Unit 02 – Chemical and Cellular Basis of Life
MCQ

1.Which property of water mainly contributes to the stability of temperature in living systems?
A. High polarity
B. Cohesion between water molecules
C. High specific heat capacity
D. Density anomaly
E. Solvent ability

2.The unusual density behaviour of water is directly due to:
A. Dipole moment of water molecules
B. Formation of hydrogen bonds in liquid state
C. Expansion caused by covalent bonds
D. Tetrahedral arrangement in ice
E. Ionization of water

3.Which bond is responsible for maintaining the secondary structure of proteins?
A. Peptide bond
B. Disulfide bond
C. Hydrogen bond
D. Ionic bond
E. Glycosidic bond

4.Which carbohydrate is correctly matched with its biological role?
A. Cellulose – energy storage in plants
B. Starch – structural component of plant cell wall
C. Glycogen – energy storage in animals
D. Chitin – transport sugar in plants
E. Sucrose – storage polysaccharide in animals

5.The bond formed between two monosaccharides during condensation is known as a:
A. Ester bond
B. Peptide bond
C. Hydrogen bond
D. Glycosidic bond
E. Phosphodiester bond

6.Which lipid component contributes most to membrane fluidity at low temperatures?
A. Saturated fatty acids
B. Unsaturated fatty acids
C. Cholesterol
D. Phospholipid heads
E. Glycolipids

7.The hydrophobic nature of lipids is mainly due to:
A. Presence of ester bonds
B. Absence of hydrogen bonds
C. Long hydrocarbon chains
D. Carboxyl group
E. Phosphate group

8.Which statement regarding enzymes is CORRECT?
A. Enzymes increase the activation energy
B. Enzymes alter equilibrium constant

C. Enzymes are consumed during reactions
D. Enzymes are protein in nature
E. Enzymes work equally at all pH values

9.Enzyme specificity is primarily determined by:
A. Temperature
B. pH
C. Active site structure
D. Cofactors
E. Substrate concentration

10. Competitive inhibition reduces enzyme activity by:
A. Binding permanently to the enzyme
B. Changing enzyme's tertiary structure
C. Competing with substrate for active site
D. Removing cofactors
E. Denaturing the enzyme

11. Which factor does NOT affect enzyme activity?
A. Substrate concentration
B. Enzyme concentration
C. Temperature
D. Light intensity
E. pH
Correct answer: D

12. The basic structural unit of the cell membrane is:
A. Protein bilayer
B. Lipid monolayer
C. Phospholipid bilayer
D. Glycoprotein layer
E. Cellulose matrix

13. Which membrane component is mainly responsible for selective permeability?
A. Cholesterol
B. Phospholipids
C. Carbohydrates
D. Membrane proteins
E. Glycolipids

14. The fluid mosaic model explains:
A. Rigidity of cell membrane
B. Static nature of membrane proteins
C. Dynamic arrangement of lipids and proteins
D. Equal distribution of proteins
E. Absence of carbohydrates

15. Which organelle is directly involved in ATP synthesis?
A. Ribosome
B. Lysosome
C. Golgi apparatus
D. Mitochondrion
E. Endoplasmic reticulum

16. Cristae in mitochondria increase efficiency by:

A. Increasing matrix volume
B. Increasing surface area for enzymes
C. Storing ATP
D. Housing mitochondrial DNA
E. Reducing diffusion distance

17. Which organelle contains hydrolytic enzymes?
A. Peroxisome
B. Lysosome
C. Vacuole
D. Golgi apparatus
E. Mitochondrion

18. Ribosomes are mainly composed of:
A. DNA and protein
B. Lipid and protein
C. rRNA and protein
D. mRNA and enzymes
E. tRNA only

19. Which organelle provides turgor pressure in plant cells?
A. Lysosome
B. Vacuole
C. Ribosome
D. Golgi apparatus
E. Peroxisome

20. The middle lamella of plant cells is mainly composed of:
A. Cellulose
B. Hemicellulose
C. Pectin
D. Lignin
E. Chitin

21Which cell organelle modifies and packages proteins?
A. Rough ER
B. Smooth ER
C. Golgi apparatus
D. Lysosome
E. Ribosome

