

**BIO · BIOLOGY**

02. Biomolecules

Official PMDC Solved Past Paper Topical Booklet · High-Yield Examination Series

🕒 142 Solved Questions

📅 2014 to 2024 Archive

🏛️ Boards: BUMHS, DUHS, KMU, MDCAT, NUMS, PMDC

📊 Weightage: 34% of MDCAT (68 MCQs)

Curated by Ibrahim for fellow bees. Every question in this chapter has been verified against official UHS, NUMS, SZABMU, DUHS, and KMU answer keys. Propolis cognitive autopsies are provided at the end of this booklet to explain core concepts and break down common distractor traps.

OFFICIAL SOLVED EDITION**Q1.**

UHS 2024

What is the percentage of H_2O in bone cells? [UHS-2024]

- (A) 70%
- (B) 20%
- (C) 99%
- (D) 60%

Q2.

SZABMU 2024

At 25 degrees Celsius, the concentration of each of H^+ and OH^- ions in pure water is about ____ moles per liter. [SZABMU-2024]

- (A) 10^{-6}
- (B) 10^{-7}
- (C) 10^{-12}
- (D) 10^{-14}

Q3.

SZABMU 2024

Which property of water helps to maintain the integrity of lipid bilayer membranes? [SZABMU-2024-Reconduct]

- (A) Specific heat capacity
- (B) Hydrogen bonding
- (C) Cohesion and adhesion
- (D) Hydrophobic exclusion

Q4.

UHS 2024

Mono-saccharides have a general formula represented by: [UHS-2024]

- (A) $C_n(H_2O)_n$
- (B) $C_n(H_2O)_{n-1}$
- (C) $C_6(H_2O)_6$
- (D) $C_n(H_2O)_{2n}$

Q5.

UHS 2024

Polysaccharides in plants are synthesized by the process of: [UHS-2024]

- (A) Hydrolysis
- (B) Oxidation
- (C) Condensation
- (D) Glycolysis

Q6.

UHS 2024

Which monosaccharide will form a gluco pyranose ring in solution? [UHS-2024]

- (A) Fructose
- (B) Glucose
- (C) Ribose
- (D) Deoxyribose

Q7.

KMU 2024

Sugarcane contains: [KMU-2024]

- (A) Fructose
- (B) Glucose
- (C) Ribose
- (D) Sucrose

Q8.

SZABMU 2024

Which of the following monosaccharides is an aldehyde-hexose sugar? [SZABMU-2024]

- (A) Ribose
- (B) Galactose
- (C) Maltose
- (D) Fructose

Q9.

SZABMU 2024

Which of the following carbohydrates gives dark brown colour with iodine solution? [SZABMU-2024]

- (A) Starch
- (B) Glycogen
- (C) Sucrose
- (D) Glucose

Q10.

NUMS 2024

Less reactivity of sucrose is due to its: [NUMS-2024]

- (A) High solubility in water
- (B) Polar nature
- (C) Unavailability of functional group
- (D) 1-2 glycosidic linkage

Q11.

NUMS 2024

Sucrose is used as a transport carbohydrate instead of glucose because: [NUMS-2024]

- (A) It is disaccharide
- (B) It is non-reducing sugar
- (C) It is soluble in water
- (D) It does not change osmotic potential of water

Q12.

SZABMU 2024

Percentage of glucose normally in human body is: [SZABMU-2024-Reconduct]

- (A) 8%
- (B) 1.8%
- (C) 0.8%
- (D) 0.08%

Q13.

SZABMU 2024

Polysaccharide found most commonly in grains and seeds is: [SZABMU-2024-Reconduct]

- (A) Starch
- (B) Glycogen
- (C) Pectin
- (D) Dextrin

Q14.

SZABMU 2024

Glycogen is most abundant in: [SZABMU-2024-Reconduct]

- (A) Brain cells
- (B) Liver cells
- (C) Adipose cells
- (D) Smooth muscle cells

Q15.

SZABMU 2024

Stereoisomers are molecules containing atoms are: [SZABMU-2024-Reconduct]

- (A) Same and bonded identically
- (B) Same and bonded dependently
- (C) Dependent and bonded identically
- (D) Dependent and bonded same

Q16.

UHS 2024

Which of the following process is involved in breakdown of protein into Amino acids? [UHS-2024]

- (A) Condensation
- (B) Hydrolysis
- (C) Glycolysis
- (D) Fixation

Q17.

KMU 2024

Sickle cell anaemia results from: [KMU-2024]

- (A) Reduction in oxygen carrying capacity of haemoglobin
- (B) Linkage between the polypeptide chains
- (C) Single amino acid substitution in the haemoglobin molecule
- (D) Viral infections of RNA viruses

Q18.

KMU 2024

Which is incorrect about the globular proteins? [KMU-2024]

- (A) Abundantly found in hair
- (B) Are spherical in shape
- (C) Have polypeptide chains
- (D) Soluble in water

Q19.

SZABMU 2024

The bond between hydroxyl group of carboxylic group of one amino acid and hydrogen of amino group of second amino acid with release of water molecule is called? [SZABMU-2024]

- (A) Glycosidic bond
- (B) Peptide bond
- (C) Hydrogen bond
- (D) Disulfide bridge

Q20.

SZABMU 2024

Which of the following does not have a quaternary structure? [SZABMU-2024]

- (A) Antibodies
- (B) Hemoglobin
- (C) DNA polymerase III
- (D) Myoglobin

Q21.

NUMS 2024

Protein with tertiary structures are helpful in: [NUMS-2024]

- (A) Carrying messages from glands to target organs
- (B) Maintaining epithelial lining of skin
- (C) Maintaining the matrix of connective tissues
- (D) Helping muscle contraction

Q22.

NUMS 2024

Rebounding is process of straightening the curly hairs, which bond is targeted by oxidizing agents used during the process? [NUMS-2024]

- (A) Peptide Bond
- (B) Ionic bond
- (C) Disulphide bridge
- (D) Hydrogen bond

Q23.

SZABMU 2024

Number of amino acids in each alpha chain of hemoglobin is: [SZABMU-2024-Reconduct]

- (A) 141
- (B) 146
- (C) 414
- (D) 416

Q24.

SZABMU 2024

Two amino acids form a dipeptide through: [SZABMU-2024-Reconduct]

- (A) Condensation reaction
- (B) Hydrolysis
- (C) Ionic bond formation
- (D) Hydrogen bonding

Q25.

SZABMU 2024

The protein present in blood plasma and involved in blood clotting is: [SZABMU-2024-Reconduct]

- (A) Hormones
- (B) Fibrinogen
- (C) Antibodies
- (D) Enzymes

Q26.

UHS 2024

When glycerol reacts with fatty acid, which type of chemical bond will form? [UHS-2024]

- (A) Ester Bond
- (B) Ether Linkage
- (C) Hydrogen Bond
- (D) Ionic Bond

Q27.

UHS 2024

The hydrophilic end of phospholipid molecule is polar because of the presence of: [UHS-2024]

- (A) Glycerol
- (B) Amine group
- (C) Fatty Acid
- (D) Phosphate group

Q28.

KMU 2024

What is the ester of fatty acids and long chain alcohol called? [KMU-2024]

- (A) Acylglycerol
- (B) Glycerol
- (C) Phospholipid
- (D) Wax

Q29.

KMU 2024

Lipids, which do not contain fatty acid are: [KMU-2024]

- (A) Neutral lipids
- (B) Phosphatidic acids
- (C) Steroids
- (D) Waxes

Q30.

SZABMU 2024

Which of the following is a basic component of lipid bilayer of plasma membrane? [SZABMU-2024]

- (A) Acylglycerol
- (B) Lecithin
- (C) Triglyceride
- (D) Waxes

Q31.

SZABMU 2024

Which fatty acid would have the highest melting point? [SZABMU-2024-Reconduct]

- (A) Oleic acid
- (B) Lauric acid
- (C) Palmitic acid
- (D) Stearic acid

Q32.

SZABMU 2024

Lipids that protect plants from water loss are:
[SZABMU-2024-Reconduct]

- (A) Phospholipids
- (B) Waxes
- (C) Terpenoid
- (D) Triglyceride

Q33.

SZABMU 2024

Which of the following is found in both messenger RNA and DNA of a mammalian cell? [SZABMU-2024-Reconduct]

- (A) Double helical structure
- (B) Ribose sugar
- (C) Thymine
- (D) Sugar phosphate backbone

Q34.

SZABMU 2024

Transcription is the process in which an RNA copy of the DNA sequence and coding the gene is produced with the help of an enzyme called: [SZABMU-2024-Reconduct]

- (A) DNA polymerase
- (B) RNA dependent DNA polymerase
- (C) RNA polymerase
- (D) RNA transcriptase

Q35.

NUMS 2024

Nucleoproteins are involved in: [NUMS-2024]

- (A) Cell to cell recognition
- (B) Passing hereditary information to next generation
- (C) Ensuring fast speed of nerve impulse
- (D) Acting as a surface marker

Q36.

UHS 2023

Energy is _____ by the breakdown of complex molecules into simpler ones, such reactions are called catabolic reactions. [UHS-2023]

- (A) Produced
- (B) Released
- (C) Consumed
- (D) Destroyed

Q37.

SZABMU 2023

Second most abundant bio element in human body is:
[SZABMU-2023]

- (A) Nitrogen
- (B) Hydrogen
- (C) Oxygen
- (D) Carbon

Q38.

KMU 2023

Which of the following is opposite of condensation reaction? [ETEA-2023 Retake]

- (A) Decarboxylation
- (B) Hydration
- (C) Hydrolysis
- (D) Dehydration

Q39.

UHS 2023

_____ forms almost three-fourth of the body by weight. [UHS-2023]

- (A) Protein
- (B) Water
- (C) Carbohydrates
- (D) Lipids

Q40.

NUMS 2023

Thermal stability of organisms in the environment is because of which characteristics of water? [NUMS-2023]

- (A) Solvent property
- (B) Ionization
- (C) Heat capacity
- (D) Protection

Q41.

UHS 2023

Biologically, _____ plays key roles in maintaining the integrity of lipid bilayer membranes. [UHS-2023]

- (A) Hydrophilic exclusion
- (B) Heat of vaporization
- (C) Hydrophobic exclusion
- (D) Specific heat capacity

Q42.

UHS 2023

The specific heat of vaporization of water plays an important role in the regulation of heat produced by _____. [UHS-2023]

- (A) Reduction
- (B) Redox
- (C) Oxidation
- (D) None of above

Q43.

UHS 2023

Which type of bond must be broken for water to vaporize? [UHS–2023]

- (A) Nonpolar covalent bonds
- (B) Hydrogen bonds
- (C) Polar covalent bonds
- (D) Covalent bonds

Q44.

KMU 2023

All are the properties of water excluding: [ETEA–2023 Retake]

- (A) Universal solvent
- (B) Polar nature
- (C) Becomes dense when it freezes
- (D) Hydrogen bonding

Q45.

KMU 2023

_____ is the heat required to convert a gram of water into vapors at its boiling point. [ETEA–2023 Retake]

- (A) Specific heat capacity
- (B) Heat of ionization
- (C) Polarity of water
- (D) Heat of vaporization

Q46.

UHS 2023

Which statement is true regarding both starch and cellulose? [UHS–2023]

- (A) They are geometric isomers of each other
- (B) They can both be digested by humans
- (C) They are both used for energy storage in plants
- (D) They are both polymers of glucose

Q47.

NUMS 2023

These carbohydrates are sweetest among all carbohydrates: [NUMS–2023]

- (A) Disaccharides
- (B) Monosaccharides
- (C) Oligosaccharides
- (D) Polysaccharides

Q48.

UHS 2023

Most of the monosaccharides form a ring structure when in solution. For example ribose will form a five cornered ring known as _____. [UHS–2023]

- (A) Ribofuranose
- (B) Glucopyranose
- (C) Glyceraldehyde
- (D) Acetaldehyde

Q49.

KMU 2023

Lactose is composed of: [ETEA–2023]

- (A) Glucose + Fructose
- (B) Glucose + Galactose
- (C) Glucose + Glucose
- (D) Fructose + Glucose

Q50.

KMU 2023

Glucose is classified as a _____. [ETEA–2023 Retake]

- (A) Disaccharides
- (B) Monosaccharides
- (C) Polysaccharides
- (D) Oligosaccharides

Q51.

KMU 2023

Sucrose is hydrolyzed into: [ETEA–2023 Retake]

- (A) Lactose and glucose
- (B) Lactose and fructose
- (C) Glucose and galactose
- (D) Glucose and fructose

Q52.

SZABMU 2023

Which of the following process is involved in decomposition of protein into amino acids? [SZABMU–2023]

- (A) Condensation
- (B) Glycolysis
- (C) Hydrolysis
- (D) Fixation

Q53.

NUMS 2023

Which of the following protein establishes the matrix of bone & cartilage? [NUMS–2023]

- (A) Elastin
- (B) Collagen
- (C) Keratin
- (D) Histone

Q54.

NUMS 2023

Most abundant organic compound in mammalian cells are: [NUMS–2023]

- (A) Lipids
- (B) Water
- (C) Proteins
- (D) Carbohydrates

Q55.

SZABMU 2023

Select the protein providing support for the connective tissues: [SZABMU-2023]

- (A) Histones
- (B) Keratin
- (C) Collagen
- (D) Elastin

Q56.

SZABMU 2023

Fibrous proteins do not take part in: [SZABMU-2023]

- (A) Formation of nails
- (B) Blood clotting
- (C) Oxygen transport in blood
- (D) Muscle contraction

Q57.

KMU 2023

In sickle cell hemoglobin molecule, glutamic acid, is replaced by: [ETEA-2023]

- (A) Proline
- (B) Glutamine
- (C) Valine
- (D) Glycine

Q58.

KMU 2023

_____ is found in the exoskeleton of crabs. [ETEA-2023]

- (A) Cellulose
- (B) Murein
- (C) Chitin
- (D) Hemi-cellulose

Q59.

KMU 2023

Amino acids mainly differ from each other by the difference in their: [ETEA-2023]

- (A) Amino group
- (B) Carboxyl group
- (C) Hydrogen alpha carbon
- (D) R-group

Q60.

SZABMU 2023

Three hydrophobic fatty acid tails and a glycerol molecule join to form a: [SZABMU-2023]

- (A) Diglyceride
- (B) Phospholipid
- (C) Triglyceride
- (D) Monoglyceride

Q61.

KMU 2023

Choose the unsaturated fatty acid among the following: [ETEA-2023]

- (A) Palmitic acid
- (B) Arachidic acid
- (C) Stearic acid
- (D) Oleic acid

Q62.

NUMS 2023

C-H bonds in lipids are important: [NUMS-2023]

- (A) As insulating material
- (B) Providing more energy
- (C) As exoskeleton
- (D) As cuticle of leaves

Q63.

SZABMU 2023

The sugar which is part of ribonucleic acid is: [SZABMU-2023]

- (A) Ribulose
- (B) Ribose
- (C) Deoxyribulose
- (D) Deoxyribose

Q64.

KMU 2023

Purines are _____ nitrogenous bases. [ETEA-2023 Retake]

- (A) Double ringed
- (B) Single ringed
- (C) Double bond
- (D) Single bond

Q65.

UHS 2023

Cells of different types can be distinguished on the basis of surface. [UHS-2023]

- (A) Phospholipids
- (B) Globular proteins
- (C) Glycolipids and glycoprotein
- (D) Cholesterol

Q66.

SZABMU 2023

The basic structural framework of all types of membranes is: [SZABMU-2023]

- (A) Glycolipids
- (B) Glycoproteins
- (C) Lipoproteins
- (D) Nucleoproteins

Q67.

KMU 2023

The conjugated molecule that is primarily present in egg albumin is: [ETEA-2023]

- (A) Lipoprotein
- (B) Nucleoprotein
- (C) Glycolipid
- (D) Glycoprotein

Q68.

UHS 2022

Hydrolysis process is a reverse of ____ process. [UHS-2022]

- (A) Convection
- (B) Condensation
- (C) Photolysis
- (D) Deduction

Q69.

NUMS 2022

Hydrolysis is the breakdown of polymers into its monomers by the addition of: [NUMS-2022]

- (A) Nitrogen
- (B) Hydrogen
- (C) Hydroxyl group
- (D) Water

Q70.

KMU 2022

The four types of fundamental biological molecules present in protoplasm are carbohydrates, proteins, lipids and _____. [ETEA-2022]

- (A) Nucleic acids
- (B) Enzymes
- (C) Hormones
- (D) Alkaloids

Q71.

KMU 2022

The most abundant element present in human body is _____. [ETEA-2022]

- (A) Sulphur
- (B) Nitrogen
- (C) Carbon
- (D) Manganese

Q72.

UHS 2022

Human bone cells contain ____ % of water. [UHS-2022]

- (A) 20
- (B) 85
- (C) 40
- (D) 90

Q73.

NUMS 2022

Due to its high heat of vaporization, water plays important role in living organisms as: [NUMS-2022]

- (A) Thermal shock resistant
- (B) Being an excellent solvent
- (C) Membrane stabilizer
- (D) Cooling agent

Q74.

NUMS 2022

Which of the following molecules would yield glucose and fructose on hydrolysis? [NUMS-2022]

- (A) Maltose
- (B) Sucrose
- (C) Starch
- (D) Lactose

Q75.

SZABMU 2022

Which property of water enables it to act as temperature stabilizer in living organisms? [SZABMU-2022]

- (A) High heat of vaporization
- (B) High specific heat capacity
- (C) High polarity
- (D) Being non-polar

Q76.

BUMHS 2022

Which of the following is antagonistic to condensation? [BUMHS-2022]

- (A) Hydration
- (B) Decarboxylation
- (C) Hydrolysis
- (D) Dehydration

Q77.

DUHS 2022

Water is the most abundant compound in living organisms its amount varies from: [DUHS-2022]

- (A) 50% to 60%
- (B) 10% to 20%
- (C) 70% to 90%
- (D) 30% to 60%

Q78.

NUMS 2022

Which of the following is not a carbohydrate? [NUMS-2022]

- (A) Sucrose ($C_{12}H_{22}O_{11}$)
- (B) Lactic acid ($C_3H_6O_3$)
- (C) Glucose ($C_6H_{12}O_6$)
- (D) Rhamnose ($C_6H_{12}O_5$)

Q79.

UHS 2022

Upon initial hydrolysis, starch yields: [UHS-2022]

- (A) Maltose
- (B) Mannose
- (C) Sucrose
- (D) Glucose

Q80.

UHS 2022

Butyric acid is a ____ carbon fatty acid. [UHS-2022]

- (A) 6
- (B) 8
- (C) 4
- (D) 2

Q81.

SZABMU 2022

Which bond is the potential source of chemical energy for cellular activities? [SZABMU-2022]

- (A) C-R
- (B) C-N
- (C) C=O
- (D) C-H

Q82.

