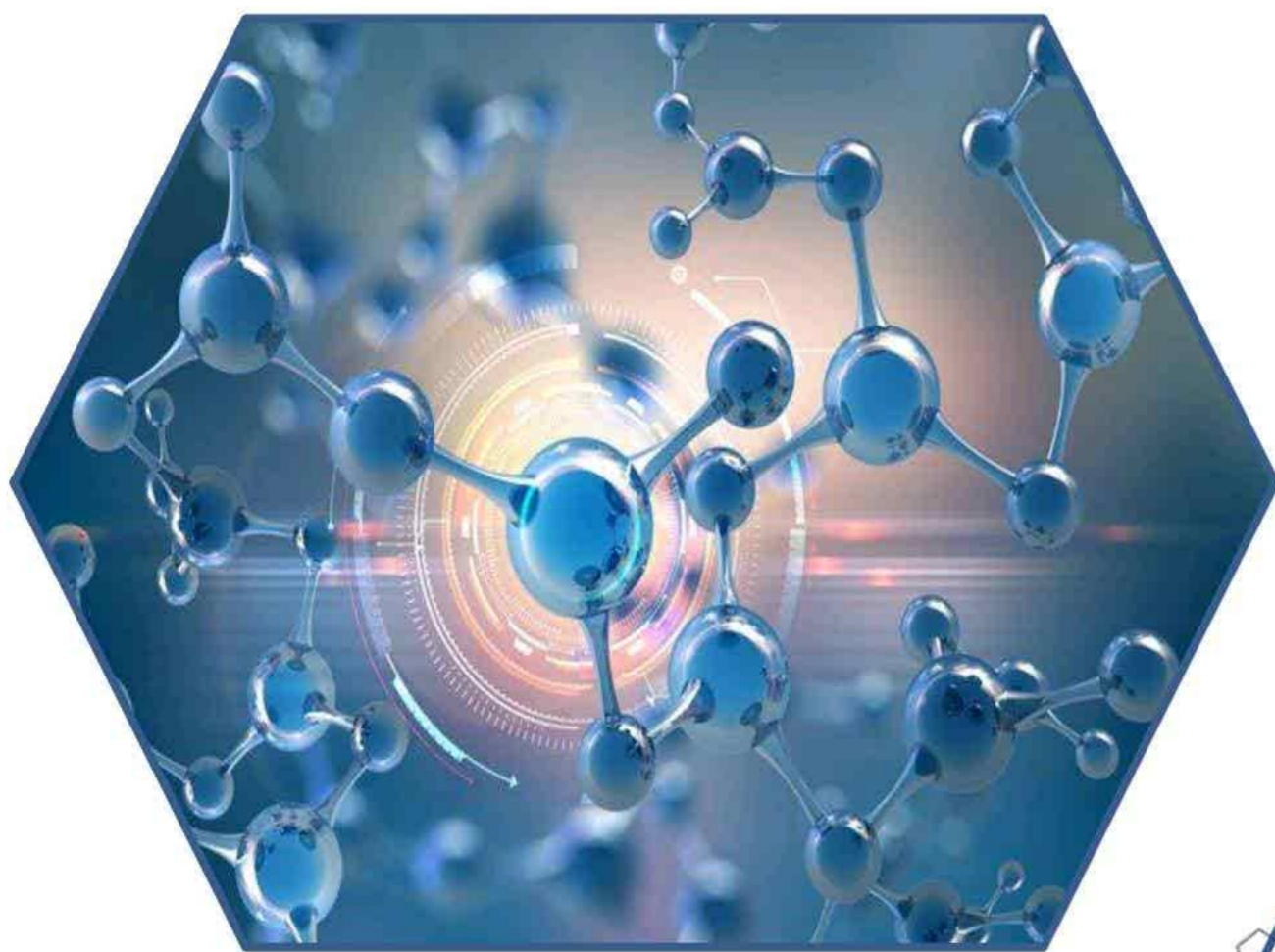


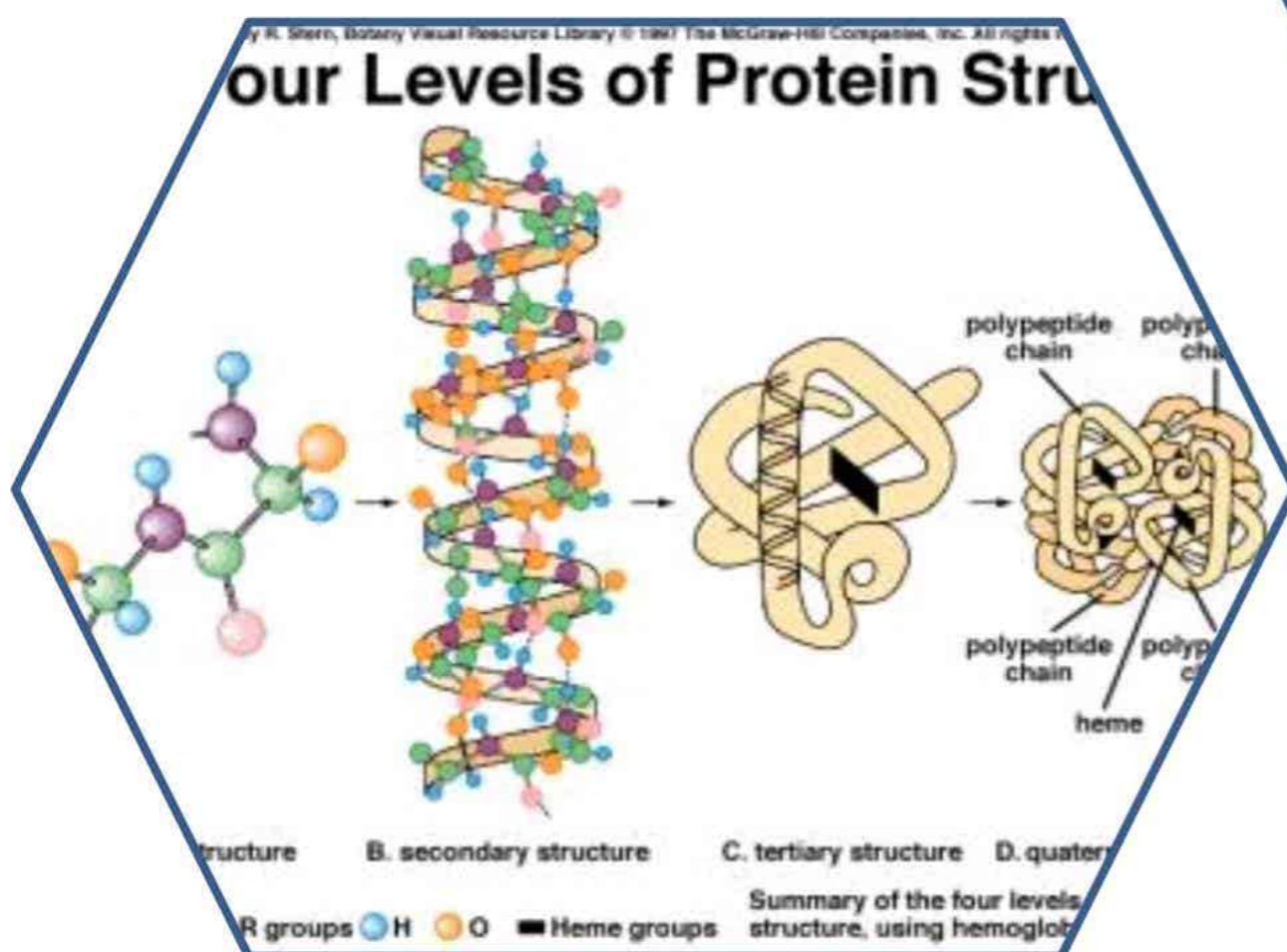
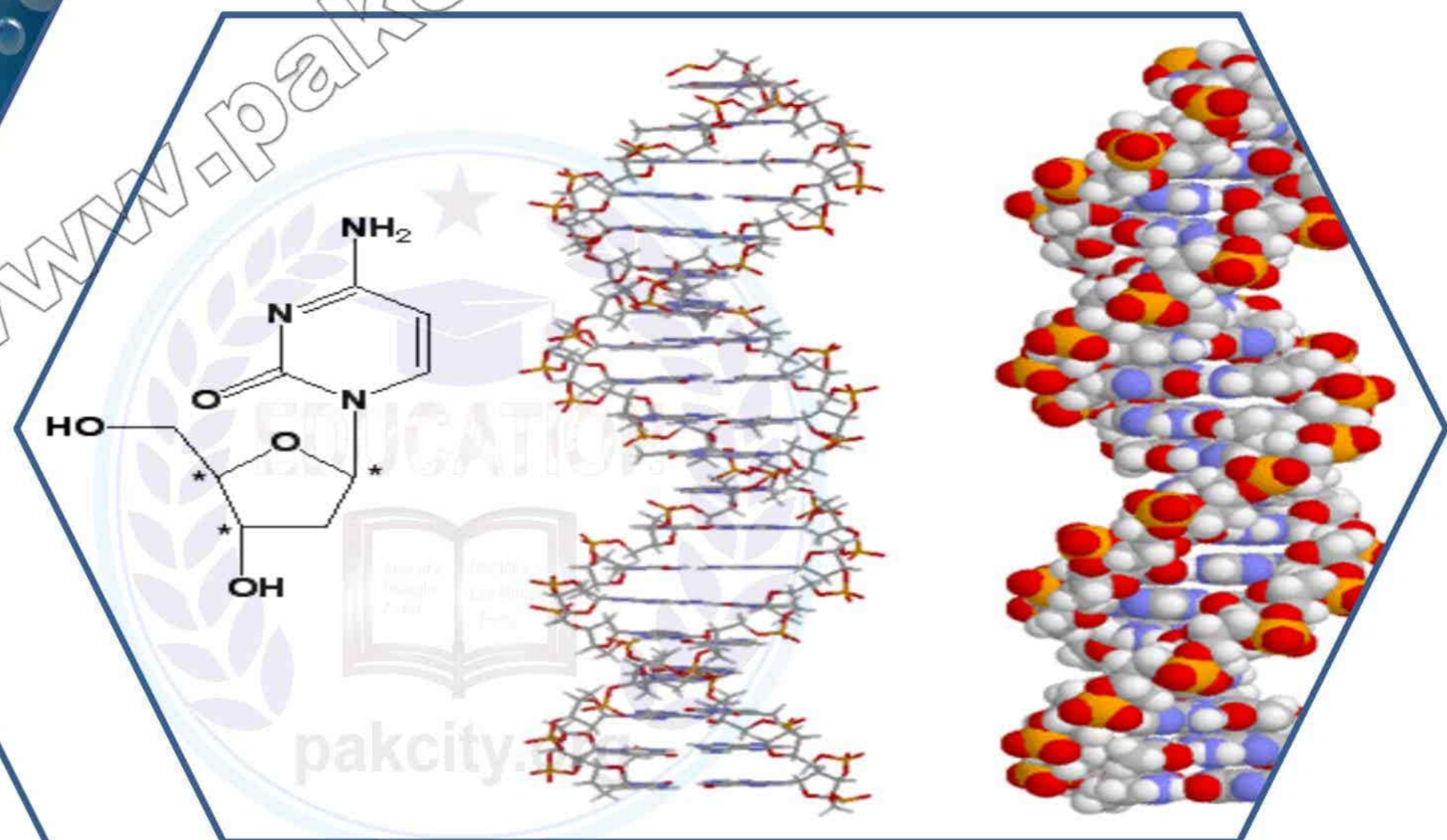


CHAPTER 2

Biological Molecules



- Exercise Short Answers
- Important Short Answers



- Exercise MCQ's
- Important Additional MCQ's
- Past MDCAT MCQ's

Exercise MCQ's



❖ Encircle the correct answer from the multiple choices.

