storage polysaccharide in plants?
A) Starch
B) Glycogen
C) Cellulose
D) Chitin
Answer: Starch

32. Which of the following is a storage polysaccharide in animals?
A) Starch
B) Glycogen
C) Cellulose
D) Chitin
Answer: Glycogen

33. Which of the following is a structural polysaccharide in plants?
A) Starch
B) Glycogen
C) Cellulose
D) Chitin
Answer: Cellulose

34. Which of the following is a structural polysaccharide in arthropods and fungi?
A) Starch
B) Glycogen
C) Cellulose
D) Chitin
Answer: Chitin

35. Cellulose is made up of:
A) α-glucose units
B) β-glucose units
C) α-fructose units
D) β-fructose units
Answer: β-glucose units

36. Starch is made up of:
A) α-glucose units
B) β-glucose units
C) α-fructose units
D) β-fructose units
Answer: α-glucose units

37. Glycogen is similar to starch but has more:
A) Branching
B) Glucose units
C) Hydrogen bonds
D) Nitrogen atoms
Answer: Branching

38. Cellulose digestion in herbivores is aided by:
A) Amylase
B) Cellulase
C) Lactase
D) Maltase
Answer: Cellulase

39. Chitin is a polymer of:
A) N-acetyl glucosamine
B) N-acetyl galactosamine
C) Glucose
D) Galactose
Answer: N-acetyl glucosamine

40. The building blocks of proteins are:
A) Nucleotides
B) Amino acids
C) Fatty acids
D) Monosaccharides
Answer: Amino acids

41. How many amino acids are commonly found in proteins?
A) 10
B) 20
C) 30
D) 40
Answer: 20

42. Amino acids are linked together by:
A) Glycosidic bonds
B) Peptide bonds
C) Ester bonds
D) Phosphodiester bonds
Answer: Peptide bonds

43. The bond between the carboxyl group of one amino acid and the amino group of another is called:
A) Hydrogen bond
B) Ionic bond
C) Peptide bond
D) Disulfide bond
Answer: Peptide bond

44. The sequence of amino acids in a protein is called its:
A) Primary structure

B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Primary structure

45. α-helix and β-pleated sheet are examples of:
A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Secondary structure

46. The overall three-dimensional shape of a protein is called:
A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Tertiary structure

47. When a protein consists of more than one polypeptide chain, it has:
A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Quaternary structure

48. Which of the following is a fibrous protein?
A) Hemoglobin
B) Collagen
C) Enzyme
D) Antibody
Answer: Collagen

49. Which of the following is a globular protein?
A) Collagen
B) Keratin
C) Hemoglobin
D) Elastin
Answer: Hemoglobin

50. Lipids are generally insoluble in water because they are:
A) Hydrophilic
B) Hydrophobic
C) Polar
D) Ionic
Answer: Hydrophobic

51. Which of the following is not a lipid?
A) Triglyceride
B) Phospholipid
C) Steroid
D) Protein
Answer: Protein

52. A triglyceride is composed of:
A) Glycerol and two fatty acids
B) Glycerol and three fatty acids
C) Glycerol and one fatty acid
D) Glycerol and phosphate
Answer: Glycerol and three fatty acids

53. The bond between glycerol and fatty acid in a triglyceride is called:
A) Peptide bond
B) Glycosidic bond
C) Ester bond
D) Phosphodiester bond
Answer: Ester bond

54. A fatty acid with no double bonds is called:
A) Saturated
B) Unsaturated
C) Monounsaturated
D) Polyunsaturated
Answer: Saturated

55. A fatty acid with one double bond is called:
A) Saturated
B) Monounsaturated
C) Polyunsaturated

D) None of the above
Answer: Monounsaturated

56. A fatty acid with more than one double bond is called:
A) Saturated
B) Monounsaturated
C) Polyunsaturated
D) None of the above
Answer: Polyunsaturated

57. Phospholipids are composed of:
A) Glycerol, two fatty acids, and a phosphate group
B) Glycerol, three fatty acids
C) Glycerol, two fatty acids, and a sugar
D) Glycerol, one fatty acid, and a phosphate group
Answer: Glycerol, two fatty acids, and a phosphate group

58. In a phospholipid, the head is:
A) Hydrophobic
B) Hydrophilic
C) Nonpolar
D) Neutral
Answer: Hydrophilic

59. In a phospholipid, the tails are:
A) Hydrophobic
B) Hydrophilic
C) Polar
D) Charged
Answer: Hydrophobic

60. Steroids are composed of:
A) Four fused carbon rings
B) Three fused carbon rings
C) Two fused carbon rings
D) One carbon ring
Answer: Four fused carbon rings

61. Cholesterol is an example of a:
A) Triglyceride
B) Phospholipid
C) Steroid
D) Wax
Answer: Steroid

62. The building blocks of nucleic acids are:
A) Nucleotides
B) Amino acids
C) Fatty acids
D) Monosaccharides
Answer: Nucleotides

63. A nucleotide consists of:
A) Sugar, phosphate, and base
B) Sugar and base
C) Phosphate and base
D) Sugar and phosphate
Answer: Sugar, phosphate, and base

64. Which base is found in DNA but not in RNA?
A) Adenine
B) Guanine
C) Cytosine
D) Thymine
Answer: Thymine

65. Which base is found in RNA but not in DNA?
A) Adenine
B) Guanine
C) Uracil
D) Thymine
Answer: Uracil

66. In DNA, adenine pairs with:
A) Thymine
B) Cytosine
C) Guanine
D) Uracil
Answer: Thymine

67. In DNA, guanine pairs with:
A) Thymine

B) Cytosine
C) Adenine
D) Uracil
Answer: Cytosine

68. The bonds that hold the two strands of DNA together are:
A) Covalent bonds
B) Hydrogen bonds
C) Ionic bonds
D) Peptide bonds
Answer: Hydrogen bonds

69. According to Chargaff's rule, in DNA the amount of adenine equals the amount of:
A) Guanine
B) Cytosine
C) Thymine
D) Uracil
Answer: Thymine

70. The model of DNA double helix was proposed by:
A) Darwin and Mendel
B) Watson and Crick
C) Franklin and Wilkins
D) Chargaff and Franklin
Answer: Watson and Crick

71. Which of the following types of RNA carries genetic information from DNA to the ribosome?
A) mRNA
B) tRNA
C) rRNA
D) snRNA
Answer: mRNA

72. Which of the following types of RNA is a component of the ribosome?
A) mRNA
B) tRNA
C) rRNA
D) snRNA
Answer: rRNA

73. Which of the following types of RNA carries amino acids to the ribosome?
A) mRNA
B) tRNA
C) rRNA
D) snRNA
Answer: tRNA

74. The triplet code on mRNA is called a:
A) Codon
B) Anticodon
C) Gene
D) Nucleotide
Answer: Codon

75. The complementary triplet on tRNA is called a:
A) Codon
B) Anticodon
C) Gene
D) Nucleotide
Answer: Anticodon

76. ATP is an example of a:
A) Nucleotide
B) Amino acid
C) Fatty acid
D) Monosaccharide
Answer: Nucleotide

77. The bond between nucleotides in a nucleic acid is called:
A) Peptide bond
B) Glycosidic bond
C) Ester bond
D) Phosphodiester bond
Answer: Phosphodiester bond

78. Which of the following is a conjugated molecule?
A) Glycolipid

B) Glycoprotein
C) Lipoprotein
D) All of the above
Answer: All of the above

79. The pH of pure water at 25°C is:
A) 0
B) 7
C) 14
D) 1
Answer: 7

80. The dissociation constant of water (Kw) at 25°C is:
A) 10^{-7}
B) 10^{-14}
C) 10^{-1}
D) 10^{-10}
Answer: 10^{-14}

81. Which of the following is a triose?
A) Glyceraldehyde
B) Ribose
C) Glucose
D) Fructose
Answer: Glyceraldehyde

82. In an aqueous solution, glucose exists mainly as:
A) Open chain
B) Ring form
C) Linear chain
D) Branched chain
Answer: Ring form

83. α-glucose and β-glucose are:
A) Structural isomers
B) Stereoisomers
C) Enantiomers
D) Diastereomers
Answer: Stereoisomers

84. Sucrose is a non-reducing sugar because:
A) It has no free anomeric carbon
B) It has a free anomeric carbon
C) It is a disaccharide
D) It is sweet
Answer: It has no free anomeric carbon

85. Lactose intolerance is due to deficiency of the enzyme:
A) Sucrase
B) Lactase
C) Maltase
D) Amylase
Answer: Lactase

86. Amylose is a linear polymer of glucose linked by:
A) α-1,4 linkages
B) α-1,6 linkages
C) β-1,4 linkages
D) β-1,6 linkages
Answer: α-1,4 linkages

87. Amylopectin is a branched polymer of glucose with branches at:
A) α-1,4 linkages
B) α-1,6 linkages
C) β-1,4 linkages
D) β-1,6 linkages
Answer: α-1,6 linkages

88. Cellulose is digested by:
A) Amylase
B) Cellulase
C) Lactase
D) Sucrase
Answer: Cellulase

89. Which of the following is a reducing sugar?
A) Sucrose
B) Lactose
C) Trehalose
D) None of the above
Answer: Lactose

90. The test for reducing sugars is:
A) Iodine test
B) Benedict's test
C) Biuret test
D) Emulsion test
Answer: Benedict's test

91. The test for starch is:
A) Iodine test
B) Benedict's test
C) Biuret test
D) Emulsion test
Answer: Iodine test

92. The test for proteins is:
A) Iodine test
B) Benedict's test
C) Biuret test
D) Emulsion test
Answer: Biuret test

93. The test for lipids is:
A) Iodine test
B) Benedict's test
C) Biuret test
D) Emulsion test
Answer: Emulsion test

94. Amino acids are amphoteric because they have:
A) Both amino and carboxyl groups
B) Only amino group
C) Only carboxyl group
D) Side chain
Answer: Both amino and carboxyl groups

95. At physiological pH, amino acids exist as:
A) Cations
B) Anions
C) Zwitterions
D) Neutral molecules
Answer: Zwitterions

96. Which of the following amino acids has a sulfur atom in its side chain?
A) Cysteine
B) Methionine
C) Both A and B
D) Neither
Answer: Both A and B

97. Which of the following amino acids is acidic?
A) Aspartic acid
B) Glutamic acid
C) Both A and B
D) Neither
Answer: Both A and B

98. Which of the following amino acids is basic?
A) Lysine
B) Arginine
C) Histidine
D) All of the above
Answer: All of the above

99. The amino acid that can form disulfide bonds is:
A) Cysteine
B) Methionine
C) Serine
D) Threonine
Answer: Cysteine

100. The peptide bond has partial double bond character because of:
A) Resonance
B) Hydrogen bonding
C) Ionic bonding
D) van der Waals forces
Answer: Resonance

101. In an α-helix, hydrogen bonds form between the carbonyl group of one amino acid and the amino group of another amino acid that is:

A) 3 residues away
B) 4 residues away
C) 5 residues away
D) 6 residues away
Answer: 4 residues away

102. In a β-pleated sheet, the polypeptide chains are:
A) Parallel or antiparallel
B) Only parallel
C) Only antiparallel
D) Neither
Answer: Parallel or antiparallel

103. Which of the following forces stabilizes the tertiary structure of proteins?
A) Hydrogen bonds
B) Ionic bonds
C) Hydrophobic interactions
D) All of the above
Answer: All of the above

104. Hemoglobin is an example of a protein with:
A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Quaternary structure

105. Myoglobin is an example of a protein with:
A) Primary structure
B) Secondary structure
C) Tertiary structure
D) Quaternary structure
Answer: Tertiary structure

106. Denaturation of proteins involves disruption of:
A) Primary structure
B) Secondary and tertiary structure
C) Quaternary structure
D) Both B and C
Answer: Both B and C

107. Which of the following can denature proteins?
A) Heat
B) pH change
C) Organic solvents
D) All of the above
Answer: All of the above

108. Lipids are not polymers in the same sense as carbohydrates because they are not built from repeating monomers. However, they are formed by dehydration reactions between:
A) Glycerol and fatty acids
B) Fatty acids only
C) Glycerol only
D) None of the above
Answer: Glycerol and fatty acids

109. The melting point of fatty acids increases with:
A) Increasing chain length
B) Increasing unsaturation
C) Decreasing chain length
D) Branching
Answer: Increasing chain length

110. The melting point of fatty acids decreases with:
A) Increasing unsaturation
B) Increasing chain length
C) Saturation
D) None of the above
Answer: Increasing unsaturation

111. Essential fatty acids for humans include:
A) Linoleic acid
B) Linolenic acid
C) Arachidonic acid
D) All of the above
Answer: All of the above

112. Phospholipids are amphipathic because they have:
A) Hydrophilic head and hydrophobic tails
B) Hydrophobic head and hydrophilic tails
C) Both hydrophilic
D) Both hydrophobic
Answer: Hydrophilic head and hydrophobic tails

113. Cholesterol is a precursor for:
A) Bile acids
B) Steroid hormones
C) Vitamin D
D) All of the above
Answer: All of the above

114. Waxes are esters of long-chain fatty acids and:
A) Glycerol
B) Long-chain alcohols
C) Phosphate
D) Sugars
Answer: Long-chain alcohols

115. Prostaglandins are derived from:
A) Arachidonic acid
B) Palmitic acid
C) Stearic acid
D) Oleic acid
Answer: Arachidonic acid

116. Aspirin works by inhibiting the synthesis of:
A) Steroids
B) Prostaglandins
C) Terpenes
D) Phospholipids
Answer: Prostaglandins

117. Lipids are transported in the blood as:
A) Lipoproteins
B) Glycolipids
C) Phospholipids
D) Triglycerides
Answer: Lipoproteins

118. Which lipoprotein has the highest density?
A) HDL
B) LDL
C) VLDL
D) Chylomicrons
Answer: HDL

119. Which lipoprotein is often called "bad cholesterol"?
A) HDL
B) LDL
C) VLDL
D) Chylomicrons
Answer: LDL

120. The nitrogenous base in nucleotides is attached to the sugar at which carbon?
A) 1'
B) 2'
C) 3'
D) 4'
Answer: 1'

121. The phosphate group in nucleotides is attached to the sugar at which carbon?
A) 3'
B) 4'
C) 5'
D) 6'
Answer: 5'

122. A nucleotide without a phosphate is called a:
A) Nucleoside
B) Nucleotide
C) Nucleosome
D) Nucleoprotein
Answer: Nucleoside