22. Smooth endoplasmic reticulum is mainly involved in:
A. Protein synthesis
B. Lipid synthesis
C. ATP production
D. Photosynthesis
E. DNA replication

23. Which component gives rigidity to the plant cell wall?
A. Pectin
B. Hemicellulose
C. Cellulose microfibrils
D. Glycoproteins
E. Lipids

24. Which bond links amino acids in a polypeptide chain?
A. Hydrogen bond
B. Glycosidic bond
C. Peptide bond
D. Ester bond
E. Disulfide bond

25. The quaternary structure of proteins refers to:
A. Sequence of amino acids
B. Folding of a single polypeptide
C. Association of multiple polypeptide chains
D. Presence of disulfide bonds
E. Hydrogen bonding only

26. Which statement best explains why water is an effective solvent for ionic compounds?
A. High density of water
B. High specific heat capacity
C. Polarity of water molecules
D. Hydrogen bonding between solute molecules
E. Cohesion between water molecules

27. Which interaction stabilizes the tertiary structure of a protein MOST strongly?
A. Hydrogen bonds
B. Peptide bonds
C. Disulfide bonds
D. Glycosidic bonds
E. Phosphodiester bonds

28. Which polysaccharide is branched?
A. Amylose
B. Cellulose
C. Amylopectin
D. Pectin
E. Inulin

29. Which carbohydrate is a component of nucleotides?
A. Glucose
B. Ribose
C. Galactose
D. Fructose
E. Inulin

30. Which molecule provides the greatest amount of energy per gram when metabolised?
A. Carbohydrates
B. Proteins
C. Lipids
D. Nucleic acids
E. Vitamins

31. The ester bond in lipids is formed between:
A. Fatty acid and fatty acid
B. Glycerol and glycerol
C. Glycerol and fatty acid
D. Fatty acid and phosphate
E. Phosphate and nitrogenous base

32. Which factor would MOST likely denature an enzyme?
A. Increase in substrate concentration
B. Decrease in enzyme concentration
C. Extreme change in pH
D. Presence of competitive inhibitor
E. Presence of cofactor

33. At very high substrate concentrations, the rate of an enzyme-catalysed reaction becomes constant because:
A. Substrate is limiting
B. Enzyme is denatured
C. Active sites are saturated
D. Product inhibits the enzyme
E. Temperature becomes limiting

34. Which enzyme component is essential for enzyme activity but is NOT a protein?
A. Active site
B. Apoenzyme
C. Cofactor
D. Peptide chain
E. Substrate

35. Which membrane transport mechanism requires ATP?
A. Diffusion
B. Facilitated diffusion
C. Osmosis
D. Active transport
E. Mass flow

36. The net movement of water molecules through a selectively permeable membrane is called:
A. Diffusion
B. Active transport
C. Osmosis
D. Plasmolysis
E. Imbibition

37. Which organelle is bounded by a double membrane and contains its own DNA?
A. Golgi apparatus
B. Ribosome
C. Lysosome
D. Mitochondrion
E. Endoplasmic reticulum

38. Which organelle is mainly involved in detoxification of harmful substances?
A. Rough ER
B. Smooth ER
C. Golgi apparatus
D. Lysosome
E. Ribosome

39. Which organelle is abundant in cells actively secreting proteins?
A. Smooth ER
B. Mitochondria
C. Lysosomes

D. Rough ER
E. Peroxisomes

40. Which cellular structure is directly responsible for intracellular digestion?
A. Peroxisome
B. Lysosome
C. Vacuole
D. Ribosome
E. Golgi vesicle

41. Which structure connects adjacent plant cells?
A. Plasmodesmata
B. Tight junctions
C. Desmosomes
D. Gap junctions
E. Middle lamella only

42. The primary cell wall is mainly composed of:
A. Lignin and cellulose
B. Pectin and lignin
C. Cellulose, hemicellulose and pectin
D. Chitin and cellulose
E. Suberin and lignin

43. Which type of bond links nucleotides in a nucleic acid chain?
A. Glycosidic bond
B. Hydrogen bond
C. Peptide bond
D. Phosphodiester bond
E. Ester bond

