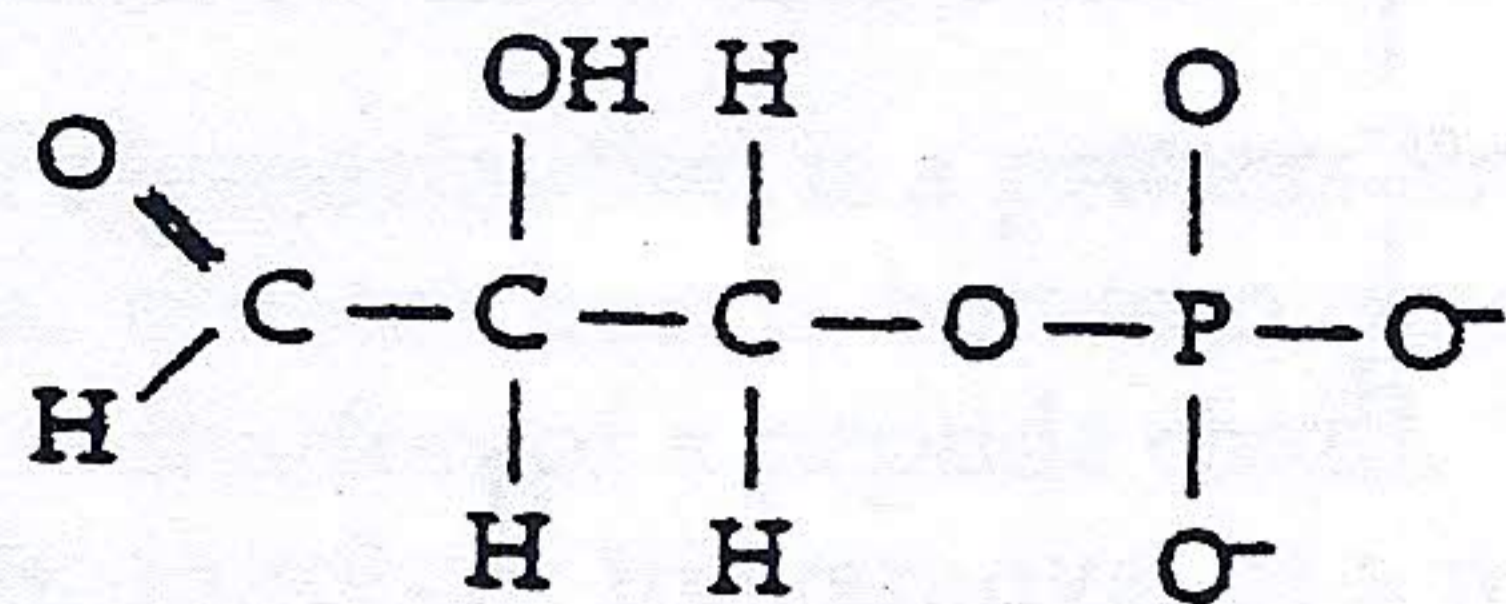
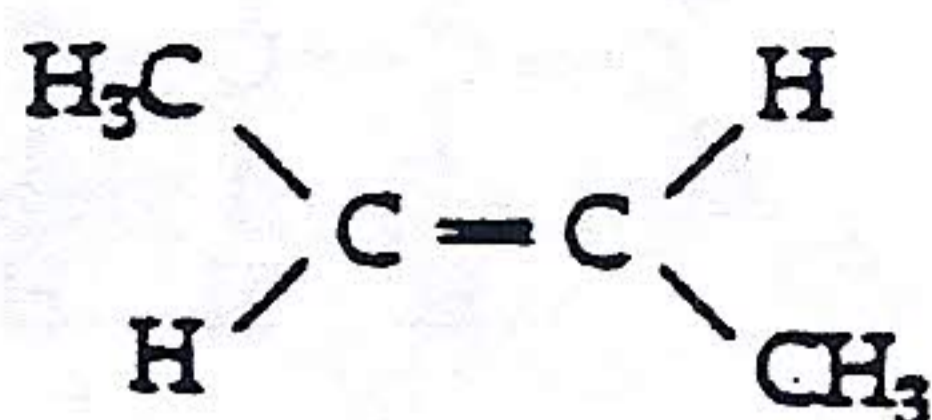


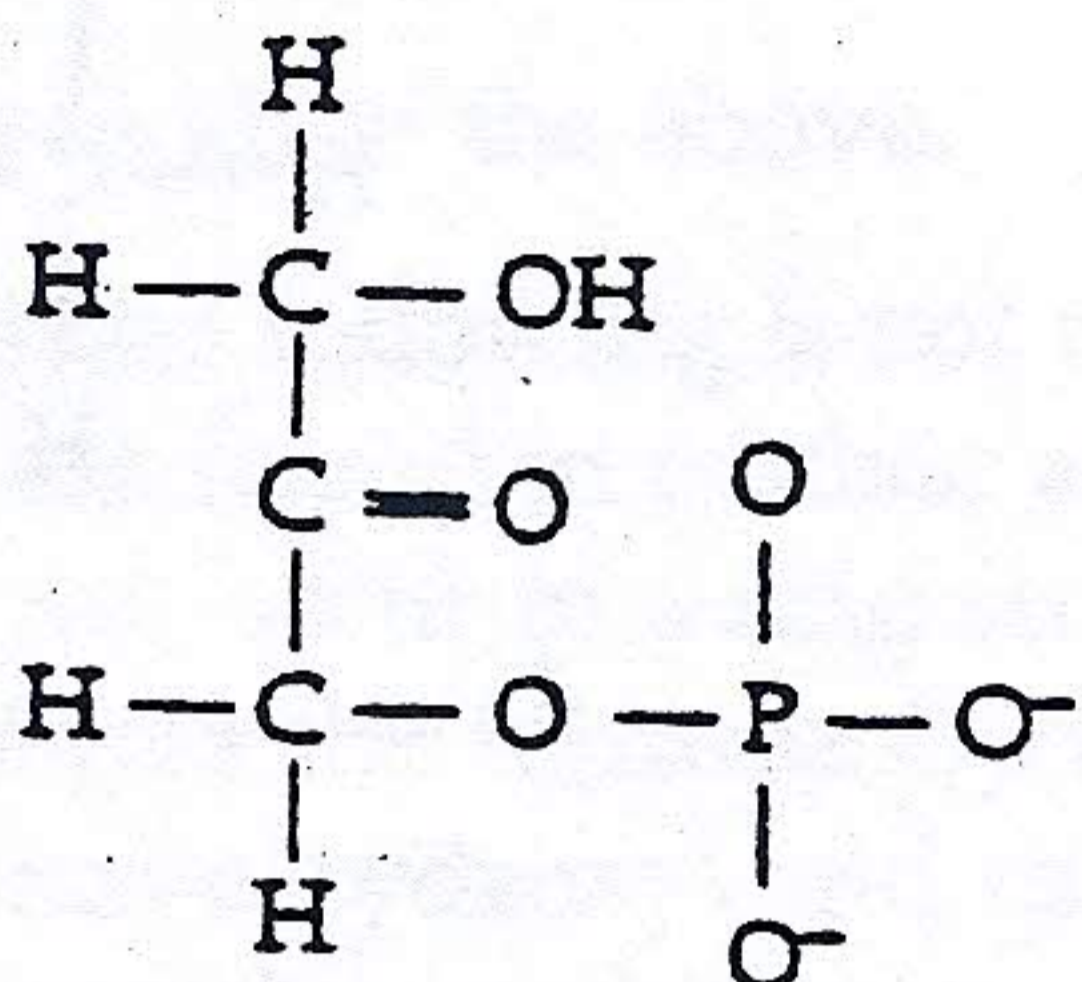
MATCHING: Match the formulas below to the terms at the right. Choices may be used more than once; more than one right choice may be available.