123. ATP is a nucleoside triphosphate. It contains:
A) Adenine, ribose, three phosphates
B) Adenine, deoxyribose, three phosphates
C) Adenine, ribose, two phosphates
D) Adenine, deoxyribose, two phosphates
Answer: Adenine, ribose, three phosphates

124. In DNA, how many hydrogen bonds are between A and T?
A) 2
B) 3
C) 4
D) 1
Answer: 2

125. In DNA, how many hydrogen bonds are between G and C?
A) 2
B) 3
C) 4
D) 1
Answer: 3

126. The two strands of DNA are:
A) Antiparallel
B) Parallel
C) Both
D) Neither
Answer: Antiparallel

127. The distance between two consecutive base pairs in DNA is about:
A) 0.34 nm
B) 3.4 nm
C) 2 nm
D) 10 nm
Answer: 0.34 nm

128. Which of the following is a pyrimidine base found in both DNA and RNA?
A) Cytosine
B) Thymine
C) Uracil
D) Adenine
Answer: Cytosine

129. Which of the following is a purine base found in both DNA and RNA?
A) Adenine
B) Guanine
C) Both A and B
D) Neither
Answer: Both A and B

130. The difference between deoxyribose and ribose is that deoxyribose has one less oxygen at which carbon?
A) 2'
B) 3'
C) 4'
D) 5'
Answer: 2'

131. Nucleosomes are composed of DNA wrapped around a core of:
A) Histones
B) RNA
C) Lipids
D) Carbohydrates
Answer: Histones

132. The ends of chromosomes are protected by structures called:
A) Telomeres
B) Centromeres
C) Kinetochores
D) Origins of replication
Answer: Telomeres

133. Glycolipids are composed of:
A) Carbohydrate and lipid
B) Protein and lipid
C) Carbohydrate and protein
D) Nucleic acid and lipid
Answer: Carbohydrate and lipid

134. Glycoproteins are composed of:
A) Carbohydrate and protein
B) Lipid and protein
C) Carbohydrate and lipid
D) Nucleic acid and protein
Answer: Carbohydrate and protein

135. Lipoproteins are composed of:
A) Lipid and protein
B) Carbohydrate and protein
C) Carbohydrate and lipid
D) Nucleic acid and protein
Answer: Lipid and protein

136. The amount of heat required to convert 1 gram of water into vapor is called:
A) Specific heat
B) Heat of vaporization
C) Latent heat
D) Boiling point
Answer: Heat of vaporization

137. When water ionizes, it produces:
A) H^+ and O^{2-}
B) H_2 and O_2
C) H^+ and OH^-
D) H_3O^+ and OH^-
Answer: H^+ and OH^-

138. How many hydrogen bonds can a single water molecule form?
A) 1
B) 2
C) 3
D) 4
Answer: 4

139. When water freezes, its volume:
A) Increases
B) Decreases
C) Remains the same
D) First increases then decreases
Answer: Increases

140. In an α-helix, there are how many amino acids per turn?
A) 3.6
B) 4.0
C) 5.0
D) 6.0
Answer: 3.6

141. Which of the following is a globular protein?
A) Insulin
B) Hemoglobin
C) Myoglobin
D) All of the above
Answer: All of the above

142. Which of the following is a fibrous protein?
A) Collagen
B) Keratin
C) Elastin
D) All of the above
Answer: All of the above

143. Collagen is rich in which amino acids?
A) Proline and hydroxyproline
B) Glycine and alanine
C) Lysine and hydroxylysine
D) All of the above
Answer: All of the above

144. Renaturation of proteins is possible if the primary structure is intact and conditions are restored. This was shown for:
A) Ribonuclease
B) Hemoglobin
C) Collagen
D) Keratin
Answer: Ribonuclease

145. Chaperone proteins assist in:
A) Protein folding
B) Protein degradation
C) Protein synthesis

D) Protein secretion
Answer: Protein folding

146. Sickle cell anemia is caused by a change in one amino acid in:
A) Alpha chain of hemoglobin
B) Beta chain of hemoglobin
C) Myoglobin
D) Collagen
Answer: Beta chain of hemoglobin

147. In sickle cell hemoglobin, glutamic acid is replaced by:
A) Valine
B) Alanine
C) Leucine
D) Serine
Answer: Valine

148. Which of the following is a function of proteins?
A) Catalysis
B) Storage
C) Information transfer
D) Transport
Answer: Information transfer

149. Which of the following proteins is involved in muscle contraction?
A) Actin and myosin
B) Collagen
C) Keratin
D) Hemoglobin
Answer: Actin and myosin

150. Which of the following proteins is involved in oxygen transport?
A) Hemoglobin
B) Myoglobin
C) Both A and B
D) Neither
Answer: Both A and B

151. The process by which two monomers are joined together with the removal of water is called:
A) Hydrolysis
B) Dehydration synthesis
C) Ionization
D) Esterification
Answer: Dehydration synthesis

152. Animal fats are usually:
A) Saturated
B) Unsaturated
C) Polyunsaturated
D) None of the above
Answer: Saturated

153. Plant oils are usually:
A) Saturated
B) Unsaturated
C) Both
D) Neither
Answer: Unsaturated

154. Terpenes are built from:
A) Isoprene units
B) Amino acids
C) Fatty acids
D) Sugars
Answer: Isoprene units

155. NAD is an example of a:
A) Dinucleotide
B) Mononucleotide
C) Amino acid
D) Fatty acid
Answer: Dinucleotide

156. The DNA double helix has a constant width because:
A) Purine pairs with pyrimidine
B) Purine pairs with purine
C) Pyrimidine pairs with pyrimidine
D) None of the above
Answer: Purine pairs with pyrimidine

157. According to Chargaff's rule, in DNA the amount of guanine equals the amount of:
A) Adenine
B) Cytosine
C) Thymine
D) Uracil
Answer: Cytosine

158. The region of DNA that codes for a polypeptide is called a:
A) Chromosome
B) Gene
C) Nucleotide
D) Codon
Answer: Gene

159. In RNA, adenine pairs with:
A) Thymine
B) Cytosine
C) Guanine
D) Uracil
Answer: Uracil

160. One complete turn of the DNA double helix has about how many base pairs?
A) 10
B) 11
C) 12
D) 13
Answer: 10

161. The length of one complete turn of the DNA double helix is about:
A) 3.4 nm
B) 2 nm
C) 0.34 nm
D) 10 nm
Answer: 3.4 nm

162. In bacterial cells, which biomolecule is present in the highest percentage after water?
A) Protein
B) Carbohydrates
C) Lipids
D) RNA
Answer: Protein

163. Which of the following is not a fundamental kind of biological molecule?
A) Carbohydrates
B) Proteins
C) Lipids
D) Enzymes
Answer: Enzymes

164. Which of the following gives a red color with iodine?
A) Starch
B) Glycogen
C) Cellulose
D) Chitin
Answer: Glycogen

165. Which of the following is a structural protein?
A) Hemoglobin
B) Collagen
C) Enzyme
D) Antibody
Answer: Collagen

166. Which of the following is a saturated fatty acid?
A) Oleic acid
B) Linoleic acid
C) Palmitic acid
D) Linolenic acid
Answer: Palmitic acid

167. Which of the following is an unsaturated fatty acid?
A) Stearic acid
B) Palmitic acid
C) Oleic acid
D) Butyric acid
Answer: Oleic acid

168. Which of the following is a steroid hormone?
A) Estrogen
B) Insulin
C) Glucagon
D) Oxytocin
Answer: Estrogen

169. Which of the following is a terpene?
A) Cholesterol
B) Vitamin A
C) Estrogen
D) Phospholipid
Answer: Vitamin A

170. Which of the following is a purine base?
A) Adenine
B) Thymine
C) Cytosine
D) Uracil
Answer: Adenine

171. Which of the following is a pyrimidine base?
A) Adenine
B) Guanine
C) Thymine
D) All of the above
Answer: Thymine

172. In RNA, the base uracil pairs with:
A) Adenine
B) Guanine
C) Cytosine
D) Thymine
Answer: Adenine

173. In DNA, the base thymine pairs with:
A) Adenine
B) Guanine
C) Cytosine
D) Uracil
Answer: Adenine

174. The human genome contains about how many genes?
A) 20,000-25,000
B) 100,000
C) 1,000,000
D) 3,000,000,000
Answer: 20,000-25,000

175. The human genome contains about how many base pairs?
A) 3 billion
B) 6 billion
C) 1 million
D) 100,000
Answer: 3 billion

176. DNA is packaged into chromosomes with the help of proteins called:
A) Histones
B) Non-histone proteins
C) Both A and B
D) Neither
Answer: Both A and B

177. Chromatin is made up of:
A) DNA and proteins
B) RNA and proteins
C) DNA and RNA
D) Only DNA
Answer: DNA and proteins

178. During cell division, chromatin condenses into:
A) Chromosomes
B) Nucleosomes
C) Chromatin fibers
D) None of the above
Answer: Chromosomes

179. Which of the following is not a polymer?
A) Starch
B) Protein
C) Lipid

D) Nucleic acid
Answer: Lipid

180. Which of the following is a polysaccharide?
A) Starch
B) Glycogen
C) Cellulose
D) All of the above
Answer: All of the above

181. Which of the following is a disaccharide?
A) Sucrose
B) Lactose
C) Maltose
D) All of the above
Answer: All of the above

182. Which of the following is a monosaccharide?
A) Glucose
B) Fructose
C) Galactose
D) All of the above
Answer: All of the above

183. Which vitamin is involved in blood clotting?
A) Vitamin K
B) Vitamin D
C) Vitamin E
D) Vitamin A
Answer: Vitamin K

184. Which of the following is not one of the four main classes of large biological molecules?
A) Carbohydrates
B) Proteins
C) Nucleic acids
D) Enzymes
Answer: Enzymes

185. What is the general term for a long molecule consisting of many similar building blocks linked by covalent bonds?
A) Monomer
B) Polymer
C) Isomer
D) Dimer
Answer: Polymer

186. Which process links monomers together, releasing a water molecule?
A) Hydrolysis
B) Hydration
C) Dehydration synthesis
D) Ionization
Answer: Dehydration synthesis

187. Which class of biological molecules is primarily used for energy storage and structural support?
A) Lipids
B) Proteins
C) Nucleic acids
D) Carbohydrates
Answer: Carbohydrates

188. What type of reaction breaks down polymers into monomers by adding a water molecule?
A) Condensation
B) Dehydration
C) Hydrolysis
D) Oxidation
Answer: Hydrolysis

189. What is the bond between two monosaccharides called?
A) Peptide bond
B) Glycosidic bond
C) Ester bond
D) Phosphodiester bond
Answer: Glycosidic bond

190. Which polysaccharide is the primary storage form of glucose in animals?
A) Starch
B) Cellulose
C) Glycogen
D) Chitin
Answer: Glycogen

191. What structural difference distinguishes cellulose from starch?
A) Type of glycosidic linkage (α vs. β)
B) Number of glucose units
C) Presence of branching
D) Solubility in water
Answer: Type of glycosidic linkage (α vs. β)

192. What characteristic do all lipids share?
A) They are polymers.
B) They are hydrophilic.
C) They are hydrophobic.
D) They contain nitrogen.
Answer: They are hydrophobic.

193. A fat molecule is composed of glycerol and how many fatty acid molecules?
A) One
B) Two
C) Three
D) Four
Answer: Three

194. Which type of fatty acid has one or more double bonds between carbon atoms?
A) Saturated
B) Unsaturated
C) Steroid
D) Phospholipid
Answer: Unsaturated

195. What is the key structural component of a phospholipid that makes it amphipathic?
A) Glycerol backbone
B) Fatty acid tails
C) Phosphate group
D) Both B and C
Answer: Both B and C

196. What are the building blocks of proteins?
A) Monosaccharides
B) Fatty acids
C) Amino acids
D) Nucleotides
Answer: Amino acids

197. The linear sequence of amino acids in a protein is its _____ structure.
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Primary

198. Alpha helices and beta pleated sheets are examples of which level of protein structure?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Secondary

199. What level of protein structure results from the aggregation of multiple polypeptide subunits?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Quaternary

200. Sickle cell anemia is caused by a single amino acid substitution in which protein?
A) Insulin
B) Collagen
C) Hemoglobin
D) Keratin
Answer: Hemoglobin

201. What are the monomers of nucleic acids?
A) Amino acids
B) Monosaccharides
C) Nucleotides
D) Fatty acids
Answer: Nucleotides

202. Which nitrogenous base is found in RNA but not in DNA?
A) Adenine
B) Thymine
C) Cytosine
D) Uracil
Answer: Uracil

203. What type of bond links nucleotides together in a polynucleotide chain?
A) Glycosidic bond
B) Peptide bond
C) Phosphodiester bond
D) Ester bond
Answer: Phosphodiester bond

204. According to Chargaff's rules, in DNA, the amount of adenine equals the amount of _____.
A) Guanine
B) Cytosine
C) Thymine
D) Uracil
Answer: Thymine

205. The two strands of a DNA double helix are held together by _____.
A) Covalent bonds
B) Peptide bonds
C) Hydrogen bonds
D) Ionic bonds
Answer: Hydrogen bonds

206. What is the primary function of tRNA?
A) Structural component of ribosomes
B) Carries amino acids to the ribosome
C) Carries genetic information from nucleus
D) Catalyzes peptide bond formation
Answer: Carries amino acids to the ribosome

207. The process of copying DNA into mRNA is called _____.
A) Translation
B) Replication
C) Transcription
D) Transformation
Answer: Transcription

208. The process of synthesizing a protein from mRNA is called _____.
A) Translation
B) Replication
C) Transcription
D) Transformation
Answer: Translation

209. What term describes molecules that are attracted to water?
A) Hydrophobic
B) Hydrophilic
C) Amphipathic
D) Lipophilic
Answer: Hydrophilic

210. The dissociation of water molecules into H^+ and OH^- ions is called _____.
A) Hydrolysis
B) Ionization
C) Dehydration
D) Condensation
Answer: Ionization

211. Which carbohydrate is known as milk sugar?
A) Maltose
B) Sucrose
C) Lactose
D) Fructose
Answer: Lactose

212. Which disaccharide is composed of glucose and fructose?
A) Maltose
B) Sucrose
C) Lactose
D) Galactose
Answer: Sucrose

213. What is the storage polysaccharide in plants?
A) Glycogen
B) Cellulose
C) Starch
D) Chitin
Answer: Starch

214. Which polysaccharide is a major component of the exoskeleton of arthropods?
A) Cellulose
B) Starch
C) Glycogen
D) Chitin
Answer: Chitin