SZABMU 2022

Which of the following carbohydrates are the sweetest among all? [SZABMU-2022]

- (A) Monosaccharides
- (B) Polysaccharides
- (C) Oligosaccharides
- (D) Disaccharides

Q83.

KMU 2022

Ribose is a pentose sugar (5-carbon) that contains: [ETEA-2022]

- (A) Ketone group
- (B) Carboxyl group
- (C) Aldehyde group
- (D) Ester group

Q84.

BUMHS 2022

Diastase/amylase acts on: [BUMHS-2022]

- (A) Lactose
- (B) Starch
- (C) Sucrose
- (D) Maltose

Q85.

BUMHS 2022

Maltose is a: [BUMHS-2022]

- (A) Oligosaccharide
- (B) Monosaccharide
- (C) Disaccharide
- (D) Polysaccharide

Q86.

DUHS 2022

Synthesis of disaccharide by condensation two glucose joined by glycosidic linkage to form: [DUHS-2022]

- (A) Lactose
- (B) Fructose
- (C) Maltose
- (D) Galactose

Q87.

DUHS 2022

Molecules of amylose consists of unbranched chains of hundreds of glucose sub units, join together by: [DUHS-2022]

- (A) 1-3 glycosidic linkage
- (B) 1-2 glycosidic linkage
- (C) 1-4 glycosidic linkage
- (D) 2-3 glycosidic linkage

Q88.

UHS 2022

Unique three-dimensional shape of the fully folded polypeptide constitutes: [UHS-2022]

- (A) Primary structure of protein
- (B) Quaternary structure of protein
- (C) Secondary structure of protein
- (D) Tertiary structure of protein

Q89.

NUMS 2022

Which of the following molecules contains amino acid? [NUMS-2022]

- (A) Cellulose
- (B) Collagen
- (C) Sucrose
- (D) Ascorbic acid

Q90.

SZABMU 2022

Select an example of fibrous protein: [SZABMU-2022]

- (A) Enzymes
- (B) Collagen
- (C) Hemoglobin
- (D) Hormones

Q91.

SZABMU 2022

Which function is not performed by proteins?
[SZABMU-2022]

- (A) Providing structural support to cell
- (B) Catalyzing biochemical reactions
- (C) Transporting materials across cell membrane
- (D) Providing insulation against heat loss

Q92.

KMU 2022

Proteins are macromolecules formed of units known as amino acids. The amino acids in which the variable group (R) is represented by an H atom is: [ETEA-2022]

- (A) Lysine
- (B) Phenylalanine
- (C) Glycine
- (D) Alanine

Q93.

KMU 2022

Haemoglobin is a: [ETEA-2022]

- (A) Carbohydrate
- (B) Protein
- (C) Nucleic acid
- (D) Enzyme

Q94.

KMU 2022

The most common protein in nature is _____. [ETEA-2022]

- (A) Collagen
- (B) Rubisco
- (C) DNAase
- (D) Keratin

Q95.

KMU 2022

A haemoglobin molecule consists of ____ amino acids. [ETEA-2022]

- (A) 874
- (B) 474
- (C) 674
- (D) 574

Q96.

BUMHS 2022

Two simplest amino acids are: [BUMHS-2022]

- (A) Trypsin and glycine
- (B) Trypsin and alanine
- (C) Glycine and alanine
- (D) Glutamate and alanine

Q97.

BUMHS 2022

Which protein establishes the matrix of bone and cartilage? [BUMHS-2022]

- (A) Myoglobin
- (B) Hemoglobin
- (C) Fibrinogen
- (D) Collagen

Q98.

SZABMU 2022

Three hydrophobic fatty acid tails and a glycerol molecule join to form: [SZABMU-2022]

- (A) Monoglyceride
- (B) Diglyceride
- (C) Triglyceride
- (D) Phospholipid

Q99.

KMU 2022

The type of lipids which do not contain fatty acids are: [ETEA-2022]

- (A) Phospholipids
- (B) Waxes
- (C) Steroids
- (D) Acylglycerol

Q100.

KMU 2022

The glycerol is a ____ carbon compound. [ETEA-2022]

- (A) Four
- (B) Three
- (C) Five
- (D) Six

Q101.

BUMHS 2022

Which statement is wrong about saturated fats? [BUMHS-2022]

- (A) They have multiple double bonds in the carbon chains of their fatty acids
- (B) They are more common in animals than in plants
- (C) They contain more hydrogen than unsaturated fats having the same number of carbon atoms
- (D) They generally solidify at room temperature

Q102.

DUHS 2022

This lipid is most common abundant richest source of energy in plant, and animal body: [DUHS-2022]

- (A) Phospholipid
- (B) Carotenoids
- (C) Terpenoids
- (D) Acylglycerol

Q103.

UHS 2022

Which of the following is a conjugated molecule?
[UHS-2022]

- (A) Protein
- (B) Lipid
- (C) Glycoprotein
- (D) Vitamins

Q104.

PMDC 2020

Which property of water helps to maintain the integrity of lipid membranes? [PMC-2020]

- (A) Cohesion and adhesion
- (B) Specific heat capacity
- (C) Hydrogen bonding
- (D) Hydrophobic exclusion

Q105.

PMDC 2020

Water acts as universal solvent because of: [PMC-2020]

- (A) Hydrogen bonding
- (B) High polarity
- (C) Cohesion and adhesion
- (D) Heat of vaporization

Q106.

PMDC 2020

Monosaccharides have a general formula represented by: [PMC-2020]

- (A) $C(H_2O)_n$
- (B) $C_n(H_2O)_n$
- (C) $(CH_2O)_n$
- (D) $C_5(H_2O)_n$

Q107.

PMDC 2020

Lipids store double amount of energy as compared to carbohydrates because of: [PMC-2020]

- (A) High proportion of oxygen
- (B) Low proportion of carbon
- (C) High CO ratio
- (D) High proportion of CH

Q108.

MDCAT 2019

If water has high latent heat of vaporization, how this property of water could be helpful to plants and animals? [MDCAT-2019]

- (A) It will keep their temperature very high
- (B) With the release of large amount of water vapors, a small amount of heat loss can take place
- (C) With the release of small amount of water vapors, a great amount of heat loss can take place
- (D) No cooling effect with the release of even large amount of water vapors

Q109.

MDCAT 2019

Starch is present in tuber, fruits and grains but absent in animal cells. Instead, animals have a substance stored in liver and muscles known as: [MDCAT-2019]

- (A) Galactose
- (B) Glucagon
- (C) Glucose
- (D) Glycogen

Q110.

MDCAT 2019

The covalent bond or bridge between two monosaccharides to form a disaccharide is called a: [MDCAT-2019]

- (A) Hydroxyl bond
- (B) Hydrogen bond
- (C) Glycosidic bond
- (D) Carboxyl bond

Q111.

MDCAT 2019

Which is an example of a disaccharide? [MDCAT-2019]

- (A) Glycogen
- (B) Lactose
- (C) Starch
- (D) Fructose

Q112.

KMU 2019

_____ is stored in animal cells. [ETEA-2019]

- (A) Starch
- (B) Sucrose
- (C) Glycogen
- (D) Cellulose

Q113.

SZABMU 2019

Pure form of cellulose is: [AJK-2019]

- (A) Cellophane
- (B) Chitin
- (C) Cotton
- (D) Paper

Q114.

SZABMU 2019

 $C_5H_{10}O_5$ is the formula of _____. [AJK-2019]

- (A) DNA
- (B) Ribose sugar
- (C) ATP
- (D) RNA

Q115.

KMU 2019

Chitin is a: [ETEA-2019]

- (A) Lipoprotein
- (B) Phospholipid
- (C) Polysaccharide
- (D) Glycoprotein

Q116.

MDCAT 2019

Most proteins are made up of: [MDCAT-2019]

- (A) 20 types of amino acids
- (B) 170 types of amino acids
- (C) 16 types of amino acids
- (D) 10 types of amino acids

Q117.

MDCAT 2019

The structure of a fibrous protein comprises of polypeptide chains in the form of: [MDCAT-2019]

- (A) Flat uncoiled chains
- (B) Cluster
- (C) Long strands or fibrils
- (D) Spherical or curled up ball

Q118.

MDCAT 2019

In glycine, 'R' is _____. [MDCAT-2019]

- (A) Hydrogen
- (B) Methane
- (C) Ethane
- (D) Fatty acid

Q119.

SZABMU 2019

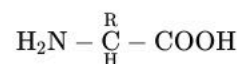
Which type of bonds is required to maintain the alpha helix configuration of a protein? [AJK-2019]

- (A) Disulfide bonds
- (B) Ionic bonds
- (C) Hydrogen bonds
- (D) Hydrophobic interactions

Q120.

NUMS 2019

The structure given below is the constituent part of:



[NUMS-2019]

- (A) Proteins
- (B) Lipids
- (C) Vitamins
- (D) Carbohydrates

Q121.

MDCAT 2019

Lipids contain double amount of energy as compared to the same amount of carbohydrates due to the presence of: [MDCAT-2019]

- (A) Lower proportion of C-H bonds
- (B) Higher proportion of C-O bonds
- (C) Higher proportion of C-H bonds
- (D) Higher proportion of oxygen

Q122.

SZABMU 2019

Lipids are organic molecules which are insoluble in: [AJK-2019]

- (A) Alcohol
- (B) Ether
- (C) Chloroform
- (D) Water

Q123.

SZABMU 2019

What type of linkage is formed when an alcohol and an acid react? [AJK-2019]

- (A) Hydrogen bond
- (B) Peptide bond
- (C) Glycosidic linkage
- (D) Ester bond

Q124.

SZABMU 2019

The head of phospholipid molecule is polar (hydrophilic) due to: [AJK-2019]

- (A) Fatty acid
- (B) Phosphate
- (C) Carboxylic acid
- (D) Triacylglycerol

Q125.

NUMS 2019

Which of the following are the most prominent part of cell membranes in living organisms? [NUMS-2019]

- (A) Terpenoids
- (B) Waxes
- (C) Phospholipids
- (D) Acylglycerols

Q126.

NUMS 2019

Which of the following is the constituent of RNA molecule? [NUMS-2019]

- (A) Fatty acids
- (B) Deoxyribonucleic acid
- (C) Ascorbic acid
- (D) Ribonucleic acid

Q127.

MDCAT 2018

Glycosidic bond is formed by the: [MDCAT-2018]

- (A) Addition of oxygen
- (B) Removal of water
- (C) Addition of water
- (D) Removal of oxygen

Q128.

MDCAT 2018

Which of the following holds the alpha helix of protein in its place? [MDCAT-2018]

- (A) Hydrogen bond
- (B) R-group
- (C) Disulphide bond
- (D) Amino group

Q129.

MDCAT 2018

The number and sequence of amino acids along a polypeptide chain is called structure of a protein. [MDCAT-2018]

- (A) Tertiary
- (B) Quaternary
- (C) Secondary
- (D) Primary

Q130.

PMDC 2018

Which of the following is an unsaturated fatty acid? [MDCAT-2018, PMC-2020]

- (A) Butyric acid
- (B) Oleic acid
- (C) Stearic acid
- (D) Palmitic acid

Q131.

MDCAT 2017

Which of the following type of carbohydrates has high molecular weight and is sparingly soluble in water? [MDCAT-2017]

- (A) Monosaccharide
- (B) Oligosaccharides
- (C) Polysaccharides
- (D) Disaccharides

Q132.

MDCAT 2017

_____ are the major sites for the storage of glycogen in an animal's body. [MDCAT-2017]

- (A) Around thighs and belly
- (B) Muscle and liver
- (C) Liver and kidneys
- (D) Around belly and hips

Q133.

MDCAT 2017

The number of amino acids that have been found to occur in cells and tissues are: [MDCAT-2017]

- (A) 25
- (B) 20
- (C) 45
- (D) 170

Q134.

MDCAT 2017

Backbone of amino acid comprises of: [MDCAT-2017]

- (A) -NH₂ Group
- (B) -COOH group
- (C) C-C-N
- (D) -H group

Q135.

MDCAT 2017

If in lipids there is a higher proportion of unsaturated fatty acid, then it will be: [MDCAT-2017]

- (A) Phenols
- (B) Waxes
- (C) Fats
- (D) Oils

Q136.

MDCAT 2016

The compounds which, on hydrolysis, yield polyhydroxy aldehyde or ketone subunits are:

[MDCAT-2016]

- (A) Carbohydrates
- (B) Proteins
- (C) Polynucleotides
- (D) Lipids

Q137.

MDCAT 2016

Secondary structure of protein is found in: **[MDCAT-2016]**

- (A) Trypsin
- (B) Keratin
- (C) Glucagon
- (D) Insulin

Q138.

MDCAT 2016

Phosphodiester bond is: **[MDCAT-2016]**

- (A) P-O-C-P-O-C
- (B) C-O-P-O-C
- (C) C-O-P
- (D) C-C-O-P

Q139.

MDCAT 2015

Which molecular structure of enzyme is essential for activity of enzyme? **[MDCAT-2015]**

- (A) Primary structure
- (B) Quaternary structure
- (C) Secondary structure
- (D) Tertiary structure

Q140.

MDCAT 2014

The simplest monosaccharide containing keto group is: **[MDCAT-2014]**

- (A) Glyceraldehyde
- (B) Dihydroxyacetone
- (C) Ribose
- (D) Glucose

Q141.

DUHS 2014

Which level of protein structure maintains the helix shape of enzymes? **[LUMHS-2014]**

- (A) Secondary
- (B) Primary
- (C) Tertiary
- (D) Quaternary

Q142.

DUHS 2014

Enzymes are molecules of one of the following group of biomolecules. Mark the correct answer which can also be defined as a biological catalyst: **[KMDC-2014]**

- (A) Vitamins
- (B) Carbohydrate
- (C) Protein
- (D) Fats

RAPID 5–COLUMN ANSWER KEY

Official PMDC verified answer keys for 02. Biomolecules.

beambeprep.com

Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD	Q#	KEY	BOARD
1	B	UHS 2024	30	B	SZABMU 2024	59	D	KMU 2023	88	D	UHS 2022	117	C	MDCAT 2019
2	B	SZABMU 2024	31	D	SZABMU 2024	60	C	SZABMU 2023	89	B	NUMS 2022	118	A	MDCAT 2019
3	D	SZABMU 2024	32	B	SZABMU 2024	61	D	KMU 2023	90	B	SZABMU 2022	119	C	SZABMU 2019
4	A	UHS 2024	33	D	SZABMU 2024	62	B	NUMS 2023	91	D	SZABMU 2022	120	A	NUMS 2019
5	C	UHS 2024	34	C	SZABMU 2024	63	B	SZABMU 2023	92	C	KMU 2022	121	C	MDCAT 2019
6	B	UHS 2024	35	B	NUMS 2024	64	A	KMU 2023	93	B	KMU 2022	122	D	SZABMU 2019
7	D	KMU 2024	36	B	UHS 2023	65	C	UHS 2023	94	B	KMU 2022	123	D	SZABMU 2019
8	B	SZABMU 2024	37	D	SZABMU 2023	66	C	SZABMU 2023	95	D	KMU 2022	124	B	SZABMU 2019
9	B	SZABMU 2024	38	C	KMU 2023	67	D	KMU 2023	96	C	BUMHS 2022	125	C	NUMS 2019
10	C	NUMS 2024	39	B	UHS 2023	68	B	UHS 2022	97	D	BUMHS 2022	126	D	NUMS 2019
11	B	NUMS 2024	40	C	NUMS 2023	69	D	NUMS 2022	98	C	SZABMU 2022	127	B	MDCAT 2018
12	D	SZABMU 2024	41	C	UHS 2023	70	A	KMU 2022	99	C	KMU 2022	128	A	MDCAT 2018
13	A	SZABMU 2024	42	C	UHS 2023	71	C	KMU 2022	100	B	KMU 2022	129	D	MDCAT 2018
14	B	SZABMU 2024	43	B	UHS 2023	72	A	UHS 2022	101	A	BUMHS 2022	130	B	PMDC 2018
15	A	SZABMU 2024	44	C	KMU 2023	73	D	NUMS 2022	102	D	DUHS 2022	131	C	MDCAT 2017
16	B	UHS 2024	45	D	KMU 2023	74	B	NUMS 2022	103	C	UHS 2022	132	B	MDCAT 2017
17	C	KMU 2024	46	D	UHS 2023	75	B	SZABMU 2022	104	D	PMDC 2020	133	D	MDCAT 2017
18	A	KMU 2024	47	B	NUMS 2023	76	C	BUMHS 2022	105	B	PMDC 2020	134	C	MDCAT 2017
19	B	SZABMU 2024	48	A	UHS 2023	77	C	DUHS 2022	106	B	PMDC 2020	135	D	MDCAT 2017
20	D	SZABMU 2024	49	B	KMU 2023	78	B	NUMS 2022	107	D	PMDC 2020	136	A	MDCAT 2016
21	A	NUMS 2024	50	B	KMU 2023	79	A	UHS 2022	108	C	MDCAT 2019	137	B	MDCAT 2016
22	C	NUMS 2024	51	D	KMU 2023	80	C	UHS 2022	109	D	MDCAT 2019	138	B	MDCAT 2016
23	A	SZABMU 2024	52	C	SZABMU 2023	81	D	SZABMU 2022	110	C	MDCAT 2019	139	D	MDCAT 2015
24	A	SZABMU 2024	53	B	NUMS 2023	82	A	SZABMU 2022	111	B	MDCAT 2019	140	B	MDCAT 2014
25	B	SZABMU 2024	54	C	NUMS 2023	83	C	KMU 2022	112	C	KMU 2019	141	A	DUHS 2014
26	A	UHS 2024	55	C	SZABMU 2023	84	B	BUMHS 2022	113	C	SZABMU 2019	142	C	DUHS 2014
27	D	UHS 2024	56	C	SZABMU 2023	85	C	BUMHS 2022	114	B	SZABMU 2019			
28	D	KMU 2024	57	C	KMU 2023	86	C	DUHS 2022	115	C	KMU 2019			
29	C	KMU 2024	58	C	KMU 2023	87	C	DUHS 2022	116	A	MDCAT 2019			

TOTAL
MCQS

142

CORRECT

INCORRECT

BLANK

ACCURACY

%

Scan the booklet QR code to enter answers in
BeambePrep Grind Mode for automated error
 autopsies.

PROPOLIS COGNITIVE ERROR AUTOPSIES

Step-by-step conceptual derivations, formula working, and distractor autopsies for every question.

Question #1 Key: (B)

UHS 2024

What is the percentage of H_2O in bone cells? [UHS-2024]

CORE CONCEPT AND DERIVATION

Tissue water content is inversely proportional to the requirement for physical rigidity.

Solution:

- Most human soft tissues average ~70% water.
- However, **bone cells** (osteocytes) are encased in a dense, heavily calcified extracellular matrix designed for maximum rigid structural support.
- Because this matrix is heavily mineralized, the overall water content of living bone tissue is uniquely low, strictly maintained at roughly **20%**.

