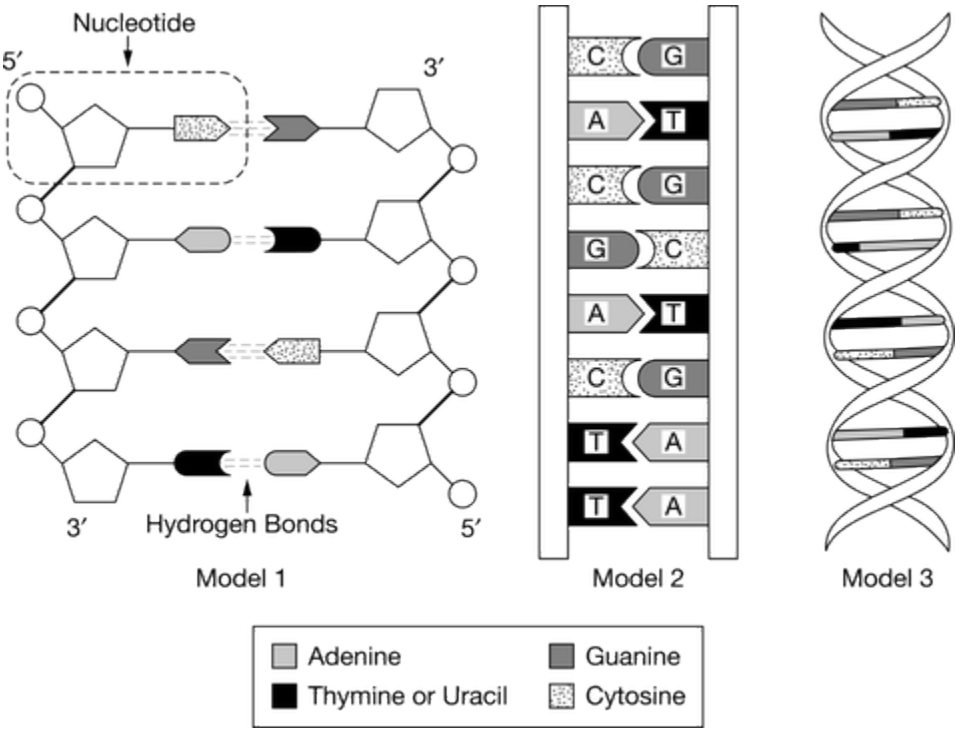
Unit 1 Progress Check: MCQ



1. Which feature of model 1 best illustrates how biological information is coded in a DNA molecule?

(A) The 5′ and 3′ labels at the ends of each strand

(B) The labeling of the hydrogen bonds between base pairs

(C) The lines connecting sugars and phosphate groups that represent covalent bonds

(D) The linear sequence of the base pairs ✓

Unit 1 Progress Check: MCQ

2.