44. Which cellular component is non-membranous?
A. Golgi apparatus
B. Lysosome
C. Mitochondrion
D. Ribosome
E. Endoplasmic reticulum

45. Which statement regarding vacuoles in plant cells is CORRECT?
A. They are absent in mature plant cells
B. They contain digestive enzymes only
C. They help maintain turgor pressure
D. They are surrounded by double membranes
E. They synthesize proteins

46. Which property of water allows it to move upward in narrow xylem vessels?
A. High specific heat
B. Density anomaly
C. Cohesion and adhesion
D. Solvent property
E. High latent heat of vaporisation

47. Hydrogen bonds in water are formed between:
A. Hydrogen atoms of adjacent molecules
B. Oxygen atoms of adjacent molecules

C. Hydrogen of one molecule and oxygen of another
D. Covalent bonds within water molecule
E. Ionized hydrogen and hydroxyl ions

48. Buffers in biological systems function mainly by:
A. Preventing ion formation
B. Maintaining constant temperature
C. Resisting sudden pH changes
D. Neutralising all acids
E. Removing hydrogen ions completely

49. Which type of carbohydrate is glucose?
A. Disaccharide
B. Polysaccharide
C. Pentose sugar
D. Hexose monosaccharide
E. Ketose only

50.
Which carbohydrate is NOT a reducing sugar?
A. Glucose
B. Fructose
C. Maltose
D. Lactose
E. Sucrose

51. Which lipid is a major component of cell membranes?
A. Triglyceride
B. Steroid
C. Wax
D. Phospholipid
E. Fatty acid

52. Which fatty acid would increase membrane fluidity the MOST?
A. Long-chain saturated fatty acid
B. Short-chain saturated fatty acid
C. Long-chain unsaturated fatty acid
D. Short-chain unsaturated fatty acid
E. Steroid fatty acid

53. Which element is present in proteins but absent in carbohydrates and lipids?
A. Carbon
B. Hydrogen
C. Oxygen
D. Nitrogen
E. Phosphorus

54. The primary structure of a protein refers to:
A. Hydrogen bonding between chains
B. Folding into α-helix or β-sheet
C. Sequence of amino acids
D. Interaction between subunits
E. Presence of disulfide bridges

55. Which level of protein structure is MOST affected by denaturation?

A. Primary structure
B. Secondary structure
C. Tertiary structure
D. Quaternary structure
E. Peptide bonding

56. Which bond stabilises α-helices in proteins?
A. Peptide bonds
B. Disulphide bonds
C. Ionic bonds
D. Hydrogen bonds
E. Ester bonds

57. Which statement about enzymes is CORRECT?
A. They are used up during reactions
B. They change reaction equilibrium
C. They lower activation energy
D. They work at any temperature
E. They are always inorganic

58. Which graph correctly represents enzyme activity vs. temperature?
A. Straight increasing line
B. Straight decreasing line
C. Asymmetrical Bell-shaped curve
D. Stepwise increase
E. Symmetrical Bell-shaped curve

59. Non-competitive inhibitors reduce enzyme activity by:
A. Competing with substrate for active site
B. Binding to active site permanently
C. Changing enzyme shape
D. Increasing substrate affinity
E. Removing substrate

60. Which factor affects BOTH enzyme activity and membrane fluidity?
A. Light
B. pH
C. Temperature
D. Pressure
E. Concentration

61. Which component of the cell membrane faces the extracellular environment?
A. Fatty acid tails
B. Phospholipid heads
C. Cholesterol molecules
D. Integral protein cores
E. Cytoskeletal filaments

62. Which membrane protein allows passive movement of ions?
A. Carrier protein (active)
B. Channel protein
C. Receptor protein
D. Enzyme protein
E. Glycoprotein

63. Facilitated diffusion differs from simple diffusion because it:
A. Requires ATP
B. Moves against gradient
C. Uses membrane proteins
D. Is slower
E. Occurs only in plants

64. Which cellular feature is common to both prokaryotic and eukaryotic cells?
A. Mitochondria
B. Endoplasmic reticulum
C. Nucleus
D. Ribosomes
E. Golgi apparatus