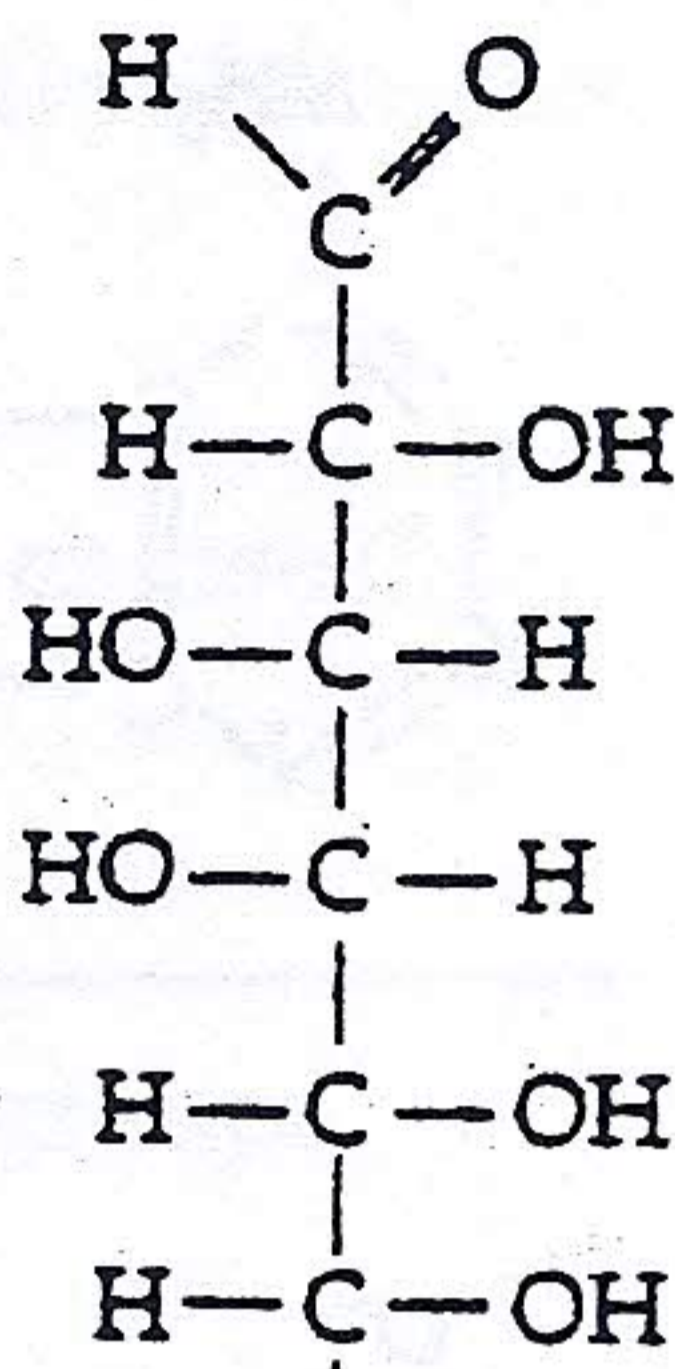
a.



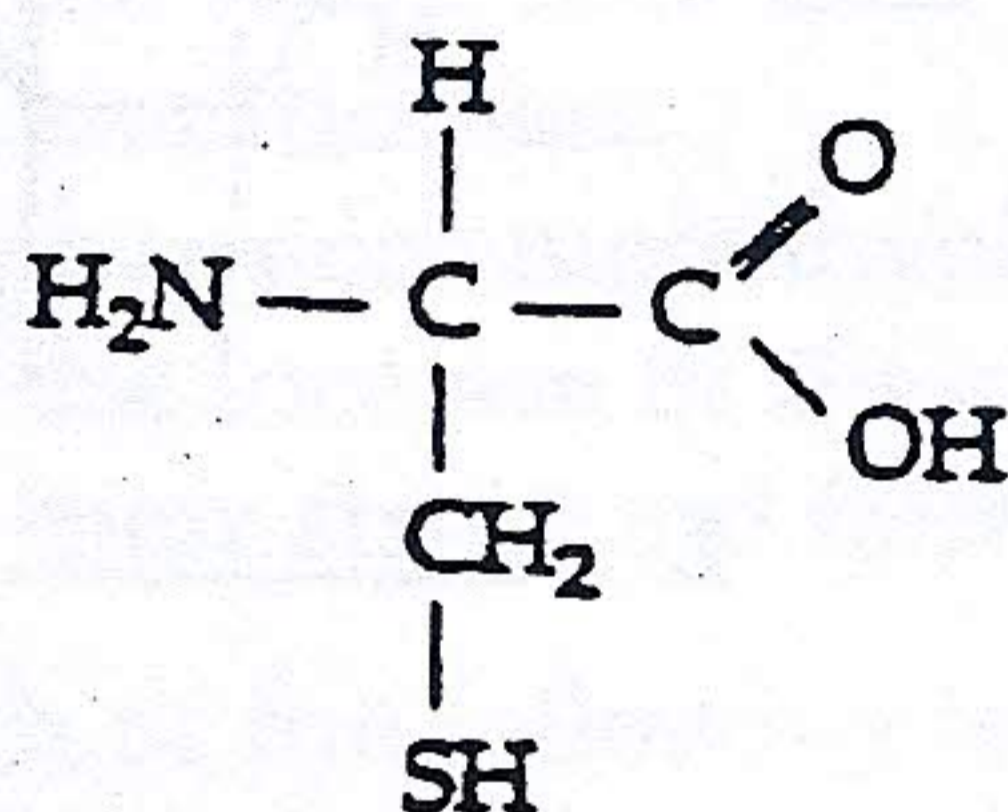
b.



