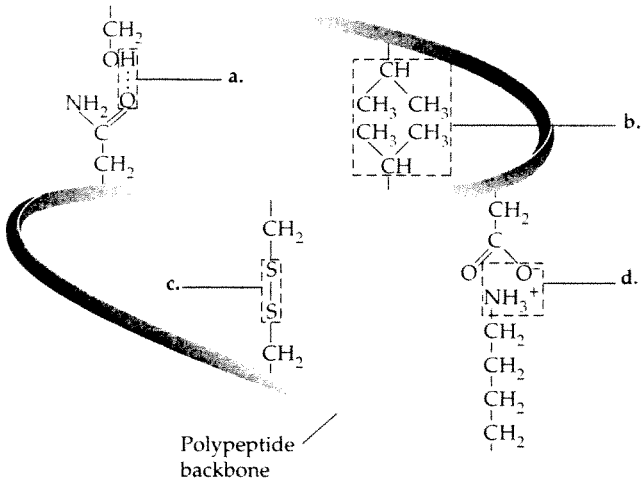


INTERACTIVE QUESTION 5.8

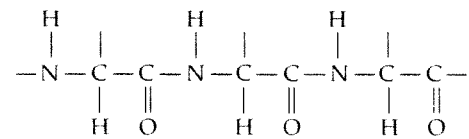
In the following diagram of a portion of a protein, label the types of interactions that are shown. What level of structure are these interactions producing?



- a. Draw the amino acids alanine (R group: $-\text{CH}_3$) and serine (R group: $-\text{CH}_2\text{OH}$) and then show how a dehydration reaction will form a peptide bond between them.

- b. Which of these amino acids has a polar R group? a non-polar R group?

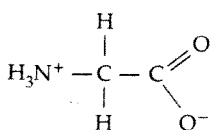
- c. What does the following molecule segment represent? (Note the $\text{N}-\text{C}-\text{C}-\text{N}-\text{C}-\text{C}$ sequence.)



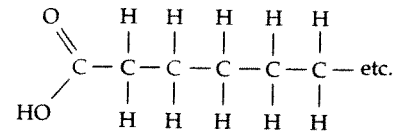
Structure Your Knowledge

- Describe the four structural levels in the functional shape of a protein.
- Identify the type of monomer or group shown by the formulas a–g. Then match the chemical formulas with their description. Answers may be used more than once.

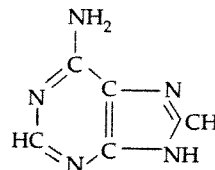
- _____ 1. molecules that would combine to form a fat
- _____ 2. molecule that would be attached to other monomers by a peptide bond
- _____ 3. molecules or groups that would combine to form a nucleotide
- _____ 4. molecules that are carbohydrates
- _____ 5. molecule that is a purine
- _____ 6. monomer of a protein
- _____ 7. groups that would be joined by phosphodiester bonds
- _____ 8. most nonpolar (hydrophobic) molecule



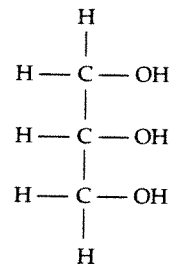
a. _____



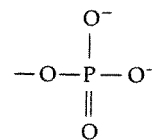
b. _____



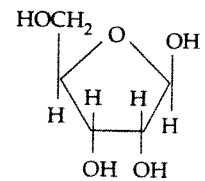
c. _____



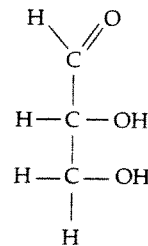
d. _____



e. _____



f. _____



g. _____

Test Your Knowledge

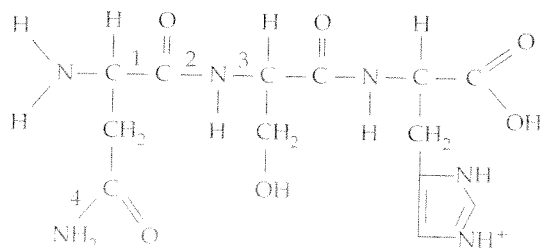
MATCHING: Match the molecule with its class of molecule.

- | | | | |
|-------|--------------------|----|--------------|
| _____ | 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.