- 1) **Animals obtain carbohydrates mainly from:**
 - a) Glucose
 - b) Starch
 - c) Sucrose
 - d) Glycogen
- 2) **Peptide bond is a:**
 - a) C-N link
 - b) C-D link
 - c) N-H link
 - d) C-H link
- 3) **Globular proteins differ from fibrous proteins in:**
 - a) Having amino acids
 - b) Their repeating units joined by peptide bond
 - c) Being soluble in aqueous medium
 - d) Being non-crystalline
- 4) **Which of the following amounts of bases are more likely to be found in an organism?**
 - a) Adenine 30.9% and Cytosine 30.7%
 - b) Guanine 27.5% and Adenine 27.8%
 - c) Cytosine 19.8% and Thymine 20.0%
 - d) Adenine 32% and Thymine 31.9 %
- 5) **Amino acids are arranged in proper sequence during protein synthesis according to the instructions transcribed on.**
 - a) Transfer RNA
 - b) Ribosomal RNA
 - c) Messenger RNA
 - d) DNA
- 6) **Which of the following kinds of atom do not occur in carbohydrates?**
 - a) Carbon
 - b) Hydrogen
 - c) Nitrogen
 - d) Oxygen

Answer key:

1	b	2	a	3	c
4	d	5	c	6	c

Most important MCQ's

❖ Encircle the correct answer from the multiple choices.

Biochemistry and chemical compounds

- In bacterial cells the water percentage is:**
a) 70% b) 40% c) 60% d) 50%
- The most organic compounds in mammalian cell:**
a) Water b) Proteins c) Carbohydrates d) Lipids
- Of the following terms, the one that includes all others is:**
a) Oxidation b) Respiration c) Metabolism d) Pollination
- The branch of biology which deals with the study of chemical compounds and the chemical processes in the living organisms is called:**
a) Chemistry b) Biochemistry c) Molecular biology d) Both a and b
- Which one is an organic compound?**
a) CO₂ b) Water c) Lipids d) HCl
- Which chemical component has the same % in bacterial as well as the mammalian cell?**
a) Water b) Carbohydrate c) Proteins d) Lipids
- Reactions in which simple substances are combined to form complex substances are called:**
a) Metabolic reactions b) Catabolic reactions c) Anabolic reactions d) None of these

Carbon and importance of water

- Carbon is:**
a) Divalent b) Trivalent c) Monovalent d) Tetravalent
- The potential source of chemically energy for cellular activities:**
a) C-H bond b) C-N bond c) C-O bond d) C-C bond
- The basic element of all organic compounds is:**
a) Oxygen b) Hydrogen c) Nitrogen d) Carbon
- Human tissues have 85% water in cells of:**
a) Brain b) Bone c) Blood d) Liver
- Name the tissues that contain about 20% of water:**
a) Nerve cells b) Brain cells c) Bone cells d) None of these
- The specific heat of vaporization of water is Kcal/kg:**
a) 374 b) 474 c) 574 d) 674
- Calories per gram vaporized is called:**
a) Heat capacity b) Specific heat c) Heat of vaporization d) Latent heat
- Which bond provides stability to complex carbohydrate molecules?**
a) C-H b) C-O c) C-C d) C-N
- The bond formed when two or more atoms complete their electron shells by sharing electrons is called:**
a) Ionic bond b) Hydrogen bond c) Covalent bond d) Electrovalent bond
- Which chemical component has the greatest contribution in the total mammalian cell weight?**
a) Proteins b) Carbohydrate c) Lipids d) Water
- The property of water due to which it works as a temperature stabilizer and hence protect living organisms from sudden thermal changes is:**
a) High specific heat of vaporization
b) High specific heat capacity
c) Its Dipole nature
d) Its liquid state
- Which statement is true about an aqueous medium:**
a) Ionic as well as non-ionic substance in aqueous media retains their identity.
b) Enzymes cannot perform catalysis reaction in this medium.
c) Ions and molecules move randomly thus are in more favorable state to react with other molecules and ions.
d) It is less favorable media for chemical reactions.
- The number of calories required to raise the temperature of 1g of water from 15 to 16°C is called?**
a) Specific Heat of Vaporization
b) Specific Heat capacity
c) Caloric Heat
d) Both a and c

Carbohydrates

- Which of the following kinds of atoms not occur in carbohydrates?**
a) Carbon b) Hydrogen c) Phosphorus d) Oxygen
- Substances which on hydrolysis yield polyhydroxy add hydro or ketone subunits:**
a) Acylglycerol b) Nucleic acid c) Carbohydrates d) Polypeptides

23) Carbohydrates are organic molecules and contain three elements:

- a) Carbon, Water and Oxygen
- b) Carbon, Sulphur and Hydrogen
- c) Carbon, Calcium and Hydrogen
- d) Carbon, Hydrogen and Oxygen

24) The covalent bond between two mono-saccharide is called:

- a) Glycosidic bond
- b) Peptide bond
- c) Hydrogen bond
- d) Ester bond

25) Glycosidic bond is a covalent bond and formed between two:

- a) Disaccharides
- b) Monosaccharides
- c) Oligosaccharides
- d) Polysaccharides

26) $C_n(H_2O)_n$ is a general formula of :

- a) Monosaccharides
- b) Oligosaccharides
- c) Polysaccharides
- d) Carbohydrates

27) Monosaccharides which are rare in nature and occur in some bacteria:

- a) Trioses
- b) Tetroses
- c) Pentoses
- d) Hexoses

28) Which one are intermediates in respiration and photosynthesis both:

- a) Ribose and Heptolose
- b) Glyceraldehyde and Dihydroxyacetone
- c) Glucose and Galactose
- d) Fructose and Ribulose



29) When to glucose ($C_6H_{12}O_6$) molecule is combined to form a molecule of maltose ($C_{12}H_{22}O_{11}$), the formula of maltose is not $C_{12}H_{24}O_{12}$ because:

- a) Hydrolysis takes place
- b) Dehydration synthesis takes place
- c) Transpiration takes place
- d) Water is added

30) Which of the following carbohydrate is tasteless?

- a) Monosaccharide
- b) Oligosaccharide
- c) Polysaccharide
- d) None of these

31) Which of the following carbohydrate cannot be hydrolysed?

- a) Monosaccharide
- b) Oligosaccharide
- c) Polysaccharide
- d) None of these

32) Ribose is an example of:

- a) Trioses
- b) Tetroses
- c) Pentose
- d) Hexose

33) % of Glucose normally present in our blood is:

- a) 0.80%
- b) 0.08%
- c) 1.80%
- d) 8%

34) Which of the following can break the glycosidic bond which joined two glucose molecules?

- a) High temperature
- b) Condensation
- c) Change in pH
- d) Hydrolysis

35) How much energy is used for the synthesis of 10.0gm of glucose:

- a) 117.6 Kcal
- b) 317.6 Kcal
- c) 517.6 Kcal
- d) 717.6 Kcal

36) In free state, glucose is present in:

- a) Dates
- b) Amylase
- c) Glycogen
- d) Cellulose

37) Animals obtain carbohydrates mainly from:

- a) Glucose
- b) Starch
- c) Sucrose
- d) Glycogen

38) The chief of carbohydrates mainly from:

- a) Glycogen
- b) Glucose
- c) Cellulose
- d) Sucrose

39) Starches with iodine give color:

- a) Blue
- b) Red
- c) Green
- d) Yellow

40) Which of the following give blue color with iodine?

- a) Starch
- b) Glycogen
- c) Cellulose
- d) All of these

41) Cellulose is:

- a) Polysaccharides
- b) Monosaccharides
- c) Oligosaccharides
- d) All of these

42) Cotton is the pure form of:

- a) Cellulose
- b) Glycogen
- c) Wax
- d) Amino acids

43) Which one of the following is not Polysaccharides?

- a) Cellulose
- b) Glycogen
- c) Wax (Cutin)
- d) Chitin

44) Which one of the following is not Polysaccharides?

- a) Glycogen
- b) Lactose
- c) Starch
- d) Dextrin

45) The most abundant carbohydrate in nature is:

- a) Starch
- b) Glycogen
- c) Cellulose
- d) Agar

46) Which one is the common polysaccharide on earth?

- a) Starch
- b) Cellulose
- c) Glycogen
- d) Dextrin

47) Which one are most complex sugar:

- a) Monosaccharides
- b) Oligosaccharides
- c) Polysaccharides
- d) None of these

48) Starch cellulose and glycogen yield _____ on complete hydrolysis.

- a) Maltose
- b) Sucrose
- c) Fructose
- d) Glucose

49) Which one is soluble in hot water?

- a) Starch
- b) Glycogen
- c) Amylose
- d) Amylopectin.

Lipids

- 50) The heterogeneous group of compounds related to fatty acid is called:
 a) Protein b) Lipids c) Glucose d) Carbohydrates
- 51) Fats and oil have specific gravity of about:
 a) 0.8 b) 0.10 c) 0.12 d) 0.16
- 52) Lipids are soluble in which of the following :
 a) Water b) Ether c) All solvents d) None of these
- 53) Which of the following substance is most favorable to form structural component of biological membranes?
 a) Hydrophilic Carbohydrates b) Hydrophobic fats c) Both a & b d) None of these
- 54) Fatty acids are components of lipids. Unsaturated fatty acids contain double bonds:
 a) No b) One c) Six d) Up to six
- 55) Fatty acids containing 18 C atoms and a single double bond is:
 a) Saturated Fatty acid b) Unsaturated fatty acid c) Oleic Acid d) Palmitic acid
- 56) Which one the following fatty acid is more soluble in an organic solvent and has higher melting point?
 a) Acetic acid b) Butyric acid c) Palmitic acid d) All have same
- 57) Which of the following statement is incorrect for fats containing unsaturated fatty acid?
 a) They contain double bond
 b) They are usually solid at room temperature
 c) They are lighter than water
 d) Their specific gravity is less than 1
- 58) Which of the following is an unsaturated fatty acid:
 a) Acetic acid b) Oleic acid c) Butyric acid d) Palmitic acid
- 59) Melting point of Palmitic acid is.....C°:
 a) -8 b) 34 c) 63.1 d) 55.6
- 60) Phosphatidylcholine is one of the common:
 a) Acylglycerol b) Phospholipid c) Terpenoid d) Wax
- 61) Which one of the following is not a lipid?
 a) Rubber b) Chitin c) Cutin d) Cholesterol
- 62) Which of the following is a lipid?
 a) Chitin b) Rubber c) Starch d) Sucrose