215. What is the main function of triglycerides?
A) Structural component of membranes
B) Long-term energy storage
C) Cellular signaling
D) Enzyme catalysis
Answer: Long-term energy storage

216. Which lipid molecule is derived from arachidonic acid and is involved in inflammation?
A) Steroid
B) Prostaglandin
C) Terpene
D) Wax
Answer: Prostaglandin

217. What is the basic building block of terpenes?
A) Glycerol
B) Isoprene unit
C) Fatty acid
D) Amino acid
Answer: Isoprene unit

218. Which of the following is a conjugated molecule formed from a protein and a carbohydrate?
A) Glycolipid
B) Glycoprotein
C) Lipoprotein
D) Nucleoprotein
Answer: Glycoprotein

219. What is the energy currency of the cell?
A) Glucose
B) ATP
C) NADH
D) FADH2
Answer: ATP

220. Which molecule is a dinucleotide coenzyme involved in redox reactions?
A) ATP
B) NAD+
C) FAD
D) CoA
Answer: NAD+

221. The central dogma of molecular biology describes the flow of information from _____.
A) DNA to RNA to protein
B) RNA to DNA to protein
C) Protein to RNA to DNA
D) DNA to protein to RNA
Answer: DNA to RNA to protein

222. The three-dimensional shape of a protein is primarily determined by its _____.
A) Primary structure
B) Secondary structure
C) Tertiary structure

D) Quaternary structure
Answer: Primary structure

223. What type of interaction is primarily responsible for the formation of protein secondary structure?
A) Disulfide bridges
B) Hydrogen bonds
C) Ionic bonds
D) Hydrophobic interactions
Answer: Hydrogen bonds

224. Which of the following is a globular protein?
A) Collagen
B) Keratin
C) Myosin
D) Hemoglobin
Answer: Hemoglobin

225. The loss of an enzyme's specific three-dimensional shape is called _____.
A) Saturation
B) Inhibition
C) Denaturation
D) Activation
Answer: Denaturation

226. The process of converting unsaturated fats to saturated fats by adding hydrogen is called _____.
A) Hydrogenation
B) Hydration
C) Oxidation
D) Esterification
Answer: Hydrogenation

227. Which lipid is a precursor for steroid hormones?
A) Cholesterol
B) Triglyceride
C) Phospholipid
D) Prostaglandin
Answer: Cholesterol

228. What is the main function of nucleic acids?
A) Energy storage
B) Structural support
C) Information storage and transfer
D) Catalysis
Answer: Information storage and transfer

229. In DNA, the base pairing rules are A with T and G with _____.
A) A
B) T
C) C
D) U
Answer: C

230. The two strands of DNA run in opposite directions and are said to be _____.
A) Complementary
B) Identical
C) Antiparallel
D) Parallel
Answer: Antiparallel

231. Which of the following is NOT a component of a nucleotide?
A) Pentose sugar
B) Phosphate group
C) Fatty acid
D) Nitrogenous base
Answer: Fatty acid

232. The bond between the sugar and the base in a nucleotide is a _____ bond.
A) Glycosidic
B) Peptide
C) Phosphodiester
D) Ester
Answer: Glycosidic

233. Which molecule is a polymer of amino acids?
A) Polysaccharide
B) Polypeptide

C) Polynucleotide
D) Triglyceride
Answer: Polypeptide

234. Which molecule is a polymer of nucleotides?
A) Polysaccharide
B) Polypeptide
C) Polynucleotide
D) Triglyceride
Answer: Polynucleotide

235. What is the term for a molecule that has both hydrophilic and hydrophobic regions?
A) Hydrophilic
B) Hydrophobic
C) Amphipathic
D) Lipophobic
Answer: Amphipathic

236. Which of the following is a function of lipids?
A) Enzymatic catalysis
B) Long-term energy storage
C) Information storage
D) Transport of oxygen
Answer: Long-term energy storage

237. Which of the following is a function of carbohydrates?
A) Enzymatic catalysis
B) Structural component of cell walls
C) Information storage
D) Transport of oxygen
Answer: Structural component of cell walls

238. Which of the following is a function of nucleic acids?
A) Enzymatic catalysis
B) Structural component of cell walls
C) Information storage and transfer
D) Transport of oxygen
Answer: Information storage and transfer

239. Amino acids are linked together by _____ bonds.
A) Glycosidic
B) Peptide
C) Phosphodiester
D) Ester
Answer: Peptide

240. The primary structure of a protein is determined by the sequence of _____.
A) Nucleotides
B) Amino acids
C) Monosaccharides
D) Fatty acids
Answer: Amino acids

241. Which level of protein structure involves hydrogen bonding between backbone atoms?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Secondary

242. Which level of protein structure involves interactions between side chains (R groups)?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Tertiary

243. Which level of protein structure involves the aggregation of multiple polypeptide chains?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Quaternary

244. Disulfide bridges contribute to which level of protein structure?
A) Primary

B) Secondary
C) Tertiary
D) Quaternary
Answer: Tertiary

245. Insulin is an example of a _____ protein.
A) Fibrous
B) Globular
C) Conjugated
D) Derived
Answer: Globular

246. Which RNA molecule is translated into a protein?
A) mRNA
B) tRNA
C) rRNA
D) snRNA
Answer: mRNA

247. Which property of water is primarily responsible for its high specific heat capacity?
A) Low density as ice
B) Universal solvent nature
C) Extensive hydrogen bonding
D) High surface tension
Answer: Extensive hydrogen bonding

248. The term "hydrophobic effect" in biochemistry is best described as:
A) Attraction of nonpolar molecules to water
B) Clustering of nonpolar molecules to minimize contact with water
C) Formation of hydration shells around ions
D) Dissociation of water into H^+ and OH^- ions
Answer: Clustering of nonpolar molecules to minimize contact with water

249. In biological systems, water acts as a reactant in which type of reaction?
A) Condensation
B) Reduction
C) Hydrolysis
D) Dehydrogenation
Answer: Hydrolysis

250. The slight autoionization of water ($H_2O \rightleftharpoons H^+ + OH^-$) is fundamental to:
A) Cohesion and adhesion
B) The pH scale and proton gradients
C) The hydrophobic effect
D) Thermal regulation
Answer: The pH scale and proton gradients

251. The α-carbon in all standard amino acids (except proline) is bonded to all EXCEPT:
A) A carboxyl group
B) An amino group
C) A hydrogen atom
D) A phosphate group
Answer: A phosphate group

252. The peptide bond has partial double-bond character because of:
A) Hydrogen bonding
B) Resonance
C) Van der Waals forces
D) Ionic interactions
Answer: Resonance

253. In an alpha-helix, hydrogen bonds form between the carbonyl oxygen of residue n and the amide hydrogen of residue:
A) n+1
B) n+2
C) n+3
D) n+4
Answer: n+4

254. Which level of protein structure is stabilized primarily by hydrophobic interactions and disulfide bonds?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary
Answer: Tertiary

255. The glycosidic bond in sucrose (α1→2β) involves which two monosaccharides?
A) Glucose + Glucose
B) Glucose + Galactose
C) Glucose + Fructose
D) Galactose + Fructose
Answer: Glucose + Fructose

256. Cellulose is indigestible by humans because we lack the enzyme to break its:
A) α(1→4) glycosidic bonds
B) β(1→4) glycosidic bonds
C) α(1→6) glycosidic bonds
D) β(1→6) glycosidic bonds
Answer: β(1→4) glycosidic bonds

257. Glycogen is highly branched due to the presence of which linkage in addition to α(1→4)?
A) α(1→1)
B) α(1→2)
C) α(1→6)
D) β(1→4)
Answer: α(1→6)

258. Which lipid is a major component of biological membranes?
A) Triacylglycerol
B) Cholesterol
C) Sphingomyelin
D) Beeswax
Answer: Sphingomyelin

259. The degree of unsaturation in a fatty acid can be measured by its:
A) Saponification value
B) Iodine number
C) Acid value
D) Polenske value
Answer: Iodine number

260. Which fatty acid is an omega-3 polyunsaturated fatty acid (PUFA)?
A) Linoleic acid (18:2)
B) α-Linolenic acid (18:3)
C) Oleic acid (18:1)
D) Arachidonic acid (20:4)
Answer: α-Linolenic acid (18:3)

261. In DNA, adenine (A) always pairs with thymine (T) via how many hydrogen bonds?
A) One
B) Two
C) Three
D) Four
Answer: Two

262. The difference between the sugar in RNA and DNA is that RNA contains:
A) Deoxyribose
B) Ribose with a 2'-OH group
C) Ribose with a 2'-H group
D) Glucose
Answer: Ribose with a 2'-OH group

263. The "cloverleaf" secondary structure is characteristic of which molecule?
A) DNA
B) mRNA
C) tRNA
D) rRNA
Answer: tRNA

264. Which form of DNA is the most common under physiological conditions?
A) A-DNA
B) B-DNA
C) Z-DNA
D) C-DNA
Answer: B-DNA

265. Nucleosomes, the fundamental unit of chromatin, consist of DNA wrapped around:
A) Polymerase enzymes
B) Histone proteins
C) Transcription factors
D) Ribosomal proteins
Answer: Histone proteins

266. Which of the following is NOT a pyrimidine base found in nucleic acids?
A) Cytosine
B) Thymine
C) Uracil
D) Adenine
Answer: Adenine

267. The process by which a polypeptide chain folds into its functional three-dimensional shape is called achieving its:
A) Primary structure
B) Native conformation
C) Denatured state
D) Prosthetic group
Answer: Native conformation

268. Which force is considered the major driving force for protein folding?
A) Hydrogen bonding
B) Hydrophobic effect
C) Disulfide bond formation
D) Ionic interactions
Answer: Hydrophobic effect

269. The monomer unit of chitin is:
A) α-D-Glucose
B) β-D-Glucose
C) N-Acetyl-β-D-Glucosamine (NAG)
D) N-Acetylmuramic Acid (NAM)
Answer: N-Acetyl-β-D-Glucosamine (NAG)

270. A fatty acid with no double bonds is classified as:
A) Monounsaturated
B) Polyunsaturated
C) Saturated
D) Trans-fatty acid
Answer: Saturated

271. Which of the following is a derived lipid?
A) Triglyceride
B) Phosphatidylcholine
C) Cholesterol
D) Wax
Answer: Cholesterol

272. Eicosanoids, such as prostaglandins, are derived from which fatty acid?
A) Stearic acid
B) Oleic acid
C) Arachidonic acid
D) Linoleic acid
Answer: Arachidonic acid

273. Carbon atoms most commonly form bonds with which of the following elements in biomolecules?
A) Sodium and Potassium
B) Iron and Magnesium
C) Hydrogen, Oxygen, Nitrogen
D) Chlorine and Fluorine
Answer: Hydrogen, Oxygen, Nitrogen

274. The property of carbon that leads to the existence of molecules that are mirror images (enantiomers) is:
A) Tetravalency
B) Catenation
C) Chirality
D) Electronegativity
Answer: Chirality

275. Which functional group is characteristic of a carboxylic acid?
A) -OH
B) $-NH_2$
C) -COOH
D) -CHO
Answer: -COOH

276. The 20 standard amino acids differ from each other primarily in their:
A) Amino group
B) Carboxyl group
C) Alpha carbon
D) Side chain (R-group)
Answer: Side chain (R-group)

277. At physiological pH (7.4), the amino group of a free amino acid typically exists as:
A) NH_2
B) NH_3^+
C) NH^-
D) N=O
Answer: NH_3^+

278. Which amino acid has a cyclic structure that imposes rigidity on the polypeptide backbone?
A) Glycine
B) Proline
C) Tryptophan
D) Histidine
Answer: Proline

279. In a beta-pleated sheet, hydrogen bonds form between:
A) Backbone atoms of adjacent strands
B) Side chains within the same strand
C) A backbone atom and a water molecule
D) Two different polypeptides only
Answer: Backbone atoms of adjacent strands

280. Denaturation of a protein results in the loss of its:
A) Primary structure
B) Secondary and tertiary structure
C) Amino acid sequence
D) Peptide bonds
Answer: Secondary and tertiary structure

MK PREPARATIONS

Enzymes

1. What is the term for the sum of all chemical reactions within a living organism?
A) Anabolism
B) Catabolism
C) Metabolism
D) Enzymology
Answer: Metabolism

2. Who first introduced the concept of metabolism?
A) Emil Fischer
B) Daniel Koshland
C) Ibn-e-Nafees
D) Wilhelm Kuhne
Answer: Ibn-e-Nafees

3. Which metabolic process involves the synthesis of complex molecules and consumes energy?
A) Catabolism
B) Glycolysis
C) Anabolism
D) Hydrolysis
Answer: Anabolism

4. What is the primary chemical nature of most enzymes?
A) Carbohydrates
B) Lipids
C) Proteins
D) Nucleic acids
Answer: Proteins

5. What are the only non-protein enzymes called?
A) Coenzymes
B) Apoenzymes
C) Ribozymes
D) Holoenzymes
Answer: Ribozymes

6. Enzymes speed up reactions by lowering what?
A) Free energy
B) Activation energy
C) Kinetic energy
D) Potential energy
Answer: Activation energy

7. The region of an enzyme where the substrate binds is called the:
A) Allosteric site
B) Cofactor site
C) Active site
D) Binding groove
Answer: Active site

8. What term describes the non-protein components required for the activity of many enzymes?
A) Substrates
B) Products
C) Cofactors
D) Inhibitors
Answer: Cofactors

9. Inorganic cofactors, such as Zn^{2+} or Mg^{2+}, are also known as:
A) Coenzymes
B) Prosthetic groups
C) Activators
D) Apoenzymes
Answer: Activators

10. Which organic cofactor is loosely attached to an enzyme and often derived from vitamins?
A) Prosthetic group
B) Coenzyme
C) Activator
D) Apoenzyme
Answer: Coenzyme

11. A cofactor that is covalently and permanently bound to an enzyme is called a:
A) Coenzyme
B) Activator
C) Prosthetic group
D) Apoenzyme
Answer: Prosthetic group

12. An enzyme without its cofactor is called an:
A) Holoenzyme
B) Coenzyme
C) Apoenzyme
D) Prosthetic enzyme
Answer: Apoenzyme

13. The functional enzyme, consisting of an apoenzyme and its cofactor, is called a:
A) Coenzyme
B) Ribozyme
C) Prosthetic group
D) Holoenzyme
Answer: Holoenzyme