Why other options are incorrect:

- **70–60%:** Represents standard soft cellular tissues (muscle, liver).
- **99%:** Represents marine invertebrates like jellyfish.

Question #2 Key: (B)

SZABMU 2024

At 25 degrees Celsius, the concentration of each of [Formula] and [Formula] ions in pure water is about ____ m...

CORE CONCEPT AND DERIVATION

The autoionization of water perfectly defines the neutral point of the pH scale.

Solution:

- Water spontaneously, but rarely, dissociates into ions:
$$H_2O \rightleftharpoons H^+ + OH^-$$
- At standard room temperature (25°C), this dissociation reaches an exact thermodynamic equilibrium.
- Because one molecule of water yields exactly one H^+ and one OH^- , their concentrations must be perfectly equal to maintain neutrality.
- The measured concentration of each specific ion at this temperature is precisely 10^{-7} **moles per liter** (which is why a neutral pH is mathematically 7: $-\log(10^{-7}) = 7$).

Why other options are incorrect:

- 10^{-14} : This is the *ion product constant* ($K_w = [H^+][OH^-]$), not the individual concentration of a single ion.
- $10^{-6}/10^{-12}$: Mathematically incorrect for neutral water at standard conditions.

Question #3 Key: (D)

SZABMU 2024

Which property of water helps to maintain the integrity of lipid bilayer membranes? [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Biological membranes are held together entirely by the thermodynamic avoidance of water.

Solution:

- Water molecules bond intensely to one another via hydrogen bonds.
- When non-polar lipid tails are placed in water, they cannot form these bonds, forcing the water molecules to adopt a highly ordered, rigid, and energetically unfavorable "cage" around them.
- To minimize this unfavorable state, water physically forces the non-polar lipid tails to clump together, hiding them away in a bilayer core.
- This driving force, termed **Hydrophobic exclusion**, is the sole physical mechanism that maintains the structural integrity of every cell membrane.

Why other options are incorrect:

- While **Hydrogen bonding** is the root cause, "Hydrophobic exclusion" is the specific, direct biochemical property/mechanism describing the membrane assembly process.
- **Specific heat / Cohesion**: Relate to thermal stability and capillary action, respectively.

Question #4 Key: (A)

UHS 2024

Mono-saccharides have a general formula represented by: [UHS-2024]

CORE CONCEPT AND DERIVATION

Monosaccharides are simple sugars (carbohydrates) with the general empirical formula $C_n(H_2O)_n$ (also written as $(CH_2O)_n$), where n represents the number of carbon atoms (typically ranging from 3 to 7). This reflects a strict 1:2:1 ratio of carbon, hydrogen, and oxygen.

Why other options are incorrect:

- $C_n(H_2O)_{n-1}$: The general formula for disaccharides and oligosaccharides formed via glycosidic condensation (removal of a water molecule).
- $C_6(H_2O)_6$: Specific molecular formula for hexoses (such as glucose, fructose, galactose), not the general algebraic formula for all monosaccharides.
- $C_n(H_2O)_{2n}$: Incorrect stoichiometric ratio not found in standard carbohydrates.

Question #5 Key: (C)

UHS 2024

Polysaccharides in plants are synthesized by the process of: [UHS-2024]

CORE CONCEPT AND DERIVATION

Building massive polymers from simple monomers requires a specific type of linking reaction.

Solution:

- When plants convert excess glucose into massive starch (or cellulose) chains for storage, they must link thousands of monomers together.
- They do this via **Condensation** reactions (specifically, dehydration synthesis).
- In this process, an $-OH$ is removed from one glucose, and an $-H$ from another, forming a covalent glycosidic bond and expelling a molecule of water as a byproduct.

Why other options are incorrect:

- **Hydrolysis**: The exact opposite; using water to break down the polymer.
- **Oxidation / Glycolysis**: Metabolic pathways dedicated to tearing glucose apart to release energy, entirely opposite to synthesizing a storage polymer.

Question #6 Key: (B)

UHS 2024

Which monosaccharide will form a gluco pyranose ring in solution? [UHS-2024]

CORE CONCEPT AND DERIVATION

Chemical nomenclature directly indicates the specific molecule and ring size.

Solution:

- The term "gluco-" specifically and exclusively refers to the sugar **Glucose**.
- The term "-pyranose" indicates that upon entering an aqueous solution, the molecule has formed a stable 6-membered ring (resembling the organic molecule pyran).
- Therefore, a "glucopyranose" ring is simply the standard, cyclic form of a **Glucose** molecule.

Why other options are incorrect:

- **Fructose:** Typically forms a 5-membered "fructofuranose" ring.
- **Ribose / Deoxyribose:** 5-carbon sugars that exclusively form 5-membered "furanose" rings.

Question #7 Key: (D)

KMU 2024

Sugarcane contains: [KMU-2024]

CORE CONCEPT AND DERIVATION

Understanding the natural biological sources of common commercial sugars.

Solution:

- Sugarcane is specifically cultivated globally to extract the common dietary sugar stored heavily in its stalks.
- This specific transport and storage sugar manufactured by the plant is the disaccharide **Sucrose** (a 1:1 dimer of glucose and fructose).
- (Table sugar is almost 100% pure crystallized sucrose extracted from sugarcane or sugar beets).

Why other options are incorrect:

- While **Glucose** and **Fructose** are the fundamental building blocks *within* the plant, they are immediately bonded together and stored massively in the stalk as the larger **Sucrose** molecule.

Question #8 Key: (B)

SZABMU 2024

Which of the following monosaccharides is an aldehyde-hexose sugar? [SZABMU-2024]

CORE CONCEPT AND DERIVATION

Aldohexoses are six-carbon sugars with a terminal aldehyde functional group at Carbon-1.

Solution: Galactose (along with Glucose) is a classic aldohexose sugar ($C_6H_{12}O_6$). Fructose is a ketohexose, and Ribose is an aldopentose.

Question #9 Key: (B)

SZABMU 2024

Which of the following carbohydrates gives dark brown colour with iodine solution? [SZABMU-2024]

CORE CONCEPT AND DERIVATION

The iodine test is a classic qualitative biochemical assay used to distinguish complex polysaccharides based on their helical coiling.

Solution:

- When I_2 interacts with the highly branched structure of **Glycogen**, the iodine molecules slip into the coils, producing a characteristic **red-brown / dark brown** color.
- This specifically differentiates it from plant starch.

Why other options are incorrect:

- **Starch:** Produces a stark, intense **blue-black** color because its long amylose helices perfectly trap the iodine chains.
- **Sucrose & Glucose:** Small, simple sugars that lack the complex helical structure to trap iodine. They yield **no color change** (the solution remains the yellowish-brown color of raw iodine).

Question #10 Key: (C)

NUMS 2024

*Less reactivity of sucrose is due to its: [NUMS-2024]***CORE CONCEPT AND DERIVATION**

Chemical reactivity in sugars is dictated by the availability of a free, unbonded anomeric carbon (the reducing end).

Solution:

- To be a reactive "reducing sugar" (capable of reacting with Benedict's or Tollens' reagent), a sugar must have a free aldehyde or ketone group that can open up from the ring structure.
- In **Sucrose**, the highly reactive anomeric carbon of glucose (C1) is covalently bonded directly to the highly reactive anomeric carbon of fructose (C2).
- Because both functional groups are entirely locked up in this unique $\alpha - 1, 2$ bond, the molecule has absolutely no free functional ends.
- This complete **unavailability of functional groups** makes sucrose non-reducing, highly stable, and exceptionally unreactive (perfect for safe transport in plant sap).

Why other options are incorrect:

- **1-2 glycosidic linkage:** While this is the cause of the unavailability, the direct chemical reason for the lack of reactivity itself is the literal "unavailability of the functional group". Both C and D are technically related, but C describes the fundamental chemical mechanism.
- **High solubility / Polar nature:** Physical properties unrelated to chemical redox reactivity.

Question #11 Key: (B)

NUMS 2024

*Sucrose is used as a transport carbohydrate instead of glucose because: [NUMS-2024]***CORE CONCEPT AND DERIVATION**

Plants must transport energy vast distances through the phloem without the sugar reacting with surrounding cellular structures along the way.

Solution:

- Glucose contains a free, highly reactive aldehyde group (it is a reducing sugar). If plants pumped pure glucose through their veins, it would indiscriminately react with and damage transport proteins along the route.
- To solve this, plants bond glucose to fructose, locking both reactive ends together to form Sucrose.
- Because Sucrose is a completely stable, **non-reducing sugar**, it acts as a chemically inert "safe" cargo, traveling unharmed through the phloem until it reaches the root sinks where enzymes finally break it apart for use.

Why other options are incorrect:

- **Soluble in water:** Both glucose and sucrose are highly soluble.
- **Osmotic potential:** All soluble sugars massively alter osmotic potential (which is actually how phloem sap physically flows).
- **Is a disaccharide:** Maltose is also a disaccharide, but it is highly reactive (reducing), so it is not used for transport. The key is being non-reducing.

Question #12 Key: (D)

SZABMU 2024

Percentage of glucose normally in human body is: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Blood glucose levels are strictly hormonally regulated to prevent osmotic shock and diabetic comas.

Solution:

- The normal, healthy homeostatic concentration of fasting glucose in human blood is rigorously maintained between 80 to 120 mg per 100 mL of blood (dL).
- Mathematically, 80 mg (0.08 grams) per 100 mL of water (roughly 100 grams) equals exactly **0.08%** by weight/volume.
- This tiny, highly regulated percentage provides constant energy without turning the blood into a thick, syrupy osmotic nightmare.

Why other options are incorrect:

- Options like 8% or 1.8% would represent blood so thick with sugar it would immediately pull all water out of the brain cells via osmosis, causing instant death.

Question #13 Key: (A)

SZABMU 2024

Polysaccharide found most commonly in grains and seeds is: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Plants require massive, insoluble energy reserves to fuel the germination of their offspring before they can grow leaves and photosynthesize.

Solution:

- The universal energy storage polysaccharide of the entire plant kingdom is **Starch**.
- Plants pack massive quantities of starch granules into their **grains** (wheat, rice, corn) and **seeds**, ensuring the embryonic plant has a massive, slow-release energy source to rely on during early underground growth.

Why other options are incorrect:

- **Glycogen:** The storage polysaccharide of animals (liver/muscle), never found in plants.
- **Pectin:** A structural gel-like carbohydrate found in the cell walls (makes jams set), not the primary bulk energy storage.
- **Dextrin:** A short, broken-down fragment of starch, not the naturally stored bulk molecule itself.

Question #14 Key: (B)

SZABMU 2024

Glycogen is most abundant in: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Animals utilize specific organs as bulk chemical warehouses to regulate systemic physiology.

Solution:

- While skeletal muscles store glycogen strictly for their own selfish, localized use during sudden sprints, the **Liver** serves as the massive, altruistic glycogen reservoir for the entire body.
- Hepatocytes (**Liver cells**) can store up to 8–10% of their total mass as glycogen.
- When blood sugar drops, the liver rapidly breaks this glycogen down into free glucose and releases it into the blood to keep the brain alive. Therefore, by percentage weight, glycogen is most abundantly concentrated in the liver.

Why other options are incorrect:

- **Brain cells:** Store virtually zero glycogen; they demand a constant, uninterrupted feed of glucose directly from the blood.
- **Adipose cells:** Store massive amounts of *lipids* (triglycerides), not carbohydrates.
- **Smooth muscle:** Has minor stores compared to the massive stockpiles in the liver and large skeletal muscles.

Question #15 Key: (A)

SZABMU 2024

Stereoisomers are molecules containing atoms are: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Isomerism dictates how identical molecular formulas can yield completely different biological functions based on 3D geometry.

Solution:

- **Stereoisomers** (spatial isomers) are molecules that have the exact **same** chemical formula and are exactly **bonded identically** in the same sequence (e.g., C-1 is bonded to C-2, which is bonded to C-3).
- Their *only* difference lies in how those identical bonds are oriented in three-dimensional space (e.g., an -OH group pointing "up" vs "down").
- A classic biological example is α -glucose vs β -glucose.

Why other options are incorrect:

- Structural isomers (like glucose vs fructose) are bonded *differently* (the double bond is on a different carbon). Stereoisomers must be bonded identically, differing only in 3D geometry. The words "dependent" in the other options represent nonsensical distractor phrasing.

Question #16 Key: (B)

UHS 2024

Which of the following process is involved in breakdown of protein into Amino acids? [UHS-2024]

CORE CONCEPT AND DERIVATION

Biological polymers are cleaved via the forced enzymatic introduction of a water molecule.

Solution:

- To digest a massive protein down into its individual, absorbable amino acid building blocks, the tough covalent peptide bonds must be broken.
- This is accomplished exclusively through **Hydrolysis** (hydro = water, lysis = split).
- A single water molecule is split and forced into the peptide bond, breaking it and capping the ends of the resulting amino acids to satisfy their valency.

Why other options are incorrect:

- **Condensation:** The reverse process; builds the protein by removing water.
- **Glycolysis:** Breakdown of glucose for energy.
- **Fixation:** Converting inorganic gases into organic matter.

Question #17 Key: (C)

KMU 2024

Sickle cell anaemia results from: [KMU-2024]

CORE CONCEPT AND DERIVATION

A single typo in a massive genetic code can drastically alter the 3D structure of the resulting protein.

Solution:

- **Sickle cell anemia** is the textbook example of a missense mutation disease.
- It is caused directly by a single, catastrophic **amino acid substitution**. Specifically, a hydrophilic Glutamic acid is replaced by a hydrophobic Valine at position 6 on the Beta-chain of the hemoglobin molecule.
- This tiny change causes the entire molecule to fold incorrectly, stick to other hemoglobin molecules, and warp the red blood cell into a rigid, deadly sickle shape that blocks capillaries.

Why other options are incorrect:

- **Reduction in oxygen capacity:** This is the *symptom/result* of the sickling, not the fundamental genetic cause.
- **Viral infection:** It is a strictly inherited genetic disorder, not an infectious disease.
- **Linkage between chains:** Normal hemoglobin already has linkages; the disease is caused by the specific substitution, not the presence of normal linkages.

Question #18 Key: (A)

KMU 2024

Which is incorrect about the globular proteins? [KMU-2024]

CORE CONCEPT AND DERIVATION

Proteins are sharply divided into functional (globular) and structural (fibrous) categories based entirely on their shape and solubility.

Solution:

- We must identify the strictly *false* statement.
- Hair, nails, and outer skin are composed entirely of **Keratin**.
- Keratin is a tough, insoluble, extended *fibrous* protein designed to be rigid and waterproof.
- Therefore, stating that globular proteins are **abundantly found in hair** is completely **incorrect**.

Why other options are incorrect (they are TRUE statements):

- **Spherical in shape:** True, the chains fold heavily inward into complex 3D globes (tertiary structure) to form active sites.
- **Soluble in water:** True, they hide their hydrophobic R-groups on the inside, exposing hydrophilic groups on the outside to dissolve in blood/cytoplasm (e.g., enzymes, antibodies).
- **Have polypeptide chains:** True, all proteins do.

Question #19 Key: (B)

SZABMU 2024

The bond between hydroxyl group of carboxylic group of one amino acid and hydrogen of amino group of second am...

CORE CONCEPT AND DERIVATION

The primary structural backbone of all proteins is formed by a highly specific, repeating covalent linkage.

Solution:

- When two amino acids approach each other, a condensation reaction occurs.
- The $-OH$ is stripped from the carboxyl group of the first amino acid, and an $-H$ is stripped from the amino group of the second.
- This expels a water molecule and forms a strong, covalent Carbon-Nitrogen bond specifically bridging the two monomers.
- In biochemistry, this specific C-N linkage between amino acids is exclusively called a **Peptide bond**.

Why other options are incorrect:

- **Glycosidic bond:** Formed between two sugars, not amino acids.
- **Disulfide bridge:** Formed between the sulfur atoms of two distant Cysteine R-groups to stabilize 3D folding, not to link the main backbone.
- **Hydrogen bond:** A weak physical attraction, not a strong covalent reaction releasing water.

Question #20 **Key: (D)**

SZABMU 2024

Which of the following does not have a quaternary structure?
[SZABMU-2024]

CORE CONCEPT AND DERIVATION

Quaternary structure only exists if a functional protein requires *multiple, separate* polypeptide chains aggregating together.

Solution:

- **Myoglobin** is the oxygen-storing protein found exclusively in muscle tissue.
- Structurally, it consists of just a **single**, highly folded polypeptide chain (containing one heme group).
- Because it is only a single chain, it functionally maxes out at the Tertiary level of structure. It physically **does not have a Quaternary structure**.

Why other options are incorrect (they DO have Quaternary structure):

- **Hemoglobin:** Classic tetramer consisting of exactly 4 separate chains (2 alpha, 2 beta).
- **Antibodies:** Complex Y-shaped molecules consisting of 4 chains (2 heavy, 2 light).
- **DNA Polymerase III:** A massive, multi-subunit enzymatic complex (holoenzyme) requiring several different chains to function together.

Question #21 **Key: (A)**

NUMS 2024

Protein with tertiary structures are helpful in: [NUMS-2024]

CORE CONCEPT AND DERIVATION

Tertiary structures define complex, soluble globular proteins (hormones, enzymes, antibodies), while secondary structures define tough, insoluble fibrous proteins.

Solution:

- Hormones (like insulin or glucagon) are chemical messengers secreted by glands.
- To travel through the aqueous bloodstream and perfectly dock into complex, 3D cellular receptors, they must be highly soluble, specifically folded **globular proteins** with intricate **tertiary structures**.
- Therefore, **Carrying messages from glands to target organs** is a direct function relying on tertiary structural folding.

Why other options are incorrect:

- **Skin lining (Keratin), Connective matrix (Collagen), Muscle contraction (Actin/Myosin):** These are all classic examples of tough, long, insoluble *fibrous* proteins. Their functions rely strictly on highly repetitive Secondary structures forming long strands, rather than 3D tertiary globes.

Question #22 Key: (C)

NUMS 2024

Rebounding is process of straightening the curly hairs, which bond is targeted by oxidizing agents used during...

CORE CONCEPT AND DERIVATION

The macroscopic shape of human hair is determined by permanent covalent cross-links within the keratin protein structure.

Solution:

- Hair is composed of keratin, which contains a high proportion of the sulfur-containing amino acid Cysteine.
- When two distant Cysteine residues align, they form strong covalent bonds called **Disulphide bridges** (S-S bonds). These rigid bridges pull the hair strand into permanent physical curls or waves.
- Chemical hair straightening (rebounding or perming) utilizes reducing agents to purposefully break these specific **Disulphide bridges**. The hair is pulled straight, and then oxidizing agents are applied to re-form the bonds in the new, straight configuration.