Proteins

- 63) The number of types of amino acids that are found to occur in cells are:
 a) 20 b) 100 c) 25 d) 170
- 64) Proteins comprise of _____% of the total dry weight of a cell.
 a) 40% b) 50% c) 60% d) 70%
- 65) Proteins are polymers of:
 a) Fatty acids b) Isoprenoid units c) Amino acids d) Nucleotides
- 66) The amino acids are mainly different from each other due to the type and nature of:
 a) R-group b) Amino group c) Carboxyl group d) Peptide bond
- 67) Peptide bond is:
 a) C-N link b) C-O link c) N-H link d) C-H link
- 68) Amino acids are linked to each other by:
 a) Ester bond b) Peptide bond c) Disulphide bond d) Glycosidic bond
- 69) Which term we will use when two amino acids join each other? (Molecules formed by two amino acids).
 a) Monopeptide b) Dipeptide c) Tripeptide d) Tetrapeptide
- 70) The sequence of amino acids in a protein molecule was determined by:
 a) Chatton b) F.Miescher c) Sanger d) J.Watson
- 71) Which structure of protein gives information about number and sequence of amino acids in it?
 a) Primary structure b) Secondary structure c) Tertiary structure d) Quaternary structure
- 72) In an aqueous environment the most stable tertiary conformation is that in which _____ amino acids are buried inside the conformation.
 a) Hydrophobic b) Hydrophilic c) Basic d) None of these
- 73) Hemoglobin molecule exhibits which structural organization of proteins:
 a) Primary structure b) Secondary structure c) Tertiary structure d) Quaternary structure
- 74) Which of the following does not show quaternary structure?
 a) Haemoglobin b) Pepsin c) Fibrin d) Insulin
- 75) Which structural organization is most common in globular proteins?
 a) Primary b) Secondary c) Tertiary d) Quaternary
- 76) Actin and myosin are the basic proteins involved in contractile machinery of our body to which type of proteins do they belong?
 a) Globular proteins b) Fibrous Proteins c) Both a & b d) None of these
- 77) Antibodies play important role against microorganisms and other pathogens to which type of proteins do they belong?
 a) Globular proteins b) Fibrous Proteins c) Both a & b d) None of these
- 78) The alpha chain of a hemoglobin has amino acid:
 a) 174 b) 171 c) 141 d) 146
- 79) Helical shape of a polypeptide is due to presence within molecule:
 a) Covalent bond b) Hydrogen bond c) Disulphide bond d) Peptide bond

80) Each turn of alpha helix contains Residues of amino acids:

- a) 36 b) 3.6 c) 2.6 d) Many

81) Which type of the bond is not formed in maintaining tertiary structure of proteins:

- a) Hydrophobic interaction b) Hydrogen c) Disulphide d) Ionic

82) Silk fiber, myosin, fibrin and keratin are examples of:

- a) Fibrous protein b) Double coiled protein c) Globular protein d) Coiled protein

83) Hemoglobin is a:

- a) Fibrous protein b) Double coiled protein c) Globular protein d) Coiled protein

84) Keratin is an example of fibrous proteins present in:

- a) Nail and hair b) Muscle c) Bones d) Blood

Nucleic acids



85) The compound formed by combination of nitrogen base and pentose sugar is called:

- a) Nucleotide b) Nucleoside c) Polypeptide d) Polysaccharide

86) Who used technique of X-ray diffraction to determine the structure of DNA:

- a) Wilkins and Franklin
b) Watson and Crick
c) Wilkins and Crick
d) Watson & Wilkins

87) ATP is an important molecule for its major function:

- a) As an energy currency of the cell
b) As a coenzyme
c) Both a and b
d) None of these

88) The first organism whose genome was completely discovered was:

- a) Human beings b) Influenza Virus c) Hemophilus Influenza d) None of these

89) Which of the following statement is incorrect about RNA?

- a) The pentose sugar in it is Ribose
b) It contains Adenine Guanine Thymine and Cytosine
c) It is present in the nucleoli
d) It may be folded back on itself to give double helical characteristics.

90) Which of the following combination of base pair is absent in DNA?

- a) A-T b) A-U c) C-G d) T-A

91) The two stands in DNA are coiled to each other:

- a) Parallel b) Anti-parallel c) Both a & b d) None of these

92) Genetic information is transmitted from DNA to:

- a) Amino acids b) Site of protein synthesis c) Proteins d) Chromosomes

93) RNA is synthesized and stored in:

- a) Nucleus b) Endoplasmic reticulum c) Nucleolus d) Lysosome

94) Messenger RNA carries genetics information from DNA to ribosomes where amino acids are arranged to form specific proteins. Hemoglobin is also such a protein which contains 574 amino acids. How many nucleotides should be present in mRNA molecules to synthesize hemoglobin molecules?

- a) 574 b) 1148 c) 1722 d) 2296

95) The mRNA, of the total cell RNA is about:

- a) 3-4% b) 1-2% c) 2-4% d) 3-5%

96) 80% of the total RNA in the cell comprises of:

- a) mRNA b) tRNA c) rRNA d) RNA-DNA hybrid

97) Messenger RNA is important in protein synthesis because it:

- a) Contains the 20 essential amino acids
b) Carries code from DNA to nucleus
c) Carries the code from DNA to ribosome
d) Is transmitted to the nucleus

98) The percentage of Ribosomal RNA in the cell is:

- a) 4% b) 20% c) 50% d) 80%

99) One similarity of DNA and RNA is that they both contain:

- a) Nucleotide b) ATP c) Thymine d) Deoxyribose sugar

Conjugated Molecules

100) Which is not a conjugated molecule?

- a) Glycoprotein b) Lipoprotein c) Polysaccharide d) Glycolipid

101) Most of cellular secretions are in nature:

- a) Proteins b) Lipids c) Carbohydrates d) Glycoproteins

102) Conjugated histone proteins are:

- a) Structural and regulatory b) Structural only c) Regulatory only d) Transport proteins

- 103) Which of the statement is not true for compounds like glycoprotein and glycolipids?
 a) They are conjugated molecules of carbohydrates
 b) Both have role in the extra cellular matrix of animals and bacterial cell wall
 c) They are components of biological membranes
 d) Both are produced and secreted by endoplasmic reticulum
- 104) Which conjugated molecules play important role in gene expression?
 a) Glycolipids b) Glycoproteins c) Nucleohistones d) None of these
- 105) Interconversion of carbohydrates proteins and lipids in living cells are an example of:
 a) Coordinated catabolic activities
 b) Coordinated anabolic activities
 c) Both a & b
 d) None of these
- 106) Glycolipids and glycoproteins have structural role in the _____ matrix of animal and bacterial cell:
 a) Extracellular b) Intracellular c) Both of these d) Glucose

Answer key:

1	a	2	b	3	c	4	b	5	c	6	a	7	c	8	d	9	a	10	d
11	a	12	c	13	c	14	c	15	c	16	c	17	d	18	b	19	c	20	b
21	c	22	c	23	c	24	a	25	b	26	a	27	b	28	b	29	b	30	c
31	a	32	c	33	b	34	d	35	d	36	a	37	b	38	a	39	a	40	a
41	a	42	a	43	c	44	b	45	c	46	b	47	c	48	d	49	c	50	b
51	a	52	b	53	b	54	d	55	c	56	c	57	b	58	b	59	c	60	b
61	b	62	b	63	d	64	b	65	c	66	a	67	a	68	b	69	b	70	b
71	a	72	a	73	d	74	c	75	c	76	b	77	a	78	c	79	b	80	b
81	a	82	c	83	c	84	a	85	b	86	a	87	a	88	c	89	b	90	b
91	b	92	b	93	a	94	c	95	a	96	c	97	c	98	d	99	a	100	c
101	d	102	a	103	d	104	c	105	c	106	a								



MDCAT MCQ'S

2008

- 1) Which bond is the potential source of chemical energy for cellular activities?
a) C-N b) C-H c) C-O d) H-O
- 2) Which of the following gives blue color with iodine?
a) Starch b) Glycogen c) Cellulose d) All of these
- 3) The two strands in DNA are coiled _____ to each other.
a) Parallel b) Both a & c c) Antiparallel d) None of these



2009

- 4) Immediate source of energy for cellular metabolism is:
a) Lipids b) Carbohydrates c) ATP d) Proteins
- 5) Haemoglobin exhibits:
a) Secondary Structure b) Quaternary Structure c) Primary Structure d) Tertiary Structure

2011

- 6) The covalent bond formed between two monosaccharides is called:
a) Glycosidic Bond b) Peptide Bond c) Hydrogen Bond d) Disulphide
- 7) The bond formed between glucose and fructose form sucrose is:
a) 1,4 Glycosidic Linkage b) 1,6 Glycosidic Linkage c) 1,2 Glycosidic Linkage d) 1,3 Glycosidic Linkage
- 8) In an amino acid in which the R-group is H, its name will be:
a) Alanine b) Leucine c) Glycine d) Valine
- 9) Fatty acid are the organic compounds containing hydrogen, oxygen and one of the following are:
a) -COOH b) Acyl c) -NH₂ d) Sucrose
- 10) The combination of a pentose sugar with a base result in a compound is known as:
a) Nucleotide b) Nucleic Acid c) Nucleoside d) Polynucleotide

2012

- 11) The ribosomal RNA is synthesized and stored in:
a) Endoplasmic reticulum b) Golgi complex c) Nucleolus d) Chromosomes
- 12) Carbohydrates are organic molecules and contain three elements:
a) Carbon, water and oxygen
b) Carbon, calcium and hydrogen
c) Carbon, Sulphur and hydrogen
d) Carbon, hydrogen and oxygen
- 13) Which one are intermediates in respiration and photosynthesis both?
a) Ribose and heptolose
b) Glucose and galactose
c) Glyceraldehydes and dihydroxyacetone
d) Fructose and ribulose
- 14) Which of the following is a peptide bond?
a) -C-N b) -C-P c) -C-O d) -C-S
- 15) Which of the following is an unsaturated fatty acid?
a) Acetic Acid b) Oleic acid c) Butyric acid d) Palmitic acid
- 16) Which of the following combination of base pair is absent in DNA?
a) A-T b) A-U c) C-G d) T-A

2013

- 17) _____ is most abundant carbohydrate in nature.
a) Waxes b) Starch c) Glycerol d) Cellulose
- 18) Which of the following is a keto sugar:
a) Glyceraldehyde b) Ribose c) Dihydroxy-acetone d) Glucose
- 19) Amino acid in which the R-group is hydrogen is:
a) Glycine b) Leucine c) Alanine d) Valine
- 20) Acyl-glycerols like fats and oils are esters formed by condensation reaction between:
a) Fatty acids and water
b) Fatty acids and glucose
c) Fatty acids and alcohols
d) Fatty acids and phosphates

21) Which of the following is purine:

- a) Guanine b) Thymine c) Cytosine d) Uracil

2014

22) The simplest monosaccharide containing keto group is:

- a) Glyceraldehyde b) Glucose c) Dihydroxy acetone d) Ribose

2015

23) Monosaccharides are major components of:

- a) DNA, ATP, Ribulose biphosphate and Cysteine
 b) DNA, NADP, ATP and Ribulose biphosphate
 c) DNA, NAD and Insulin
 d) DNA, RNA and Myosin

24) Myosin is a _____ type of protein:

- a) Intermediate b) Globular c) Simple d) Fibrous

25) Which one of the following is an example of unsaturated fatty acid?