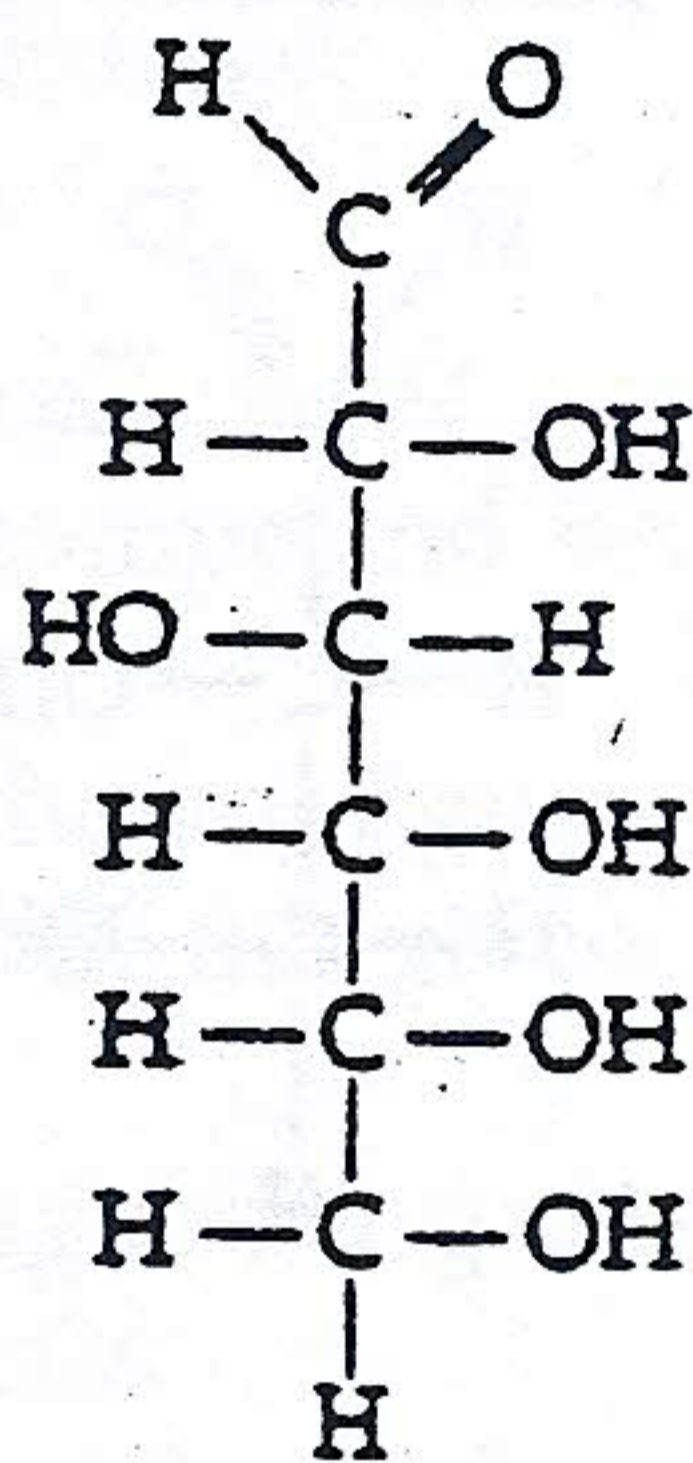
c.



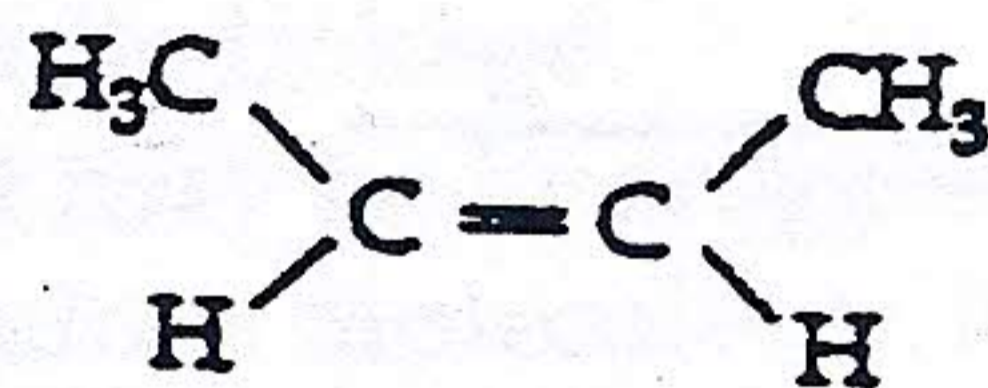
d.



e.



f.



g.