Bioenergetics

1. Which metabolic process releases energy by splitting complex molecules into smaller components?
A) Anabolism
B) Catabolism
C) Photosynthesis
D) Fermentation
Answer: Catabolism

2. In aerobic respiration, what is the final electron acceptor?
A) NAD^+
B) FAD
C) Oxygen
D) Carbon dioxide
Answer: Oxygen

3. Glycolysis occurs in which cellular location?
A) Mitochondrial matrix
B) Cytosol
C) Inner mitochondrial membrane
D) Stroma
Answer: Cytosol

4. The net ATP yield from glycolysis per glucose molecule is:
A) 1 ATP
B) 2 ATP
C) 4 ATP
D) 36 ATP
Answer: 2 ATP

5. Which molecule is produced when pyruvate is converted to acetyl CoA?
A) Glucose
B) Oxaloacetate
C) NADH
D) $FADH_2$
Answer: NADH

6. The citric acid cycle takes place in which part of the mitochondrion?
A) Intermembrane space
B) Outer membrane
C) Matrix
D) Cristae
Answer: Matrix

7. How many NADH molecules are produced per glucose molecule in the citric acid cycle?
A) 2
B) 4
C) 6
D) 8
Answer: 6

8. The chemiosmotic synthesis of ATP is driven by:
A) A sodium ion gradient
B) A proton gradient
C) Direct transfer of phosphate
D) Reduction of oxygen
Answer: A proton gradient

9. Which complex in the electron transport chain directly receives electrons from $FADH_2$?
A) Complex I
B) Complex II
C) Complex III
D) Complex IV
Answer: Complex II

10. What is the maximum ATP yield from one molecule of glucose during aerobic respiration?
A) 2 ATP
B) 12 ATP
C) 36-38 ATP
D) 42 ATP
Answer: 36-38 ATP

11. Anaerobic respiration uses which of the following as a terminal electron acceptor?
A) Oxygen
B) Nitrate
C) NAD^+
D) Pyruvate
Answer: Nitrate

12. Fermentation regenerates which molecule to keep glycolysis operating?
A) ATP
B) NAD^+
C) Glucose
D) Pyruvate
Answer: NAD^+

13. Alcohol fermentation produces which end product?
A) Lactic acid
B) Ethanol
C) Acetyl CoA

Chromosome & DNA

1. The scientist who first observed chromosomes in 1882 was studying which organism?
A) Onion root tips
B) Human blood cells
C) Salamander larvae cells
D) Fruit fly larvae
Answer: Salamander larvae cells

2. Who proposed the term "chromosome," meaning "colored body"?
A) Walther Flemming
B) Walter Sutton
C) Wilhelm Waldeyer
D) Theodor Boveri
Answer: Wilhelm Waldeyer

3. Which organism is known to have only one pair of chromosomes?
A) Drosophila melanogaster
B) Penicillium species
C) Homo sapiens
D) Escherichia coli
Answer: Penicillium species

4. What is the diploid chromosome number in human somatic cells?
A) 23
B) 46
C) 48
D) 92
Answer: 46

5. The visual representation of an individual's chromosome set is termed:
A) Genotype
B) Phenotype
C) Karyotype
D) Haplotype
Answer: Karyotype

6. A chromosome with the centromere at the very end is classified as:
A) Metacentric
B) Submetacentric
C) Acrocentric
D) Telocentric
Answer: Telocentric

7. The protective structures at chromosome ends that prevent fusion are:
A) Centromeres
B) Telomeres
C) Kinetochores
D) Satellites
Answer: Telomeres

8. Approximately what percentage of a chromosome's composition is DNA?
A) 20%
B) 40%
C) 60%
D) 80%
Answer: 40%

9. A typical human chromosome contains roughly how many nucleotide pairs?
A) 14 million
B) 140 million
C) 1.4 billion
D) 14 billion
Answer: 140 million

10. The positively charged proteins that DNA wraps around to form nucleosomes are:
A) Enzymes
B) Histones
C) Collagens
D) Keratins
Answer: Histones

11. The fundamental repeating structural unit of eukaryotic chromatin is the:
A) Chromosome
B) Nucleosome
C) Ribosome
D) Lysosome
Answer: Nucleosome

12. The transcriptionally inactive, highly condensed form of chromatin is called:
A) Euchromatin
B) Heterochromatin
C) Nucleochromatin
D) Asterochromatin
Answer: Heterochromatin

13. Who, in 1900, first suggested that chromosomes play a central role in heredity?
A) Walter Sutton
B) Gregor Mendel
C) Theodor Boveri
D) Karl Correns
Answer: Karl Correns

Regulation of Gene Expression

1. In prokaryotes, the primary level of control for gene expression occurs at which stage?
A) RNA processing
B) translation initiation
C) transcription initiation
D) protein degradation
Answer: transcription initiation

2. Regulatory proteins influence transcription by modulating the ability of RNA polymerase to bind to the:
A) operator
B) enhancer
C) promoter
D) terminator
Answer: promoter

3. The pattern of chemical groups in the DNA major groove allows regulatory proteins to:
A) unwind the DNA helix
B) read the sequence of bases
C) methylate cytosine residues
D) catalyze RNA splicing
Answer: read the sequence of bases

4. A common DNA-binding motif consisting of two α-helical segments linked by a short turn is called:
A) zinc finger
B) leucine zipper
C) helix-turn-helix
D) homeodomain
Answer: helix-turn-helix

5. The *lac* operon in *E. coli* is an example of a(n):
A) repressible operon
B) inducible operon
C) constitutive operon
D) anabolic operon
Answer: inducible operon

6. In the absence of lactose, the *lac* repressor binds to the operator and:
A) activates transcription
B) blocks RNA polymerase binding
C) degrades allolactose
D) recruits CAP protein
Answer: blocks RNA polymerase binding

7. Maximal expression of the *lac* operon requires both the absence of the repressor and the presence of:
A) high glucose and cAMP
B) low glucose and cAMP
C) high lactose and glucose
D) low lactose and tryptophan
Answer: low glucose and cAMP

8. In the *trp* operon, tryptophan acts as a:
A) inducer
B) coactivator
C) corepressor
D) inhibitor
Answer: corepressor

9. Eukaryotic transcription factors that are required for the assembly of the transcription apparatus at all promoters are called:
A) specific transcription factors
B) enhancer-binding proteins
C) general transcription factors
D) mediators
Answer: general transcription factors

10. DNA sequences that can stimulate transcription from a distance and are binding sites for activators are called:
A) promoters
B) operators
C) enhancers
D) silencers
Answer: enhancers

11. The packaging of DNA into nucleosomes primarily complicates which cellular process?
A) DNA replication
B) transcription
C) translation
D) protein folding
Answer: transcription

12. The addition of acetyl groups to histone tails generally leads to:
A) chromatin condensation and gene silencing
B) chromatin loosening and increased transcription
C) DNA methylation and imprinting
D) recruitment of repressive complexes
Answer: chromatin loosening and increased transcription

13. Which process can produce multiple different mRNA transcripts from a single

Biotechnology

1. Biotechnology is best defined as:
A) The study of rocks and minerals using biological tools
B) The use of machines in agricultural processes
C) The use of living organisms to make useful products or provide services
D) The analysis of planetary systems through biology
Answer: The use of living organisms to make useful products or provide services
2. An example of traditional biotechnology is:
A) Production of human insulin using bacteria
B) DNA fingerprinting
C) Fermentation in yogurt making
D) Gene therapy for cystic fibrosis
Answer: Fermentation in yogurt making
3. The artificial manipulation of DNA to alter an organism's traits is known as:
A) Fermentation
B) Bioremediation
C) Genetic engineering
D) Tissue culture
Answer: Genetic engineering
4. The proof that DNA carries genetic information was established in:
A) 1857
B) 1944
C) 1970
D) 1990
Answer: 1944
5. Human insulin was first produced using recombinant DNA technology in:
A) 1970
B) 1978
C) 1990
D) 2002
Answer: 1978
6. The Human Genome Project was launched in:
A) 1978
B) 1990
C) 2002
D) 2003
Answer: 1990
7. Which of the following is NOT an application of biotechnology?
A) Gene therapy
B) Fermentation
C) Mineral extraction
D) DNA fingerprinting
Answer: Mineral extraction
8. The process of inserting genetic material into human cells to treat disorders is called:
A) Genetic screening
B) Gene therapy
C) Genetic counselling
D) DNA sequencing
Answer: Gene therapy
9. Fermentation is best described as:
A) Complete oxidation of glucose for maximum ATP yield
B) The mass culture of microorganisms to produce any product
C) A purely chemical process without biological components
D) The conversion of ethanol to acetic acid
Answer: The mass culture of microorganisms to produce any product
10. Alcoholic fermentation is carried out by:
A) Lactobacillus
B) Streptococcus
C) Saccharomyces cerevisiae
D) Escherichia coli
Answer: Saccharomyces cerevisiae
11. Lactic acid fermentation is primarily performed by:
A) Yeast
B) Molds
C) Lactobacillus
D) Viruses
Answer: Lactobacillus
12. Which of the following is a product of lactic acid fermentation?
A) Ethanol and CO_2
B) Lactic acid
C) Acetic acid
D) Formic acid
Answer: Lactic acid
13. A device that provides an optimal environment for microbial growth and product formation is a:
A) Centrifuge

Pharmacology

1. What is the scientific study of drugs, including their composition and medical applications, called?
A) Pharmacy
B) Toxicology
C) Pharmacology
D) Biochemistry
Answer: Pharmacology

2. The term "pharmacology" is derived from which language?
A) Latin
B) Greek
C) Arabic
D) French
Answer: Greek

3. Which term was used for pharmacology until 1890?
A) Pharmacognosy
B) Materia Medica
C) Therapeutics
D) Posology
Answer: Materia Medica

4. What is any chemical substance that alters normal body function when absorbed into a living organism called?
A) Toxin
B) Drug
C) Enzyme
D) Hormone
Answer: Drug

5. Which of the following is used in diagnosis, cure, treatment, or prevention of disease?
A) Pharmaceutical drug
B) Addictive drug
C) Hallucinogen
D) Narcotic
Answer: Pharmaceutical drug

6. What is an important part of the medical field that relies on pharmacology called?
A) Surgery
B) Pharmacotherapy
C) Diagnostics
D) Epidemiology
Answer: Pharmacotherapy

7. Which drugs are sold only on a physician's order?
A) OTC drugs
B) Prescription drugs
C) Herbal drugs
D) Nutraceuticals
Answer: Prescription drugs

8. What are drugs considered safe enough to be sold without a prescription called?
A) Prescription drugs
B) Controlled substances
C) Over-the-counter drugs
D) Ethical drugs
Answer: Over-the-counter drugs

9. Which of the following is NOT a source of drugs?
A) Synthetic
B) Plants
C) Fungi
D) Sunlight
Answer: Sunlight

10. Which drug is an example of a synthetic drug?
A) Penicillin
B) Morphine
C) Aspirin
D) Quinine
Answer: Aspirin

11. From which fungus is Penicillin derived?
A) Aspergillus
B) Penicillium notatum
C) Saccharomyces
D) Candida
Answer: Penicillium notatum

12. Digitalis, a cardiotonic, is obtained from which plant?
A) Opium poppy
B) Foxglove
C) Cinchona
D) Cannabis
Answer: Foxglove

13. Morphine is extracted from which plant?
A) Foxglove
B) Opium poppy
C) Cinchona
D) Cannabis
Answer: Opium poppy

Biostatistics & Computational Biology

1. Biostatistics is best defined as the application of statistical principles to which fields?
A) Physics and Chemistry
B) Economics and Business
C) Biology, Medicine, and Health Sciences
D) Engineering and Technology
Answer: Biology, Medicine, and Health Sciences

2. Which of the following is NOT a common measure of central tendency?
A) Mean
B) Range
C) Median
D) Mode
Answer: Range

3. The formula for the arithmetic mean for ungrouped data is:
A) $\frac{\sum fx}{\sum f}$
B) $\frac{\sum x}{n}$
C) $\frac{n+1}{2}$
D) $\frac{\text{Highest}-\text{Lowest}}{2}$
Answer: $\frac{\sum x}{n}$

4. In a dataset, the value that appears most frequently is called the:
A) Mean
B) Median
C) Mode
D) Range
Answer: Mode

5. The middle value in an ordered dataset is known as the:
A) Mean
B) Median
C) Mode
D) Standard Deviation
Answer: Median

6. Which measure of dispersion is calculated as the difference between the highest and lowest values?
A) Variance
B) Standard Deviation
C) Range
D) Percentile
Answer: Range

7. Standard Deviation is a measure of:
A) Central Tendency
B) Data Dispersion
C) Data Frequency
D) Data Accuracy
Answer: Data Dispersion

8. The 50th percentile in a dataset is equivalent to the:
A) Mean
B) Mode
C) Median
D) First Quartile
Answer: Median

9. In a normal distribution curve, what percentage of data lies within one standard deviation of the mean?
A) 25%
B) 50%
C) 68%
D) 95%
Answer: 68%

10. Which graphical representation uses bars of equal width but variable heights?
A) Pie Chart
B) Line Graph
C) Bar Chart
D) Scatter Plot
Answer: Bar Chart

11. Error bars on a bar chart typically represent variability using:
A) Mean or Median
B) Range or Standard Deviation
C) Mode or Percentile
D) Variance or Mean
Answer: Range or Standard Deviation

12. In an experiment, the variable that is manipulated by the researcher is called the:
A) Dependent Variable

Evolution

1. Who proposed the theory of inheritance of acquired characteristics?
A) Charles Darwin
B) Alfred Russel Wallace
C) Jean-Baptiste Lamarck
D) Gregor Mendel
Answer: Jean-Baptiste Lamarck

2. Which concept is central to Darwin's theory of evolution?
A) Use and disuse
B) Natural selection
C) Inheritance of acquired traits
D) Special creation
Answer: Natural selection

3. The study of geographical distribution of plants and animals is known as:
A) Paleontology
B) Biogeography
C) Comparative anatomy
D) Molecular biology
Answer: Biogeography

4. Structures that are similar in origin but different in function are called:
A) Analogous structures
B) Vestigial structures
C) Homologous structures
D) Convergent structures
Answer: Homologous structures

5. Which of the following is an example of homologous organs?
A) Wing of bat and wing of butterfly
B) Flipper of whale and wing of bird
C) Eye of octopus and eye of human
D) Leg of horse and leg of insect
Answer: Flipper of whale and wing of bird

6. The fossil record provides evidence for evolution by showing:
A) Sudden appearance of species
B) Sequential changes over time
C) Identical species across eras
D) Independent creation events
Answer: Sequential changes over time