- a) Butyric Acid b) Palmitic Acid c) Oleic Acid d) Acetic Acid

26) Number of base pairs in one turn of DNA is:

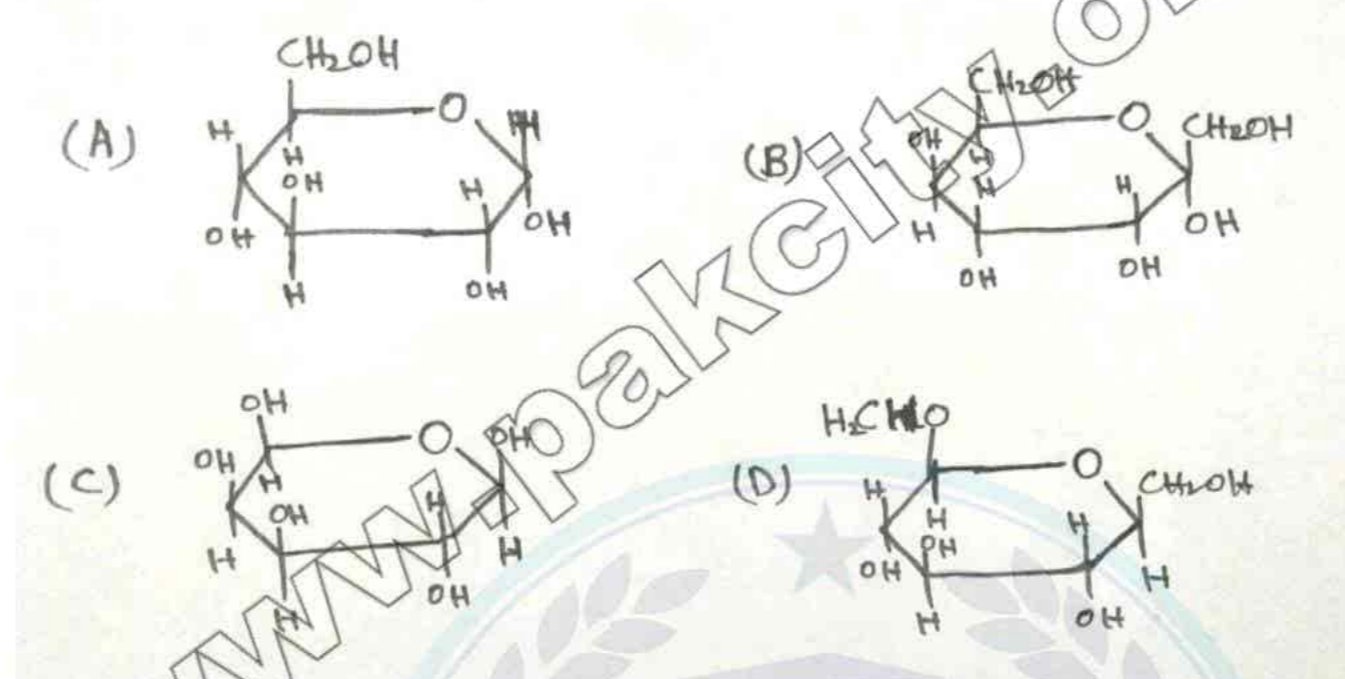
- a) 10 b) 34 c) 2 d) 54

2016

27) The compounds which on hydrolysis yield poly-hydroxy aldehyde or ketone subunits are:

- a) Lipids b) Polynucleotides c) Proteins d) Carbohydrates

28) Which one of the following is the formula structure of D (α) glucose?



29) Secondary structure of protein is found in:

- a) Trypsin b) Insulin c) Keratin d) Glucagon

30) Waxes are formed by combination of fatty acids with:

- a) Alcohol b) Serine c) Glycerol d) Cysteine

31) Phosphodiester bond is:

- a) P—O—C—P—O—C b) C—O—P—O—C c) C—O—P d) C—C—O—P

2017

32) _____ are the specific structures related to monosaccharides:

- a) Glycosidic bond b) Maltose c) Keto group d) Fructose

33) _____ are the major site for storage of glycogen in animal's body:

- a) Muscle and liver b) Around belly and hips c) Around thighs and belly d) Liver and kidneys

34) The number of amino acids that have been found to occur in cells and tissues are:

- a) 170 b) 25 c) 2 d) 45

35) Most proteins are made up of _____ type of amino acids:

- a) 20 b) 25 c) 170 d) 200

36) If in lipids there is an higher proportion of unsaturated fatty acids then it will be:

- a) Oils b) Phenols c) Waxes d) Fats

37) When X-rays are passed through crystalline DNA, it shows helix making one twist every:

- a) 2nm b) 34nm c) 3.4nm d) 4nm

Answer key:

1	a	2	a	3	c	4	c	5	b
6	a	7	c	8	c	9	c	10	a
11	c	12	c	13	d	14	c	15	a
16	b	17	b	18	d	19	c	20	a
21	c	22	a	23	c	24	b	25	d
26	c	27	a	28	d	29	a	30	c
31	a	32	b	33	c				

Exercise Short Answers

Q:1 Name the carbohydrates suitable as food for man.

Ans: Carbohydrates suitable for man:

- Glucose
- Sucrose
- Lactose
- Starch

Q:2 Why are fats are considered as high energy compounds?

Ans: Because of higher proportions of C-H bonds and very low proportion of oxygen, lipids store double the amount of energy as compared to the same amount of any carbohydrate.

Q:3 What is the function of mRNA?

Ans: Function of mRNA:



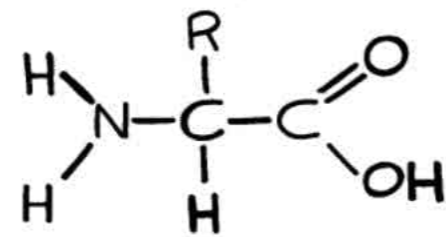
- mRNA takes the genetic message from the nucleus to the ribosomes in the cytoplasm to form particular proteins.
- mRNA carries the genetic information from DNA to ribosomes, where amino acids are arranged according to the information in mRNA to form specific protein molecule. This is a type of a single strand of variable length. Its length depends upon the size of the gene as well as the protein form which it is taking the message.

Q:4 What is the general formula of Amino acids?

Ans: Amino acids:

The compounds with an amino group (NH₂) and a carboxyl group (COOH) attached to the same carbon atom, known as alpha carbon are called amino acids. These are basic units of protein.

General formula of Amino acids:



Q:5 What is the percentage of water in brain cells of men?

Ans: Percentage of water in brain cells:

- Human body contains 85 percent water in brain cells.

Q:6 What are the symptoms of Turner's syndromes?

Ans: Symptoms of Turner's syndromes: Such individual often do not survive pregnancy and are aborted. Those who survive have female appearance with short stature, webbed neck, without ovaries and complete absence of germ cells.

Important Short Answers

Q:1 Why carbon is considered as the basic element of organic compounds?

Ans: Basic element of organic acid:

Carbon is considered as the basic element of organic compounds, because it is tetravalent. Due to its unique properties, carbon occupies the central position in the skeleton of life. It can react with oxygen, hydrogen, nitrogen, phosphorus and sulphur forming covalent bonds. It is also important due to following associations.

- **Carbon-Hydrogen Bond:** It is potential source of chemical energy for cellular activities.
- **Carbon-Oxygen Bond:** Carbon Oxygen association in glycosidic linkages provides stability to complex carbohydrate molecules.
- **Carbon-Nitrogen Bond:** Carbon combines with nitrogen in amino acids linkages to form peptide bonds and forms proteins which are very important due to their diversity in structure and functions.

Q:2 Define Biochemistry? Why study of biochemistry is essential in the field of biology or in the study of living organisms?

Ans: Biochemistry: Biochemistry is a branch of Biology, which deals with the study of chemical components and the chemical processes in living organisms.

Importance of Biochemistry:

A basic knowledge of biochemistry is essential for understanding anatomy and physiology, because all of the structures of an organism have biochemical organization. Photosynthesis, respiration, digestion, muscle contraction can all be described in biochemical terms.

Q:3 Define Metabolism. Differentiate between Catabolism and Anabolism.

Ans: Metabolism: All the chemical reactions taking place within a cell are collectively called metabolism.

- Metabolism = Anabolism + Catabolism
- Energy is taken and released simultaneously.

Catabolism	Anabolism
<ul style="list-style-type: none"> • The breakdown of complex molecules into simpler ones, such reactions are called catabolic reactions. 	<ul style="list-style-type: none"> • Those reactions in which substances are combined to form complex substances are called anabolic reactions.
<ul style="list-style-type: none"> • Energy is released during catabolic reactions. 	<ul style="list-style-type: none"> • Anabolic reactions need energy.
<ul style="list-style-type: none"> • Catabolism is an exergonic reaction. 	<ul style="list-style-type: none"> • Anabolism is an endergonic reaction.
<ul style="list-style-type: none"> • Catabolism is the destructive phase of metabolism. 	<ul style="list-style-type: none"> • Anabolism is the constructive phase of metabolism.
<ul style="list-style-type: none"> • Catabolism is functional at body activities. 	<ul style="list-style-type: none"> • Anabolism is functional at resting or sleeping.
<ul style="list-style-type: none"> • Catabolism occurs during cellular respiration, digestion, and excretion. 	<ul style="list-style-type: none"> • Anabolism occurs during photosynthesis in plants, protein synthesis, glycogen synthesis and assimilation in animals.
<ul style="list-style-type: none"> • Examples: The breakdown of proteins into amino acids, glycogen into glucose and triglycerides into fatty acids are examples for catabolic processes. 	<ul style="list-style-type: none"> • Examples: The synthesis of polypeptides from amino acids, glycogen from glucose and triglycerides from fatty acids are examples for the anabolic processes.

Q:4 Water is excellent solvent for polar substances. Justify this statement.

Ans: Water is excellent solvent for polar substances:

Due to its polarity, water is an excellent solvent for polar substances. Ionic substances when dissolves in water dissociate into positive and negative ions. Non-ionic substances having charged groups in their molecules are dispersed in water. Almost all the reactions in cell occur in aqueous media.

Q:5 How water works as a temperature stabilizer for living organisms?

Ans: Water works as a temperature stabilizer for living organisms:

Water has great ability of absorbing heat with minimum of change in its own temperature. This is because much of the energy is used to break hydrogen bonds. Water thus works as temperature stabilizer for organisms in the environment and hence protects living material against sudden thermal changes.

Q: 6 How heat of vaporization of water is beneficial in daily life?

Ans: Heat of vaporization of water:

The specific heat of vaporization of water is 574 K cal/kg, which plays an important role in the regulation of heat produced by oxidation. It also provides cooling effect to plants when water is transpired, or to animals when water is respired.