65. Which organelle contains enzymes for hydrogen peroxide metabolism?
A. Lysosome
B. Peroxisome
C. Golgi apparatus
D. Mitochondrion
E. Vacuole

66. Which property of water allows organisms to survive sudden environmental temperature changes?
A. Density anomaly
B. High latent heat of vaporisation
C. High specific heat capacity
D. Cohesion
E. Adhesion

67. Which ion concentration change directly affects cellular pH?
A. Na^+
B. K^+
C. Ca^{2+}
D. H^+
E. Cl^-

68. Which carbohydrate serves as the main transport sugar in plants?
A. Glucose
B. Fructose
C. Maltose
D. Sucrose
E. Cellulose

69. Which polysaccharide is highly branched, allowing rapid release of glucose?
A. Cellulose
B. Starch
C. Amylose
D. Glycogen
E. Chitin

70. Which lipid is NOT mainly used for energy storage?
A. Triglyceride
B. Phospholipid
C. Fat
D. Oil
E. Neutral lipid

71. Which statement correctly compares saturated and unsaturated fatty acids?
A. Saturated fatty acids contain double bonds
B. Unsaturated fatty acids are straight-chained
C. Saturated fatty acids pack more closely
D. Unsaturated fatty acids increase melting point
E. Saturated fatty acids increase membrane fluidity

72. Which feature is common to both mitochondria and chloroplasts?
A. Presence of cristae
B. Thylakoids
C. Double membrane
D. Cellulose covering
E. Lysosomal enzymes

73. Which organelle is absent in mature mammalian red blood cells?
A. Ribosomes
B. Nucleus
C. Plasma membrane
D. Cytoplasm
E. Cytoskeleton

74. Which structure is responsible for protein synthesis in the cytoplasm?
A. Rough ER
B. Free ribosome
C. Golgi apparatus
D. Smooth ER
E. Vacuole

75. Proteins synthesised on rough ER are MOST likely to be:
A. Cytosolic enzymes
B. Nuclear proteins
C. Secretory proteins
D. Mitochondrial proteins
E. Ribosomal proteins

76. Which organelle modifies proteins by glycosylation?
A. Ribosome
B. Rough ER
C. Golgi apparatus
D. Smooth ER
E. Lysosome

77. Which vesicle transports enzymes for intracellular digestion?
A. Secretory vesicle
B. Transport vesicle
C. Lysosome
D. Peroxisome
E. Endosome

78. Which cellular structure maintains plant cell turgidity?
A. Cell wall
B. Vacuole
C. Plasma membrane

D. Cytoskeleton
E. Middle lamella

79. Which membrane transport process moves substances AGAINST their concentration gradient?
A. Simple diffusion
B. Facilitated diffusion
C. Osmosis
D. Active transport
E. Mass flow

80. Which structure separates the vacuole from the cytoplasm?
A. Plasma membrane
B. Cell wall
C. Tonoplast
D. Middle lamella
E. Nuclear membrane

81. Which plant cell structure allows direct cytoplasmic continuity?
A. Cell wall
B. Tonoplast
C. Plasmodesmata
D. Middle lamella
E. Cuticle

82. Which statement about lysosomes is CORRECT?
A. Present in all plant cells
B. Have double membranes
C. Contain hydrolytic enzymes
D. Carry out photosynthesis
E. Synthesize proteins

83. Which organelle plays a major role in spindle formation during cell division?
A. Ribosome
B. Golgi apparatus
C. Centriole
D. Lysosome
E. Vacuole

84. Which cellular structure is present in plant cells but absent in animal cells?
A. Mitochondria
B. Ribosomes
C. Chloroplast
D. Golgi apparatus
E. Endoplasmic reticulum

85. Which statement correctly describes the middle lamella?
A. Made of cellulose
B. Made of lignin
C. Rich in pectin
D. Rich in proteins
E. Rich in lipids

86. Which factor MOST directly determines the rate of diffusion across a membrane?
A. Shape of the cell
B. Thickness of the membrane