Why other options are incorrect:

- **Hydrogen bonds:** These are weak and are broken simply by wetting the hair (which is why wet hair hangs straight), but they reform immediately upon drying. They don't require harsh chemical oxidizing agents.
- **Peptide bonds:** Breaking these would completely dissolve and destroy the entire protein backbone, dissolving the hair entirely rather than just straightening it.

Question #23 Key: (A)

SZABMU 2024

Number of amino acids in each alpha chain of hemoglobin is: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

The primary sequence of human Hemoglobin A is highly conserved and numerically precise.

Solution:

- Human hemoglobin consists of four total chains.
- The two shorter **alpha (α) chains** each consist of exactly **141** amino acids.
- (The two slightly longer beta (β) chains each consist of exactly 146 amino acids).

Why other options are incorrect:

- **146:** This is the specific count for the Beta chains, not the Alpha chains.
- **414 / 416:** These are random, incorrect numbers holding no biological significance to this structure.

Question #24 Key: (A)

SZABMU 2024

Two amino acids form a dipeptide through: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Biological monomers are forced together via specific water-removing synthetic reactions.

Solution:

- To link two separate amino acids into a unified dipeptide, the carboxyl group of the first must covalently bond to the amino group of the second.
- To free up the bonding electrons required, an $-OH$ and an $-H$ are forcefully stripped away from the monomers and expelled as a newly formed water molecule.
- Because a larger molecule is built via the removal of water, this is universally termed a **Condensation reaction** (or dehydration synthesis).

Why other options are incorrect:

- **Hydrolysis:** The exact opposite; adds water to smash the dipeptide back into two separate amino acids.
- **Hydrogen bonding / Ionic bond:** These are weak physical interactions that govern 3D folding later on; they do not form the tough covalent backbone required to link monomers.

Question #25 Key: (B)

SZABMU 2024

The protein present in blood plasma and involved in blood clotting is: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

The body must maintain the ability to rapidly seal circulatory leaks using a highly specialized, soluble protein precursor.

Solution:

- **Fibrinogen** is a massive, soluble protein continuously synthesized by the liver and floated passively in the blood plasma.
- When a blood vessel is ruptured, an enzymatic cascade is triggered. The enzyme thrombin chops a piece off the soluble Fibrinogen, converting it instantly into *insoluble* Fibrin.
- These fibrin threads violently polymerize, forming a sticky, fibrous net that traps platelets and red blood cells, effectively creating the solid **blood clot**.

Why other options are incorrect:

- **Antibodies:** Proteins used to hunt and destroy foreign pathogens (immunity), not for structural clotting.
- **Hormones:** Chemical messengers.
- **Enzymes:** Biological catalysts. While enzymes (like thrombin) *trigger* the process, Fibrinogen is the actual structural protein that forms the clot itself.

Question #26 Key: (A)

UHS 2024

When glycerol reacts with fatty acid, which type of chemical bond will form? [UHS-2024]

CORE CONCEPT AND DERIVATION

Lipid synthesis is defined by the reaction between an alcohol group and a carboxylic acid group.

Solution:

- Glycerol contains reactive hydroxyl (alcohol, $-OH$) groups.
- Fatty acids contain reactive carboxylic acid ($-COOH$) heads.
- When these two specific functional groups undergo a condensation reaction to join together, they release water and form a robust $-C-O-C(=O)-$ covalent bridge.
- In organic chemistry, this specific linkage connecting an acid to an alcohol is universally termed an **Ester Bond**.

Why other options are incorrect:

- **Ether Linkage:** Formed between two alcohols ($-C-O-C-$), such as the glycosidic bond in sugars.
- **Hydrogen/Ionic Bonds:** Weak physical attractions, not covalent synthetic bonds.

Question #27 Key: (D)

UHS 2024

The hydrophilic end of phospholipid molecule is polar because of the presence of: [UHS-2024]

CORE CONCEPT AND DERIVATION

Amphipathic molecules possess severely contrasting regions of electrical charge.

Solution:

- A phospholipid consists of a non-polar glycerol backbone attached to two incredibly non-polar fatty acid tails.
- However, the third binding site on the glycerol is occupied by a massive **Phosphate group** (PO_4^{3-}).
- This phosphate group carries a strong, permanent negative electrical charge. Because water is highly polar, it intensely targets and forms hydrogen bonds with this charged region, making the entire 'head' of the molecule highly **polar and hydrophilic** (water-loving).

Why other options are incorrect:

- **Fatty Acid:** These are the intensely non-polar, hydrophobic "tails" that aggressively repel water.
- **Glycerol:** Its polar $-OH$ groups are destroyed during ester bond formation, rendering the central backbone relatively neutral.
- **Amine group:** While some specific head groups (like choline) have nitrogen, the fundamental universal cause of polarity in *all* phospholipids is the negatively charged phosphate base.

Question #28 Key: (D)

KMU 2024

What is the ester of fatty acids and long chain alcohol called? [KMU-2024]

CORE CONCEPT AND DERIVATION

Waxes are the ultimate biological waterproofing agents, designed for maximum hydrophobicity.

Solution:

- Unlike standard fats which use the short 3-carbon glycerol as a backbone, **Waxes** are synthesized by forming a single ester bond between one massively long-chain fatty acid and one massively long-chain monohydroxy alcohol (often 20 to 30 carbons long each).
- This creates an incredibly long, rigid, straight-chain lipid that packs tightly into a solid, forming an impenetrable, highly hydrophobic barrier (e.g., beeswax, cutin on leaves, earwax).

Why other options are incorrect:

- **Acylglycerol / Phospholipid:** These are specifically defined as esters formed uniquely with the short 3-carbon alcohol *glycerol*, not "long chain alcohols".
- **Glycerol:** This is just the bare alcohol molecule itself, not the resulting esterified lipid product.

Question #29 Key: (C)

KMU 2024

Lipids, which do not contain fatty acid are: [KMU-2024]

CORE CONCEPT AND DERIVATION

The lipid family is a diverse "catch-all" group defined only by water insolubility, allowing for radically different core structures.

Solution:

- Most standard lipids (fats, oils, waxes) are built by chemically bonding long, straight **fatty acid** chains to an alcohol backbone.
- **Steroids** (like cholesterol, estrogen, and testosterone) are entirely different. They contain absolutely **zero fatty acids**.
- Instead, their structure is based entirely on a rigid, fused skeleton of exactly four interlocking carbon rings (derived from polymerized isoprene units).

Why other options are incorrect:

- **Neutral lipids (triglycerides) & Phosphatidic acids:** Directly built using 2 to 3 long fatty acid chains attached to glycerol.
- **Waxes:** Contain exactly one very long fatty acid chain.

Question #30 **Key: (B)**

SZABMU 2024

Which of the following is a basic component of lipid bilayer of plasma membrane? [SZABMU-2024]

CORE CONCEPT AND DERIVATION

Membranes require amphipathic molecules (having both polar and non-polar regions) to spontaneously form a bilayer in water.

Solution:

- The fundamental building blocks of the membrane bilayer are phospholipids.
- **Lecithin** (scientifically known as Phosphatidylcholine) is the most abundant, classically textbook example of a major **phospholipid** found continuously throughout the plasma membranes of both plants and animals.
- Its amphipathic nature (polar choline/phosphate head, non-polar tails) makes it perfectly suited for bilayer formation.

Why other options are incorrect:

- **Acylglycerol / Triglyceride / Waxes:** These are entirely non-polar, hydrophobic molecules used strictly for dense energy storage or waterproofing. Because they completely lack a polar head, they violently clump into spherical droplets in water rather than forming flat, structured bilayers.

Question #31 **Key: (D)**

SZABMU 2024

Which fatty acid would have the highest melting point? [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Melting point in lipids is strictly determined by two factors: saturation (lack of double bonds) and chain length (number of carbons).

Solution:

- First, rule out unsaturated fats. **Oleic acid** has a double bond (kink), preventing tight packing, making it a liquid (oil) with a very low melting point.
- The remaining three are fully saturated (straight chains that pack tightly into solids). For saturated fats, the longer the carbon chain, the more London dispersion forces hold them together, pushing the melting point higher.
- **Lauric acid:** 12 carbons.
- **Palmitic acid:** 16 carbons.
- **Stearic acid:** 18 carbons.
- Because **Stearic acid** has the longest, fully saturated, unkinked hydrocarbon chain, it possesses the strongest intermolecular forces and thus the **highest melting point** (it forms very hard, solid fats).

Why other options are incorrect:

- Oleic acid is liquid. Lauric and Palmitic are shorter, so they melt at lower temperatures than Stearic.

Question #32 Key: (B)

SZABMU 2024

Lipids that protect plants from water loss are: [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

Terrestrial plants face the constant threat of desiccation (drying out) from the sun, requiring extreme external waterproofing.

Solution:

- Plants secrete a highly hydrophobic, solid, protective lipid layer over their exposed epidermis (leaves, stems, fruits).
- This specific layer is composed entirely of **Waxes** (specifically forming the cuticle, utilizing a wax polymer called cutin).
- Because waxes are formed from extreme long-chain fatty acids and long-chain alcohols, they are completely insoluble in water and form a rigid, impermeable barrier that traps vital moisture inside the plant.

Why other options are incorrect:

- Phospholipids:** Used strictly for internal cell membranes, not massive external waterproofing.
- Triglycerides:** Used internally for energy storage (e.g., in seeds like peanuts), not on the surface.
- Terpenoids:** Used for internal pigments and fragrant volatile oils, not bulk structural waterproofing.

Question #33 Key: (D)

SZABMU 2024

Which of the following is found in both messenger RNA and DNA of a mammalian cell? [SZABMU-2024-Reconduct]

CORE CONCEPT AND DERIVATION

DNA and RNA serve vastly different cellular functions, but they share the exact same fundamental polymer architecture.

Solution:

- Both DNA and RNA are classified broadly as nucleic acids.
- As such, they are both built by polymerizing nucleotides. Every single nucleotide, regardless of whether it's destined for DNA or RNA, connects to the next via a phosphodiester bond.
- This creates a continuous, universal **Sugar-phosphate backbone** that forms the structural exterior of the molecule, serving as the universal scaffolding for both mRNA and DNA alike.

Why other options are incorrect:

- Double helical structure:** Found almost exclusively in DNA. Mammalian mRNA is inherently single-stranded.
- Thymine:** A base found exclusively in DNA (RNA replaces it with Uracil).
- Ribose sugar:** Found exclusively in RNA (DNA uses deoxyribose).

Question #34 Key: (C)

SZABMU 2024

Transcription is the process in which an RNA copy of the DNA sequence and coding the gene is produced with the...

CORE CONCEPT AND DERIVATION

Enzymes in the central dogma are named directly for the polymer they synthesize (build).

Solution:

- Transcription is the biological process of reading a DNA blueprint to build a complementary messenger RNA (mRNA) strand.
- The massive enzyme responsible for prying the DNA apart, reading the template, and stitching together the new RNA nucleotides is **RNA polymerase** (specifically, it polymerizes RNA).

Why other options are incorrect:

- **DNA polymerase:** Synthesizes new DNA during cellular replication, not transcription.
- **RNA dependent DNA polymerase:** Also known as Reverse Transcriptase; used by retroviruses (like HIV) to turn RNA back into DNA.
- **RNA transcriptase:** A mostly fabricated/colloquial term not used in formal biochemistry (the actual enzyme is RNA polymerase).

Question #35 Key: (B)

NUMS 2024

Nucleoproteins are involved in: [NUMS-2024]

CORE CONCEPT AND DERIVATION

Conjugated molecules are named by combining the names of their constituent parts, dictating their physiological location and function.

Solution:

- A **Nucleoprotein** is a complex formed by the direct binding of a nucleic acid (DNA or RNA) to a protein structure.
- The most prominent biological example is **Chromatin/Chromosomes**, where long strands of DNA are tightly spooled around basic Histone proteins to protect the delicate genetic code.
- Because these DNA-protein complexes physically constitute the chromosomes, their primary, foundational biological role is **passing hereditary information to the next generation** safely during cell division.

Why other options are incorrect:

- **Cell to cell recognition / Surface marker:** This is the job of Glycoproteins (sugar + protein) sticking out of the cell membrane, entirely unrelated to nuclear DNA complexes.
- **Fast speed of nerve impulse:** This relies on the myelin sheath, which is formed by massive amounts of Sphingolipids (lipids), not nucleoproteins.

Question #36 Key: (B)

UHS 2023

Energy is _____ by the breakdown of complex molecules into simpler ones, such reactions are called catabolic re...

CORE CONCEPT AND DERIVATION

Metabolism is divided into energy-requiring building (anabolism) and energy-yielding breaking (catabolism).

Solution:

- Large, complex biomolecules store significant amounts of potential chemical energy locked within their intricate covalent bonds.
- When these molecules are broken down (catabolized) into smaller, simpler components, that locked thermodynamic energy is strictly **released**.
- The cell then captures a portion of this released energy to synthesize ATP.

Why other options are incorrect:

- **Consumed:** This defines anabolic reactions, which require an input of energy to build molecules.
- **Produced / Destroyed:** According to the First Law of Thermodynamics, energy cannot be created (produced) or destroyed; it can only be transferred or released from one form to another.

Question #37 Key: (D)

SZABMU 2023

Second most abundant bio element in human body is: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Understanding the mass percentage composition of the six major biological elements (CHNOPS) is foundational.

Solution:

- The total mass of the human body is dominated primarily by just a few key elements:
- **1. Oxygen:** ~65% (Most abundant, primarily due to massive water content).
- **2. Carbon:** ~18% (The **second most abundant**, serving as the central backbone for all organic macromolecules).
- **3. Hydrogen:** ~10%.
- **4. Nitrogen:** ~3%.

Why other options are incorrect:

- Oxygen is #1. Hydrogen is #3. Nitrogen is #4. The question specifically asks for the *second* most abundant.

Question #38 **Key: (C)**

KMU 2023

Which of the following is opposite of condensation reaction?
[ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Biological polymers are built and destroyed through opposing water-mediated chemical reactions.

Solution:

- **Condensation** (dehydration synthesis) joins two smaller monomers together into a larger polymer while removing and expelling a water molecule.
- The exact chemical opposite is **Hydrolysis**, which forcefully introduces a water molecule to cleave the covalent bond holding the polymer together, splitting it back into two smaller monomers.

Why other options are incorrect:

- **Dehydration:** This is merely a synonym for condensation, not the opposite.
- **Hydration:** Simply dissolving or surrounding a molecule with water (physical change), not cleaving a covalent bond.
- **Decarboxylation:** Removing a carbon dioxide group, entirely unrelated to polymer backbone synthesis.

Question #39 **Key: (B)**

UHS 2023

_____ forms almost three-fourth of the body by weight. [UHS-2023]

CORE CONCEPT AND DERIVATION

All biological reactions occur in an aqueous medium.

Solution:

- Mammalian cells, extracellular fluids, blood plasma, and intracellular matrices are vastly composed of a single, small inorganic compound.
- **Water** constitutes approximately 70% to 75% (nearly three-fourths) of the total mass of an adult human body.
- This massive aqueous presence is required for thermal regulation, solvent capability, and transport.

Why other options are incorrect:

- **Protein (~18%), Lipids (~10–15%), Carbohydrates (~1%):** While these organic macromolecules define structural form and function, their total combined mass is dwarfed by the sheer volume of inorganic water.

Question #40 **Key: (C)**

NUMS 2023

Thermal stability of organisms in the environment is because of which characteristics of water? [NUMS-2023]

CORE CONCEPT AND DERIVATION

Because living organisms are roughly 70% water, their internal temperature is deeply linked to the thermal properties of water itself.

Solution:

- Water molecules are bound together by an extensive network of hydrogen bonds.
- When thermal energy (heat) is applied, much of that energy is absorbed and used strictly to stretch and break these hydrogen bonds, rather than increasing the kinetic speed (temperature) of the molecules.
- This gives water a remarkably high **specific heat capacity**, meaning organisms can endure massive fluctuations in environmental heat without experiencing dangerous spikes in their own internal body temperature.

Why other options are incorrect:

- **Solvent property & Ionization:** Govern cellular chemical reactions and pH, not thermal resistance.
- **Protection:** A vague term (water does provide mechanical cushioning like CSF, but thermal stability is strictly a thermodynamic "heat capacity" function).

Question #41 **Key: (C)**

UHS 2023

Biologically, _____ plays key roles in maintaining the integrity of lipid bilayer membranes. [UHS-2023]

CORE CONCEPT AND DERIVATION

Cell membranes are not held together by covalent bonds, but rather by the powerful physical forces exerted by surrounding water.

Solution:

- Water molecules are highly polar and constantly seek to form low-energy hydrogen bonds with each other.
- When non-polar (hydrophobic) fatty acid tails are placed in water, they disrupt these hydrogen bonds. Consequently, the water molecules aggressively "squeeze" the tails away to restore their own bonding network.
- This phenomenon, **Hydrophobic exclusion**, forces the lipid tails into a tight, shielded bilayer core, completely defining and stabilizing the structural integrity of every cell membrane.

Why other options are incorrect:

- **Hydrophilic exclusion:** A non-existent/incorrect term. Polar heads are hydrophilic and actively interact with water, they are not excluded.
- **Heat properties:** Relate strictly to temperature control, not membrane aggregation.

Question #42 **Key: (C)**

UHS 2023

The specific heat of vaporization of water plays an important role in the regulation of heat produced by _____.

CORE CONCEPT AND DERIVATION

Metabolism is fundamentally an exothermic burning of carbon fuels, requiring an efficient cooling system.

Solution:

- Cellular respiration continuously extracts energy from food molecules (like glucose) primarily through severe **Oxidation** reactions (stripping away high-energy hydrogen electrons).
- These massive oxidative cascades are not 100% efficient; large amounts of the energy are inevitably lost as waste heat.
- If not removed, this oxidative waste heat would denature cellular enzymes. The body utilizes water's high heat of vaporization (sweating) to absorb and carry away this specific metabolic heat.

Why other options are incorrect:

- Reduction:** Usually requires energy input, rather than releasing waste heat.
- Redox:** While respiration involves redox entirely, "oxidation of food" is the specific term universally used to describe the heat-generating breakdown of carbon fuels.

Question #43 **Key: (B)**

UHS 2023

Which type of bond must be broken for water to vaporize? [UHS-2023]

CORE CONCEPT AND DERIVATION

Phase changes (boiling, melting) involve disrupting intermolecular forces holding distinct molecules together, not tearing apart the molecule itself.

Solution:

- A water molecule consists of two H's and one O firmly attached by unbreakable polar covalent bonds.
- However, individual water molecules stick to each other in a liquid state via weaker intermolecular attractions called **Hydrogen bonds**.
- When water vaporizes (turns to steam), the individual H_2O molecules remain completely intact. Only the **Hydrogen bonds** between neighboring molecules are stretched and physically broken to allow them to escape into the gas phase.

Why other options are incorrect:

- Covalent / Polar covalent bonds:** Breaking these would chemically destroy the water molecule, separating it into explosive Hydrogen and Oxygen gas (electrolysis), rather than just boiling it into steam.