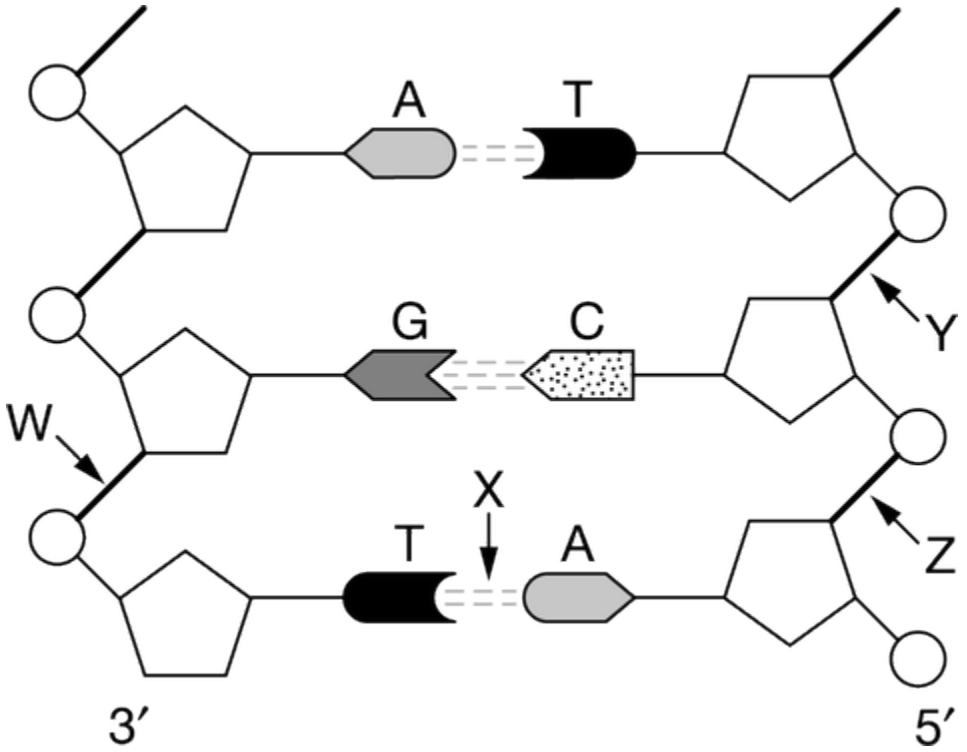


Figure 1. Four different bonds (W, X, Y, and Z) in a DNA molecule

Figure 1 represents a segment of DNA. Radiation can damage the nucleotides in a DNA molecule. To repair some types of damage, a single nucleotide can be removed from a DNA molecule and replaced with an undamaged nucleotide. Which of the four labeled bonds in Figure 1 could be broken to remove and replace the cytosine nucleotide without affecting the biological information coded in the DNA molecule?

(A) Bond X only

(B) Bond W only

(C) Bonds Y and Z at the same time ✓

(D) Bonds W and Z at the same time

3. A student wants to modify model 1 so that it represents an RNA double helix instead of a DNA double helix. Of the following possible changes, which would be most effective in making model 1 look more like RNA than DNA ?

(A) Changing the sequence of the base pairs

(B) Changing the deoxyriboses to riboses by adding $-OH$ groups ✓

(C) Changing the shapes of the nitrogenous bases to match those shown in model 2

(D) Changing the sugar-phosphate backbone to a ribbon, as shown in model 3

Unit 1 Progress Check: MCQ

Different polysaccharides are used by plants for energy storage and structural support. The molecular structures for two common polysaccharides are shown in Figure 1. Starch is used by plants for energy storage, and cellulose provides structural support for cell walls. The monomer used to construct both molecules is glucose.

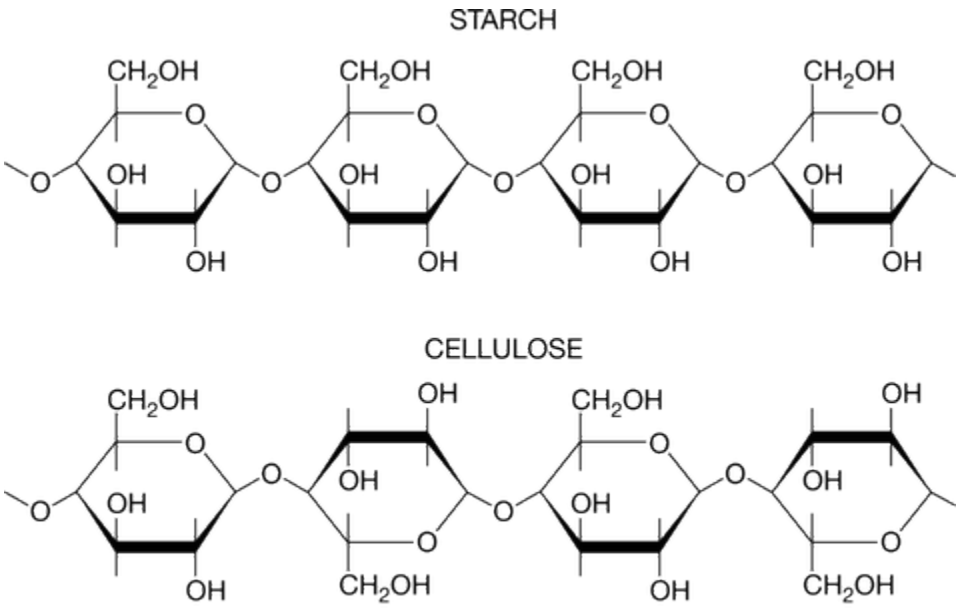


Figure 1. Comparison of segments of starch and cellulose

A study determined the effect of two different digestive enzymes, A and B, on these two polysaccharides. Table 1 presents the data from the study.

Table 1. Effect of Enzymes A and B on Cellulose and Starch

Test Tube	Polysaccharide Added	Enzyme Added	Glucose Detected after 5 Minutes at 37°C
1	Cellulose	A	No
2	Cellulose	B	Yes
3	Starch	A	Yes
4	Starch	B	No

Mammals do not produce digestive enzyme B. However, sheep and cattle are two types of mammals that contain microorganisms in their digestive tract that produce enzyme B.

4. Based on Figure 1, which of the following best compares the atomic structures of starch and cellulose?

Unit 1 Progress Check: MCQ

(A) Starch is composed of carbon, hydrogen, and oxygen, while cellulose also contains nitrogen.

(B) Starch and cellulose are composed of repeating glucose monomers; however, in cellulose every other glucose monomer is rotated 180 degrees. ✓

(C) Starch is composed of monomers that each have a CH_2OH group, while cellulose only has a CH_2OH group on every other monomer.

(D) Starch and cellulose are composed of identical monomers and therefore have identical structures.

5. Based the information provided, which of the following statements best describes why starch and cellulose provide different functions in plants?