7. Which scientist is credited with the theory of natural selection independently of Darwin?
A) Thomas Malthus
B) Charles Lyell
C) Alfred Russel Wallace
D) James Hutton
Answer: Alfred Russel Wallace

8. The term 'survival of the fittest' was coined by:
A) Charles Darwin
B) Herbert Spencer
C) Jean-Baptiste Lamarck
D) Ernst Haeckel
Answer: Herbert Spencer

9. Which of the following is a vestigial organ in humans?
A) Appendix
B) Heart
C) Liver
D) Lung
Answer: Appendix

10. The endosymbiotic theory explains the origin of:
A) Prokaryotic cells
B) Eukaryotic organelles
C) Viruses
D) Ribosomes
Answer: Eukaryotic organelles

11. Who proposed the endosymbiotic theory?
A) Lynn Margulis
B) Charles Darwin
C) Carl Woese
D) Robert Whittaker
Answer: Lynn Margulis

12. Which of the following is NOT a condition of the Hardy-Weinberg equilibrium?
A) No mutation
B) No gene flow
C) Non-random mating
D) Large population size
Answer: Non-random mating

13. Genetic drift is most significant in:
A) Large populations
B) Small populations
C) Stable environments
D) Global populations
Answer: Small populations

14. The phenomenon where unrelated species evolve similar traits is called:
A) Divergent evolution

Ecology & Ecosystems

1. What term describes a group of populations of different species living close enough to interact?
A) Ecosystem
B) Community
C) Population
D) Biosphere
Answer: Community

2. Which of the following is a +/- interaction?
A) Mutualism
B) Commensalism
C) Predation
D) Competition
Answer: Predation

3. The principle that two species competing for the same limiting resources cannot coexist is called?
A) Resource partitioning
B) Character displacement
C) Competitive exclusion
D) Niche differentiation
Answer: Competitive exclusion

4. The specific set of biotic and abiotic resources used by an organism is its?
A) Habitat
B) Niche
C) Territory
D) Range
Answer: Niche

5. Differentiation of niches to enable similar species to coexist is called?
A) Competitive exclusion
B) Character displacement
C) Resource partitioning
D) Exploitation
Answer: Resource partitioning

6. The tendency for characteristics to diverge more in sympatric populations than in allopatric populations is?
A) Competitive exclusion
B) Resource partitioning
C) Character displacement
D) Niche differentiation
Answer: Character displacement

7. Bright coloration that warns predators of prey toxicity is called?
A) Cryptic coloration
B) Batesian mimicry
C) Aposematic coloration
D) Müllerian mimicry
Answer: Aposematic coloration

8. When a harmless species mimics a harmful one, it is called?
A) Cryptic coloration
B) Aposematic coloration
C) Batesian mimicry
D) Müllerian mimicry
Answer: Batesian mimicry

9. An interaction where one organism eats part of a plant or alga is?
A) Predation
B) Parasitism
C) Herbivory
D) Commensalism
Answer: Herbivory

10. A +/- interaction where one organism derives nourishment from a host is?
A) Herbivory
B) Predation
C) Parasitism
D) Mutualism
Answer: Parasitism

11. A +/+ interaction benefiting both species is?
A) Commensalism
B) Mutualism
C) Predation
D) Competition
Answer: Mutualism

12. A +/0 interaction where one species benefits and the other is unaffected is?
A) Mutualism
B) Commensalism
C) Amensalism
D) Parasitism
Answer: Commensalism

13. The variety of different kinds of organisms in a community is its?
A) Relative abundance
B) Species richness
C) Species diversity

Systemetics, Phylogeny & Tree of Life

1. In the binomial nomenclature system, what is the correct format for writing the scientific name of humans?
A) Homo Sapiens
B) homo sapiens
C) *Homo sapiens*
D) *Homo Sapiens*
Answer: *Homo sapiens*

2. Which of the following taxonomic ranks is the most inclusive?
A) Order
B) Family
C) Phylum
D) Genus
Answer: Phylum

3. The three-domain system of classification includes:
A) Protista, Fungi, Plantae
B) Bacteria, Archaea, Eukarya
C) Monera, Protista, Animalia
D) Prokaryota, Eukaryota, Virus
Answer: Bacteria, Archaea, Eukarya

4. A phylogenetic tree that depicts evolutionary relationships based on shared derived characters is called a:
A) Phenogram
B) Cladogram
C) Phylogram
D) Dendrogram
Answer: Cladogram

5. Similar structures in different species due to common ancestry are termed:
A) Analogous
B) Homologous
C) Homoplastic
D) Convergent
Answer: Homologous

6. The evolutionary history of a group of organisms is known as:
A) Taxonomy
B) Systematics
C) Phylogeny
D) Cladistics
Answer: Phylogeny

7. Which kingdom in the five-kingdom system includes multicellular, photosynthetic organisms?
A) Fungi
B) Plantae
C) Animalia
D) Protista
Answer: Plantae

8. A taxon that includes an ancestor and all of its descendants is:
A) Paraphyletic
B) Polyphyletic
C) Monophyletic
D) Periphyletic
Answer: Monophyletic

9. The principle that favors the simplest explanation in cladogram construction is:
A) Maximum likelihood
B) Parsimony
C) Outgroup analysis
D) Synapomorphy
Answer: Parsimony

10. Horizontal gene transfer is a process where genes move between:
A) Parent and offspring
B) Different species in the same generation
C) Mitochondria and nucleus
D) Homologous chromosomes
Answer: Different species in the same generation

11. The science of naming, describing, and classifying organisms is:
A) Phylogenetics
B) Systematics
C) Taxonomy
D) Cladistics
Answer: Taxonomy

12. In a cladogram, the point where two lineages diverge is called a:
A) Root
B) Node
C) Branch
D) Tip
Answer: Node

13. Which of the following is a shared derived character for mammals?
A) Vertebrae
B) Jaws

Viruses

1. Who first discovered viruses using a filtration experiment with Tobacco Mosaic Disease?
A) Louis Pasteur
B) Robert Koch
C) Dmitri Iwanowsky
D) W.M. Stanley
Answer: Dmitri Iwanowsky

2. The outer protein shell of a virus is called the:
A) Envelope
B) Capsomere
C) Capsid
D) Nucleocapsid
Answer: Capsid

3. Individual protein subunits that assemble to form a viral capsid are known as:
A) Peplomers
B) Capsomeres
C) Prions
D) Viroids
Answer: Capsomeres

4. A virus that lacks a lipid bilayer outside its capsid is termed a:
A) Enveloped virus
B) Naked virus
C) Bacteriophage
D) Retrovirus
Answer: Naked virus

5. Viruses that specifically infect bacterial cells are called:
A) Retroviruses
B) Bacteriophages
C) Adenoviruses
D) Picornaviruses
Answer: Bacteriophages

6. The Baltimore classification system categorizes viruses primarily based on:
A) Host organism and disease symptoms
B) Genome type and replication strategy
C) Capsid symmetry and size
D) Presence or absence of an envelope
Answer: Genome type and replication strategy

7. Human Immunodeficiency Virus (HIV) is classified as a:
A) Double-stranded DNA virus
B) Single-stranded RNA retrovirus
C) Double-stranded RNA virus
D) Single-stranded DNA virus
Answer: Single-stranded RNA retrovirus

8. Viral host specificity is mainly determined by:
A) The shape of the capsid
B) Interaction between viral surface proteins and host cell receptors
C) The type of viral nucleic acid
D) The presence of a lipid envelope
Answer: Interaction between viral surface proteins and host cell receptors

9. A virus that requires a host cell to replicate is best described as a/an:
A) Facultative intracellular parasite
B) Obligate intracellular parasite
C) Extracellular pathogen
D) Autotrophic organism
Answer: Obligate intracellular parasite

10. The viral replication cycle that results in the immediate rupture and death of the host cell is the:
A) Lysogenic cycle
B) Lytic cycle
C) Latent cycle
D) Persistent cycle
Answer: Lytic cycle

11. Integrated viral DNA within a bacterial chromosome during lysogeny is called a:
A) Provirus
B) Virion
C) Prophage
D) Retrovirus
Answer: Prophage

12. In genetic engineering, modified viruses are often used as:
A) Antibiotics
B) Vectors for gene delivery
C) Primary energy sources
D) Food additives
Answer: Vectors for gene delivery

13. The primary cellular targets of HIV are:
A) Red blood cells
B) Helper T-lymphocytes (CD4+ cells)

Bacteria

1. Which of the following is NOT a characteristic of prokaryotic cells?
A) Presence of a membrane-bound nucleus
B) Presence of ribosomes
C) Genetic material in the form of circular DNA
D) Cell wall containing peptidoglycan in many species
Answer: Presence of a membrane-bound nucleus

2. The three-domain system of classification divides organisms into Bacteria, Archaea, and what else?
A) Protista
B) Eukarya
C) Monera
D) Fungi
Answer: Eukarya

3. Who first discovered bacteria using a simple microscope and called them "animalcules"?
A) Louis Pasteur
B) Robert Koch
C) Antonie van Leeuwenhoek
D) Christian Gram
Answer: Antonie van Leeuwenhoek

4. Which scientist developed the Gram staining technique?
A) Robert Koch
B) Louis Pasteur
C) Christian Gram
D) Edward Jenner
Answer: Christian Gram

5. Bacteria that retain the crystal violet stain and appear purple are termed:
A) Gram-negative
B) Gram-variable
C) Gram-positive
D) Acid-fast
Answer: Gram-positive

6. The primary structural component of the bacterial cell wall is:
A) Cellulose
B) Chitin
C) Peptidoglycan
D) Lignin
Answer: Peptidoglycan

7. Which structure is used by bacteria for motility?
A) Pili
B) Flagella
C) Capsule
D) Mesosome
Answer: Flagella

8. Bacterial flagella are composed primarily of which protein?
A) Actin
B) Tubulin
C) Flagellin
D) Pilin
Answer: Flagellin

9. Thin, hair-like appendages involved in bacterial conjugation are called:
A) Flagella
B) Cilia
C) Fimbriae
D) Pili
Answer: Pili

10. The protective, gelatinous layer outside the cell wall of some bacteria is the:
A) Slime layer
B) Capsule
C) S-layer
D) Glycocalyx
Answer: Capsule

11. Bacteria that require oxygen for growth are classified as:
A) Anaerobes
B) Facultative anaerobes
C) Aerobes
D) Microaerophiles
Answer: Aerobes

12. Bacteria that can grow in the presence or absence of oxygen are called:
A) Obligate aerobes
B) Obligate anaerobes
C) Facultative anaerobes
D) Capnophiles
Answer: Facultative anaerobes

13. The process by which bacteria reproduce asexually is known as:
A) Conjugation
B) Binary fission

Protists

1. Which feature definitively separates protists from prokaryotic organisms?
A) Presence of a cell wall
B) Membrane-bound nucleus and organelles
C) Ability to perform photosynthesis
D) Unicellular body plan
Answer: Membrane-bound nucleus and organelles

2. The evolutionary relationship of Kingdom Protista is best described as:
A) Monophyletic
B) Paraphyletic
C) Polyphyletic
D) Holophyletic
Answer: Paraphyletic

3. What is the primary basis for grouping diverse organisms into the protist kingdom?
A) Shared common ancestry
B) Similar modes of reproduction
C) They do not fit into other eukaryotic kingdoms
D) All are microscopic
Answer: They do not fit into other eukaryotic kingdoms

4. Which characteristic is NOT typical of most protists?
A) Presence in aquatic environments
B) Prokaryotic cellular structure
C) Unicellular or simple multicellular organization
D) Lack of embryonic development
Answer: Prokaryotic cellular structure

5. Which scientist is credited with proposing the five-kingdom classification system?
A) Carl Woese
B) Robert Whittaker
C) Ernst Haeckel
D) Herbert Copeland
Answer: Robert Whittaker

6. Animal-like protists are collectively known as:
A) Algae
B) Protozoa
C) Slime molds
D) Oomycetes
Answer: Protozoa

7. The locomotory structure formed by temporary extensions of cytoplasm is called:
A) Cilium
B) Flagellum
C) Pseudopod
D) Axopod
Answer: Pseudopod

8. Amoebic dysentery is caused by which parasitic protist?
A) Giardia lamblia
B) Entamoeba histolytica
C) Trypanosoma brucei
D) Plasmodium vivax
Answer: Entamoeba histolytica

9. Zooflagellates primarily move using which structure?
A) Pseudopodia
B) Cilia
C) One or more whip-like flagella
D) Gliding motility
Answer: One or more whip-like flagella

10. African sleeping sickness is transmitted by the tsetse fly and caused by:
A) Leishmania spp.
B) Trypanosoma brucei
C) Plasmodium falciparum
D) Trichomonas vaginalis
Answer: Trypanosoma brucei

11. Ciliates are characterized for movement and feeding by numerous:
A) Flagella
B) Pseudopodia
C) Short, hair-like cilia
D) Tentacles
Answer: Short, hair-like cilia

12. A classic example of a ciliate protist often studied in labs is:
A) Amoeba proteus
B) Euglena gracilis
C) Paramecium caudatum
D) Plasmodium malariae
Answer: Paramecium caudatum

13. The organelle in freshwater protists that expels excess water is the:
A) Food vacuole
B) Contractile vacuole

Fungi

1. What is the primary structural component of fungal cell walls?
A) Cellulose
B) Peptidoglycan
C) Chitin
D) Lignin
Answer: Chitin

2. Fungi are most closely related to which kingdom?
A) Plantae
B) Bacteria
C) Animalia
D) Archaea
Answer: Animalia

3. The vegetative, feeding network of a fungus is called the:
A) Sporangium
B) Mycelium
C) Thallus
D) Rhizoid
Answer: Mycelium

4. What are the individual, thread-like filaments that compose a mycelium?
A) Septa
B) Hyphae
C) Conidiophores
D) Sterigmata
Answer: Hyphae

5. Hyphae that lack cross-walls and are essentially a continuous tube with multiple nuclei are termed:
A) Septate
B) Dikaryotic
C) Coenocytic
D) Monokaryotic
Answer: Coenocytic

6. The main carbohydrate storage molecule in fungi is:
A) Starch
B) Glycogen
C) Cellulose
D) Inulin
Answer: Glycogen

7. In fungal sexual reproduction, which process involves the fusion of cytoplasm from two parent cells?
A) Karyogamy
B) Meiosis
C) Plasmogamy
D) Mitosis
Answer: Plasmogamy