Question #44 **Key: (C)**

KMU 2023

All are the properties of water excluding: [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Water has one profound, life-saving physical anomaly regarding its solid state.

Solution:

- Nearly all substances in the universe become denser as they transition from a liquid to a solid because molecular kinetic energy drops, allowing molecules to pack tighter.
- Water is the stark exception. As it approaches freezing (below 4°C), its hydrogen bonds lock into a rigid, open-spaced hexagonal crystal lattice.
- This vast empty space in the lattice means ice is strictly **less dense** than liquid water, allowing it to float.
- Therefore, the claim that it "becomes dense when it freezes" is physically false.

Why other options are incorrect (they are true properties of water):

- **Universal solvent & Polar nature:** Driven by its dipole moment.
- **Hydrogen bonding:** The core force defining its behavior.

Question #45 **Key: (D)**

KMU 2023

_____ is the heat required to convert a gram of water into vapors at its boiling point. [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Thermodynamic definitions relating to phase transitions.

Solution:

- The amount of thermal energy specifically required to completely break the intermolecular hydrogen bonds of 1 gram of a liquid, transitioning it entirely into a gas at a constant temperature (boiling point), is defined strictly as its **Heat of vaporization**.
- For water, this value is exceptionally high (574 kcal/kg), powering the massive cooling effect of sweating.

Why other options are incorrect:

- **Specific heat capacity:** This is the heat required to merely raise the temperature of 1 gram of a substance by 1°C, without changing its phase.
- **Heat of ionization / Polarity:** Unrelated to thermal phase change measurements.

Question #46 Key: (D)

UHS 2023

Which statement is true regarding both starch and cellulose? [UHS-2023]

CORE CONCEPT AND DERIVATION

Despite having drastically different physical structures and functions, both molecules share the exact same foundational building block.

Solution:

- Both starch and cellulose are massive, complex polysaccharides found exclusively in plants.
- Both are constructed 100% entirely by polymerizing thousands of single **glucose** monomer units.
- The only difference is the geometric linkage: starch uses α -glucose (helical), while cellulose uses β -glucose (straight, rigid fibers).

Why other options are incorrect:

- **Digested by humans:** Humans easily digest starch (amylase), but completely lack the cellulase enzyme required to digest cellulose (it passes as roughage/fiber).
- **Energy storage:** Starch is for energy storage; cellulose is strictly for rigid structural support of the cell wall.
- **Geometric isomers:** The monomers (α and β glucose) are isomers, but the massive polymeric structures themselves are not simply isomers of one another.

Question #47 Key: (B)

NUMS 2023

These carbohydrates are sweetest among all carbohydrates: [NUMS-2023]

CORE CONCEPT AND DERIVATION

The sensation of sweetness is mediated by taste-bud receptors which bind specifically to small, highly soluble molecules.

Solution:

- As the chain length of a carbohydrate polymer increases, its solubility and its physical ability to fit into tongue receptors rapidly decrease.
- **Monosaccharides** (like fructose and glucose) are the smallest, simplest, and most soluble sugar units available, rendering them the absolute **sweetest** of all carbohydrate classes.

Why other options are incorrect:

- **Disaccharides (sucrose):** Sweet, but generally less so than fructose (a monosaccharide).
- **Oligosaccharides & Polysaccharides:** As they grow massive (like starch or cellulose), they become completely tasteless and insoluble in the mouth.

Question #48 Key: (A)

UHS 2023

Most of the monosaccharides form a ring structure when in solution. For example ribose will form a five corner...

CORE CONCEPT AND DERIVATION

In an aqueous solution, pentoses and hexoses undergo intramolecular reactions to form stable, closed rings.

Solution:

- **Ribose** is a 5-carbon pentose sugar.
- When it forms a closed ring in solution, it strictly forms a 5-membered ring (four carbon atoms and one oxygen atom in the ring).
- Chemically, any 5-membered sugar ring is termed a "furanose" (named after the chemical furan). Thus, cyclic ribose is technically termed **Ribofuranose**.

Why other options are incorrect:

- **Glucopyranose:** A 6-membered ring (pyranose) formed by Glucose, not Ribose.
- **Glyceraldehyde / Acetaldehyde:** Small linear molecules that do not form these complex rings.

Question #49 Key: (B)

KMU 2023

Lactose is composed of: [ETEA-2023]

CORE CONCEPT AND DERIVATION

Memorizing the constituent monosaccharides of the three primary dietary disaccharides is essential.

Solution:

- **Lactose** is the primary sugar naturally found in mammalian milk.
- It is a disaccharide synthesized by a condensation reaction linking one molecule of **Glucose** to one molecule of **Galactose** via a β -1,4-glycosidic bond.

Why other options are incorrect:

- **Glucose + Fructose:** Forms Sucrose (table sugar).
- **Glucose + Glucose:** Forms Maltose (malt sugar).

Question #50 Key: (B)

KMU 2023

Glucose is classified as a _____. [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Carbohydrate classification is strictly based on whether the molecule can be broken down into simpler sugars via hydrolysis.

Solution:

- **Glucose** ($C_6H_{12}O_6$) is a single, fundamental, un-bonded sugar unit.
- It cannot be hydrolyzed (broken down by water) into any smaller or simpler sugar molecule.
- Therefore, it is the classic archetype of a **Monosaccharide**.

Why other options are incorrect:

- All other options (Di-, Oligo-, Poly-) are polymers that yield multiple glucose/sugar molecules upon hydrolysis.

Question #51 Key: (D)

KMU 2023

Sucrose is hydrolyzed into: [ETEA-2023 Retake]

CORE CONCEPT AND DERIVATION

Hydrolysis of a disaccharide yields its exact original building blocks.

Solution:

- **Sucrose** (common cane sugar / table sugar) is formed in plants by linking α -glucose and β -fructose.
- When the enzyme sucrase catalyzes the hydrolysis of sucrose, it splits the α -1,2-glycosidic bond, releasing exactly one molecule of **Glucose** and one molecule of **Fructose** into the bloodstream.

Why other options are incorrect:

- **Glucose + Galactose:** This is the hydrolysis product of Lactose, not Sucrose.
- **Lactose:** Is a disaccharide itself; it is never produced by breaking down another disaccharide.

Question #52 **Key: (C)**

SZABMU 2023

Which of the following process is involved in decomposition of protein into amino acids? [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Biological digestion is entirely reliant on the chemical cleavage of macromolecules using water.

Solution:

- When we consume a protein, our digestive enzymes (like pepsin and trypsin) must break the tough, covalent peptide bonds linking the amino acid chain.
- This is accomplished strictly through a **Hydrolysis** reaction, wherein a single water molecule is forced into the peptide bond, splitting it apart to release individual, absorbable amino acids.

Why other options are incorrect:

- **Condensation:** The exact opposite process; removes water to build the protein up.
- **Glycolysis:** The metabolic breakdown of glucose for energy, entirely unrelated to protein digestion.
- **Fixation:** Converting inorganic gas (like CO_2 or N_2) into organic forms (photosynthesis).

Question #53 **Key: (B)**

NUMS 2023

Which of the following protein establishes the matrix of bone & cartilage? [NUMS-2023]

CORE CONCEPT AND DERIVATION

The structural integrity of skeletal connective tissue relies on a highly specialized extracellular fibrous protein network.

Solution:

- **Collagen** is the primary structural protein of the extracellular matrix in all connective tissues.
- It forms tough, inextensible fibers that act as the physical scaffold (matrix) into which calcium phosphate is deposited to form rigid **bone**, or proteoglycans are deposited to form flexible **cartilage**.

Why other options are incorrect:

- **Keratin:** Structural protein, but strictly for external appendages like hair, nails, and epidermis, not internal skeletal matrices.
- **Elastin:** Provides elasticity to lungs and arteries, not rigid skeletal structure.
- **Histone:** A nuclear globular protein used to spool DNA.

Question #54 **Key: (C)**

NUMS 2023

Most abundant organic compound in mammalian cells are: [NUMS-2023]

CORE CONCEPT AND DERIVATION

It is crucial to distinguish between total compounds and organic compounds in cellular composition.

Solution:

- While Water is universally the most abundant compound overall (70%), it is strictly an *inorganic* molecule.
- The question explicitly asks for the most abundant **organic** compound (carbon-based macromolecules).
- **Proteins** make up roughly 18% of the total cellular mass (over half of the dry weight of a cell), making them the most abundant organic compounds in any mammalian cell by a massive margin.

Why other options are incorrect:

- **Water:** Inorganic.
- **Lipids (~3%) & Carbohydrates (~4%):** These represent significantly smaller mass fractions compared to the ubiquitous presence of structural and enzymatic proteins.

Question #55 **Key: (C)**

SZABMU 2023

Select the protein providing support for the connective tissues: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Connective tissues (tendons, ligaments, fascia) require extreme tensile strength to prevent tearing under tension.

Solution:

- **Collagen** forms unique triple-helices that assemble into massive, highly cross-linked fibrils.
- This specific fibrous architecture provides incredible tensile strength, making it the primary, unyielding support protein for the entire mammalian connective tissue system.

Why other options are incorrect:

- **Elastin:** Found in connective tissue, but provides stretch/recoil rather than unyielding rigid support.
- **Keratin:** Found strictly in epithelial structures (skin/hair), not internal connective tissue.
- **Histones:** Nuclear proteins that organize DNA.

Question #56 **Key: (C)**

SZABMU 2023

Fibrous proteins do not take part in: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Fibrous proteins perform static, mechanical, and structural roles, whereas globular proteins perform dynamic, functional, transport, and catalytic roles.

Solution:

- **Oxygen transport in blood** is solely carried out by hemoglobin.
- Hemoglobin is a highly complex, 3D folded, functional **globular protein**, entirely lacking the tough, extended string-like structure of a fibrous protein.
- Therefore, fibrous proteins have absolutely no role in gas transport.

Why other options are incorrect:

- **Formation of nails:** Keratin (fibrous).
- **Blood clotting:** Fibrin (fibrous polymer formed from fibrinogen).
- **Muscle contraction:** Actin and myosin (fibrous structures generating mechanical tension).

Question #57 **Key: (C)**

KMU 2023

In sickle cell hemoglobin molecule, glutamic acid, is replaced by: [ETEA-2023]

CORE CONCEPT AND DERIVATION

A single point mutation in DNA can radically alter the primary, and thus tertiary/quaternary, structure of a protein.

Solution:

- Sickle cell anemia is caused by a precise point mutation in the gene encoding the beta-chain of hemoglobin.
- This genetic error causes a highly polar, hydrophilic amino acid (Glutamic acid) at position 6 to be erroneously replaced by a highly non-polar, hydrophobic amino acid (**Valine**).
- Because valine is hydrophobic, it tries to hide from water by sticking to other hemoglobin molecules, causing the proteins to polymerize into long, sharp fibers that distort the red blood cell into a sickle shape.

Why other options are incorrect:

- This is a specific memorization fact. Proline, Glutamine, and Glycine are not the specific amino acid substituted in this famous genetic disorder.

Question #58 **Key: (C)**

KMU 2023

_____ is found in the exoskeleton of crabs. [ETEA-2023]

CORE CONCEPT AND DERIVATION

Different phylogenetic kingdoms employ distinct structural polysaccharides to build their protective outer boundaries.

Solution:

- Arthropods (such as crabs, lobsters, and insects) possess a hard outer exoskeleton.
- This exoskeleton is built entirely from **Chitin**, a tough, nitrogenous structural polysaccharide made of highly cross-linked chains of N-acetylglucosamine.

Why other options are incorrect:

- **Cellulose & Hemi-cellulose:** Exclusive structural components of the *plant* kingdom's cell walls.
- **Murein (Peptidoglycan):** The defining structural component of *bacterial* cell walls.

Question #59 Key: (D)

KMU 2023

Amino acids mainly differ from each other by the difference in their: [ETEA-2023]

CORE CONCEPT AND DERIVATION

All amino acids share a universal backbone, yet 20 vastly different types exist to build complex proteins.

Solution:

- Every single amino acid possesses the exact same structural backbone: a central alpha carbon bonded to an amino group, a carboxyl group, and a solitary hydrogen atom.
- The only structural component that varies from one amino acid to the next is the fourth bond: the highly variable side chain, universally termed the **R-group**.
- It is this specific R-group that dictates whether an amino acid is acidic, basic, polar, or non-polar.

Why other options are incorrect:

- **Amino, Carboxyl, and Hydrogen:** These three groups are absolutely identical across all 20 standard amino acids; they do not differ.

Question #60 Key: (C)

SZABMU 2023

Three hydrophobic fatty acid tails and a glycerol molecule join to form a: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Biological nomenclature directly reflects the stoichiometry of the molecule's constituents.

Solution:

- The prefix "Tri-" means three.
- When a single glycerol molecule undergoes dehydration synthesis to bond covalently via ester linkages to exactly **three fatty acid tails**, it forms a massive, fully non-polar lipid used for energy storage.
- By direct definition, this molecule is a **Triglyceride** (Triacylglycerol).

Why other options are incorrect:

- **Mono/Diglyceride:** Contain 1 and 2 fatty acids, respectively.
- **Phospholipid:** Contains exactly 2 fatty acids. The third spot on the glycerol is occupied by a polar phosphate group instead of a third tail.

Question #61 Key: (D)

KMU 2023

Choose the unsaturated fatty acid among the following: [ETEA-2023]

CORE CONCEPT AND DERIVATION

Fatty acids are classed as saturated (no double bonds) or unsaturated (contains double bonds).

Solution:

- **Oleic acid** (18 carbons) contains exactly one carbon-carbon double bond (it is monounsaturated), making it the primary liquid fat found in olive oil.

Why other options are incorrect:

- **Palmitic (16C), Stearic (18C), and Arachidic (20C) acids:** These are all classic examples of fully saturated fatty acids, forming straight chains that are solid at room temperature.

Question #62 **Key: (B)**

NUMS 2023

*C-H bonds in lipids are important: [NUMS-2023]***CORE CONCEPT AND DERIVATION**

The massive thermodynamic yield of lipids is rooted strictly in their chemical structure.

Solution:

- During cellular respiration, high-energy electrons are harvested directly from non-polar C-H bonds to power the electron transport chain.
- Lipids contain incredibly long aliphatic tails composed almost entirely of C-H bonds.
- Because they possess such a massive proportion of these easily oxidizable bonds compared to carbohydrates, the specific fundamental importance of C-H bonds is **providing more energy** (more than double the yield per gram).

Why other options are incorrect:

- **Insulation / Cuticle:** These are macroscopic physical functions of the lipid molecule as a whole (due to its hydrophobicity), not the specific thermodynamic importance of the individual C-H bond itself.
- **Exoskeleton:** Formed by chitin (a carbohydrate), not lipids.

Question #63 **Key: (B)**

SZABMU 2023

*The sugar which is part of ribonucleic acid is: [SZABMU-2023]***CORE CONCEPT AND DERIVATION**

Nucleic acids are named directly after the pentose sugar making up their backbone.

Solution:

- **Ribonucleic acid** (RNA) utilizes the standard 5-carbon sugar **Ribose** ($C_5H_{10}O_5$) in every single one of its nucleotide building blocks.

Why other options are incorrect:

- **Deoxyribose:** The sugar found exclusively in DNA (missing one oxygen atom).
- **Ribulose / Deoxyribulose:** These are ketose sugars; nucleic acid backbones strictly require the specific ring structure formed by aldoses.

Question #64 **Key: (A)**

KMU 2023

*Purines are ____ nitrogenous bases. [ETEA-2023 Retake]***CORE CONCEPT AND DERIVATION**

Nitrogenous bases fall into two structurally distinct families.

Solution:

- **Purines** (Adenine and Guanine) are the larger, more complex nitrogenous bases.
- They are formed by fusing a six-membered pyrimidine ring directly to a five-membered imidazole ring.
- Because of this fused structure, they are structurally classified as **Double ringed** bases.

Why other options are incorrect:

- **Single ringed:** Defines the Pyrimidines (Cytosine, Thymine, Uracil).
- **Single/Double bond:** Both types of rings contain multiple single and double bonds; these terms do not classify the base families.

Question #65 **Key: (C)**

UHS 2023

Cells of different types can be distinguished on the basis of surface. [UHS-2023]

CORE CONCEPT AND DERIVATION

Cell-to-cell recognition relies on highly specific molecular "name tags" sticking out from the outer membrane leaflet.

Solution:

- Attached to the exterior surface of the plasma membrane are branching carbohydrate chains bound to either lipids (**Glycolipids**) or proteins (**Glycoproteins**).
- These unique, complex "sugar coatings" (the glycocalyx) act as highly specific biological markers. They allow the immune system to distinguish "self" from "non-self" and help tissues organize, effectively distinguishing different cell types.

Why other options are incorrect:

- **Phospholipids & Cholesterol:** These are generic, ubiquitous structural components shared identically across almost all mammalian cell membranes; they offer no unique identification.
- **Globular proteins:** While they serve functions (channels/receptors), it is specifically the attached carbohydrate chains (glyco-) that provide the complex combinatorial "ID tags" for cell recognition.

Question #66 **Key: (C)**

SZABMU 2023

The basic structural framework of all types of membranes is: [SZABMU-2023]

CORE CONCEPT AND DERIVATION

Biological membranes are fundamentally fluid mosaics composed of two distinct macromolecule classes working in tandem.

Solution:

- The universal architecture of *all* biological membranes is a phospholipid bilayer extensively embedded with integral and peripheral proteins.
- Because a membrane is essentially a massive, co-assembled structure of lipids providing the barrier and proteins providing the function, this entire structural framework is broadly classified as a massive **Lipoprotein** complex (a conjugated structure of lipids and proteins).

Why other options are incorrect:

- **Glycolipids & Glycoproteins:** These are minor surface modifications for recognition, not the bulk *basic structural framework* spanning the entire membrane.
- **Nucleoproteins:** Complexes of DNA/RNA and protein (like chromatin or ribosomes), completely unrelated to membranes.

Question #67 Key: (D)

KMU 2023

The conjugated molecule that is primarily present in egg albumin is:
[ETEA-2023]

CORE CONCEPT AND DERIVATION

Ovalbumin (the main protein in egg white) requires slight carbohydrate modification to maintain solubility and structure.

Solution:

- Egg albumin (ovalbumin) is a massive globular storage protein.
- However, it is not a pure protein; it has short carbohydrate chains covalently attached to its surface to enhance its solubility in the aqueous environment of the egg white.
- Because it is a protein chemically bonded to a carbohydrate, it is classified specifically as a **Glycoprotein**.

Why other options are incorrect:

- **Lipoprotein:** Found in blood plasma (HDL/LDL) for lipid transport, not bulk egg white storage.
- **Nucleoprotein:** Found in the nucleus (chromatin).
- **Glycolipid:** Found on cell membranes, entirely lacking the massive protein component of albumin.