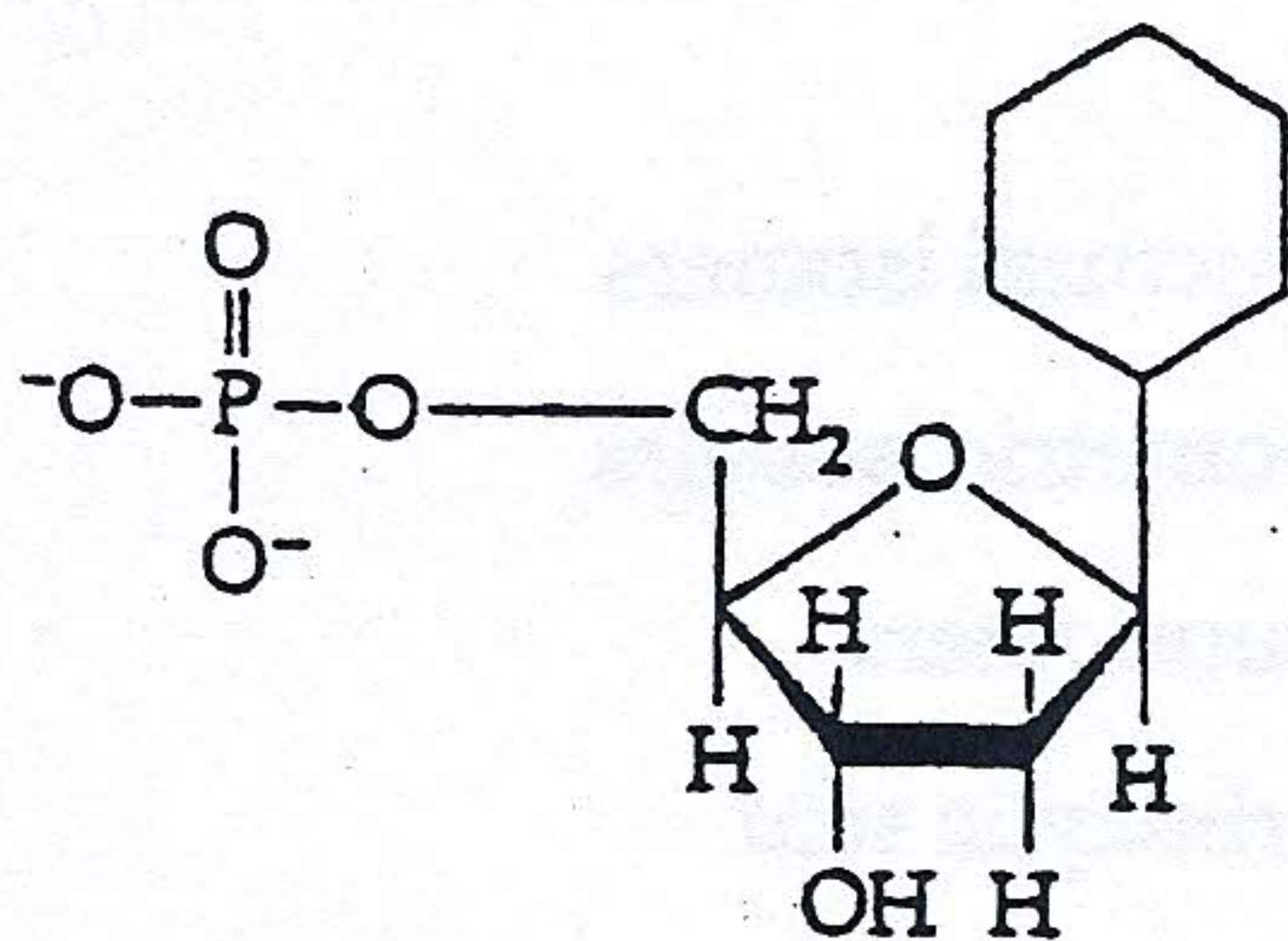
- _____ 1. structural isomers
- _____ 2. geometric isomers
- _____ 3. enantiomers
- _____ 4. carboxylic acid
- _____ 5. can make cross-link in protein
- _____ 6. hydrophilic
- _____ 7. hydrocarbon
- _____ 8. amino acid
- _____ 9. organic phosphate
- _____ 10. aldehyde
- _____ 11. amine
- _____ 12. ketone

2. Fill in the following table on the functional groups.

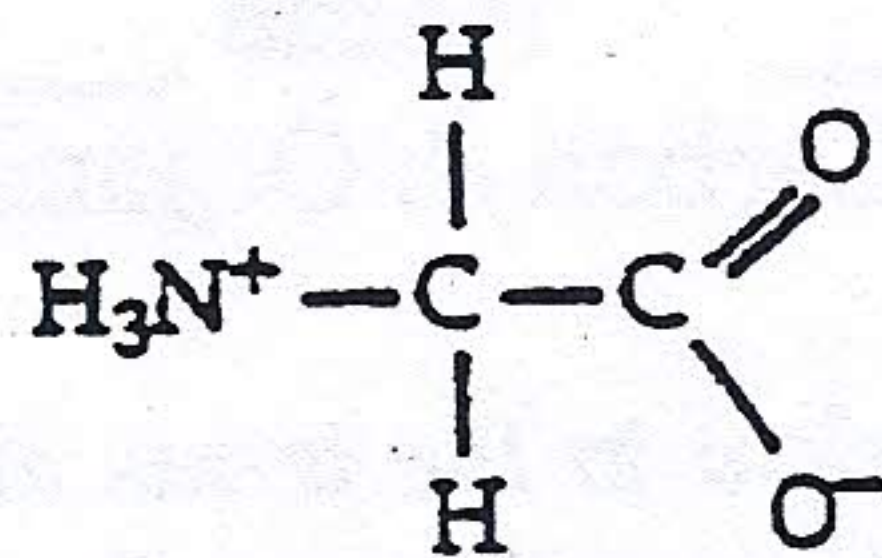
Functional Group	Molecular Formula	Names and Characteristics of Organic Compounds Containing Functional Group
	-OH	
		Aldehyde or ketone; polar group
Carboxyl		
	-NH ₂	
		Thiols; cross-links stabilize protein structure
Phosphate		

Fill in the blanks to review the structure of monosaccharides.