8. A fungal cell containing two genetically distinct, haploid nuclei is described as:
A) Diploid
B) Heterokaryotic
C) Homokaryotic
D) Coenocytic
Answer: Heterokaryotic

9. Which fungal phylum is now considered paraphyletic?
A) Ascomycota
B) Basidiomycota
C) Zygomycota
D) Glomeromycota
Answer: Zygomycota

10. The dikaryotic (n+n) phase is a prominent feature in the life cycles of:
A) Chytridiomycota and Zygomycota
B) Zygomycota and Glomeromycota
C) Ascomycota and Basidiomycota
D) Glomeromycota and Chytridiomycota
Answer: Ascomycota and Basidiomycota

11. Which fungal phylum produces motile spores (zoospores) with a single, posterior flagellum?
A) Ascomycota
B) Basidiomycota
C) Chytridiomycota
D) Zygomycota
Answer: Chytridiomycota

12. A symbiotic association between a fungus and a photosynthetic alga or cyanobacterium is known as a:
A) Mycorrhiza
B) Lichen
C) Endophyte
D) Haustorium
Answer: Lichen

13. Which specialized structure in arbuscular mycorrhizae penetrates plant root cells to facilitate nutrient exchange?
A) Conidiophore

Kingdom Plantae

1. Which of the following is the closest algal relative of land plants?
A) Brown algae
B) Red algae
C) Charophyte green algae
D) Dinoflagellates
Answer: Charophyte green algae

2. What is the primary function of the cuticle in land plants?
A) Photosynthesis
B) Gas exchange
C) Minimizing water loss
D) Nutrient absorption
Answer: Minimizing water loss

3. In the alternation of generations, the multicellular diploid phase is called the:
A) Gametophyte
B) Sporophyte
C) Zygote
D) Embryo
Answer: Sporophyte

4. Which generation is dominant in the bryophyte life cycle?
A) Sporophyte
B) Gametophyte
C) Zygote
D) Spore
Answer: Gametophyte

5. What are the tiny pores on plant surfaces that allow gas exchange called?
A) Cuticles
B) Lenticels
C) Stomata
D) Hydathodes
Answer: Stomata

6. In the plant life cycle, meiosis produces:
A) Gametes
B) Spores
C) Zygotes
D) Embryos
Answer: Spores

7. Which of the following is NOT a bryophyte?
A) Moss
B) Liverwort
C) Hornwort
D) Club moss
Answer: Club moss

8. The moss gametophyte develops from a filamentous structure called the:
A) Prothallus
B) Protonema
C) Rhizome
D) Seta
Answer: Protonema

9. In bryophytes, the sporophyte is:
A) Dominant and independent
B) Dominant but dependent on gametophyte
C) Reduced and dependent on gametophyte
D) Free-living and photosynthetic
Answer: Reduced and dependent on gametophyte

10. Which bryophyte group has a lobed, flattened thallus and reproduces via gemmae cups?
A) Mosses
B) Hornworts
C) Liverworts
D) Club mosses
Answer: Liverworts

11. What is the main water-conducting cell in seedless vascular plants?
A) Sieve tube element
B) Vessel element
C) Tracheid
D) Parenchyma
Answer: Tracheid

12. Which plant group possesses microphylls?
A) Ferns
B) Horsetails
C) Club mosses
D) Whisk ferns
Answer: Club mosses

13. What is the dominant generation in ferns?
A) Gametophyte
B) Sporophyte
C) Protonema
D) Archegonium
Answer: Sporophyte

14. Fern spores are produced in structures called:
A) Antheridia

Plants Forms & Functions

1. Which of the following is a macronutrient essential for chlorophyll synthesis?
A) Iron
B) Magnesium
C) Boron
D) Zinc
Answer: Magnesium

2. Chlorosis in older leaves is a typical deficiency symptom of which element?
A) Nitrogen
B) Calcium
C) Sulphur
D) Phosphorus
Answer: Nitrogen

3. Carnivorous plants like the Venus flytrap primarily supplement their diet with insects to obtain:
A) Water
B) Carbon
C) Phosphorus
D) Nitrogen
Answer: Nitrogen

4. The primary site for gaseous exchange in plant leaves is the:
A) Cuticle
B) Palisade mesophyll
C) Stomata
D) Epidermis
Answer: Stomata

5. During daylight, when photosynthesis is active, a plant typically shows a net intake of:
A) Oxygen and release of carbon dioxide
B) Carbon dioxide and release of oxygen
C) Both oxygen and carbon dioxide
D) Neither gas
Answer: Carbon dioxide and release of oxygen

6. Which tissue is responsible for the transport of organic solutes like sucrose throughout the plant?
A) Xylem
B) Phloem
C) Collenchyma
D) Sclerenchyma
Answer: Phloem

7. The movement of water from root hair cells into the cortex follows a water potential gradient and is primarily driven by:
A) Active transport
B) Osmosis
C) Capillary action
D) Transpiration pull
Answer: Osmosis

8. The pathway where water moves through the interconnected cytoplasm of plant cells via plasmodesmata is the:
A) Apoplast pathway
B) Symplast pathway
C) Vacuolar pathway
D) Transmembrane pathway
Answer: Symplast pathway

9. Which component of the TACT theory refers to the attraction between water molecules and the walls of xylem vessels?
A) Transpiration pull
B) Adhesion
C) Cohesion
D) Tension
Answer: Adhesion

10. Mature sieve tube elements in phloem lack which cellular structure?
A) Cell wall
B) Cytoplasm
C) Nucleus
D) Vacuole
Answer: Nucleus

11. The opening of stomata is associated with the guard cells becoming:
A) Flaccid
B) Turgid
C) Plasmolyzed
D) Dehydrated
Answer: Turgid

12. According to the starch-sugar interconversion theory, stomata open when guard cell solute potential decreases due to an increase in:
A) Starch
B) Glucose
C) Potassium ions

MK PREPARATIONS

Kingdome Animalia

1. Which of the following is NOT a characteristic of all animals?
A) Multicellularity
B) Presence of a coelom
C) Heterotrophic nutrition
D) Eukaryotic cells
Answer: Presence of a coelom

2. The body cavity that is completely lined by mesoderm is called:
A) Pseudocoelom
B) Haemocoel
C) Coelom
D) Acoelom
Answer: Coelom

3. Animals belonging to phylum Porifera are commonly known as:
A) Roundworms
B) Flatworms
C) Sponges
D) Jellyfish
Answer: Sponges

4. The special cells unique to cnidarians that contain stinging organelles are called:
A) Choanocytes
B) Nematocysts
C) Cnidocytes
D) Flame cells
Answer: Cnidocytes

5. Which of the following exhibits radial symmetry?
A) Earthworm
B) Planaria
C) Hydra
D) Snail
Answer: Hydra

6. The skeletal elements found in sponges are called:
A) Spicules
B) Setae
C) Radula
D) Notochord
Answer: Spicules

7. Which phylum includes animals that are diploblastic and have a gastrovascular cavity with a single opening?
A) Platyhelminthes
B) Cnidaria
C) Nematoda
D) Annelida
Answer: Cnidaria

8. The free-swimming, ciliated larva characteristic of many mollusks and annelids is the:
A) Trochophore
B) Planula
C) Nauplius
D) Bipinnaria
Answer: Trochophore

9. In protostomes, the blastopore develops into the:
A) Anus
B) Mouth
C) Coelom
D) Notochord
Answer: Mouth

10. Which of the following is an example of a pseudocoelomate animal?
A) Earthworm
B) Roundworm
C) Flatworm
D) Snail
Answer: Roundworm

11. The body of an annelid is characterized by:
A) Radial symmetry
B) Metameric segmentation
C) A mantle and shell
D) Jointed appendages
Answer: Metameric segmentation

12. The rasping tongue-like organ found in most mollusks is the:
A) Radula
B) Mantle
C) Proboscis
D) Siphon
Answer: Radula

13. Which class of arthropods includes animals with two pairs of antennae and biramous appendages?
A) Insecta
B) Crustacea
C) Arachnida

Nutrition & Digestion

1. Which of the following is the correct sequence of the digestive tract from proximal to distal?
A) Esophagus, Stomach, Duodenum, Jejunum, Ileum
B) Stomach, Esophagus, Ileum, Jejunum, Duodenum
C) Duodenum, Jejunum, Ileum, Stomach, Esophagus
D) Jejunum, Ileum, Duodenum, Stomach, Esophagus
Answer: Esophagus, Stomach, Duodenum, Jejunum, Ileum

2. Which hormone is responsible for stimulating the release of bicarbonate-rich pancreatic juice?
A) Gastrin
B) Secretin
C) Cholecystokinin
D) Gastric Inhibitory Peptide
Answer: Secretin

3. Which of the following cells secrete pepsinogen in the stomach?
A) Parietal Cells
B) G Cells
C) Chief Cells
D) Mucous Neck Cells
Answer: Chief Cells

4. The majority of nutrient absorption occurs in which part of the small intestine?
A) Duodenum
B) Jejunum
C) Ileum
D) All parts equally
Answer: Jejunum

5. Which vitamin requires intrinsic factor for its absorption in the ileum?
A) Vitamin C
B) Vitamin B12
C) Vitamin D
D) Vitamin K
Answer: Vitamin B12

6. The process of breaking down large fat globules into smaller droplets is primarily the function of:
A) Pancreatic Lipase
B) Bile Salts
C) Gastric Lipase
D) Colipase
Answer: Bile Salts

7. Which of the following is NOT a primary function of the liver?
A) Gluconeogenesis
B) Production of Insulin
C) Synthesis of Plasma Proteins
D) Detoxification of Ammonia
Answer: Production of Insulin

8. The muscular contractions that mix food with digestive juices in the small intestine are called:
A) Peristalsis
B) Segmentation
C) Haustration
D) Mass Movements
Answer: Segmentation

9. Which enzyme is responsible for the digestion of starch in the mouth and small intestine?
A) Maltase
B) Sucrase
C) Amylase
D) Lactase
Answer: Amylase

10. The hormone that inhibits gastric emptying and secretion when fats are present in the duodenum is:
A) Gastrin
B) Secretin
C) Cholecystokinin
D) Motilin
Answer: Cholecystokinin

11. The main function of the large intestine is:
A) Digestion of Proteins
B) Absorption of Amino Acids
C) Absorption of Water and Electrolytes
D) Production of Bile
Answer: Absorption of Water and Electrolytes

12. Which of the following is a zymogen (inactive enzyme precursor)?
A) Pepsin
B) Trypsin

Respiratory System & Gas Exchange

1. Which of the following structures is primarily responsible for preventing food aspiration into the airway?
A) Uvula
B) Glottis
C) Epiglottis
D) Tongue
Answer: Epiglottis

2. What is the primary muscle of inspiration during quiet breathing?
A) External intercostals
B) Internal intercostals
C) Diaphragm
D) Abdominals
Answer: Diaphragm

3. The majority of carbon dioxide in blood is transported as:
A) Dissolved CO2
B) Carbaminohemoglobin
C) Bicarbonate ions
D) Carbonic acid
Answer: Bicarbonate ions

4. The oxygen-hemoglobin dissociation curve shifts to the right in response to:
A) Increased pH
B) Decreased temperature
C) Increased 2,3-DPG
D) Decreased PCO2
Answer: Increased 2,3-DPG

5. Which respiratory disorder is characterized by destruction of alveolar walls and loss of elastic recoil?
A) Chronic bronchitis
B) Asthma
C) Emphysema
D) Pulmonary fibrosis
Answer: Emphysema

6. The enzyme carbonic anhydrase catalyzes the reaction between:
A) O2 and hemoglobin
B) CO2 and water
C) CO and plasma
D) H+ and bicarbonate
Answer: CO2 and water

7. The partial pressure of oxygen in alveolar air is approximately:
A) 40 mmHg
B) 100 mmHg
C) 46 mmHg
D) 160 mmHg
Answer: 100 mmHg

8. Which lung volume cannot be measured directly by spirometry?
A) Tidal volume
B) Expiratory reserve volume
C) Inspiratory reserve volume
D) Residual volume
Answer: Residual volume

9. The chemoreceptors most sensitive to changes in arterial PCO2 are located in the:
A) Carotid bodies
B) Aortic bodies
C) Medulla oblongata
D) Lungs
Answer: Medulla oblongata

10. Surfactant is produced by which type of alveolar cells?
A) Type I pneumocytes
B) Type II pneumocytes
C) Alveolar macrophages
D) Goblet cells
Answer: Type II pneumocytes

11. The condition of low oxygen levels in tissues is termed:
A) Hypoxemia
B) Hypercapnia
C) Hypoxia
D) Anemia
Answer: Hypoxia

12. Which law states that the total pressure of a gas mixture is the sum of partial pressures?
A) Boyle's Law
B) Dalton's Law
C) Henry's Law
D) Fick's Law
Answer: Dalton's Law

13. The primary stimulus for increasing ventilation during moderate exercise is:
A) Decreased PO2
B) Increased PCO2 and H+
C) Increased lactic acid

Circulation

1. The thickest walled chamber of the human heart is the:
A) Right Atrium
B) Left Atrium
C) Right Ventricle
D) Left Ventricle
Answer: Left Ventricle

2. The membrane that encloses the heart in a double-layered sac is the:
A) Myocardium
B) Endocardium
C) Pericardium
D) Epicardium
Answer: Pericardium

3. The pacemaker of the heart, which initiates each heartbeat, is the:
A) Atrioventricular Node
B) Bundle of His
C) Purkinje Fibers
D) Sinoatrial Node
Answer: Sinoatrial Node

4. Blood vessels that carry blood away from the heart are called:
A) Veins
B) Venules
C) Capillaries
D) Arteries
Answer: Arteries

5. The valve present between the left atrium and left ventricle is the:
A) Tricuspid Valve
B) Pulmonary Semilunar Valve
C) Aortic Semilunar Valve
D) Bicuspid (Mitral) Valve
Answer: Bicuspid (Mitral) Valve

6. Deoxygenated blood from the body enters the heart through the:
A) Pulmonary Veins
B) Aorta
C) Superior and Inferior Vena Cavae
D) Pulmonary Arteries
Answer: Superior and Inferior Vena Cavae

7. The phase of the cardiac cycle when the ventricles contract is called:
A) Atrial Systole
B) Ventricular Diastole
C) Ventricular Systole
D) Atrial Diastole
Answer: Ventricular Systole

8. The 'lub' heart sound is primarily caused by the closure of the:
A) Semilunar Valves
B) Atrioventricular Valves
C) Pulmonary Valve Only
D) Aortic Valve Only
Answer: Atrioventricular Valves