C. Concentration gradient
D. Presence of nucleus
E. Size of vacuole

87. Which statement best explains why membranes are described as “fluid”?
A. Proteins dissolve in lipids
B. Lipids are permanently fixed
C. Components can move laterally
D. Membranes are fully permeable
E. Carbohydrates float freely

88.ATP is classified as a:
A. Lipid
B. Protein
C. Nucleotide
D. Polysaccharide
E. Enzyme

89. The energy in ATP is mainly stored in:
A. Adenine base
B. Ribose sugar
C. Hydrogen bonds
D. High-energy phosphate bonds
E. Glycosidic bonds

90. Which process in cells is the MAIN source of ATP?
A. Photosynthesis only
B. Diffusion
C. Cellular respiration
D. Osmosis
E. Active transport

91.ATP synthesis in eukaryotic cells mainly occurs in the:
A. Cytoplasm
B. Nucleus
C. Ribosome
D. Mitochondrion
E. Golgi apparatus

92. Which structure of mitochondria provides a large surface area for ATP synthesis?
A. Matrix
B. Outer membrane
C. Inner membrane
D. Cristae
E. Intermembrane space

93. Which molecule acts as the immediate energy currency of the cell?
A. Glucose
B. Glycogen
C. ATP
D. NADP
E. ADP

94. Which compound is produced during cellular respiration AND used in photosynthesis?

A. Oxygen
B. Carbon dioxide
C. ATP
D. Glucose
E. Water

95. Which organelle is responsible for photosynthesis?
A. Mitochondrion
B. Ribosome
C. Chloroplast
D. Golgi apparatus
E. Peroxisome

96. Which pigment primarily absorbs light energy in photosynthesis?
A. Carotene
B. Xanthophyll
C. Chlorophyll a
D. Chlorophyll b
E. Anthocyanin

97. Light-dependent reactions of photosynthesis mainly occur in the:
A. Stroma
B. Outer membrane
C. Matrix
D. Thylakoid membranes
E. Cytoplasm

98. Which energy-rich molecule is produced during the light reactions?
A. Glucose
B. ATP
C. CO_2
D. Ribose
E. Pyruvate

99. Which structure is common to both photosynthesis and respiration in terms of ATP synthesis?
A. Cristae
B. Matrix
C. Thylakoid membrane
D. Inner membrane system
E. Cell wall

100. Which process directly requires enzymes?
A. Diffusion
B. Osmosis
C. All metabolic reactions
D. Active transport only
E. Simple diffusion

101. Which enzyme property allows repeated use in metabolic reactions?
A. Large molecular size
B. Being consumed in reactions
C. Remaining unchanged after reaction
D. Acting at high temperatures only
E. Being substrate-specific

102. Which molecule supplies energy for active transport across membranes?
A. Glucose
B. ADP
C. ATP
D. NADP
E. Oxygen

103. Which cellular process is MOST directly dependent on ATP?
A. Diffusion
B. Osmosis
C. Active transport
D. Facilitated diffusion
E. Plasmolysis

104. During cell division, DNA replication occurs to ensure:
A. Increase in cytoplasm
B. Equal genetic material distribution
C. Increase in cell size
D. ATP synthesis
E. Protein production

105. Which molecule acts as a template during DNA replication?
A. RNA
B. Protein
C. DNA
D. ATP
E. Ribosome

106.DNA replication requires enzymes mainly to:
A. Store genetic information
B. Provide energy
C. Catalyse bond formation
D. Absorb light
E. Transport DNA

107. Which type of bond is formed during DNA replication?
A. Hydrogen bond only
B. Glycosidic bond
C. Peptide bond
D. Phosphodiester bond
E. Disulfide bond

108. Which cellular condition would MOST reduce enzyme activity during respiration?
A. High substrate concentration
B. Optimal temperature
C. Extreme pH change
D. Presence of cofactors
E. Increased enzyme concentration

109. Which molecule links photosynthesis and respiration energetically?
A. Oxygen
B. Carbon dioxide
C. ATP
D. Water
E. Chlorophyll

110. Which process converts light energy into chemical energy?
A. Respiration
B. Transpiration
C. Photosynthesis
D. Diffusion
E. Active transport