Question #68 Key: (B)

UHS 2022

Hydrolysis process is a reverse of ____ process. [UHS-2022]

CORE CONCEPT AND DERIVATION

Hydrolysis is fundamentally the reverse of condensation (also known as dehydration synthesis).

Solution:

- In a **condensation** reaction, two monomers join together. A hydroxyl group (-OH) is removed from one monomer and a hydrogen atom (-H) from the other, synthesizing water and forming a covalent bond.
- In **hydrolysis**, the polymer is broken down into its constituent monomers by the addition of a water molecule, which splits back into a hydroxyl group and a hydrogen atom.

Why other options are incorrect:

- **Photolysis:** The breakdown of molecules caused by light.
- **Deduction/Convection:** Unrelated logical and physical processes.

Question #69 Key: (D)

NUMS 2022

Hydrolysis is the breakdown of polymers into its monomers by the addition of: [NUMS-2022]

CORE CONCEPT AND DERIVATION

Hydrolysis literally translates to 'water-splitting' (hydro = water, lysis = to break).

Solution:

- During hydrolysis, polymers are broken down into monomers strictly by the addition of **water**.
- The water molecule splits: a hydroxyl group is attached to one monomer, and a hydrogen atom is attached to the other monomer to satisfy their valencies.
- Digestion reactions in the human body are classic examples of enzyme-controlled hydrolysis.

Why other options are incorrect:

- **Hydrogen / Hydroxyl group:** These are individual components of water, but the entire water molecule must be added to facilitate the reaction.
- **Nitrogen:** Unrelated to the cleavage of standard glycosidic, peptide, or ester bonds.

Question #70 Key: (A)

KMU 2022

The four types of fundamental biological molecules present in protoplasm are carbohydrates, proteins, lipids a...

CORE CONCEPT AND DERIVATION

The protoplasm is primarily composed of four fundamental classes of organic macromolecules that sustain life.

Solution:

- The four major types of biological macromolecules are **carbohydrates, proteins, lipids, and nucleic acids**.
- Nucleic acids (DNA and RNA) are essential for storing and transmitting genetic information.

Why other options are incorrect:

- **Enzymes / Hormones:** These are specific functional sub-categories (mostly proteins or lipids), not fundamental structural classes of macromolecules.
- **Alkaloids:** Secondary metabolites found primarily in plants, not a fundamental building block of all protoplasm.

Question #71 Key: (C)

KMU 2022

The most abundant element present in human body is _____. [ETEA-2022]

CORE CONCEPT AND DERIVATION

Bio-elements combine to form the living mass of an organism. While Oxygen is the most abundant element overall (65%), it is not listed in the options.

Solution:

- We must select the most abundant element from the given choices based on standard human body composition percentages:
- **Carbon:** 18%
- **Nitrogen:** 3%
- **Sulphur:** 0.25%
- **Manganese:** Trace element
- Therefore, Carbon is the most abundant element among the provided options.

Why other options are incorrect:

- Nitrogen, Sulphur, and Manganese make up significantly smaller percentages of human body mass compared to Carbon.

Question #72 Key: (A)

UHS 2022

Human bone cells contain ____ % of water. [UHS-2022]

CORE CONCEPT AND DERIVATION

Water is the primary medium of life, but its percentage varies drastically depending on the specific tissue's function and structural density.

Solution:

- **Brain cells:** Require high metabolic activity and fluidity, containing about 85–90% water.
- **Bone cells:** Require extreme structural rigidity and calcification, containing only about **20%** water.
- **Jellyfish:** Can be up to 99% water.

Why other options are incorrect:

- 85% and 90% are characteristic of brain cells, not dense connective tissues like bone.

Question #73 Key: (D)

NUMS 2022

Due to its high heat of vaporization, water plays important role in living organisms as: [NUMS-2022]

CORE CONCEPT AND DERIVATION

Heat of vaporization is the energy required to convert a liquid to a gas.

Solution:

- Because water requires a massive influx of heat energy to break its hydrogen bonds and vaporize, evaporation removes substantial heat from the surface it leaves behind.
- This gives animals an efficient way to release excess body heat in hot environments (e.g., sweating or panting), strictly acting as a **cooling agent**.

Why other options are incorrect:

- **Thermal shock resistant:** This is related to water's *High Specific Heat Capacity*, which prevents rapid temperature fluctuations, not vaporization.
- **Solvent / Membrane stabilizer:** Governed by polarity and hydrophobic exclusion, not phase changes.

Question #74 Key: (B)

NUMS 2022

Which of the following molecules would yield glucose and fructose on hydrolysis? [NUMS-2022]

CORE CONCEPT AND DERIVATION

Disaccharides yield two monosaccharide monomers upon hydrolysis (the breaking of the glycosidic bond).

Solution:

- **Sucrose** (table sugar) is a disaccharide composed of an alpha-glucose molecule linked to a beta-fructose molecule.
- When hydrolyzed by the enzyme sucrase (or dilute acid), it strictly yields one molecule of **glucose** and one molecule of **fructose**.

Why other options are incorrect:

- **Maltose:** Yields two molecules of glucose.
- **Lactose:** Yields one glucose and one galactose.
- **Starch:** A polysaccharide that yields thousands of glucose units, not fructose.

Question #75 Key: (B)

SZABMU 2022

Which property of water enables it to act as temperature stabilizer in living organisms? [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Temperature stabilization implies resisting sudden fluctuations in internal or environmental temperature.

Solution:

- Due to extensive intermolecular hydrogen bonding, water has a **high specific heat capacity**.
- This means water has a great ability to absorb massive amounts of thermal energy with only a minimal change to its own temperature.
- This property buffers cellular environments against extreme thermal shocks, acting as a crucial thermo-stabilizer.

Why other options are incorrect:

- **High heat of vaporization:** Enables cooling through phase change (sweating), but specific heat capacity is what actively prevents the temperature from spiking in the first place.
- **High polarity:** Relates to solvent properties, not thermal properties.

Question #76 Key: (C)

BUMHS 2022

Which of the following is antagonistic to condensation? [BUMHS-2022]

CORE CONCEPT AND DERIVATION

Antagonistic means acting in direct opposition.

Solution:

- **Condensation (Dehydration Synthesis):** Two monomers are joined together to form a polymer, releasing a molecule of water in the process.
- **Hydrolysis:** A polymer is broken down into two monomers by the consumption/addition of a water molecule.
- Therefore, hydrolysis is the exact biological and chemical antagonist (reverse) of condensation.

Why other options are incorrect:

- **Dehydration:** This is synonymous with condensation, not antagonistic to it.
- **Hydration:** Simply means adding water to a substance, but 'hydrolysis' specifically implies breaking a covalent bond using water.
- **Decarboxylation:** Removal of carbon dioxide, unrelated to water-mediated monomer linking.

Question #77 Key: (C)

DUHS 2022

Water is the most abundant compound in living organisms its amount varies from: [DUHS-2022]

CORE CONCEPT AND DERIVATION

Water is the fundamental matrix of life, making up the vast bulk of cellular and extracellular fluid.

Solution:

- In almost all living organisms, water is the most abundant compound.
- Across different species and tissue types, the generalized overall water content typically ranges from **70% to 90%** of the total body mass.
- For instance, humans are roughly 70% water, while some organisms like jellyfish reach up to 99%.

Why other options are incorrect:

- Values like 10–60% drastically underestimate the required aqueous environment needed for biochemical reactions to sustain life.

Question #78 Key: (B)

NUMS 2022

Which of the following is not a carbohydrate? [NUMS-2022]

CORE CONCEPT AND DERIVATION

Not all molecules that loosely fit the empirical formula of a carbohydrate are biologically classified as carbohydrates.

Solution:

- **Lactic acid** has the formula $C_3H_6O_3$, which mathematically fits the $C_n(H_2O)_n$ ratio.
- However, structurally, it contains a carboxylic acid group ($-COOH$) and a single hydroxyl group, not the polyhydroxy aldehyde/ketone structure required to be a sugar.
- It is a metabolic by-product of anaerobic respiration, completely distinct from carbohydrates.

Why other options are incorrect:

- **Glucose & Sucrose:** Standard textbook carbohydrates.
- **Rhamnose:** A naturally occurring deoxy sugar (a true carbohydrate, despite deviating from the strict 1 : 2 : 1 water ratio).

Question #79 Key: (A)

UHS 2022

Upon initial hydrolysis, starch yields: [UHS-2022]

CORE CONCEPT AND DERIVATION

Enzymatic digestion of massive polymers occurs in stepwise stages rather than instant reduction to monomers.

Solution:

- When salivary or pancreatic **amylase** acts upon the massive starch polymer (amylose/amylopectin), it performs an *initial*, partial hydrolysis.
- This specific enzyme cleaves the chain into two-unit fragments, yielding the disaccharide **maltose**.
- Later in digestion, a separate enzyme (maltase) is required to break maltose down into final glucose monomers.

Why other options are incorrect:

- **Glucose:** This is the final end-product of complete digestion, not the initial yield of amylase activity.
- **Sucrose/Mannose:** Completely different sugars unrelated to starch breakdown.

Question #80 Key: (C)

UHS 2022

Butyric acid is a ____ carbon fatty acid. [UHS-2022]

CORE CONCEPT AND DERIVATION

Fatty acids are categorized by their specific aliphatic chain lengths.

Solution:

- **Acetic acid:** 2 carbons.
- **Butyric acid: 4 carbons.** It is famously found in rancid butter (from Latin *butyrum* = butter).
- **Caproic acid:** 6 carbons.
- **Octanoic acid:** 8 carbons.

Why other options are incorrect:

- Options 2, 6, and 8 correspond to entirely different fatty acids.

Question #81 Key: (D)

SZABMU 2022

Which bond is the potential source of chemical energy for cellular activities? [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Cellular respiration extracts thermodynamic energy stored in highly reduced organic molecules.

Solution:

- The electrons shared within the non-polar **Carbon-Hydrogen (C-H)** bonds are held relatively loosely compared to polar bonds (like C=O).
- Because they are held loosely, these electrons possess high potential energy.
- During cellular respiration, these high-energy electrons are stripped from the C-H bonds and allowed to 'fall' towards highly electronegative oxygen, releasing massive amounts of usable chemical energy to synthesize ATP.

Why other options are incorrect:

- **C=O:** Highly oxidized bonds holding electrons tightly in a low-energy state.
- **C-N / C-R:** Not the primary thermodynamic fuel utilized during massive oxidative phosphorylation.

Question #82 Key: (A)

SZABMU 2022

Which of the following carbohydrates are the sweetest among all? [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Sweetness is inversely proportional to the complexity and size of the carbohydrate polymer.

Solution:

- **Monosaccharides** (like fructose and glucose) are structurally the smallest and simplest sugars.
- Their small size and exposed functional groups easily interact with the sweet-taste receptors on the tongue, making them biologically the sweetest class of carbohydrates. (Fructose, a monosaccharide, is notoriously the sweetest naturally occurring sugar).

Why other options are incorrect:

- As sugar chains grow longer (Disaccharides → Oligosaccharides → Polysaccharides), they lose their ability to interact with taste receptors. Polysaccharides like starch and cellulose are entirely tasteless.

Question #83 Key: (C)

KMU 2022

Ribose is a pentose sugar (5-carbon) that contains: [ETEA-2022]

CORE CONCEPT AND DERIVATION

Monosaccharides are classified structurally as either aldoses (having an aldehyde group at Carbon-1) or ketoses (having a ketone group at Carbon-2).

Solution:

- **Ribose** is an aldo-pentose. It possesses a terminal **aldehyde group** (-CHO) at carbon-1.
- Its structural isomer, Ribulose, is the ketose version possessing a ketone group.

Why other options are incorrect:

- **Ketone group:** Found in Ribulose and Fructose.
- **Carboxyl / Ester groups:** These characterize organic acids and lipids, not standard sugar molecules.

Question #84 Key: (B)

BUMHS 2022

*Diastase/amylase acts on: [BUMHS-2022]***CORE CONCEPT AND DERIVATION**

Enzymes are highly substrate-specific.

Solution:

- **Amylase** (also historically called diastase) is specifically designed to recognize and cleave the α -1,4-glycosidic linkages found exclusively in **starch** (and glycogen).
- It breaks the large starch polymer down into smaller fragments and ultimately into the disaccharide maltose.

Why other options are incorrect:

- **Lactose, Sucrose, Maltose:** These are disaccharides digested by entirely different, specific enzymes (lactase, sucrase, and maltase, respectively).

Question #86 Key: (C)

DUHS 2022

*Synthesis of disaccharide by condensation two glucose joined by glycosidic linkage to form: [DUHS-2022]***CORE CONCEPT AND DERIVATION**

Knowing the specific monosaccharide components of common disaccharides is fundamental biochemistry.

Solution:

- When a condensation reaction occurs strictly between **two α -glucose molecules**, the resulting disaccharide product is **Maltose**.

Why other options are incorrect:

- **Lactose:** Formed by Glucose + Galactose.
- **Fructose & Galactose:** These are single monosaccharide units, not disaccharide products.

Question #85 Key: (C)

BUMHS 2022

*Maltose is a: [BUMHS-2022]***CORE CONCEPT AND DERIVATION**

Saccharides are classified by the number of monomeric units joined together.

Solution:

- **Maltose** (malt sugar) is synthesized by the condensation of exactly two glucose molecules linked by an α -1,4-glycosidic bond.
- Because it consists of strictly two units, it is classified as a **Disaccharide**.

Why other options are incorrect:

- **Monosaccharide:** A single unit (e.g., glucose).
- **Oligosaccharide / Polysaccharide:** Consist of 3 to 10 units, and hundreds of units, respectively.

Question #87 Key: (C)

DUHS 2022

*Molecules of amylose consists of unbranched chains of hundreds of glucose sub units, join together by: [DUHS-2022]***CORE CONCEPT AND DERIVATION**

Starch comes in two forms: unbranched amylose and highly branched amylopectin.

Solution:

- **Amylose** is the simple, unbranched, linear component of starch.
- It forms a helical chain because its glucose units are linked strictly end-to-end via **α -1,4-glycosidic linkages** (Carbon 1 of one glucose binding to Carbon 4 of the next).

Why other options are incorrect:

- Branching in amylopectin/glycogen occurs at 1-6 linkages. The other listed linkages (1-2, 1-3, 2-3) do not form the standard backbone of plant starch.

Question #88 Key: (D)

UHS 2022

Unique three-dimensional shape of the fully folded polypeptide constitutes: [UHS-2022]

CORE CONCEPT AND DERIVATION

Protein folding reaches functional maturity at specific structural hierarchies.

Solution:

- The **Tertiary structure** is defined exactly as the ultimate, overall three-dimensional shape of a single, fully folded polypeptide chain.
- It is uniquely determined by complex interactions (disulfide bridges, hydrophobic exclusions, ionic bonds, hydrogen bonds) strictly between the varying R-groups of the constituent amino acids.

Why other options are incorrect:

- **Primary/Secondary:** Refer only to linear sequence and localized coils/sheets, lacking full 3D completion.
- **Quaternary:** Refers to the arrangement of *multiple* distinct polypeptide subunits together (e.g., Hemoglobin), rather than a single folded chain.

Question #89 Key: (B)

NUMS 2022

Which of the following molecules contains amino acid? [NUMS-2022]

CORE CONCEPT AND DERIVATION

Macromolecules are composed of specific fundamental monomers. Proteins are polymers of amino acids.

Solution:

- **Collagen** is the most abundant structural protein in the mammalian body, found extensively in connective tissues.
- Because it is a protein, it is synthesized exclusively from **amino acid** monomers linked by peptide bonds.

Why other options are incorrect:

- **Cellulose & Sucrose:** These are carbohydrates, composed entirely of monosaccharide sugars (glucose/fructose).
- **Ascorbic acid:** Also known as Vitamin C, it is a small, water-soluble organic compound (a sugar acid), not a protein.

Question #90 Key: (B)

SZABMU 2022

Select an example of fibrous protein: [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Proteins are structurally classed into two main groups: fibrous (long, structural strands) and globular (spherical, functional folded units).

Solution:

- **Collagen** consists of three polypeptide chains wrapped around each other into a tough, rope-like triple helix.
- This extended, uncoiled macroscopic shape makes it the classic example of a **fibrous protein**, granting immense tensile strength to tendons, ligaments, and skin.

Why other options are incorrect:

- **Enzymes, Hemoglobin, Hormones:** These perform highly specific, dynamic metabolic tasks (catalysis, transport, signaling) and must fold into complex 3D spherical active shapes, making them strictly **globular** proteins.

Question #91 Key: (D)

SZABMU 2022

Which function is not performed by proteins? [SZABMU-2022]

CORE CONCEPT AND DERIVATION

While proteins are the most versatile macromolecules in the body, certain passive, long-term physiological roles are delegated to other biomolecules.

Solution:

- **Providing insulation against heat loss** is fundamentally the physiological role of adipose tissue (fat), which consists of **lipids** (specifically triglycerides).
- Lipids form thick, non-conductive subcutaneous layers (like blubber) that trap heat, a function proteins do not inherently perform.

Why other options are incorrect:

- **Structural support:** Performed by fibrous proteins like cytoskeleton, collagen, and keratin.
- **Catalyzing reactions:** Performed by enzymatic proteins.
- **Transporting materials:** Performed by channel/carrier proteins and hemoglobin.

Question #92 Key: (C)

KMU 2022

Proteins are macromolecules formed of units known as amino acids. The amino acids in which the variable group ...

CORE CONCEPT AND DERIVATION

The chemical identity and properties of each amino acid are dictated solely by its unique 'R' side-chain.

Solution:

- **Glycine** is the simplest, most basic amino acid found in nature.
- Its variable R-group consists of just a single **Hydrogen (H) atom**.
- Because of this tiny side chain, glycine can comfortably fit into incredibly tight structural turns within protein folding architectures, such as the collagen triple helix.

Why other options are incorrect:

- **Alanine:** R-group is a methyl group ($-CH_3$).
- **Phenylalanine:** R-group contains a large, bulky benzyl ring.
- **Lysine:** R-group is a long, positively charged hydrocarbon chain ending in an amino group.

Question #93 Key: (B)

KMU 2022

Haemoglobin is a: [ETEA-2022]

CORE CONCEPT AND DERIVATION

Hemoglobin is the primary oxygen-transporting molecule in the blood of vertebrates.

Solution:

- **Haemoglobin** is a complex, conjugated **globular protein**.
- It consists of four distinct polypeptide chains (two alpha and two beta chains), heavily folded into a Quaternary structure around non-protein heme groups that bind oxygen.

Why other options are incorrect:

- **Enzyme:** Although it is a protein, hemoglobin does not catalyze chemical reactions; it passively binds and transports gas, so it is a transport protein, not an enzyme.
- **Carbohydrate / Nucleic acid:** Completely different macromolecule classes.

Question #94 Key: (B)

KMU 2022

The most common protein in nature is _____. [ETEA-2022]

CORE CONCEPT AND DERIVATION

Biological abundance is determined by evaluating the total biomass of organisms on Earth, which is overwhelmingly dominated by photosynthetic life.