9. The inner lining of the heart chambers is called the:
A) Epicardium
B) Myocardium
C) Pericardium
D) Endocardium
Answer: Endocardium

10. Which blood vessels have the thinnest walls to allow for material exchange?
A) Arteries
B) Arterioles
C) Capillaries
D) Veins
Answer: Capillaries

11. The QRS complex in an Electrocardiogram (ECG) represents:
A) Atrial Depolarization
B) Atrial Repolarization
C) Ventricular Depolarization
D) Ventricular Repolarization
Answer: Ventricular Depolarization

12. The hormone Epinephrine (Adrenaline) causes:
A) Vasoconstriction Only
B) Vasodilation Only
C) Both Vasoconstriction and Vasodilation
D) No Effect on Blood Vessels
Answer: Both Vasoconstriction and Vasodilation

13. The medical term for a heart attack is:
A) Angina Pectoris
B) Atherosclerosis
C) Myocardial Infarction
D) Congestive Heart Failure
Answer: Myocardial Infarction

14. The liquid part of the blood is called:
A) Serum
B) Lymph

Homeostasis

1. Which term describes the maintenance of a stable internal environment despite external changes?
A) Metabolism
B) Homeostasis
C) Adaptation
D) Acclimatization
Answer: Homeostasis

2. Who first proposed the concept of the constancy of the internal environment?
A) Walter Cannon
B) Claude Bernard
C) Louis Pasteur
D) Anton van Leeuwenhoek
Answer: Claude Bernard

3. The primary nitrogenous waste excreted by most aquatic animals is:
A) Urea
B) Uric acid
C) Ammonia
D) Creatinine
Answer: Ammonia

4. Which structure in flatworms functions in osmoregulation and excretion?
A) Metanephridia
B) Malpighian tubules
C) Protonephridia
D) Nephridiopores
Answer: Protonephridia

5. Birds primarily excrete nitrogenous waste in the form of:
A) Ammonia
B) Urea
C) Uric acid
D) Allantoin
Answer: Uric acid

6. Freshwater fish are _____ to their environment and tend to _____ water.
A) hypertonic, gain
B) hypotonic, lose
C) isotonic, neither gain nor lose
D) hypertonic, lose
Answer: hypertonic, gain

7. Marine bony fishes compensate for water loss by:
A) Producing large volumes of dilute urine
B) Drinking seawater and excreting excess salts through gills
C) Retaining urea in their blood
D) Absorbing water through skin
Answer: Drinking seawater and excreting excess salts through gills

8. The functional unit of the vertebrate kidney is the:
A) Glomerulus
B) Bowman's capsule
C) Nephron
D) Collecting duct
Answer: Nephron

9. Which hormone increases water reabsorption in the collecting ducts?
A) Aldosterone
B) Renin
C) Antidiuretic hormone (ADH)
D) Atrial natriuretic peptide
Answer: Antidiuretic hormone (ADH)

10. The process forcing fluid from glomerular capillaries into Bowman's capsule is:
A) Tubular secretion
B) Tubular reabsorption
C) Glomerular filtration
D) Countercurrent multiplication
Answer: Glomerular filtration

11. Animals that maintain constant internal osmolarity regardless of environment are:
A) Osmoconformers
B) Osmoregulators
C) Stenohaline
D) Euryhaline
Answer: Osmoregulators

12. Uric acid excretion as a paste is especially advantageous for:
A) Aquatic animals
B) Terrestrial animals conserving water
C) Animals producing large urine volumes
D) Animals with high protein diets
Answer: Terrestrial animals conserving water

13. Malpighian tubules are excretory structures found in:
A) Earthworms

Support Protection & Movement

1. Which of the following is the primary function of the integumentary system?
A) Nutrient absorption
B) Gas exchange
C) Protection from mechanical injury and microbial invasion
D) Hormone production
Answer: Protection from mechanical injury and microbial invasion

2. The integument of many invertebrates consists of a single layer of epithelial cells called the:
A) Dermis
B) Hypodermis
C) Epidermis
D) Cuticle
Answer: Epidermis

3. In arthropods, the non-living outer covering secreted by the epidermis is called the:
A) Shell
B) Mantle
C) Cuticle
D) Scale
Answer: Cuticle

4. The process by which arthropods shed their old exoskeleton to accommodate growth is called:
A) Keratinization
B) Sclerotization
C) Ecdysis
D) Ossification
Answer: Ecdysis

5. The vertebrate integument is typically composed of two main layers: the epidermis and the:
A) Hypodermis
B) Subcutaneous layer
C) Dermis
D) Basement membrane
Answer: Dermis

6. Which group of fishes possesses tooth-like dermal scales known as denticles?
A) Bony fishes
B) Hagfishes
C) Lampreys
D) Cartilaginous fishes
Answer: Cartilaginous fishes

7. The scales of bony fishes are primarily derived from which layer?
A) Epidermis
B) Dermis
C) Hypodermis
D) Subcutaneous layer
Answer: Dermis

8. Amphibian skin is characterized by being thin and moist, and it contains glands that secrete mucus and noxious fluids. These glands are:
A) Dermal in origin
B) Epidermal in origin
C) Hypodermal in origin
D) Subcutaneous in origin
Answer: Epidermal in origin

9. The tough, impermeable protein that helps protect tetrapod skin from desiccation is:
A) Collagen
B) Chitin
C) Keratin
D) Resilin
Answer: Keratin

10. Reptilian scales, claws, and beaks are primarily composed of:
A) Dermal bone
B) Keratin
C) Dentine
D) Cartilage
Answer: Keratin

11. Feathers in birds are derived from which epidermal layer?
A) Stratum germinativum
B) Stratum corneum
C) Stratum granulosum
D) Basement membrane
Answer: Stratum corneum

12. A diagnostic derived character of mammals first seen in Mesozoic fossils is:
A) Scales
B) Feathers
C) Hair

Nervous & Sensory System

1. Which division of the peripheral nervous system is under conscious control?
A) Sympathetic nervous system
B) Parasympathetic nervous system
C) Somatic nervous system
D) Autonomic nervous system
Answer: Somatic nervous system

2. The resting membrane potential of a typical neuron is approximately:
A) +70 mV
B) -70 mV
C) 0 mV
D) -90 mV
Answer: -70 mV

3. What is the primary ion responsible for the depolarization phase of an action potential?
A) Potassium (K+)
B) Chloride (Cl-)
C) Sodium (Na+)
D) Calcium (Ca2+)
Answer: Sodium (Na+)

4. The gap between two neurons where neurotransmitters are released is called the:
A) Node of Ranvier
B) Synaptic cleft
C) Axon hillock
D) Myelin sheath
Answer: Synaptic cleft

5. Which glial cells produce myelin in the central nervous system?
A) Schwann cells
B) Astrocytes
C) Oligodendrocytes
D) Microglia
Answer: Oligodendrocytes

6. The part of the brain responsible for coordination and balance is the:
A) Cerebrum
B) Cerebellum
C) Medulla oblongata
D) Thalamus
Answer: Cerebellum

7. Which neurotransmitter is primarily involved in muscle contraction at neuromuscular junctions?
A) Dopamine
B) Serotonin
C) Acetylcholine
D) GABA
Answer: Acetylcholine

8. The sympathetic nervous system is most active during which response?
A) Rest and digest
B) Fight or flight
C) Sleep and arousal
D) Nutrient absorption
Answer: Fight or flight

9. Saltatory conduction occurs in:
A) Unmyelinated axons
B) Myelinated axons
C) Dendrites
D) Cell bodies
Answer: Myelinated axons

10. Which part of the brain is considered the major integrating center for sensory information?
A) Hypothalamus
B) Cerebellum
C) Thalamus
D) Hippocampus
Answer: Thalamus

11. An inhibitory postsynaptic potential (IPSP) is usually caused by the opening of channels for which ion?
A) Sodium
B) Potassium
C) Calcium
D) Chloride
Answer: Chloride

12. Broca's area is primarily involved in:
A) Language comprehension
B) Speech production
C) Visual processing
D) Emotional responses
Answer: Speech production

13. The refractory period of an action potential is primarily due to:
A) Inactivation of sodium channels
B) Opening of potassium channels
C) Hyperpolarization

Endocrine System

1. Which gland is referred to as the "master gland" of the endocrine system?
A) Thyroid
B) Hypothalamus
C) Adrenal
D) Pituitary
Answer: Pituitary

2. Hormones that are secreted into the bloodstream and act on distant target cells are classified as:
A) Autocrine
B) Paracrine
C) Endocrine
D) Exocrine
Answer: Endocrine

3. Which hormone is secreted by the alpha cells of the pancreatic islets?
A) Insulin
B) Somatostatin
C) Glucagon
D) Pancreatic polypeptide
Answer: Glucagon

4. A patient presents with excessive thirst and urination; which hormone deficiency is most likely?
A) Aldosterone
B) Antidiuretic hormone
C) Cortisol
D) Thyroxine
Answer: Antidiuretic hormone

5. Graves' disease is caused by antibodies that mimic the action of which hormone?
A) Thyroxine
B) Thyroid-stimulating hormone
C) Calcitonin
D) Parathyroid hormone
Answer: Thyroid-stimulating hormone

6. Which hormone is secreted in response to low blood calcium levels?
A) Calcitonin
B) Thyroxine
C) Parathyroid hormone
D) Aldosterone
Answer: Parathyroid hormone

7. Oxytocin is synthesized in the hypothalamus and stored in which gland?
A) Anterior pituitary
B) Posterior pituitary
C) Pineal gland
D) Adrenal medulla
Answer: Posterior pituitary

8. Which of the following is a steroid hormone?
A) Insulin
B) Epinephrine
C) Thyroxine
D) Cortisol
Answer: Cortisol

9. Acromegaly in adults is caused by the overproduction of which hormone?
A) Thyroxine
B) Growth hormone
C) Prolactin
D) Adrenocorticotropic hormone
Answer: Growth hormone

10. Which gland produces melatonin?
A) Pituitary
B) Thyroid
C) Pineal
D) Thymus
Answer: Pineal

11. Cushing's syndrome is associated with excessive secretion of which hormone?
A) Insulin
B) Cortisol
C) Aldosterone
D) Glucagon
Answer: Cortisol

12. The "fight-or-flight" response is primarily mediated by which hormones?
A) Insulin and glucagon
B) Estrogen and progesterone
C) Epinephrine and norepinephrine
D) Thyroxine and calcitonin
Answer: Epinephrine and norepinephrine

13. Which hormone directly lowers blood glucose levels?
A) Glucagon
B) Cortisol

Reproduction & Development

1. Each testis consists of a complex duct system called the:
A) Ejaculatory duct
B) Seminiferous tubules
C) Epididymis
D) Sperm duct
Answer: Seminiferous tubules

2. Spermatogonia increase in size and differentiate into:
A) Secondary spermatocyte
B) Spermatids
C) Spermatozoa
D) Primary spermatocyte
Answer: Primary spermatocyte

3. In pregnant infected women, a virus transmitted to the infant during birth can damage eyes and CNS. This is:
A) Gonorrhea
B) Syphilis
C) Genital Herpes
D) AIDS
Answer: Genital Herpes

4. Mature sperm are formed from spermatids by the process of:
A) Meiosis I
B) Meiosis II
C) Mitosis
D) Spermiogenesis (Differentiation)
Answer: Spermiogenesis (Differentiation)

5. During human meiosis and fertilization, which of the following cells is diploid?
A) Primary spermatocyte, primary oocyte, zygote
B) Oogonia, spermatids, egg
C) Secondary oocyte, secondary spermatocyte, second polar body
D) Secondary polar body, embryo, spermatogonia
Answer: Primary spermatocyte, primary oocyte, zygote

6. How many blood vessels are present in the umbilical cord of the placenta?
A) Two, one artery & one vein
B) Three, two arteries & one vein
C) Three, one artery & two veins
D) Four, two arteries & two veins
Answer: Three, two arteries & one vein

7. In humans, which meiotic phase has the longest duration?
A) Anaphase I in females
B) Prophase I in females
C) Prophase II in males
D) Metaphase II in females
Answer: Prophase I in females

8. Which one of the following is part of the male reproductive system only?
A) Urethra
B) Bulbourethral gland
C) Gonads
D) Urinary bladder
Answer: Bulbourethral gland

9. Between the seminiferous tubules are cells which secrete testosterone. These are:
A) Sertoli cells
B) Germ cells
C) Interstitial (Leydig) cells
D) Epithelial cells
Answer: Interstitial (Leydig) cells

10. What is the correct trajectory of sperm during ejaculation?
A) Ejaculatory duct → Epididymis → Vas deferens → Urethra
B) Epididymis → Ejaculatory duct → Vas deferens → Urethra
C) Epididymis → Vas deferens → Ejaculatory duct → Urethra
D) Vas deferens → Ejaculatory duct → Urethra → Epididymis
Answer: Epididymis → Vas deferens → Ejaculatory duct → Urethra

11. Germ cells in the ovary produce:
A) One oogonium
B) Many oogonia
C) Infinite oogonia
D) Few oogonia
Answer: Many oogonia

12. Oogonia divide mitotically to form:
A) Secondary oocyte
B) Primary oocyte
C) Ovum

Behaviour

1. Ethology is best defined as the scientific study of:
A) Human psychology in laboratory settings.
B) Animal behavior, particularly under natural conditions.
C) The genetic basis of all behaviors.
D) Learned behaviors only.
Answer: Animal behavior, particularly under natural conditions.

2. The 1973 Nobel Prize in Physiology or Medicine was awarded to ethologists for pioneering work in animal behavior; who among the following was NOT a recipient?
A) Karl von Frisch
B) Konrad Lorenz
C) Niko Tinbergen
D) E.O. Wilson
Answer: E.O. Wilson

3. Questions about the immediate mechanistic causes of a behavior, such as hormonal triggers, address its:
A) Ultimate causation.
B) Phylogenetic history.
C) Proximate causation.
D) Adaptive significance.
Answer: Proximate causation.

4. The egg-retrieval behavior of a greylag goose, once initiated, continues to completion even if the egg is removed. This is an example of a:
A) Conditioned reflex.
B) Fixed action pattern.
C) Habituated response.
D) Cognitive map.
Answer: Fixed action pattern.

5. In classical ethology, a simple environmental stimulus that triggers a fixed action pattern is called a:
A) Conditioned stimulus.
B) Reinforcer.
C) Sign stimulus or releaser.
D) Cognitive signal.
Answer: Sign stimulus or releaser.