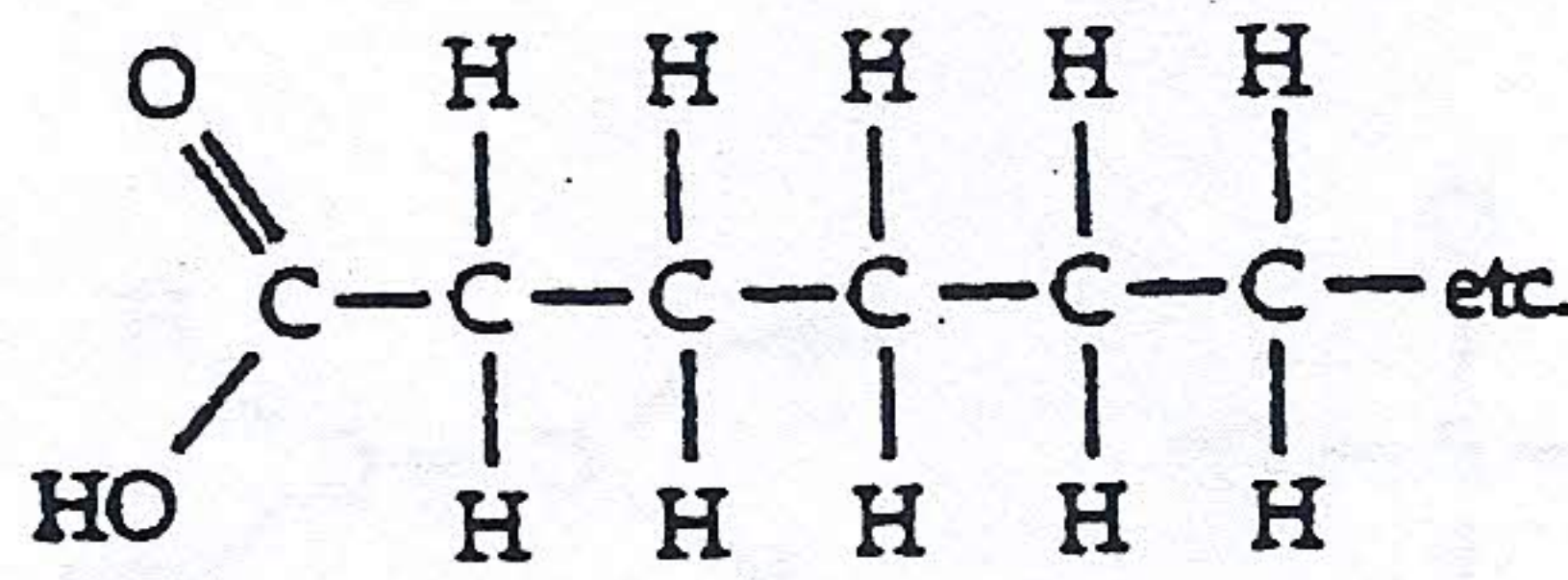
You can recognize monosaccharides because each carbon except one bears a (a) _____ group. The remaining carbon bears a (b) _____ group and its location determines whether the sugar is an (c) _____ or a (d) _____. In aqueous solutions, most monosaccharides form (e) _____.



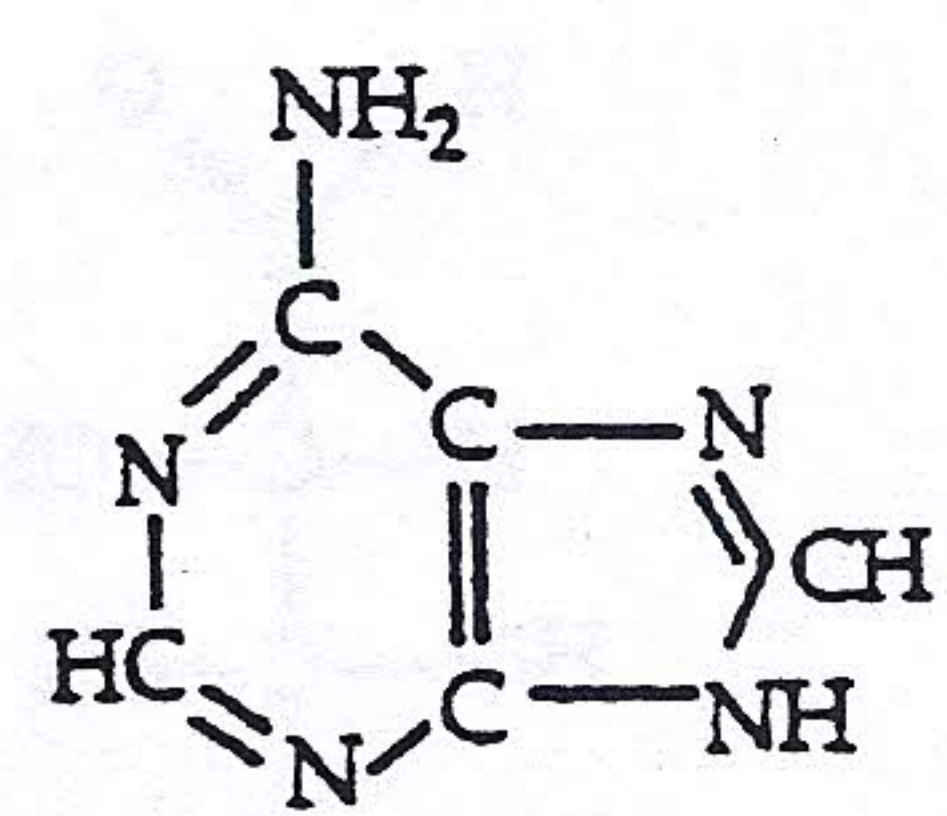
- Label the three parts of this nucleotide. Indicate with an arrow where the phosphate group of the next nucleotide would attach to build a polynucleotide.
- Is this a purine or a pyrimidine?
- Is this a DNA or RNA nucleotide?