Q:7: How water act as an effective lubricant?

Ans: Water act as an effective lubricant: Water is effective lubricant that provides protection against damage resulting from friction.

For example:

- Tears protect the surface of eye from the rubbing of eyelids
- Water also forms a fluid cushion around organs that helps to protect them from trauma.

Q:8: Compare the chemical composition of Bacterial and Mammalian cell.

Chemical Components	% Total Cell Weight Bacterial Cell	% Total Cell Weight Mammalian Cell
Water	70%	70%
Proteins	15%	15%
Carbohydrates	3%	4%
Lipids	2%	3%
DNA	1%	0.25%
RNA	6%	1.1%
Other organic molecules(Enzymes, hormones, metabolites)	2%	2%
Inorganic ions (Na+, K+, Ca+2, Mg+2, Cl-, (SO-2)4)	1%	1%

Q:9 Name the most important organic and inorganic compounds in living organisms.

Ans: Organic Compounds in living organisms:

Most important organic compounds in living organisms are carbohydrates, proteins, lipids and nucleic acids.



Inorganic compounds in living organisms:

Among inorganic compounds are water carbon dioxide, acids, bases and salts.

Q:10 What are carbohydrates? Carbohydrates are classified into how many groups?

Ans: Carbohydrates: The word carbohydrate literally means hydrated carbons. They are composed of carbon, oxygen and hydrogen.

- **Formula:** Their formula is $C_n(H_2O)_n$.

Chemical Definition:

Chemically, carbohydrates are defined as polyhydroxy aldehydes, or complex substances which no hydrolysis yields polyhydroxy aldehyde or ketone subunits.

Carbohydrates are classified into three groups:

1. Mono saccharides
2. Oligosaccharides
3. polysaccharides

Q:11 List some important functions of carbohydrates.

Ans: Functions of Carbohydrates: Carbohydrates occur abundantly in living organisms. They are found in all organisms and in almost all parts of the cell.

- Carbohydrates play both structural and functional roles. Simple carbohydrates are the main source of energy in cells.
- Some carbohydrates are the main constituent of cell walls in plants and microorganisms.
- Cellulose of wood cotton and paper, starches present cereals, roots tubers, cane sugar and milk sugar are all examples of carbohydrates.

Q:12 How glucose is prepared / produced naturally?

Ans: Glucose production:

Glucose is naturally produced in green plants which take carbon dioxide from air and water from the soil to synthesize glucose. Energy is consumed in this process which is provided by sunlight. That is why this process is called photosynthesis.

Q:13 Differentiate between Monosaccharides and Disaccharides.

Monosaccharides	Disaccharides
<ul style="list-style-type: none"> They are composed of single saccharide unit. 	<ul style="list-style-type: none"> They are composed of 2-10 saccharide units.
<ul style="list-style-type: none"> They are simple sugars. 	<ul style="list-style-type: none"> These are comparatively complex sugar.
<ul style="list-style-type: none"> They are sweet in taste. 	<ul style="list-style-type: none"> These are comparatively less sweet in taste
<ul style="list-style-type: none"> They are easily soluble in water. 	<ul style="list-style-type: none"> They are less soluble in water
<ul style="list-style-type: none"> They cannot be hydrolyzed into simple sugar. 	<ul style="list-style-type: none"> On hydrolysis oligosaccharides yield from 2-10 mono saccharides. <ul style="list-style-type: none"> The one yielding two mono saccharides are known as disaccharides Those yielding three are known as trisaccharides and so on.
<ul style="list-style-type: none"> No glycosidic linkage occurs in them. 	<ul style="list-style-type: none"> Glycosidic linkage occurs in them.
<ul style="list-style-type: none"> These have many types like trioses, tetroses, pentose, hexoses etc. 	<ul style="list-style-type: none"> Most of these are disaccharides.
<ul style="list-style-type: none"> Their general formula is $(CH_2O)_n$. 	<ul style="list-style-type: none"> Their general formula is $C_{12}H_{22}O_{11}$.
<ul style="list-style-type: none"> Examples: Glucose, ribose, fructose. 	<ul style="list-style-type: none"> Examples: Lactose, maltose, sucrose.

Q:14 What are polysaccharides? Name some biologically important polysaccharides.

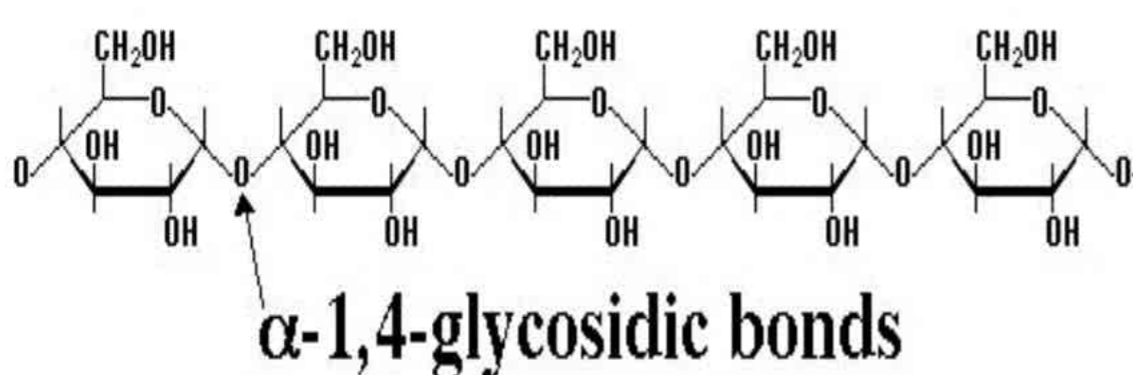
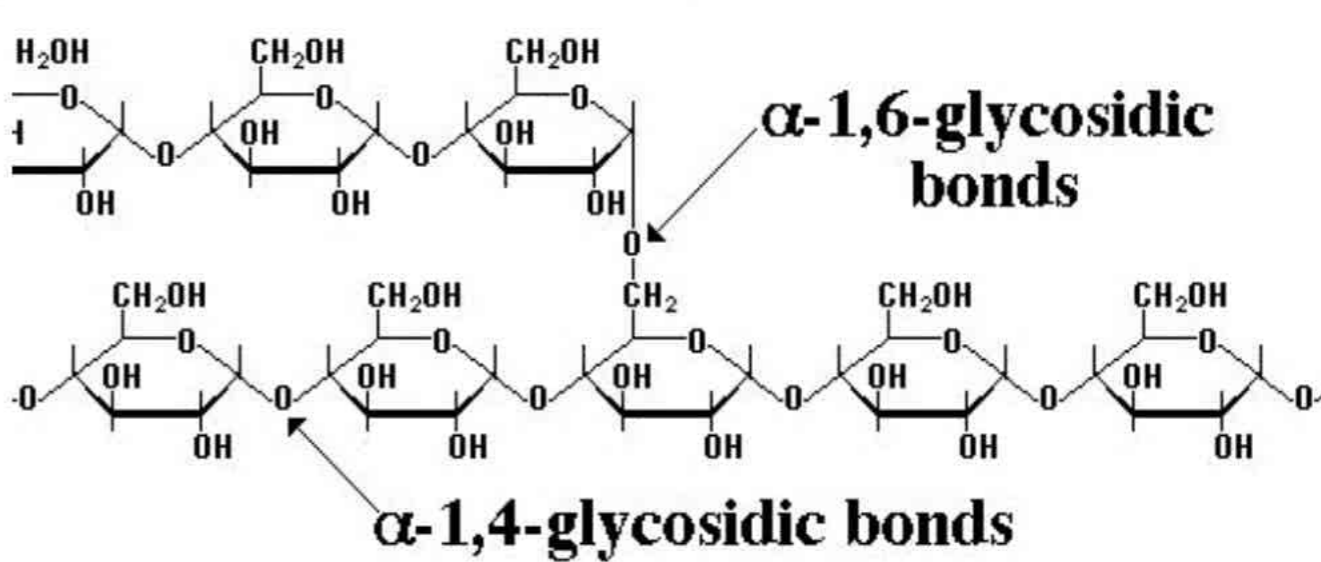
Ans: Polysaccharide: Poly saccharides are the most complex and most abundant carbohydrate in nature.

- They are usually branched and tasteless.
- They are formed by several mono saccharides units linked by glycosidic bonds.
- Polysaccharides have high molecular weights and are only sparingly soluble in water.

Some biologically important poly saccharides:

Some biologically important poly saccharides are starch, a gas, glycogen, cellulose, dextrans, pectin and chitin.

Q:15 Differentiate between Amylase and Amylopectin.

Amylose	Amylopectin
<ul style="list-style-type: none"> Amylose starches have unbranched chains of glucose. 	<ul style="list-style-type: none"> Amylopectin starches have branched
<ul style="list-style-type: none"> These are soluble in hot water. 	<ul style="list-style-type: none"> insoluble in hot or cold water
<ul style="list-style-type: none"> Amylose is a straight chain polymer of D-glucose units. 	<ul style="list-style-type: none"> Amylopectin is a branched chain polymer of D-glucose units.
<ul style="list-style-type: none"> Amylose has α 1-4 glycosidic linkages. 	<ul style="list-style-type: none"> Amylopectin has α 1-4 glycosidic linkages and α 1-6 glycosidic linkages.
<ul style="list-style-type: none"> Amylose gives a dark blue/black color when iodine solution is added. 	<ul style="list-style-type: none"> Amylopectin gives a reddish brown color when iodine solution is added.
<p>Amylose</p>  <p>α-1,4-glycosidic bonds</p>	<p>Amylopectin</p>  <p>α-1,6-glycosidic bonds</p> <p>α-1,4-glycosidic bonds</p>

Q:16 Differentiate between Reducing and Non-reducing sugars.

Reducing sugars	Non reducing sugars
<ul style="list-style-type: none"> Sugars that can carry out a type of chemical reaction, known as reduction, are called reducing sugar. 	<ul style="list-style-type: none"> Sugars that cannot carry out a type of chemical reaction, known as reduction, are called non-reducing sugar.
<ul style="list-style-type: none"> These sugars have free anomeric carbon. 	<ul style="list-style-type: none"> These sugars do not have any free anomeric carbon.
<ul style="list-style-type: none"> These sugars can reduce metallic reagents like Fehling's reagent. 	<ul style="list-style-type: none"> These sugars can reduce metallic reagents like Fehling's reagent.

<ul style="list-style-type: none"> For example maltose, lactose and all monosaccharides are reducing sugars. 	<ul style="list-style-type: none"> For example sucrose is the only common non-reducing sugar because aldehyde group of glucose and ketone group of fructose are combined to make the bond between these two molecules and there is no reducing group present in sucrose.
---	---

Q:17 Differentiate between Glycosidic and Peptide bond.