- Polymerization (the formation of polymers) is a process that
 - creates bonds between amino acids in the formation of a polypeptide.
 - involves the removal of a water molecule.
 - links the sugar of one nucleotide with the phosphate of the next.
 - involves a dehydration reaction.
 - may involve all of the above.
- Which of the following statements is *not* true of a pentose?
 - It can be found in nucleic acids.
 - It can occur in a ring structure.
 - It has the formula $C_5H_{12}O_5$.
 - It has one carbonyl and four hydroxyl groups.
 - It may be an aldose or a ketose.
- Disaccharides can differ from each other in all of the following ways *except*
 - in the number of their monosaccharides.
 - in their structural formulas.
 - in the monomers involved.
 - in the location of their glycosidic linkage.
 - They can differ in all of these ways.
- Which of the following statements is *not* true of cellulose?
 - It is the most abundant organic compound on Earth.
 - It differs from starch because of the configuration of glucose and the geometry of the glycosidic linkage.
 - It may be hydrogen-bonded to neighboring cellulose molecules to form microfibrils.
 - Few organisms have enzymes that hydrolyze its glycosidic linkages.
 - Its monomers are glucose with nitrogen-containing appendages.
- Plants store most of their energy for later use as
 - unsaturated fats.
 - glycogen.
 - starch.
 - sucrose.
 - cellulose.
- Sucrose is made from joining a glucose molecule and a fructose molecule in a dehydration reaction. What is the molecular formula for this disaccharide?
 - $C_6H_{12}O_6$
 - $C_{10}H_{20}O_{10}$
 - $C_{12}H_{22}O_{11}$
 - $C_{12}H_{24}O_{12}$
 - $C_{12}H_{24}O_{13}$
- A cow can derive nutrients from cellulose because
 - it can produce the enzymes that break the β linkages between glucose molecules.
 - it chews and rechews its cud so that cellulose fibers are finally broken down.
 - its rumen contains prokaryotes that can hydrolyze the bonds of cellulose.
 - its intestinal tract contains termites, which harbor microbes that hydrolyze cellulose.
 - it can convert cellulose to starch and then hydrolyze starch to glucose.
- Which of the following substances is the major component of the cell membrane of a fungus?
 - cellulose
 - chitin
 - cholesterol
 - phospholipids
 - unsaturated fatty acids
- A fatty acid that has the formula $C_{16}H_{32}O_2$ is
 - saturated.
 - unsaturated.
 - branched.
 - hydrophilic.
 - part of a steroid molecule.
- Three molecules of the fatty acid in question 9 are joined to a molecule of glycerol ($C_3H_8O_3$). The resulting molecule has the formula
 - $C_{48}H_{96}O_6$.
 - $C_{48}H_{98}O_9$.
 - $C_{51}H_{102}O_8$.
 - $C_{51}H_{98}O_6$.
 - $C_{51}H_{104}O_9$.
- What are trans fats?
 - hydrogenated fish oils that have been identified with health risks
 - fats made from cholesterol that are components of plaques in the walls of blood vessels
 - fats that are derived from animal sources and are associated with cardiovascular disease
 - fats that contain *trans* double bonds and may contribute to atherosclerosis
 - polyunsaturated fats produced by removing H from fatty acids and forming *cis* double bonds

12. Which of the following molecules is the most hydrophobic?
 a. cholesterol d. phospholipid
 b. nucleotide e. glucose
 c. chitin
13. Which of the following molecules provides the most energy (kcal/g) when eaten and digested?
 a. glucose d. fat
 b. starch e. protein
 c. glycogen
14. Which of the following is *not* one of the many functions performed by proteins?
 a. acting as signals and receptors
 b. acting as an enzymatic catalyst for metabolic reactions
 c. providing protection against disease
 d. serving as contractile components of muscle
 e. forming primary structural component of membranes
15. What happens when a protein denatures?
 a. Its primary structure is disrupted.
 b. Its secondary and tertiary structures are disrupted.
 c. It always flips inside out.
 d. It hydrolyzes into component amino acids.
 e. Its hydrogen bonds, ionic bonds, hydrophobic interactions, disulfide bridges, and peptide bonds are disrupted.
16. The α helix of proteins is
 a. part of the protein's tertiary structure and is stabilized by disulfide bridges.
 b. a double helix.
 c. stabilized by hydrogen bonds and is commonly found in fibrous proteins.
 d. found in some regions of globular proteins and is stabilized by hydrophobic interactions.
 e. a complementary sequence to messenger RNA.
17. β 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 the polypeptide backbone.
 d. membrane sheets composed of phospholipids.
 e. hydrogen bonds between adjacent cellulose molecules.
18. What is the best description of the following molecule?



- a. chitin d. nucleotide
 b. amino acid e. protein
 c. tripeptide

19. Which number(s) in the molecule in question 18 refer(s) to a peptide bond?
 a. 1 c. 3 e. both 2 and 4
 b. 2 d. 4
20. What *determines* the sequence of the amino acids in a particular protein?
 a. its primary structure
 b. the sequence of nucleotides in RNA, which was determined by the sequence of nucleotides in the gene for that protein
 c. the sequence of nucleotides in DNA, which was determined by the sequence of nucleotides in RNA
 d. the sequence of RNA nucleotides making up the ribosome
 e. the three-dimensional shape of the protein
21. Both hydrophobic and hydrophilic interactions are important for which of the following types of molecules?
 a. proteins d. polynucleotides
 b. saturated fats e. all of the above
 c. glycogen and cellulose
22. How are nucleotide monomers connected to form a polynucleotide?
 a. by hydrogen bonds between complementary nitrogenous base pairs
 b. by ionic attractions between phosphate groups
 c. by disulfide bridges between cysteines
 d. by covalent bonds between the sugar of one nucleotide and the phosphate of the next
 e. by ester linkages between the carboxyl group of one nucleotide and the hydroxyl group on the ribose of the next
23. If the nucleotide sequence of one strand of a DNA helix is 5'GCCTAA3', what would be the 3'-5' sequence on the complementary strand?
 a. GCCTAA d. ATTCCG
 b. CGGAUU e. TAAGCC
 c. CGGATT
24. Monkeys and humans share many of the same DNA sequences and have similar proteins, indicating that
 a. the two groups belong to the same species.
 b. the two groups share a relatively recent common ancestor.
 c. humans evolved from monkeys.
 d. monkeys evolved from humans.
 e. the two groups evolved about the same time.