111. Which organelle supplies ATP for cell division?
A. Ribosome
B. Lysosome
C. Golgi apparatus
D. Mitochondrion
E. Vacuole

112. Which statement BEST summarizes the role of enzymes in metabolism?
A. They provide energy
B. They increase reaction equilibrium
C. They speed up biochemical reactions
D. They are consumed during reactions
E. They work without specificity

113.A nucleotide is composed of:
A. Nitrogenous base and sugar only
B. Sugar and phosphate only
C. Nitrogenous base, sugar, and phosphate
D. Amino acid and phosphate
E. Lipid and sugar

114. Which sugar is present in DNA?
A. Ribose
B. Deoxyribose
C. Fructose
D. Glucose
E. Galactose

115. Which nitrogenous base is present in RNA but absent in DNA?
A. Adenine
B. Guanine
C. Cytosine
D. Thymine
E. Uracil

116. Which bond links the sugar and phosphate groups in a DNA strand?
A. Hydrogen bond
B. Glycosidic bond
C. Peptide bond
D. Phosphodiester bond
E. Disulfide bond

117. Hydrogen bonds in DNA are formed between:
A. Sugar and phosphate
B. Adjacent nucleotides
C. Complementary nitrogenous bases

D. Phosphate groups only
E. Ribose sugars

118. Which base pairing is CORRECT in DNA?
A. A–G
B. A–C
C. T–G
D. A–T
E. C–T

119. Which feature gives DNA its structural stability?
A. Glycosidic bonds
B. Hydrogen bonds only
C. Double-stranded structure
D. Phosphodiester backbone
E. Combination of C and D

120.RNA differs from DNA because RNA:
A. Is double-stranded
B. Contains deoxyribose
C. Contains thymine
D. Is usually single-stranded
E. Cannot carry information

121. Which molecule stores genetic information?
A. Protein
B. RNA
C. DNA
D. ATP
E. Enzyme

122. During DNA replication, complementary base pairing ensures:
A. Increased ATP production
B. Protein synthesis
C. Accurate genetic copying
D. Enzyme activation
E. Cell growth

123. Which enzyme property is MOST important for DNA replication?
A. Ability to provide energy
B. Specificity for substrate
C. Sensitivity to light
D. High molecular weight
E. Being inorganic

124. Which statement BEST links enzymes and ATP?
A. Enzymes are a source of ATP
B. ATP acts as an enzyme
C. ATP supplies energy for enzyme-catalysed reactions
D. Enzymes destroy ATP
E. ATP replaces enzymes

125. Which cellular process requires both enzymes and ATP?
A. Simple diffusion
B. Osmosis

C. Active transport
D. Passive diffusion
E. Imbibition

126. Which cellular structure ensures controlled internal environment?
A. Cell wall
B. Plasma membrane
C. Cytoplasm
D. Nucleus
E. Vacuole

127. Which membrane component acts as receptors for chemical signals?
A. Phospholipids
B. Cholesterol
C. Carbohydrates attached to proteins
D. Fatty acid tails
E. Glycolipids only

128. Which structure is directly involved in cell communication in plants?
A. Middle lamella
B. Cell wall
C. Tonoplast
D. Plasmodesmata
E. Cuticle

129. Which organelle coordinates cell activities by controlling gene expression?
A. Ribosome
B. Mitochondrion
C. Nucleus
D. Golgi apparatus
E. Lysosome

130. Which comparison between prokaryotic and eukaryotic cells is CORRECT?
A. Prokaryotes have mitochondria
B. Eukaryotes lack ribosomes
C. Prokaryotes lack membrane-bound organelles
D. Eukaryotes lack DNA
E. Prokaryotes have nuclear membrane

131. Which factor would MOST disrupt metabolic balance in a cell?
A. Minor temperature fluctuation
B. Stable pH
C. Enzyme denaturation
D. Adequate ATP supply
E. Proper membrane structure

132. Which factor is ESSENTIAL for continuity of life at the cellular level?
A. Constant temperature only
B. Availability of enzymes
C. Accurate replication of DNA
D. Presence of water only
E. Presence of oxygen