Glycosidic bond	Peptide bond
<ul style="list-style-type: none"> A covalent bond formed between two monosaccharides is called glycosidic bond. 	<ul style="list-style-type: none"> A covalent bond formed between two amino acids in carboxylic of one amino acid combine with amino group of other amino acid.
<ul style="list-style-type: none"> In this C-O linkage is formed. 	<ul style="list-style-type: none"> In this C-N linkage is called peptide bond.
<ul style="list-style-type: none"> It provides stability to the complex carbohydrate molecules. 	<ul style="list-style-type: none"> It forms diversity structure and functions of proteins.
<ul style="list-style-type: none"> Example: In sucrose molecules (cane sugar) two monosaccharides i.e. glucose and sucrose linked by glycosidic bond. 	<ul style="list-style-type: none"> Example: Alanine and glycine are joined to form peptide linkage.

Q: 18 Differentiate between Starch and Glycogen.

Characters	Starch	Glycogen
Monomer	<ul style="list-style-type: none"> α-glucose 	<ul style="list-style-type: none"> α-glucose
Type of bond between monomers	<ul style="list-style-type: none"> 1,4 glycosidic bond (amylose) +1,4 and 1,6 glycosidic bond (amylopectin) 	<ul style="list-style-type: none"> 1,4 and 1,6 glycosidic bonds
Nature of chain	<ul style="list-style-type: none"> Amylose is coiled unbranched. Amylopectin is long branched chains, some coiled. 	<ul style="list-style-type: none"> Short many branched chains, some coiled
Occurrence	<ul style="list-style-type: none"> In plants 	<ul style="list-style-type: none"> In animals and fungi
Function	<ul style="list-style-type: none"> Carbohydrate energy store 	<ul style="list-style-type: none"> Carbohydrate energy store
General form	<ul style="list-style-type: none"> Grains 	<ul style="list-style-type: none"> Small granules

Q:19 What is cellulose?

Ans: Cellulose: It is most abundant in nature. Cotton is pure form of cellulose.

- It is the main constituent of cell wall of plants and is highly insoluble in water.
- On hydrolysis, it also yields glucose molecules.
- Cellulose gives no color with iodine.
- It is not digested in human digestive system.
- In the herbivores, it is digested because of micro-organism in their digestive tract. These micro-organisms secrete an enzyme called cellulase for its digestion.

Q:20 What are lipids? What is the use of lipids in daily life?

Ans: Lipids: The lipids are heterogeneous group of compounds related to fatty acids.

- They are insoluble in water but soluble in organic solvents such as ether, alcohol, chloroform and benzene.
- Lipids include fats, oils, waxes, cholesterol and related compounds.

Uses of lipids in daily life:

- Lipids as hydrophobic compounds are components of cellular membranes.
- They are used to store energy.
- Some lipids provide insulation against atmospheric heat and cold and also act as water proof material waxes, in the exoskeleton of insects and cutin, an additional protective layer on the cuticle of epidermis of some plants organs. e.g., leaves fruits, seeds etc., protect them.

Q: 21 Give the classification of lipids.

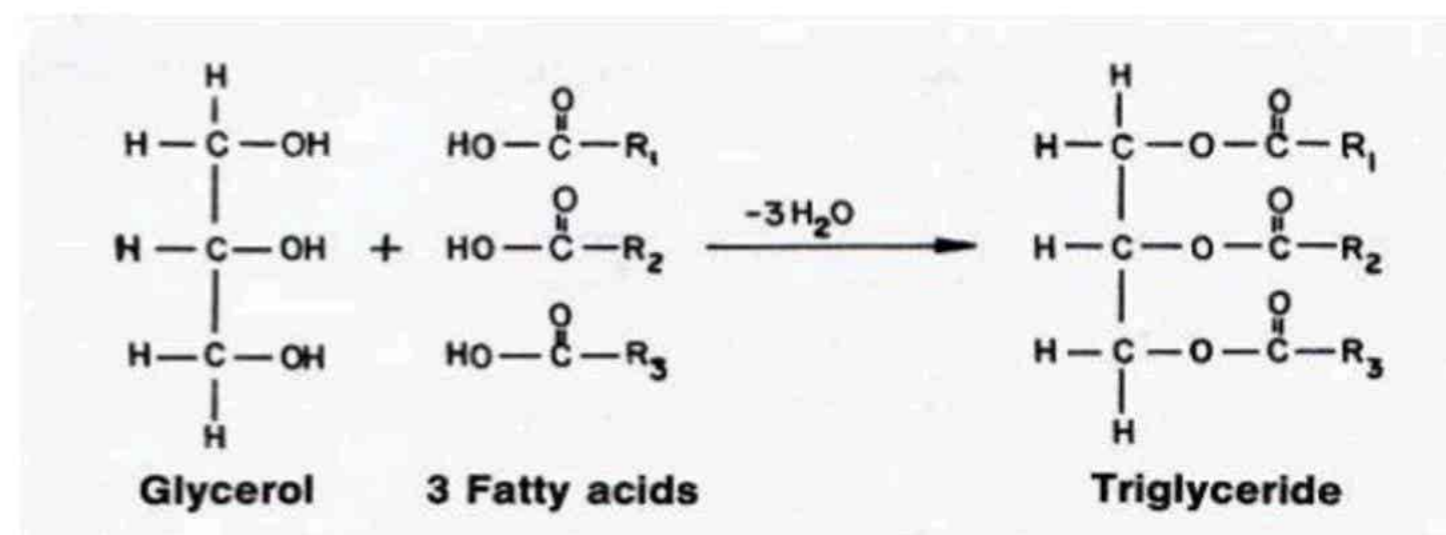
Ans: Classification of lipids: Lipids have been classified as;

- Acylglycerols
- Waxes
- Phospholipids
- Sphingolipids
- Glycolipids
- Terpenoids lipids including carotenoids and steroids

Q:22 What are acylglycerols?

Ans: Acylglycerols: Acylglycerols are composed of glycerol and fatty acids.

- The most widely spread acylglycerol is triacylglycerol also triglycerides or neutral lipids.
- Chemically acylglycerol can be defined as esters of fatty acids and alcohol.
- An ester is the compound produced as the result of a chemical reaction of an alcohol with an acid and a water molecule is released.



Q:23 What are waxes? What is the importance of waxes?

Ans: Waxes: Chemically, waxes are mixtures of long chain alkanes and alcohols, ketones and esters of long chain fatty acids.

- Waxes are widespread as protective coatings on fruits and leaves.
- Some insects also secrete wax.

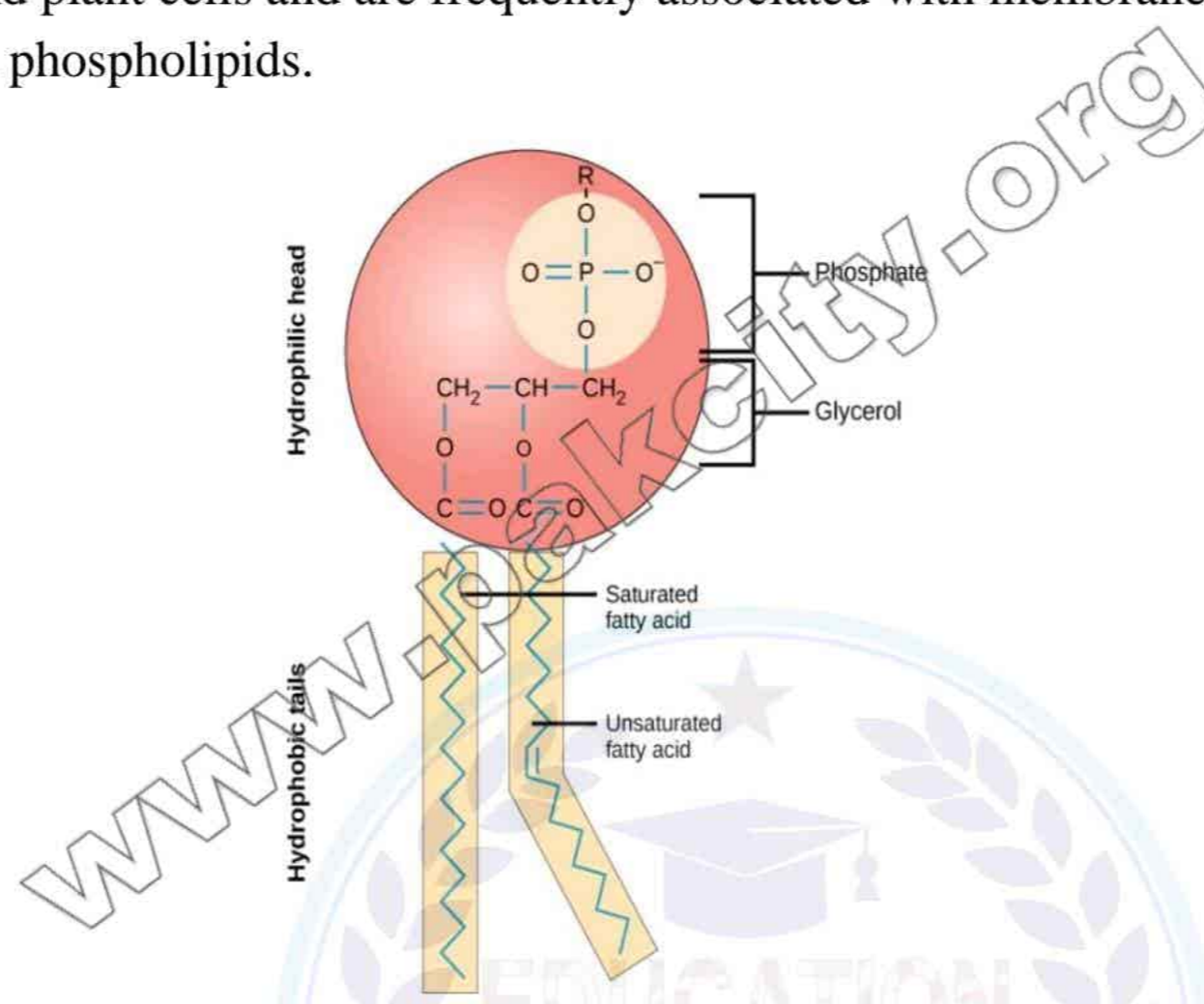
Importance:

- Waxes protect plants from water loss and abrasive damage.
- They also provide barrier for insects, birds and animals such as sheep.

Q:24 What are phospholipids?

Ans: Phospholipids: Phospholipids are derivatives of phosphoric acid, which are composed of glycerol, fatty acids and phosphoric acid.

- Nitrogenous bases such as choline ethanolamine and serine are important components of phospholipids.
- They are widespread in bacteria, animal and plant cells and are frequently associated with membranes.
- Phosphatidylcholine is one of the common phospholipids.



Q:25 What are terpenoids?

Ans: Terpenoids:

Terpenoids are a very large and important group of compounds which are made up of simple repeating simple units, isoprenoid units.

- This unit by condensation in different ways gives rise to compounds such as rubber, carotenoids, steroids terpenes etc.

Q:26 Differentiate between saturated & unsaturated fatty acids OR How fats differ from oil?