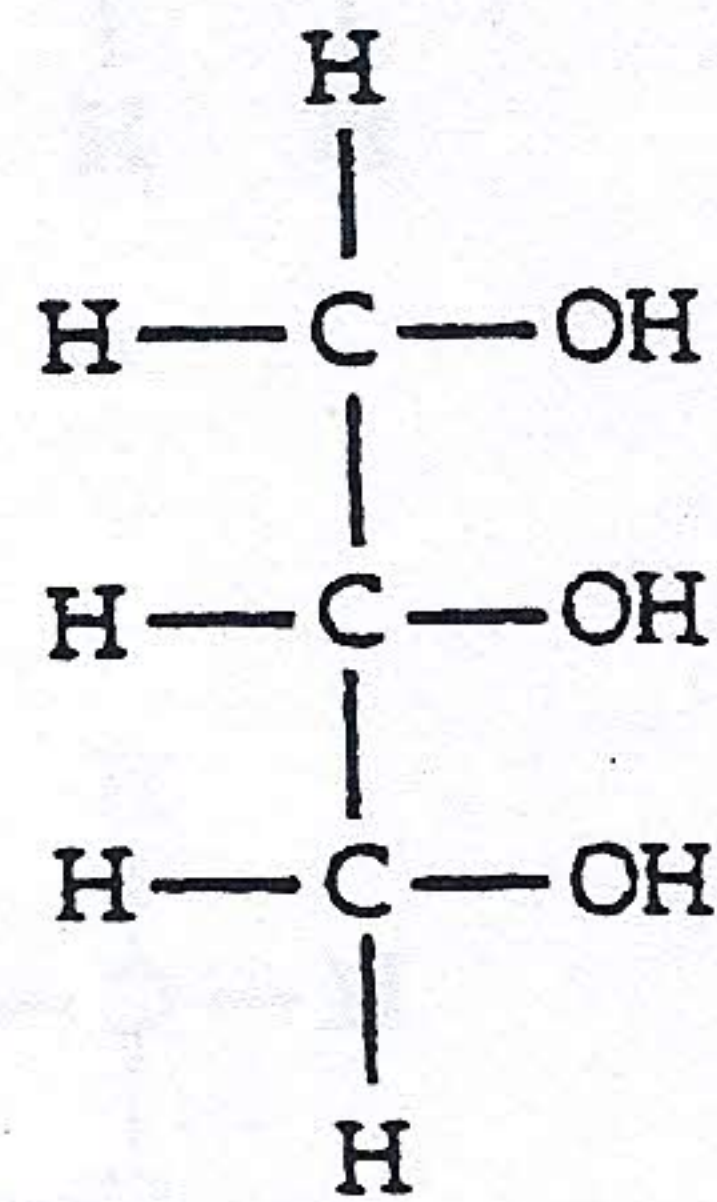
a. _____



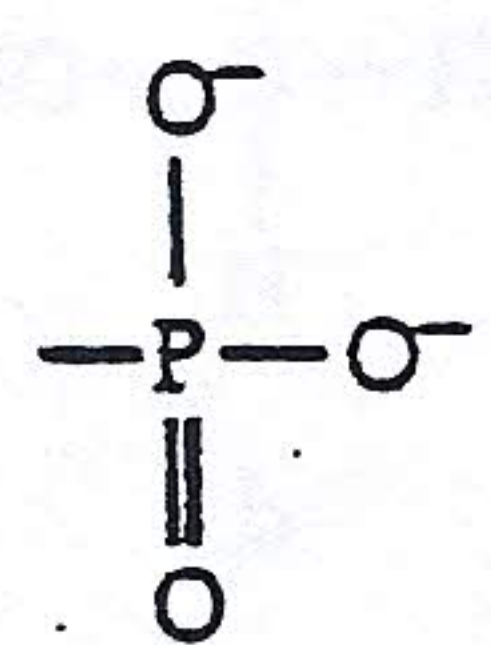
b. _____



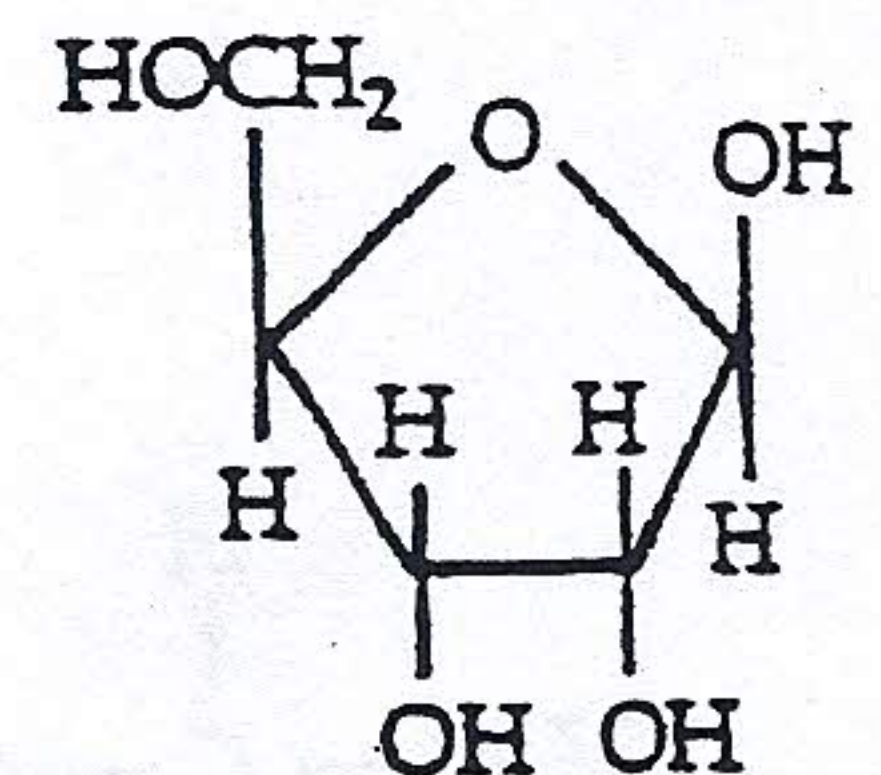
c. _____



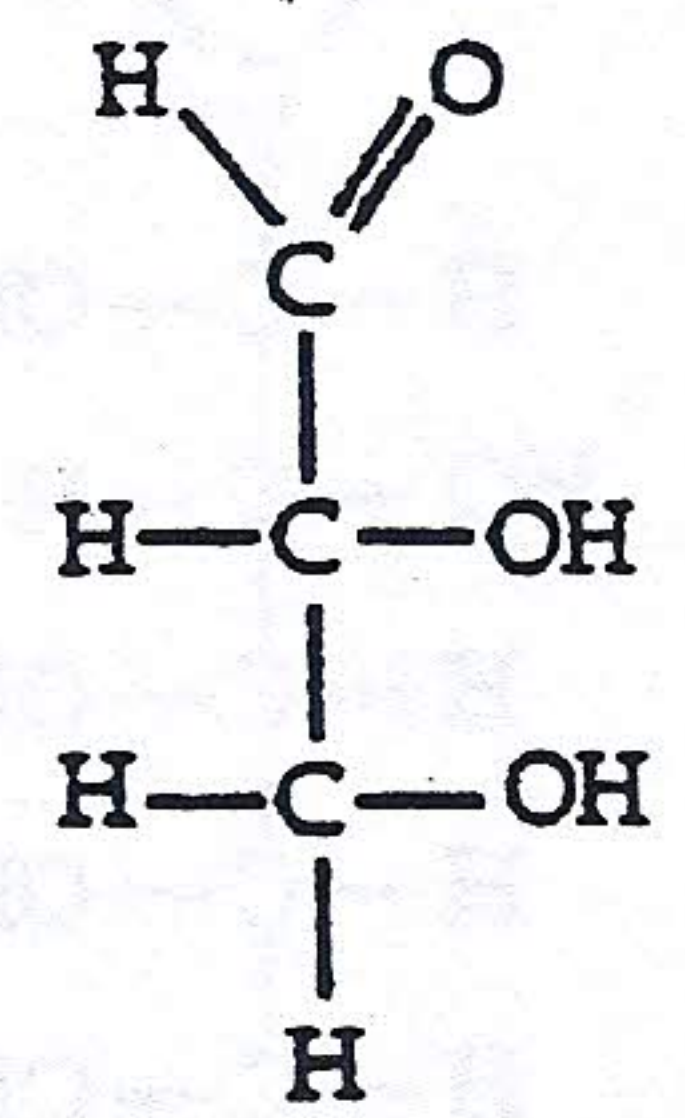
d. _____



e. _____



f. _____



g. _____

STRUCTURE YOUR KNOWLEDGE

- Describe the four structural levels in the conformation of a protein.
- Identify the type of monomer or group shown by these formulae. Then match the chemical formulae with their description. Answers may be used more than once.

- | | |
|-------|--|
| _____ | 1. molecules that would combine to form a fat |
| _____ | 2. molecule that would be attached to other monomers by a peptide bond |
| _____ | 3. molecules or groups that would combine to form a nucleotide |