6. A male stickleback fish aggressively attacks any model with a red underside, even if it doesn't resemble a fish. This demonstrates the role of a:
A) Pheromone.
B) Sign stimulus.
C) Imprinting cue.
D) Dominance display.
Answer: Sign stimulus.

7. Behavioral ecology primarily focuses on the study of:
A) Neural circuits controlling behavior.
B) The adaptive value and evolutionary history of behavior.
C) Learning in controlled laboratory settings.
D) Genetic sequences coding for behavioral traits.
Answer: The adaptive value and evolutionary history of behavior.

8. A suite of correlated behaviors that show consistency across different situations in individuals is termed a:
A) Fixed action pattern.
B) Behavioral syndrome.
C) Cognitive bias.
D) Ritualized display.
Answer: Behavioral syndrome.

9. The rover and sitter foraging types in Drosophila melanogaster larvae are an example of behavioral variation caused by:
A) Environmental conditioning only.
B) Alternative alleles at a single gene locus.
C) Imprinting during a critical period.
D) Random mutation with no heritability.
Answer: Alternative alleles at a single gene locus.

10. Hygienic behavior in honeybees, involving uncapping cells and removing diseased larvae, is controlled by:
A) One dominant gene.
B) Two independently assorting recessive genes.
C) Queen pheromones only.
D) Environmental temperature.
Answer: Two independently assorting recessive genes.

11. When hybrid lovebirds show intermediate and poorly executed nest-building techniques

Conservation Biology

1. Conservation biology is best defined as which of the following?
A) The study of animal behavior in the wild.
B) The science of protecting and restoring biodiversity.
C) The management of zoos and captive breeding.
D) A discipline focused only on saving popular species.
Answer: The science of protecting and restoring biodiversity.

2. What are the three main levels at which biodiversity is measured?
A) Species, community, ecosystem.
B) Genetic, species, ecosystem.
C) Individual, population, landscape.
D) Cellular, organismal, ecological.
Answer: Genetic, species, ecosystem.

3. Which human activity is considered the single greatest threat to biodiversity worldwide?
A) Overharvesting.
B) Climate change.
C) Habitat loss and fragmentation.
D) Introduction of invasive species.
Answer: Habitat loss and fragmentation.

4. What term describes the number of different species in a given area?
A) Genetic diversity.
B) Species richness.
C) Ecosystem diversity.
D) Population density.
Answer: Species richness.

5. An endangered species is officially defined as one that is:
A) Likely to become threatened in the near future.
B) Restricted to a very small geographic range.
C) In immediate danger of extinction throughout all or much of its range.
D) No longer found in the wild.
Answer: In immediate danger of extinction throughout all or much of its range.

6. The process by which pollutants become more concentrated in successive trophic levels is called:
A) Bioaccumulation.
B) Eutrophication.
C) Biological magnification.
D) Genetic drift.
Answer: Biological magnification.

7. What is the minimum viable population (MVP)?
A) The largest population an environment can support.
B) The smallest population size that can avoid extinction in the foreseeable future.
C) The number of individuals in a habitat fragment.
D) The effective breeding population size.
Answer: The smallest population size that can avoid extinction in the foreseeable future.

8. Which formula is used to estimate the effective population size (N_e)?
A) $N_e = N_m + N\_f$.
B) $N_e = (4N_mN\_f)/(N_m + N\_f)$.
C) $N_e = N_t / 2$.
D) $N_e = N_m \times N\_f$.
Answer: $(4N_mN\_f)/(N_m + N\_f)$.

9. What does an "extinction vortex" describe?
A) A rapid increase in population size.
B) The interaction of small population size, genetic drift, and inbreeding leading to extinction.
C) The natural background rate of species loss.
D) The process of habitat fragmentation.
Answer: The interaction of small population size, genetic drift, and inbreeding leading to extinction.

10. Biodiversity hotspots are characterized primarily by having:
A) Very low human population density.
B) High numbers of endemic species under significant threat.
C) The world's largest protected areas.
D) Extremely stable climatic conditions.
Answer: High numbers of endemic species under significant threat.

PPSC, FPSC, SPSC, KPPSC, AJKPSC & BPSC LECTIRER BIOLOGY & ZOOLOGY MOST REPEATED & PAST PAPERS MCQs

1. The amphibians and the _____ represent the two major branches of the tetrapod lineage.
A) reptiles
B) birds
C) tennospondyls
D) amniotes
Answer: amniotes

2. Which of the following statements about hair is true?
A) it is homologous to feathers
B) it is a dermal structure
C) it is found in all mammals
D) it is possessed by all endotherms
Answer: it is found in all mammals

3. The endoskeleton of the echinoderms is composed of.
A) keratin ossicles
B) calcareous ossicles
C) keratin spicules
D) calcareous spicules
Answer: calcareous ossicles

4. The first hormone that was isolated.
A) thyroxine
B) vasopressin
C) secretin
D) adrenaline
Answer: secretin

5. The ultimate source of organic variations is.
A) sexual reproduction
B) hormonal action
C) natural selection
D) mutation
Answer: mutation

6. The structure of molluscs that forms the shell and houses the gills is the.
A) mantle
B) epidermis
C) gastrovascular cavity
D) odontophore
Answer: mantle

7. In an ecosystem, which one shows one way passage?
A) nitrogen
B) carbon
C) potassium
D) free energy
Answer: free energy

8. The central fluid filled cavity of the blastula is known as.
A) archenteron
B) blastocoel
C) blastocyst
D) morula
Answer: blastocoel

9. The mammalian skull may be characterized as _____.
A) anapsid
B) diapsid
C) biaspid
D) synapsid
Answer: synapsid

10. The first terrestrial tetrapods were probably the.
A) rhipidistians
B) amniotes
C) coelacanths
D) leptocephalans
Answer: rhipidistians

11. Which of the following phyla of animals is exclusively marine?
A) protozoa
B) porifera
C) echinodermata
D) mollusca
Answer: echinodermata

12. A normal green male Maize is crossed with albino female. The progeny is albino because.
A) trait for albinism is dominant
B) the albinos have biochemical to destroy plastids derived from green male
C) plastids are inherited from female parent
D) green plastids of male must have mutated

Answer: plastids are inherited from female parent

13. Sertoli cells are found in.
A) liver
B) seminiferous tubules
C) pancreas
D) gut
Answer: seminiferous tubules

14. The sum total of the populations of the same kind of organisms constitute.
A) colony
B) genus
C) species
D) community
Answer: species

15. A molluscan shell is made of three layers arranged from the outside to the inside.
A) periostracum, prismatic layer, nacreous layer
B) mantle layer, prismatic layer, periostracum
C) nacreous layer, periostracum, mantle layer
D) none of these
Answer: periostracum, prismatic layer, nacreous layer

16. Which one of the following can achieve protection and conservation of biodiversity?
A) eco-development
B) biosphere reserve
C) national park
D) game sanctuary
Answer: biosphere reserve

17. Lamarck's "Theory of Organic Evolution" is based upon.
A) effect of environment
B) use and disuse of body parts
C) inheritance of acquired characters
D) all of these
Answer: all of these

18. Myxoedema in adults is caused due to.
A) hyperthyrodism
B) deficiency of thyroid hormone
C) overproduction of PTH
D) deficiency of PTH
Answer: deficiency of thyroid hormone

19. "The animals of colder countries have small ears, short tail and limbs to avoid more loss of heat" is the theme of.
A) Allen's law
B) Dollo's law
C) Gause's law
D) Cope's Law
Answer: Allen's law

20. Testosterone is secreted by.
A) sertoli cells
B) leydig cells
C) spermatoepte
D) histiocyte
Answer: leydig cells

21. Changing from a bilaterally symmetrical larval form to a radially symmetrical adult involves relocation of various parts. In this process, the left side becomes the _____ and the right side becomes the _____.
A) aboral surface, oral surface
B) anterior surface, posterior surface
C) dorsal surface, ventral surface
D) oral surface, aboral surface
Answer: oral surface, aboral surface

22. The class name Myxini, or the hagfishes, refers to their.
A) lack of eyes
B) unique circulatory system
C) production of slime
D) parasitic lifestyle
Answer: production of slime

23. The earliest therians (mammals) evolved in the _____.
A) Permian
B) Triassic
C) Cretaceous
D) Cenozoic
Answer: Triassic

24. The development of limbs probably aided the first amphibians in.
A) finding mates
B) swimming
C) moving between bodies of water
D) none of these
Answer: moving between bodies of water

25. Which of the following is odd one?
A) cockroach, spider, silver-fish
B) whale, bat, lizard
C) star-fish, sea-cucumber, sea-urchin
D) cray-fish, cuttle-fish hag-fish
Answer: cray-fish, cuttle-fish hag-fish

26. ABO blood group system is due to.
A) multifactor inheritance

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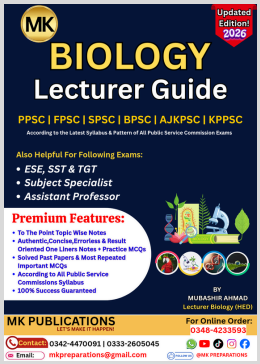

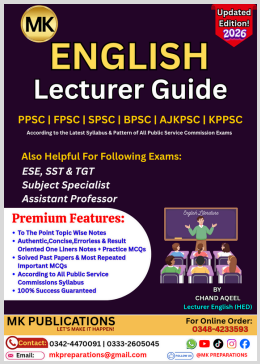

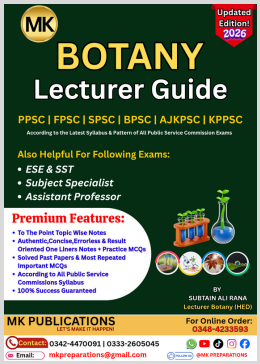

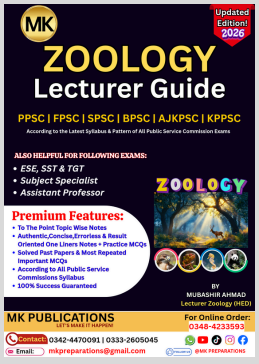

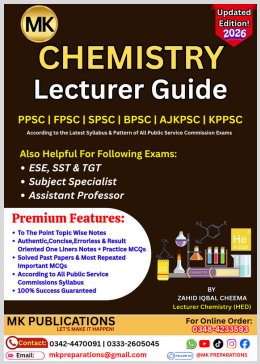

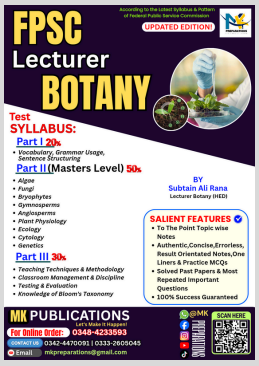

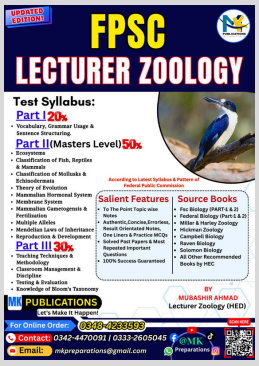

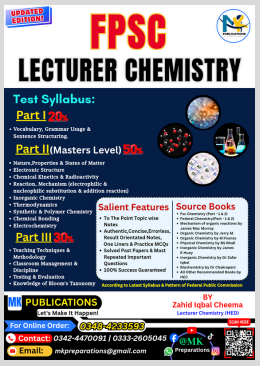

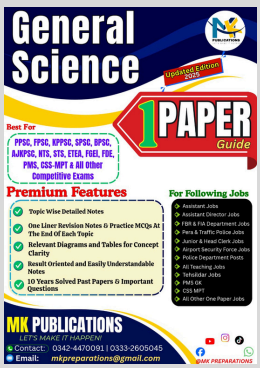

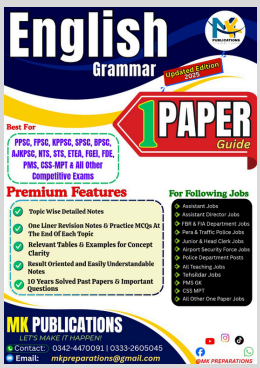

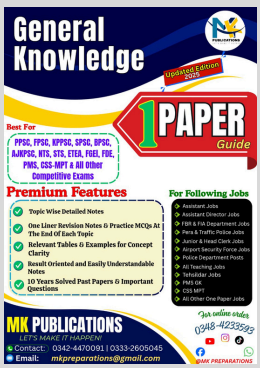

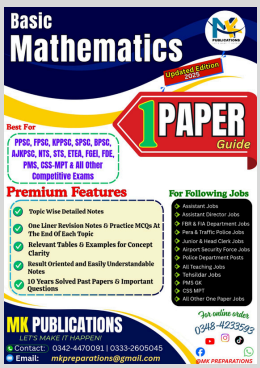

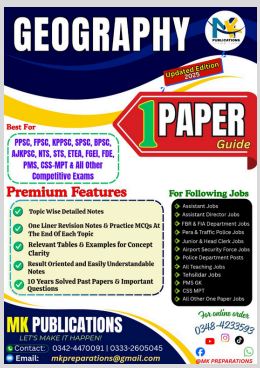

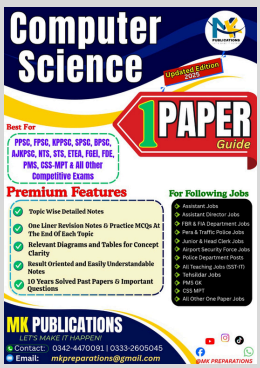

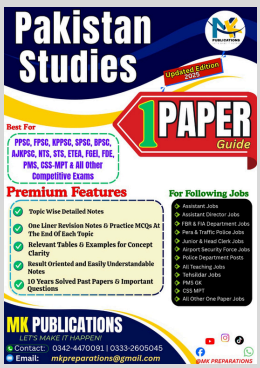

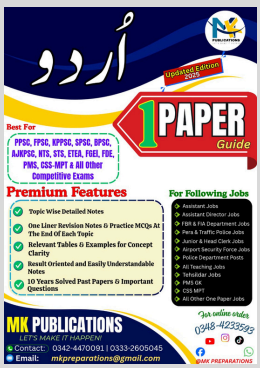

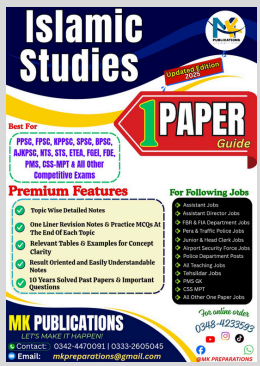

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