Saturated fatty acids (Animal Fats)	Unsaturated fatty acids (Plant fats/Oils)
• They do not possess double bond in their carbon chains.	• They possess one or more double bonds in their carbon chains.
• They are straight chain.	• They have bend or twist at the double bond.
• They have higher melting point than oil.	• They have lower melting point.
• They are solid at room temperature.	• They are liquid at ordinary temperature.
• They occur in most animal fats.	• They occur in most plant fats.
• Hydrogenation has no effect on saturated fatty acids.	• Hydrogenation converts unsaturated fatty acids into saturated ones.

Q:27 What are proteins? Illustrate the important functions performed by proteins.

Ans: Proteins: Proteins are polymers of amino acid, the compounds containing nitrogen oxygen and hydrogen.

- Proteins are the most abundant organic compounds to be found in cells and comprise over 50% of their total dry weight.

Important functions performed by proteins:

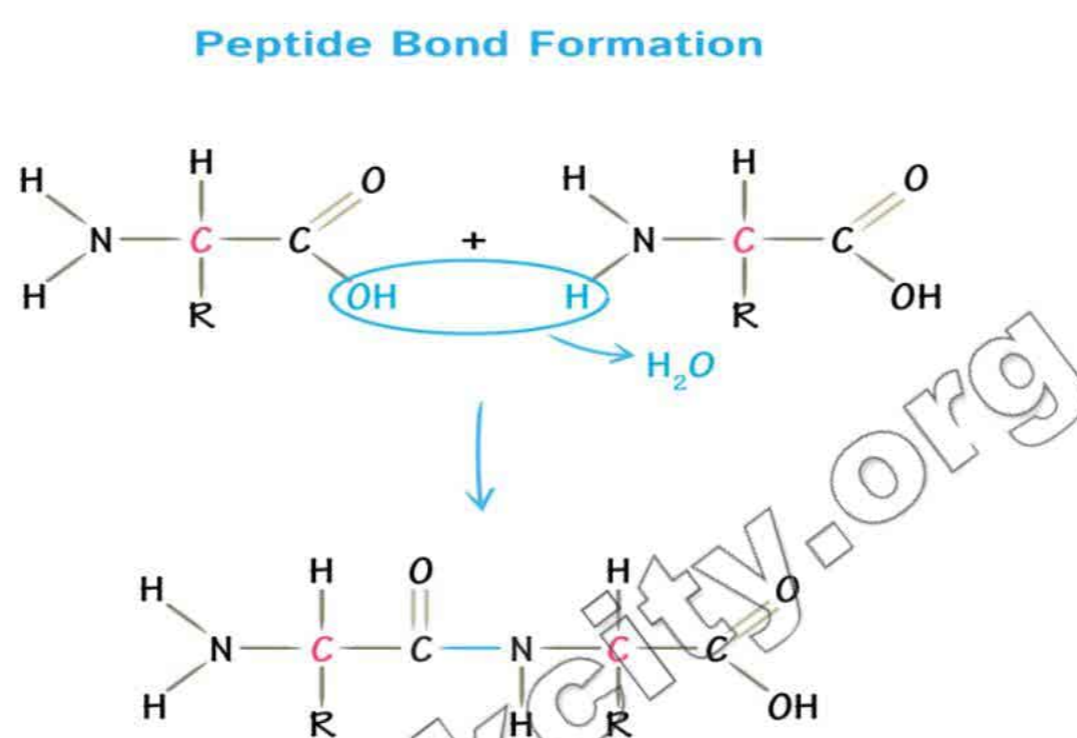


- 1) **Building Structures of Cell:** Proteins build many structures of the cell.
- 2) **As Enzymes:** All enzymes are proteins in this way they control the whole metabolism of the cell.
- 3) **As Hormones:** As hormones, proteins regulate metabolic processes.
- 4) **As carriers:** Some proteins work as carriers and transport specific substances such as oxygen, lipids, ions etc.
- 5) **As Antibodies:** Some proteins called antibodies defend the body against pathogens.
- 6) **Blood Clotting Proteins:** They prevent loss of blood from the body after an injury.
- 7) **Movement of Organs:** Movement of organs and organisms, and movement of chromosomes during anaphase of cell division are caused by proteins.

Q:28 How peptide bond is formed between two amino acids?

Ans: Peptide bond formation:

The linkage between the hydroxyl group of carboxyl group of one amino acid and the hydrogen of amino group of another amino acid release H₂O and C-N link to form a bond called peptide bond. The resultant compound of glycylalanine has two amino acid subunits and is a dipeptide. A dipeptide has an amino group at one end and a carboxyl group at the other end of the molecule.



Q:29 Who was the first scientist who determined the sequence of amino acids in a protein molecule?

Ans:

F.Sanger was the first scientist who determined the sequence of amino acids in protein molecules. After ten years, of careful work he concluded that insulin is composed of 51 amino acids in two chains. One of the chains had 21 amino acids and the other had 30 amino acids and they were held together by disulphide bridges. Haemoglobin is composed of four chains, two alpha and two beta chains. Each alpha chain contains 141 amino acids, while beta chain contains 146 amino acids.

Q:30 How fibrous proteins differed from globular proteins?

Fibrous Proteins	Globular proteins
• Their chains are preset in the form of fibrils.	• Their chains are spherical or ellipsoidal.
• Secondary structure is most important in them.	• Tertiary structure is the most important in them.
• They are insoluble in aqueous media.	• They are soluble in aqueous media such as salt solution, solution of acids or bases or aqueous alcohol.
• They are non-crystalline and are elastic in nature.	• They can be crystallized.
• They do not easily disorganize with the change of physical and physiological environment.	• They disorganize with the change in the physical and physiological environment.
• They perform structural role in cells and organisms.	• They have mostly functional role in the organism.
• Examples: Silk fibers. Actin, myosin, fibrin, keratin.	• Examples: Enzymes antibodies, hemoglobin, hormones

Q:31 How many type of cell walls are present in different organisms?

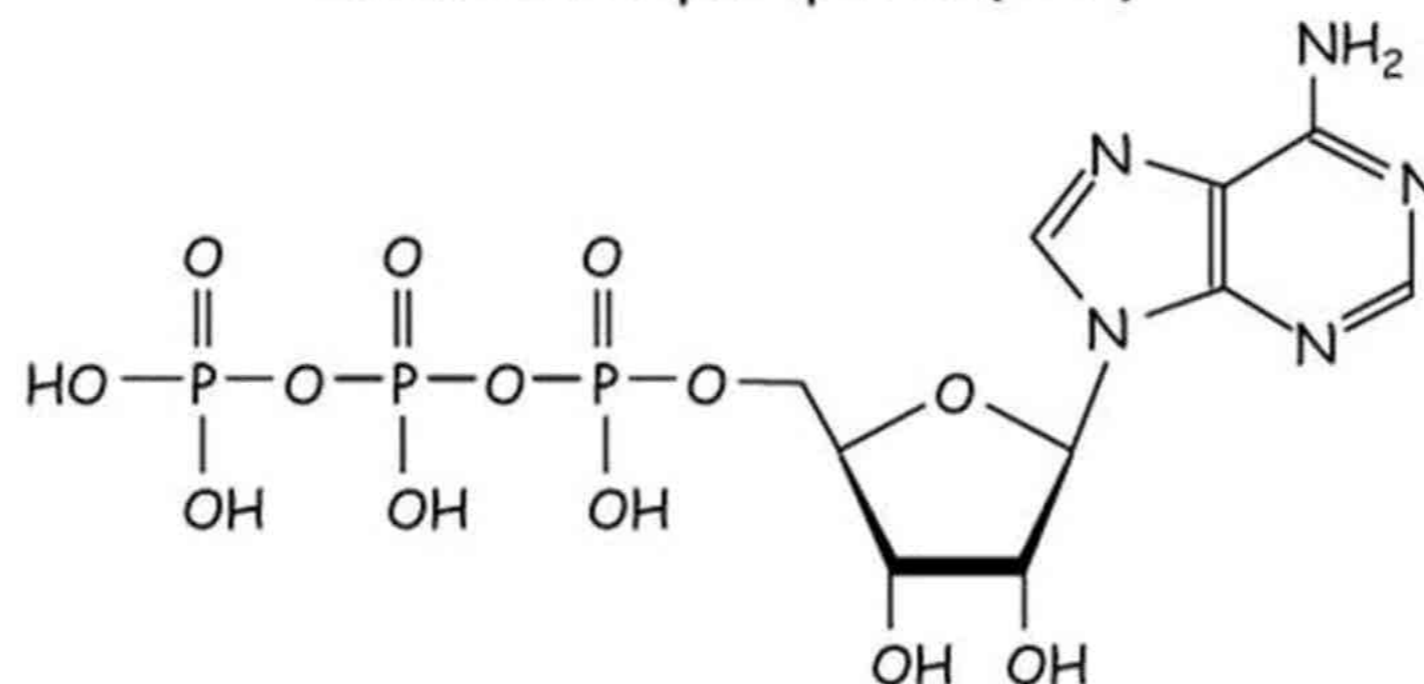
Organism	Cell Wall
Bacteria	• Peptidoglycan and lipopolysaccharides (lipoprotein complex)
Blue green algae	• Muramic acid

Fungi	<ul style="list-style-type: none"> • Chitin
Algae and other Plants	<ul style="list-style-type: none"> • Mainly cellulose

Q:32 Draw structure of ATP.

Ans:

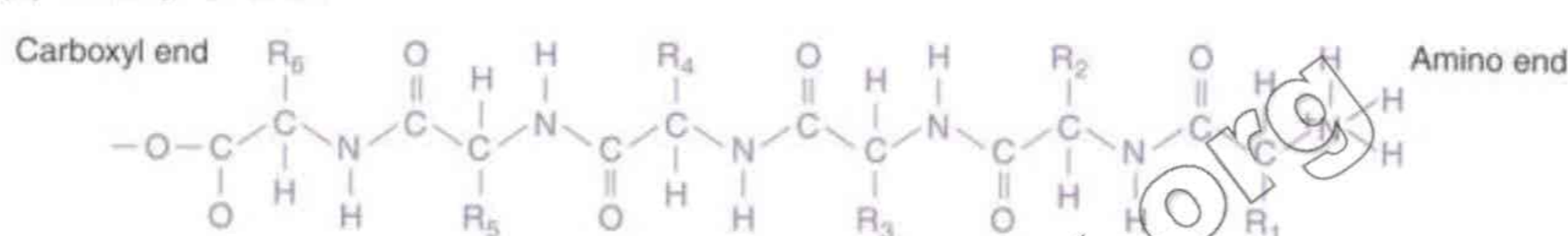
Adenosine triphosphate (ATP)



Q:33 Describe and draw primary structure of proteins.

Ans: Primary structure: The primary structure comprises the number and sequence of amino acids in a single chain in a protein molecule. The size of protein molecule is determined by the type of amino acids and the number of amino acids comprising that particular molecule.