Solution:

- **Rubisco** (Ribulose-1,5-bisphosphate carboxylase-oxygenase) is the primary enzyme responsible for carbon fixation in the Calvin cycle of photosynthesis.
- Because it is present in massive quantities in the chloroplasts of almost every single plant and photosynthetic algae across the globe, it is unequivocally recognized as the **most abundant protein in the world**.

Why other options are incorrect:

- **Collagen:** The most abundant protein in the *animal kingdom* (roughly 25–35% of mammalian protein mass), but animals represent a tiny fraction of global biomass compared to plants.
- **Keratin & DNAase:** Abundant in specific tissues, but dwarfed globally by Rubisco.

Question #95 Key: (D)

KMU 2022

A haemoglobin molecule consists of _____ amino acids. [ETEA-2022]

CORE CONCEPT AND DERIVATION

Hemoglobin structure is a classic textbook example of quaternary protein assembly.

Solution:

- A standard human Hemoglobin A molecule is a tetramer, consisting of exactly four polypeptide chains:
- **Two alpha (α) chains**, each containing exactly **141** amino acids (Total = 282).
- **Two beta (β) chains**, each containing exactly **146** amino acids (Total = 292).
- Summing them up: $282 + 292 = 574$ total amino acids.

Why other options are incorrect:

- The numbers 474, 674, and 874 do not correlate with the highly conserved genetic sequence encoding mammalian hemoglobin chains.

Question #96 Key: (C)

BUMHS 2022

Two simplest amino acids are: [BUMHS-2022]

CORE CONCEPT AND DERIVATION

The complexity of an amino acid is dictated by the size and branching of its R-group.

Solution:

- **Glycine:** The absolute simplest amino acid, with an R-group consisting of just a hydrogen atom ($-H$).
- **Alanine:** The second simplest amino acid, with an R-group consisting of just a small methyl group ($-CH_3$).
- These two have the smallest molecular weights and least complex side chains.

Why other options are incorrect:

- **Trypsin:** This is not an amino acid at all; it is a massive, complex digestive *protein* (enzyme).
- **Glutamate:** Contains a larger, negatively charged carboxylic acid side chain, making it significantly more complex.

Question #97 Key: (D)

BUMHS 2022

Which protein establishes the matrix of bone and cartilage? [BUMHS-2022]

CORE CONCEPT AND DERIVATION

Connective tissues rely heavily on extracellular fibrous proteins to resist mechanical stress.

Solution:

- **Collagen** is the primary structural protein secreted into the extracellular space.
- It forms an incredibly dense, tough fibrous network (matrix) that acts as the physical scaffolding for cartilage, tendons, ligaments, and the calcified structure of bone.

Why other options are incorrect:

- **Hemoglobin & Myoglobin:** Globular proteins strictly dedicated to oxygen transport/storage.
- **Fibrinogen:** A soluble plasma protein that converts to fibrin to facilitate blood clotting, not bone structure.

Question #98 **Key: (C)**

SZABMU 2022

Three hydrophobic fatty acid tails and a glycerol molecule join to form: [SZABMU-2022]

CORE CONCEPT AND DERIVATION

Acylglycerols are formed by linking fatty acid chains to the three hydroxyl groups of a glycerol backbone.

Solution:

- Glycerol is a 3-carbon alcohol with exactly three reactive hydroxyl ($-OH$) sites.
- When all three of these sites undergo condensation reactions to bond with exactly **three distinct fatty acid tails**, the resulting molecule is a neutral fat scientifically known as a **Triglyceride** (or Triacylglycerol).

Why other options are incorrect:

- **Monoglyceride / Diglyceride:** Contain only one or two fatty acid tails, respectively.
- **Phospholipid:** Contains exactly two fatty acid tails, with the third glycerol site occupied by a charged phosphate group.

Question #99 **Key: (C)**

KMU 2022

The type of lipids which do not contain fatty acids are: [ETEA-2022]

CORE CONCEPT AND DERIVATION

Lipids are a chemically diverse group united primarily by their insolubility in water, rather than a shared monomer structure.

Solution:

- Most standard lipids (fats, oils, waxes, phospholipids) are built by chemically bonding long-chain **fatty acids** to an alcohol backbone.
- **Steroids**, however, are a structurally distinct class of lipids entirely devoid of fatty acid chains.
- Instead, they are constructed from a rigid skeleton of exactly four fused carbon rings (synthesized from isoprene units). Examples include cholesterol, testosterone, and estrogen.

Why other options are incorrect:

- **Acylglycerols & Phospholipids:** Directly built using 2 to 3 fatty acid tails.
- **Waxes:** Esters of one very long-chain fatty acid linked to one very long-chain alcohol.

Question #100 **Key: (B)**

KMU 2022

The glycerol is a ____ carbon compound. [ETEA-2022]

CORE CONCEPT AND DERIVATION

Glycerol acts as the universal foundational backbone for triacylglycerols and phospholipids.

Solution:

- **Glycerol** (also known as glycerin) is structurally a simple polyol (sugar alcohol).
- Its chemical formula is $C_3H_8O_3$.
- Structurally, it consists of exactly **three carbon atoms**, each holding one reactive hydroxyl ($-OH$) group available to form ester bonds with fatty acids.

Why other options are incorrect:

- Compounds with four, five, or six carbons (like ribose or glucose) belong to entirely different carbohydrate classes and are not the lipid backbone.

Question #101 Key: (A)

BUMHS 2022

Which statement is wrong about saturated fats? [BUMHS-2022]

CORE CONCEPT AND DERIVATION

The term "saturated" refers to the maximum possible amount of hydrogen atoms bonded to the carbon skeleton.

Solution:

- To be completely "saturated" with hydrogen, every single carbon atom in the chain must be bonded to its neighbors via single covalent bonds only.
- Therefore, the statement claiming they have **multiple double bonds** is completely factually **wrong**.
- (Fatty acids with double bonds are specifically classified as *unsaturated*).

Why other options are incorrect (they are true statements):

- **Common in animals:** True (e.g., lard, butter, tallow).
- **Solidify at room temp:** True, because the straight single-bond chains pack tightly together.
- **Contain more hydrogen:** True, because replacing a double bond with single bonds requires adding two hydrogen atoms.

Question #102 Key: (D)

DUHS 2022

This lipid is most common abundant richest source of energy in plant, and animal body: [DUHS-2022]

CORE CONCEPT AND DERIVATION

Organisms require an extremely dense, lightweight storage molecule for long-term energy reservoirs.

Solution:

- **Acylglycerols** (specifically, Triacylglycerols or neutral fats/oils) are dedicated entirely to massive energy storage.
- Because they are completely non-polar, they can be stored in massive anhydrous droplets within adipose cells (in animals) or seeds (in plants) without dragging heavy water weight along.
- They pack more than double the caloric energy of carbohydrates, making them unequivocally the richest and most abundant energy source.

Why other options are incorrect:

- **Phospholipids:** Highly structural, dedicated to building membranes, not bulk energy storage.
- **Carotenoids & Terpenoids:** Minor lipid pigments and signaling molecules, existing in tiny quantities.

Question #103 Key: (C)

UHS 2022

Which of the following is a conjugated molecule? [UHS-2022]

CORE CONCEPT AND DERIVATION

Conjugated molecules are complex structures formed by the covalent bonding of two entirely different classes of biological macromolecules.

Solution:

- A **Glycoprotein** is formed when short chains of carbohydrates (glyco-) are covalently bonded to a polypeptide backbone (protein).
- Because it merges two distinct fundamental macromolecule groups into one functional unit (often used for cell surface recognition), it is officially classified as a **conjugated molecule**.

Why other options are incorrect:

- **Protein, Lipid, Vitamins:** These are all simple, single-class molecules. They are not conjugated to a secondary, distinct chemical group.

Question #104 Key: (D)

PMDC 2020

Which property of water helps to maintain the integrity of lipid membranes? [PMC-2020]

CORE CONCEPT AND DERIVATION

The structural integrity of biological membranes relies on how water interacts with non-polar substances.

Solution:

- Water molecules are highly polar and form strong hydrogen bonds with each other.
- When non-polar (hydrophobic) molecules like the fatty acid tails of lipids are in an aqueous environment, water molecules tend to 'exclude' them to maximize their own hydrogen-bonding network.
- This phenomenon, known as **hydrophobic exclusion**, forces lipid tails to aggregate inward away from water, thereby driving the spontaneous formation and structural stability of the lipid bilayer membrane.

Why other options are incorrect:

- While **hydrogen bonding** drives the exclusion, 'hydrophobic exclusion' is the direct specific property that forces lipids into a bilayer formation.
- **Cohesion/Adhesion** and **Specific heat** regulate water transport and thermal stability, respectively, not membrane formation.

Question #105 Key: (B)

PMDC 2020

Water acts as universal solvent because of: [PMC-2020]

CORE CONCEPT AND DERIVATION

A solvent dissolves solutes. Water is considered a 'universal solvent' because it dissolves more substances than any other liquid.

Solution:

- Water's ability to act as a powerful solvent is primarily due to its **high polarity**.
- The partial negative charge on the oxygen atom and partial positive charges on the hydrogen atoms allow water molecules to attract and surround charged ions and other polar molecules, breaking them apart and keeping them in solution.

Why other options are incorrect:

- **Hydrogen bonding:** This is a consequence of water's polarity and aids in dissolving, but the foundational reason it interacts with ionic compounds (like NaCl) is its dipole nature/polarity.
- **Cohesion/Adhesion & Heat of vaporization:** These govern physical fluid dynamics and thermal regulation, not solvent capacity.

Question #106 Key: (B)

PMDC 2020

Monosaccharides have a general formula represented by: [PMC-2020]

CORE CONCEPT AND DERIVATION

The term "carbo-hydrate" historically stems from the observation that these molecules appear to be "hydrates of carbon".

Solution:

- The general stoichiometric formula for simple monosaccharides is typically represented as $C_n(H_2O)_n$.
- This reflects that for every carbon atom, there is roughly the equivalent of one water molecule (two hydrogens and one oxygen), yielding a 1:2:1 ratio of C:H:O.
- Here, n is a whole number ranging from 3 to 7.

Why other options are incorrect:

- $C_5(H_2O)_n$: Incorrectly limits the carbon count strictly to 5.
- $C(H_2O)_n$: Suggests only one carbon atom exists in the molecule, which is chemically impossible for sugars.

Question #107 Key: (D)

PMDC 2020

Lipids store double amount of energy as compared to carbohydrates because of: [PMC-2020]

CORE CONCEPT AND DERIVATION

The thermodynamic potential of a biological fuel depends entirely on its state of reduction (availability of oxidizable hydrogen).

Solution:

- The vast majority of a lipid's molecular structure is a long aliphatic chain composed purely of carbons bonded to hydrogens.
- This **high proportion of C-H bonds** provides an abundance of easily strippable, high-energy electrons that power the electron transport chain to make ATP.
- Carbohydrates, in contrast, have a much lower C-H proportion because many of their carbons are already bonded to oxygen (hydroxyls), meaning they are "partially burned" fuels.

Why other options are incorrect:

- **High proportion of oxygen / High CO ratio:** These represent an oxidized state (lower energy potential), characteristic of carbohydrates, not lipids.
- **Low proportion of carbon:** Lipids actually have massive carbon chains.

Question #108 Key: (C)

MDCAT 2019

If water has high latent heat of vaporization, how this property of water could be helpful to plants and anima...

CORE CONCEPT AND DERIVATION

The specific heat of vaporization of water is very high due to extensive hydrogen bonding.

Solution:

- Water absorbs a massive amount of heat as it changes from a liquid state to a gaseous state.
- Because of this high energy requirement, the evaporation of just a **small amount of water** effectively carries away a **great amount of heat**.
- For example, the evaporation of only 2 mL out of 1 liter of water lowers the temperature of the remaining 998 mL by a full 1°C. This provides a highly efficient cooling mechanism for organisms (like sweating in animals or transpiration in plants).

Why other options are incorrect:

- **Option B:** The relationship is inverted; a small volume of vapor releases a large amount of heat, not vice versa.
- **Options A & D:** Contradict the fundamental physical reality that evaporation produces a profound cooling effect.

Question #109 Key: (D)

MDCAT 2019

Starch is present in tuber, fruits and grains but absent in animal cells. Instead, animals have a substance st...

CORE CONCEPT AND DERIVATION

Both plants and animals require a macromolecular storage form of glucose to prevent osmotic lysis.

Solution:

- Plants store excess glucose as **starch**.
- Animals store excess glucose as a highly branched polysaccharide known as **glycogen**.
- Glycogen is often colloquially referred to as 'animal starch' and is stored abundantly in the liver and skeletal muscles.

Why other options are incorrect:

- Glucose/Galactose:** Simple monomers, not bulk storage molecules.
- Glucagon:** A hormone secreted by the pancreas that triggers the *breakdown* of glycogen; it is a protein, not a carbohydrate.

Question #110 Key: (C)

MDCAT 2019

The covalent bond or bridge between two monosaccharides to form a disaccharide is called a: [MDCAT-2019]

CORE CONCEPT AND DERIVATION

Different biological macromolecules rely on specific signature covalent bonds.

Solution:

- The specific oxygen bridge formed between two sugar monomers after a condensation reaction is called a **glycosidic bond** (or glycosidic linkage).

Why other options are incorrect:

- Peptide bond:** Found in proteins.
- Phosphodiester bond:** Found in nucleic acids.
- Ester bond:** Found in lipids.
- Hydrogen bond:** A weak intermolecular force, not the strong covalent bridge uniting monomers.

Question #111 Key: (B)

MDCAT 2019

Which is an example of a disaccharide? [MDCAT-2019]

CORE CONCEPT AND DERIVATION

Carbohydrates are categorized by the number of monomeric units they contain.

Solution:

- Lactose** (milk sugar) is a disaccharide comprised of precisely two monomers: glucose and galactose linked by a β -1,4-glycosidic bond.

Why other options are incorrect:

- Starch & Glycogen:** Polysaccharides consisting of hundreds to thousands of glucose monomers.
- Fructose:** A simple single-unit monosaccharide.

Question #112 Key: (C)

KMU 2019

_____ is stored in animal cells. [ETEA-2019]

CORE CONCEPT AND DERIVATION

Energy storage molecules differ structurally between the plant and animal kingdoms.

Solution:

- Animals synthesize and store **glycogen** as their primary short-term energy reserve carbohydrate, sequestering it mainly within hepatocytes (liver cells) and myocytes (muscle cells).

Why other options are incorrect:

- Starch:** The storage polysaccharide of plants.
- Cellulose:** The structural polysaccharide of plant cell walls.
- Sucrose:** A transport disaccharide synthesized exclusively in plants.

Question #113 Key: (C)

SZABMU 2019

*Pure form of cellulose is: [AJK-2019]***CORE CONCEPT AND DERIVATION**

Cellulose is a linear β -D-glucose polymer found heavily in nature.

Solution:

- **Cotton** fibers are renowned for being almost entirely composed of cellulose (upwards of 90–95%), representing the purest natural form of cellulose available.

Why other options are incorrect:

- **Paper & Cellophane:** These are manufactured, derivative products made from cellulose, subjected to chemical processing and contain impurities/additives.
- **Chitin:** A completely different structural polysaccharide (containing nitrogen) found in fungal walls and arthropod exoskeletons.

Question #114 Key: (B)

SZABMU 2019

*[Formula] is the formula of _____. [AJK-2019]***CORE CONCEPT AND DERIVATION**

Pentose sugars follow the general monosaccharide empirical formula $C_n(H_2O)_n$.

Solution: Ribose sugar has the molecular formula $C_5H_{10}O_5$. (Deoxyribose lacks one oxygen atom, giving it the formula $C_5H_{10}O_4$).

Question #115 Key: (C)

KMU 2019

*Chitin is a: [ETEA-2019]***CORE CONCEPT AND DERIVATION**

Chitin is a modified, nitrogen-containing biological macromolecule.

Solution:

- **Chitin** is a structural polysaccharide.
- Unlike standard carbohydrates, it is a polymer composed of N-acetylglucosamine monomers.
- It forms the structural backbone of fungal cell walls and the hard exoskeletons of arthropods (insects, crustaceans).

Why other options are incorrect:

- **Lipoproteins/Phospholipids:** These are lipid-based structures related to transport and cell membranes.
- **Glycoprotein:** A protein with a small carbohydrate chain attached, completely structurally distinct from the pure carbohydrate polymer chitin.

Question #116 Key: (A)

MDCAT 2019

*Most proteins are made up of: [MDCAT-2019]***CORE CONCEPT AND DERIVATION**

The universal genetic code translates RNA into a very specific subset of biological monomers.

Solution:

- While about 170 amino acids exist in nature, only about 25 are used as constituents in biological proteins.
- Of those 25, exactly **20 standard types of amino acids** are directly encoded by the universal genetic code (DNA/RNA) and make up the overwhelming majority of nearly all cellular proteins across all domains of life.

Why other options are incorrect:

- 170 represents the total found anywhere in tissues, not those used to build proteins. The numbers 16 and 10 have no biochemical significance here.

Question #117 Key: (C)

MDCAT 2019

The structure of a fibrous protein comprises of polypeptide chains in the form of: [MDCAT-2019]

CORE CONCEPT AND DERIVATION

A protein's macroscopic structure perfectly dictates its physiological function (structure-function relationship).

Solution:

- **Fibrous proteins** (like collagen, keratin, silk) function to provide immense tensile strength and structural support.
- To achieve this, their polypeptide chains do not fold into complex 3D shapes. Instead, they align closely in parallel, forming tough, extended **long strands or fibrils**.

Why other options are incorrect:

- **Spherical / curled up ball / cluster:** These describe the highly folded nature of Globular proteins (enzymes, antibodies, hormones).

Question #118 Key: (A)

MDCAT 2019

In glycine, 'R' is _____. [MDCAT-2019]

CORE CONCEPT AND DERIVATION

The R-group (side chain) is the only variable part distinguishing one amino acid from another.

Solution:

- **Glycine** is the absolute simplest and smallest of all 20 standard amino acids.
- Its unique 'R' variable group is simply a single **Hydrogen** atom (-H).
- Because its side chain is so small, glycine can fit into very tight spatial environments where other amino acids cannot.

Why other options are incorrect:

- **Methane/Ethane:** These are independent hydrocarbon gases. (A methyl group -CH₃ is found in Alanine).
- **Fatty acid:** A massive lipid monomer, entirely unrelated.

Question #119 Key: (C)

SZABMU 2019

Which type of bonds is required to maintain the alpha helix configuration of a protein? [AJK-2019]

CORE CONCEPT AND DERIVATION

The delicate, repeating architecture of secondary structures is maintained by repeating weak interactions.