| _____ | 4. molecules that are carbohydrates |
| _____ | 5. molecule that is a purine |
| _____ | 6. monomer of a protein |
| _____ | 7. groups that would be joined by phosphodiester bonds |

TEST YOUR KNOWLEDGE

MATCHING: Match the molecule with its class of macromolecules.

- | | | |
|-------|----------------|-----------------|
| _____ | 1. glycogen | A. carbohydrate |
| _____ | 2. cholesterol | B. lipid |
| _____ | 3. RNA | C. protein |
| _____ | 4. collagen | D. nucleic acid |
| _____ | 5. hemoglobin | |

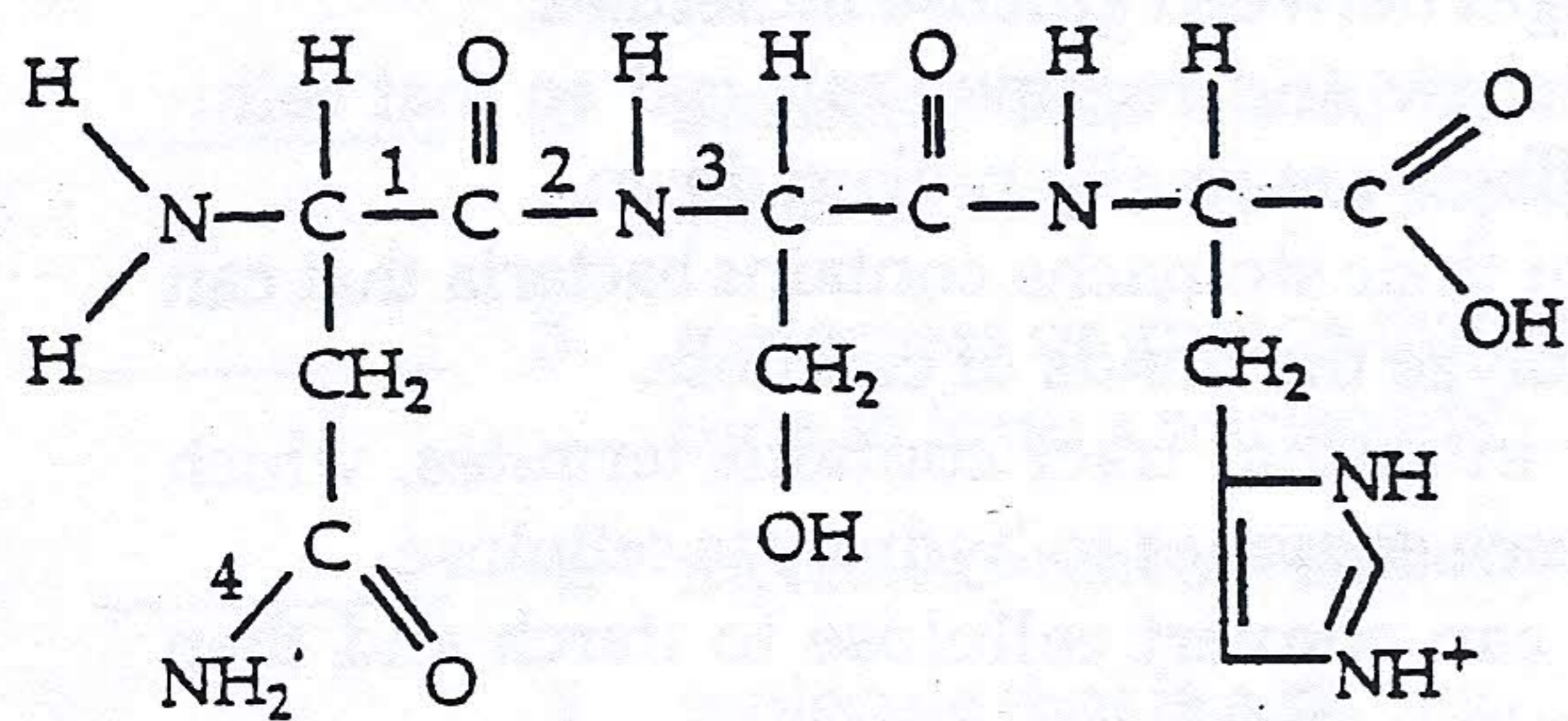
- _____ 6. a gene
- _____ 7. triacylglycerol
- _____ 8. enzyme
- _____ 9. cellulose
- _____ 10. chitin

MULTIPLE CHOICE: Choose the one best answer.