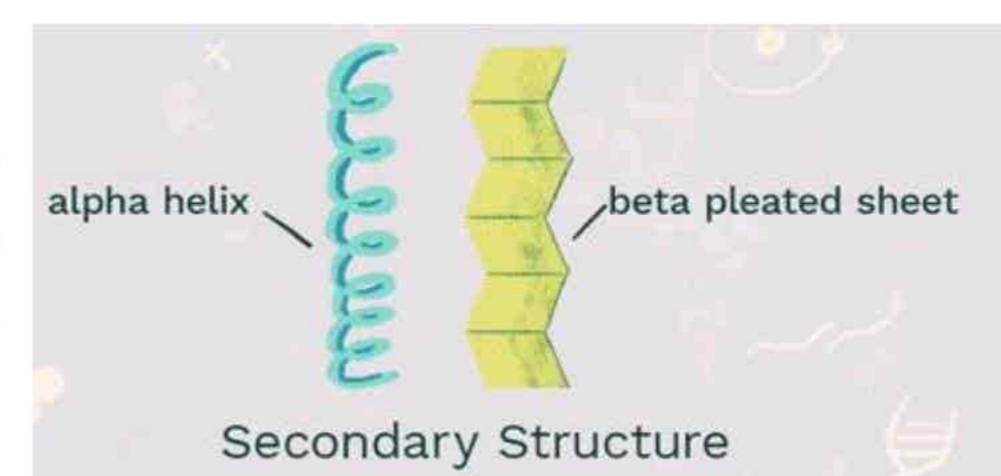
(a) Primary structure



Q:34 Describe and draw secondary structure of protein.

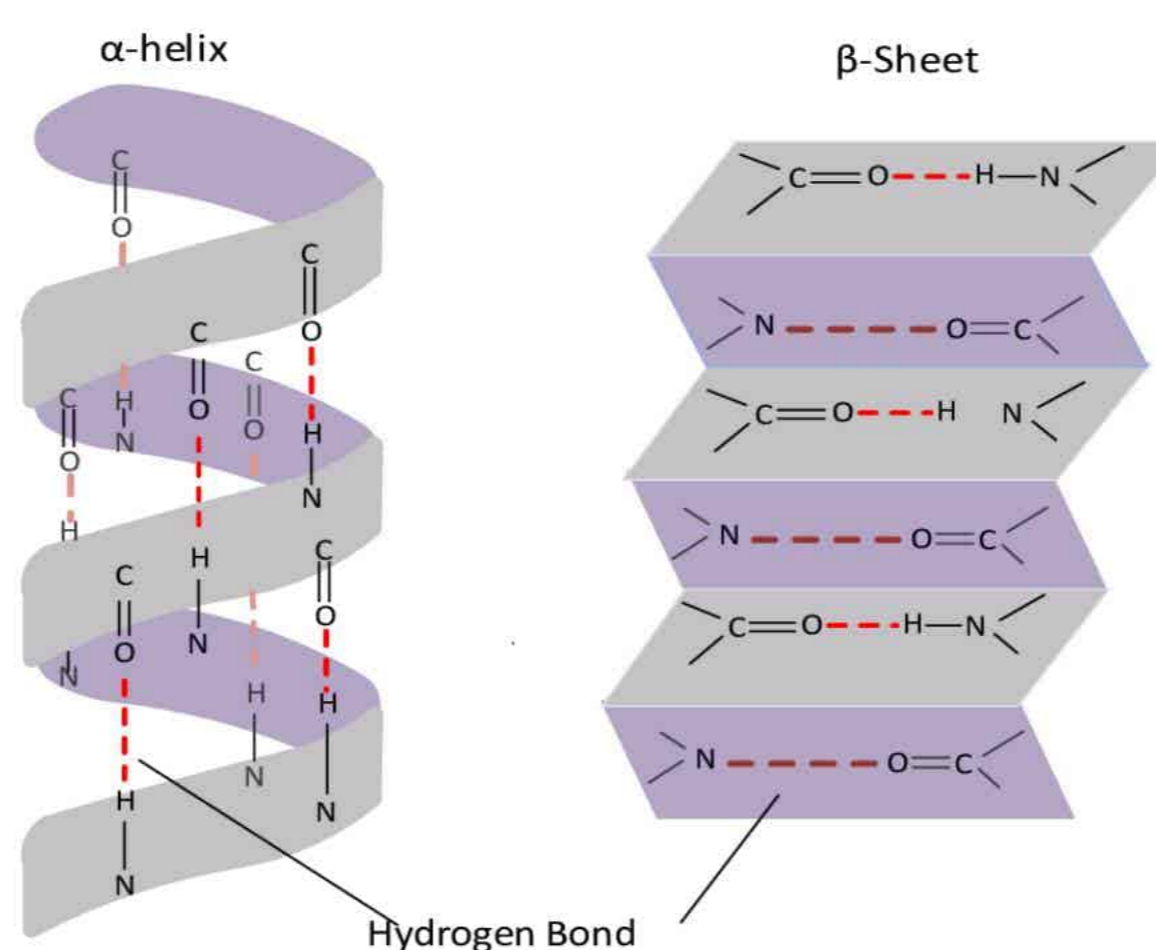
Ans: Secondary structure of protein:

The polypeptide chain in secondary does not lie flat. They coil into a helix or some other configuration. Common secondary structure is alpha-helix which involves spiral formation of the polypeptide chain. It has 3.6 amino acids in each turn. This structure is kept by the formation of hydrogen bonds among amino acids molecules. Beta-pleated Sheet is formed by folding back of the polypeptide.



Q:35 Differentiate between α helix and β sheets.

α helix	β sheets
<ul style="list-style-type: none"> • It is helical in structure. 	<ul style="list-style-type: none"> • It is plate (sheet) like form.
<ul style="list-style-type: none"> • It is simple unit. 	<ul style="list-style-type: none"> • It is a complex unit.
<ul style="list-style-type: none"> • It is spirally coiled polypeptide chain in which 3.6 amino acids are present in each turn and this spiral structure is maintained by hydrogen bonds between nearby amino acids. 	<ul style="list-style-type: none"> • It is like a folded sheet which is formed by the folding back of the polypeptides in which amino acids change their directions.



Q:37 Differentiate between DNA and RNA.

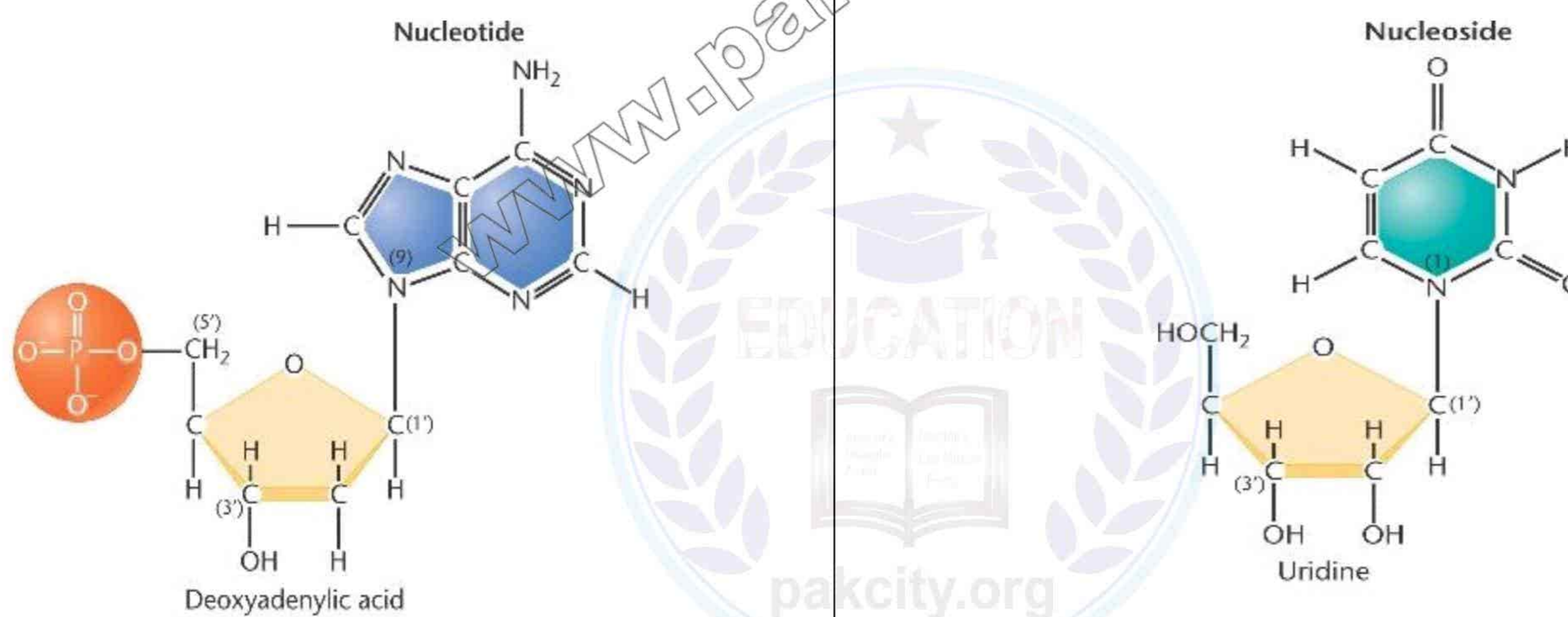
DNA	RNA
• It is called de-oxy-ribonucleic acids.	• It is called ribonucleic acids.
• It is double helix.	• It is single stranded.
• In it nitrogen bases are A,T,G and C.	• In it nitrogen bases are A,U,G and C.
• It has fixed amount in a cell.	• It has variable amount in a cell.
• It has deoxyribose with formula $C_5H_{10}O_4$.	• It has ribose with formula $C_5H_{10}O_5$.
• It functions in inheritance.	• They are involved in protein synthesis.
• It is involved in the synthesis of chromosomes.	• They are involved in protein synthesis.
• They are found and function usually in nucleus.	• They are formed in nucleus but function in cytoplasm.



Q:37 How were nucleic acids isolated? Differentiate between nucleotide and nucleoside.

Ans: . Nucleic acids were isolated in 1870 by F. Miesches from the nuclei of the pus cells. Due to their isolation from nuclei and their acidic nature, they were named nucleic acids.

Nucleotide	Nucleoside
• Nucleotide is made up of nitrogen base, pentose sugar, and phosphate group.	• Nucleoside is made up of a nitrogen base, pentose sugar only.
• A nucleotide is the precursor of polynucleotides, DNA and RNA.	• A nucleoside is the precursor of nucleotide.
• It is basic unit/ building block of Nucleic acids (DNA, RNA).	• It is not a basic unit/ building block of nucleic acids (DNA, RNA).
• Examples: ATP, ADP, AMP,GTP	• Examples: Adenosine, Guanosine, Thymidine.



Q:38 Differentiate between mRNA and rRNA.

Characters	Mrna	rRNA
Number of strands	• Single stranded	• Single stranded
Location	• In nucleus and cytoplasm (mainly ribosomes)	• Only in ribosomes
Amount	• 3-4%	• 80%
Function	• It takes the genetic message from the nucleus to the ribosomes in the cytoplasm to form particular proteins messenger RNA carries the genetic information from DNA to ribosomes, where amino acids are arranged according to the information in mRNA to form specific protein molecule.	• It acts as machinery for the synthesis of proteins. On the surface of the ribosomal the mRNA and tRNA molecules interact to translate the information from genes into a specific protein.