Solution:

- The α -helix coils the polypeptide chain into a rigid cylinder.
- This specific spiral configuration is stabilized exclusively by repeating **Hydrogen bonds** forming vertically down the axis of the helix between the peptide backbone groups (C=O of one amino acid binding to the N-H of an amino acid four positions away).

Why other options are incorrect:

- **Disulfide, Ionic, and Hydrophobic bonds:** These strictly mediate the large-scale folding of Tertiary and Quaternary structures by interacting between the distant R-groups, not the backbone.

Question #120 Key: (A)

NUMS 2019

The structure given below is the constituent part of: [Formula]
 $\text{H}_2\text{N}-\text{CH}(\text{R})-\text{COOH}$

CORE CONCEPT AND DERIVATION

Identifying biological monomers from structural formulas.

Solution:

- The given formula vividly depicts a central alpha-carbon atom bonded to an amino group ($-\text{NH}_2$), a carboxyl acidic group ($-\text{COOH}$), a variable side chain ($-\text{R}$), and a hydrogen atom.
- This is the universal, defining backbone structure of an **amino acid**.
- Amino acids strictly polymerize to form **Proteins**.

Why other options are incorrect:

- Lipids:** Comprised of fatty acids and glycerol.
- Carbohydrates:** Comprised of polyhydroxy aldehydes/ketones (monosaccharides).
- Vitamins:** Highly varied small organic co-factors, lacking this specific uniform backbone.

Question #121 Key: (C)

MDCAT 2019

Lipids contain double amount of energy as compared to the same amount of carbohydrates due to the presence of:...

CORE CONCEPT AND DERIVATION

Biological energy yield is fundamentally determined by the oxidation state of the carbon atoms in a molecule.

Solution:

- The chemical energy harvested during cellular respiration comes from stripping high-energy electrons away from non-polar **Carbon-Hydrogen (C-H)** bonds.
- Lipids** (fatty acids) consist of massive, long hydrocarbon tails almost entirely composed of these C-H bonds, with very little oxygen present.
- Because they possess a vastly **higher proportion of C-H bonds** compared to carbohydrates (which are already partially oxidized with many C-O bonds), lipids yield more than double the energy upon complete oxidation (~9 kcal/g vs ~4 kcal/g).

Why other options are incorrect:

- Higher proportion of C-O / Oxygen:** This describes carbohydrates. Molecules with high oxygen content are already partially oxidized, meaning they have *less* potential energy left to release.
- Lower proportion of C-H bonds:** The direct opposite of reality.

Question #122 Key: (D)

SZABMU 2019

Lipids are organic molecules which are insoluble in: [AJK-2019]

CORE CONCEPT AND DERIVATION

The universal solvent rule: "Like dissolves like."

Solution:

- **Lipids** are fundamentally defined by their predominantly non-polar, hydrophobic hydrocarbon structures.
- **Water** is a highly polar, hydrogen-bonding solvent.
- Because water energetically prefers to bond with itself rather than non-polar molecules (hydrophobic exclusion), lipids are famously **insoluble in water**.

Why other options are incorrect:

- **Alcohol, Ether, and Chloroform:** These are classic *non-polar or weakly polar organic solvents*. Lipids readily dissolve in them.

Question #123 Key: (D)

SZABMU 2019

What type of linkage is formed when an alcohol and an acid react? [AJK-2019]

CORE CONCEPT AND DERIVATION

Specific functional group reactions define the synthesis of biological polymers.

Solution:

- When a carboxylic **acid** (such as a fatty acid) reacts with an **alcohol** (such as glycerol), a condensation reaction occurs.
- The resulting covalent linkage uniting the two molecules is specifically called an **Ester bond** ($-C-O-C(=O)-$), accompanied by the release of water.
- This is the fundamental reaction that builds triglycerides and other lipids.

Why other options are incorrect:

- **Peptide bond:** Formed between an amino group and a carboxyl group (proteins).
- **Glycosidic linkage:** Formed between two hydroxyl (alcohol) groups (carbohydrates).
- **Hydrogen bond:** A weak intermolecular physical attraction, not a covalent reaction product.

Question #124 Key: (B)

SZABMU 2019

The head of phospholipid molecule is polar (hydrophilic) due to:
[AJK-2019]

CORE CONCEPT AND DERIVATION

Phospholipids are amphipathic molecules, meaning they possess both a water-loving head and water-fearing tails.

Solution:

- A phospholipid consists of a glycerol backbone attached to two non-polar fatty acid tails and one strongly polar head group.
- This head group derives its intense polarity and negative electrical charge from the **Phosphate group** (PO_4^{3-}).
- Because the phosphate is charged, it readily forms electrostatic interactions and hydrogen bonds with water, making the "head" completely hydrophilic.

Why other options are incorrect:

- **Fatty acids:** Form the long, highly non-polar, *hydrophobic* tails.
- **Carboxylic acid:** These groups on the fatty acids are lost (converted to ester bonds) during synthesis, so they don't contribute to head polarity.
- **Triacylglycerol:** A completely different, fully non-polar storage fat molecule that lacks a phosphate entirely.

Question #125 Key: (C)

NUMS 2019

Which of the following are the most prominent part of cell membranes in living organisms? [NUMS-2019]

CORE CONCEPT AND DERIVATION

The physical boundary of every living cell on Earth relies on the spontaneous self-assembly of specific amphipathic molecules.

Solution:

- **Phospholipids** are uniquely structured with a hydrophilic head and hydrophobic tails.
- When placed in an aqueous environment, they spontaneously arrange themselves tail-to-tail to form the **lipid bilayer**, effectively hiding their hydrophobic tails from water.
- This bilayer forms the primary, ubiquitous structural matrix (the most prominent part) of all plasma membranes across all domains of life.

Why other options are incorrect:

- **Acylglycerols (Triglycerides) & Waxes:** Wholly non-polar molecules used primarily for energy storage and waterproofing, respectively; they cannot form a bilayer.
- **Terpenoids:** While some derivatives (like cholesterol) exist in membranes, they act as minor fluid-modifiers, not the prominent structural matrix itself.

Question #126 Key: (D)

NUMS 2019

Which of the following is the constituent of RNA molecule? [NUMS-2019]

CORE CONCEPT AND DERIVATION

Basic terminology of genetic macromolecules.

Solution:

- The acronym **RNA** directly stands for **Ribonucleic acid**.
- *Note: While the question phrasing "constituent of RNA molecule" is somewhat tautological and poorly worded in the original exam, "Ribonucleic acid" is the only option that correctly names the molecule itself, distinguishing it from DNA.*

Why other options are incorrect:

- **Fatty acids / Ascorbic acid:** Completely unrelated lipid and vitamin classes.
- **Deoxyribonucleic acid:** This is DNA, a distinctly different molecule featuring a different sugar and the base thymine.

Question #127 Key: (B)

MDCAT 2018

Glycosidic bond is formed by the: [MDCAT-2018]

CORE CONCEPT AND DERIVATION

Glycosidic bonds link simple sugars together via a dehydration synthesis reaction.

Solution:

- When two monosaccharides bond to form a disaccharide, an -OH group from one sugar and an -H from the other sugar are excised.
- These excised atoms combine to form a water molecule (H_2O), which is expelled from the reaction site.
- Thus, the covalent O-glycosidic bond is formed precisely by the **removal of water**.

Why other options are incorrect:

- **Addition of water:** This would describe hydrolysis (breaking the bond), not forming it.
- **Removal/Addition of oxygen:** Does not account for the hydrogen atoms involved in forming the water byproduct.

Question #128 Key: (A)

MDCAT 2018

Which of the following holds the alpha helix of protein in its place? [MDCAT-2018]

CORE CONCEPT AND DERIVATION

The structural stability of secondary shapes relies on extensive, repeating weak interactions.

Solution:

- The α -helix is a right-handed coil where the backbone spirals around a central axis.
- This delicate geometric spiral is held tightly in place entirely by **Hydrogen bonds**.
- These bonds occur specifically between the slightly positive Hydrogen of an amino group (N-H) and the slightly negative Oxygen of a carboxyl group (C=O) located exactly four amino acids further down the chain.

Why other options are incorrect:

- **Disulphide bonds / R-group interactions:** These strictly dictate the overall Tertiary (3D) folding pattern, not the local secondary helix.

Question #129 Key: (D)

MDCAT 2018

The number and sequence of amino acids along a polypeptide chain is called structure of a protein. [MDCAT-2018...]

CORE CONCEPT AND DERIVATION

The hierarchical levels of protein structure begin with the basic genetic blueprint.

Solution:

- The most basic foundational level is the **Primary structure**.
- It is defined strictly as the exact number, specific type, and linear sequence in which amino acids are strung together by covalent peptide bonds (directly dictated by mRNA).

Why other options are incorrect:

- **Secondary, Tertiary, Quaternary:** These describe how that linear primary sequence bends, folds, and aggregates into three-dimensional space.

Question #130 Key: (B)

PMDC 2018

Which of the following is an unsaturated fatty acid? [MDCAT-2018, PMC-2020]

CORE CONCEPT AND DERIVATION

Knowing the common names and saturation status of major biological fatty acids is a standard requirement.

Solution:

- **Oleic acid** (the primary component of olive oil) is an 18-carbon fatty acid containing exactly one double bond between carbons 9 and 10.
- Because of this double bond, it is classified as a mono-unsaturated fatty acid.

Why other options are incorrect:

- **Butyric acid (C4), Palmitic acid (C16), and Stearic acid (C18):** These are all fully saturated fatty acids, containing absolutely zero carbon-carbon double bonds in their aliphatic chains.

Question #132 Key: (B)

MDCAT 2017

_____ are the major sites for the storage of glycogen in an animal's body. [MDCAT-2017]

CORE CONCEPT AND DERIVATION

Glycogen serves as the primary short-term biological energy buffer in vertebrates.

Solution:

- Glycogen is abundantly synthesized and stored in **liver cells** (to regulate overall blood glucose levels) and **skeletal muscle cells** (to serve as an immediate local energy reserve during vigorous contraction).

Why other options are incorrect:

- **Around thighs, belly, and hips:** These regions represent adipose tissue, which stores long-term energy as triglycerides (lipids), not glycogen.
- **Kidneys:** While capable of some metabolic functions, they are not the primary mass-storage sites for glycogen.

Question #131 Key: (C)

MDCAT 2017

Which of the following type of carbohydrates has high molecular weight and is sparingly soluble in water? [MDC...]

CORE CONCEPT AND DERIVATION

As carbohydrates increase in polymer chain length, their physical properties shift from small, sweet, soluble crystals to massive, tasteless, insoluble structural units.

Solution:

- **Polysaccharides** (like starch, cellulose, and glycogen) are formed by hundreds or thousands of monosaccharide monomers.
- Because of their immense chain length and complex three-dimensional folding, they have exceptionally high molecular weights.
- This massive structure prevents water from easily forming hydration shells around them, making them sparingly soluble or entirely insoluble in water.

Why other options are incorrect:

- **Monosaccharides & Disaccharides:** Have low molecular weights and are highly soluble in water due to exposed hydroxyl groups readily forming hydrogen bonds.

Question #133 Key: (D)

MDCAT 2017

The number of amino acids that have been found to occur in cells and tissues are: [MDCAT-2017]

CORE CONCEPT AND DERIVATION

There is a vast difference between the total amino acids found in nature versus the specific few encoded by DNA to build proteins.

Solution:

- Biochemists have identified approximately **170** different types of amino acids scattered throughout various cells and tissues in nature.
- Many of these serve independent metabolic functions (e.g., ornithine, citrulline) and are never incorporated into proteins.

Why other options are incorrect:

- **20-25:** This refers strictly to the "standard" proteinogenic amino acids that are used specifically as building blocks to synthesize cellular proteins, not the total number found in biological tissues.

Question #134 Key: (C)

MDCAT 2017

Backbone of amino acid comprises of: [MDCAT-2017]

CORE CONCEPT AND DERIVATION

The polypeptide backbone forms a continuous, repeating structural chain along the length of a protein.

Solution:

- Every single amino acid contains an amino group (nitrogen), an alpha-carbon, and a carboxyl carbon.
- When they bond linearly via peptide bonds, the continuous repeating sequence making up the unbranched structural "spine" of the protein is precisely **N-C-C** (or C-C-N).

Why other options are incorrect:

- The individual -NH₂ and -COOH groups represent the functional ends of a monomer, but the actual polymerized backbone is the repeating C-C-N sequence itself.

Question #135 Key: (D)

MDCAT 2017

If in lipids there is a higher proportion of unsaturated fatty acid, then it will be: [MDCAT-2017]

CORE CONCEPT AND DERIVATION

The physical state of a lipid at room temperature is dictated by the chemical saturation of its hydrocarbon tails.

Solution:

- **Unsaturated fatty acids** contain one or more carbon-carbon double bonds ($C = C$).
- These double bonds introduce rigid "kinks" or bends into the hydrocarbon chain, physically preventing the lipid molecules from packing tightly together.
- Because they cannot pack densely, the intermolecular forces remain weak, causing the lipid to exist as a liquid (**Oil**) at room temperature.

Why other options are incorrect:

- **Fats:** Highly saturated lipids (no double bonds), allowing them to pack tightly and remain solid at room temperature (e.g., butter, lard).
- **Waxes:** Extreme long-chain solid lipids, used for waterproofing.
- **Phenols:** Aromatic organic compounds completely unrelated to triacylglycerols.

Question #136 Key: (A)

MDCAT 2016

The compounds which, on hydrolysis, yield polyhydroxy aldehyde or ketone subunits are: [MDCAT-2016]

CORE CONCEPT AND DERIVATION

Chemical definition of a specific macromolecule class.

Solution:

- By strict biochemical definition, **Carbohydrates** are either direct polyhydroxy aldehydes (aldoses) or polyhydroxy ketones (ketoses), or they are larger complex substances (like di- or polysaccharides) that yield these exact simple sugar subunits upon hydrolysis.

Why other options are incorrect:

- Proteins:** Yield amino acids upon hydrolysis.
- Lipids:** Yield fatty acids and glycerol (or other alcohols).
- Polynucleotides:** Yield nucleotides (sugar, phosphate, base).

Question #137 Key: (B)

MDCAT 2016

Secondary structure of protein is found in: [MDCAT-2016]

CORE CONCEPT AND DERIVATION

Proteins generally fall into two broad structural classes: Fibrous and Globular.

Solution:

- Fibrous proteins exist as long, parallel strands or sheets, primarily relying on highly repetitive **Secondary structure** to provide immense tensile strength.
- Keratin** (found in hair, nails, and feathers) is a classic fibrous protein dominated almost entirely by alpha-helical secondary structures wound together into supercoils.

Why other options are incorrect:

- Trypsin (enzyme), Insulin & Glucagon (hormones):** These are all Globular proteins, meaning they fold extensively into Tertiary structures to perform highly specific biochemical functions.

Question #138 Key: (B)

MDCAT 2016

Phosphodiester bond is: [MDCAT-2016]

CORE CONCEPT AND DERIVATION

The nucleic acid backbone relies on bridging multiple atoms to link independent nucleotides together.

Solution:

- A **phosphodiester bond** connects the 3' carbon of one sugar to the 5' carbon of the next sugar via a central phosphate group.
- Structurally, it forms two distinct ester linkages branching off the central phosphorus.
- The linear atomic sequence through this bridge is precisely: Carbon (from sugar 1) - Oxygen - Phosphorus - Oxygen - Carbon (from sugar 2).
- This is perfectly represented by the formula **C-O-P-O-C**.

Why other options are incorrect:

- C-O-P / C-C-O-P:** These represent only a single ester linkage (like attaching a phosphate to just one sugar), not the *diester* bridge linking two.
- P-O-C-P-O-C:** Incorrect atomic repetition; a single phosphate (P) bridges the gap.

Question #139 Key: (D)

MDCAT 2015

Which molecular structure of enzyme is essential for activity of enzyme? [MDCAT-2015]

CORE CONCEPT AND DERIVATION

An enzyme must have a specific, complex three-dimensional shape (the active site) to bind to its substrate.

Solution:

- The functional active site of an enzyme is formed when the linear polypeptide chain twists, bends, and folds back upon itself into a complex, 3D globular shape.
- This overall 3D folding pattern is the **Tertiary structure**. Without attaining at least the tertiary level, the active site physically does not exist, and the enzyme is utterly inactive.

Why other options are incorrect:

- **Primary/Secondary:** These form a straight chain or simple spirals, lacking the 3D pocket required for catalysis.
- **Quaternary:** While some enzymes have multiple subunits, many enzymes function perfectly with just a single polypeptide chain in its tertiary state.

Question #140 Key: (B)

MDCAT 2014

The simplest monosaccharide containing keto group is: [MDCAT-2014]

CORE CONCEPT AND DERIVATION

Monosaccharides are polyhydroxy aldehydes or ketones. The simplest sugars are trioses, containing exactly three carbon atoms.

Solution:

- There are two three-carbon sugars (trioses):
- **Glyceraldehyde:** Contains an aldehyde functional group (an aldotriose).
- **Dihydroxyacetone:** Contains a ketone functional group (a ketotriose).
- Therefore, the simplest possible monosaccharide with a keto group is Dihydroxyacetone.

Why other options are incorrect:

- **Glyceraldehyde:** The simplest aldo-sugar, not keto.
- **Ribose:** A 5-carbon aldo-sugar.
- **Glucose:** A 6-carbon aldo-sugar.

Question #141 Key: (A)

DUHS 2014

Which level of protein structure maintains the helix shape of enzymes? [LUMHS-2014]

CORE CONCEPT AND DERIVATION

Protein architecture is divided into hierarchical levels based on folding patterns and bond interactions.

Solution:

- The **Secondary structure** of a protein refers specifically to the localized, regular folding patterns of the polypeptide backbone.
- These folded geometries strictly take the form of either the **alpha-helix** or the **beta-pleated sheet**, maintained rigidly by hydrogen bonds forming between the N-H and C=O groups along the backbone.
- *Note: While enzymes functionally rely on their overall 3D Tertiary shape, the specific 'helix shape' geometric component is entirely dictated and maintained by secondary structure.*

Why other options are incorrect:

- **Primary:** Defines the linear sequence of amino acids via peptide bonds.
- **Tertiary:** Defines overall 3D globular folding via R-group interactions.
- **Quaternary:** Defines multiple subunits binding together.

Question #142 Key: (C)

DUHS 2014

Enzymes are molecules of one of the following group of biomolecules. Mark the correct answer which can also be...

CORE CONCEPT AND DERIVATION

Biocatalysts lower activation energy to accelerate reactions necessary for life.

Solution:

- The vast majority of enzymes (biological catalysts) are globular **Proteins**.
- Their complex, 3D folded amino acid structure creates a highly specific active site capable of binding substrates. (Note: A very small minority are catalytic RNAs called ribozymes, but protein is the primary class).

Why other options are incorrect:

- Fats, carbohydrates, and vitamins do not possess the complex tertiary folding architectures required to form catalytic active sites. (Vitamins often act merely as co-enzymes assisting the main protein).