1. Polymerization is a process that
 - a. creates bonds between amino acids in the formation of a peptide chain.
 - b. involves the removal of a water molecule.
 - c. links the phosphate of one nucleotide with the sugar of the next.
 - d. requires a condensation or dehydration reaction.
 - e. involves all of the above.
2. Which of the following is *not* true of pentoses?
 - a. They are found in nucleic acids.
 - b. They can occur in a ring structure.
 - c. They have the formula $C_5H_{12}O_5$.
 - d. They have hydroxyl and carbonyl groups.
 - e. They may be an aldose or a ketose.
3. Disaccharides can differ from each other in all of the following ways *except*
 - a. in the number of their monosaccharides.
 - b. as enantiomers.
 - c. in the monomers involved.
 - d. in the location of their glycosidic linkage.
 - e. in their structural formulae.
4. Which of the following is *not* true of cellulose?
 - a. It is the most abundant organic compound on Earth.
 - b. It differs from starch because of the configuration of glucose and the geometry of the glycosidic linkage.
 - c. It may be hydrogen-bonded to neighboring cellulose molecules to form microfibrils.
 - d. Few organisms have enzymes that hydrolyze its glycosidic linkages.
 - e. Its monomers are glucose with nitrogen-containing appendages.
5. Plants store most of their energy as
 - a. glucose.
 - b. glycogen.
 - c. starch.
 - d. sucrose.
 - e. cellulose.
6. What happens when a protein denatures?
 - a. It loses its primary structure.
 - b. It loses its secondary and tertiary structure.
 - c. It becomes irreversibly insoluble and precipitates.
 - d. It hydrolyzes into component amino acids.
 - e. Its hydrogen bonds, ionic bonds, hydrophobic interactions, disulfide bridges, and peptide bonds are disrupted.
7. The alpha helix of proteins is
 - a. part of the tertiary structure and is stabilized by disulfide bridges.
 - b. a double helix.
 - c. stabilized by hydrogen bonds and commonly found in fibrous proteins.
 - d. found in some regions of globular proteins and stabilized by hydrophobic interactions.
 - e. a complementary sequence to messenger RNA.
8. A fatty acid that has the formula $C_{16}H_{32}O_2$ is
 - a. saturated.
 - b. unsaturated.
 - c. branched.
 - d. hydrophilic.
 - e. part of a steroid molecule.
9. Three molecules of the fatty acid in question 8 are joined to a molecule of glycerol ($C_3H_8O_3$). The resulting molecule has the formula
 - a. $C_{48}H_{96}O_6$.
 - b. $C_{48}H_{98}O_9$.
 - c. $C_{51}H_{102}O_8$.
 - d. $C_{51}H_{98}O_6$.
 - e. $C_{51}H_{104}O_9$.
10. Pleated sheets are characterized by
 - a. disulfide bridges between cysteine amino acids.
 - b. parallel regions of the polypeptide chain held together by hydrophobic interactions.
 - c. folds stabilized by hydrogen bonds between segments of polypeptide chains.
 - d. membrane sheets composed of phospholipids.
 - e. hydrogen bonds between adjacent cellulose molecules.
11. Cows can derive nutrients from cellulose because
 - a. they can produce the enzymes that break the β linkages between glucose molecules.
 - b. they chew and re-chew their cud so that cellulose fibers are finally broken down.
 - c. one of their stomachs contains bacteria that can hydrolyze the bonds of cellulose.
 - d. their intestinal tract contains termites, which produce enzymes to hydrolyze cellulose.
 - e. they can convert cellulose to starch and then hydrolyze starch to glucose.
12. Which of these molecules would provide the most energy (kcal/g) when eaten?
 - a. glucose
 - b. starch
 - c. glycogen
 - d. fat
 - e. protein

13. What *determines* the sequence of the amino acids in a particular protein?
- its primary structure
 - the sequence of nucleotides in RNA, which was determined by the sequence of nucleotides in the gene for that protein
 - the sequence of nucleotides in DNA, which was determined by the sequence of nucleotides in RNA
 - the sequence of RNA nucleotides making up the ribosome
 - the three-dimensional shape of the protein
14. Sucrose is made from joining a glucose and a fructose molecule in a dehydration reaction. What is the molecular formula for this disaccharide?
- $C_6H_{12}O_6$
 - $C_{12}H_{24}O_{12}$
 - $C_{12}H_{24}O_{13}$
 - $C_{12}H_{22}O_{11}$
 - $C_{10}H_{20}O_{10}$
15. How are the nucleotide monomers connected to form a polynucleotide?
- hydrogen bonds between complementary nitrogenous base pairs
 - ionic attractions between phosphate groups
 - disulfide bridges between cysteine amino acids
 - covalent bonds between the sugar of one nucleotide and the phosphate of the next
 - ester linkages between the carboxyl group of one nucleotide and the hydroxyl group on the ribose of the next
16. Which of the following would be a hydrophobic molecule?
- cholesterol
 - nucleotide
 - amino acid
 - chitin
 - glucose

17. What is the best description of this molecule?



- chitin
- amino acid
- polypeptide

- nucleotide
 - protein
18. Which number(s) in the molecule above refer(s) to a peptide bond?
- 1
 - 2
 - 3
 - 4
 - both 2 and 4
19. If the nucleotide sequence of one strand of a DNA helix is GCCTAA, what would be the sequence on the complementary strand?
- GCCTAA
 - CGGAUU
 - CGGATT
 - ATTCGG
 - TAAGCC
20. Monkeys and humans share many of the same DNA sequences and have similar proteins, indicating that
- the two groups belong to the same species.
 - the two groups share a relatively recent common ancestor.
 - humans evolved from monkeys.
 - monkeys evolved from humans.
 - the two groups first appeared on Earth at about the same time.

FILL IN THE BLANKS

- The man who determined the amino acid sequence of insulin was _____.
- Cytosine always pairs with _____.
- Adenine and guanine are _____.
- A pentose joined to a nitrogenous base and a phosphate group is called a _____.
- The conformation of a protein is determined by its _____.
- Proteins with more than one polypeptide chain have _____ structure.
- The carbohydrate energy storage molecule of animals is _____.
- Membranes are composed of a bilayer of _____.
- The linkages between amino acids in a protein are called _____.
- A technique used to determine the three-dimensional structure of macromolecules is _____.

Worksheet 3 Essays:

1. Why would a change in pH cause a protein to denature?
2. Why would transfer to a nonpolar organic solvent (such as ether) cause denaturation?
3. When you hard boil an egg, the clear liquid part surrounding the yolk becomes white and solid. Discuss why this happens.