(A) The differences in the assembly and organization of the monomers of these two polymers result in different chemical properties. ✓

(B) Since starch and cellulose are composed of identical monomers, the cellular environment where they are located controls their function.

(C) The monomers of cellulose are connected by covalent bonds, making it idea for structural support.

(D) The monomers of starch are connected by ionic bonds, making it ideal for energy storage for plants.

6. Which of the following best describes the process that adds a monosaccharide to an existing polysaccharide?

(A) The monosaccharide is completely broken down by a specific enzyme and then the atoms are reorganized and made into a polysaccharide.

(B) Ionic bonds are formed between adjacent carbon atoms of the monosaccharide and the polysaccharide by adding water (H_2O) and a specific enzyme.

(C) A specific enzyme removes the hydrogen (H) from the monosaccharide and the hydroxide (OH) from the polysaccharide, creating a bond between the two and creating a water (H_2O) molecule. ✓

(D) A specific enzyme removes two hydroxides (OH), one from the monosaccharide, and one from the polysaccharide, creating a bond between the two monosaccharides and creating a hydrogen peroxide (H_2O_2) molecule.

7. Which of the following would most likely occur if cattle lost the ability to maintain a colony of microorganisms in their digestive tract?

(A) Cattle would no longer be able to synthesize cellulose.

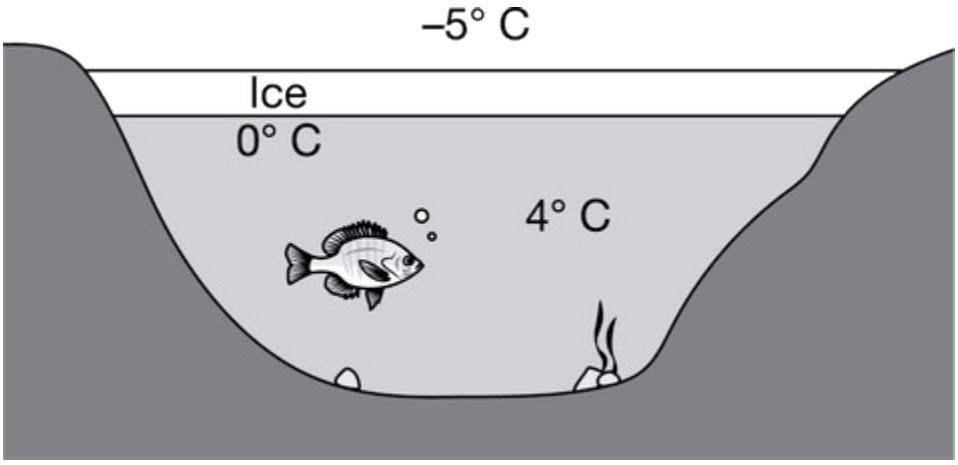
(B) Cattle would have to convert cellulose to starch before digesting it.

(C) Cattle would have to start producing enzyme B without the help of the bacteria.

(D) Cattle would no longer be able to use cellulose as a primary source of glucose. ✓

Unit 1 Progress Check: MCQ

8.



As shown in the diagram, when environmental temperatures drop below freezing, a layer of ice typically forms on the surface of bodies of freshwater such as lakes and rivers.

Which of the following best describes how the structure of ice benefits the organisms that live in the water below?

(A) The water molecules in ice are closer together than those in liquid water, so the ice prevents the passage of air to the water, maintaining a constant gas mixture in the water.

(B) The water molecules in ice are closer together than those in liquid water, so the ice forms a barrier that protects the organisms in the water from the freezing air temperatures.

(C) The water molecules in ice are farther apart than those in liquid water, so the ice floats, maintaining the warmer, denser water at the lake bottom. ✓

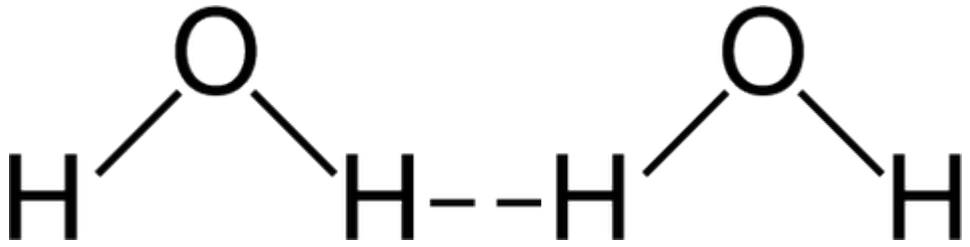
(D) The water molecules in ice are farther apart than those in liquid water, so the ice floats, preventing the escape of gases from the liquid water.

9. Water molecules are polar covalent molecules. There is a partial negative charge near the oxygen atom and partial positive charges near the hydrogen atoms due to the uneven distribution of electrons between the atoms, which results in the formation of hydrogen bonds between water molecules. The polarity of water molecules contributes to many properties of water that are important for biological processes.

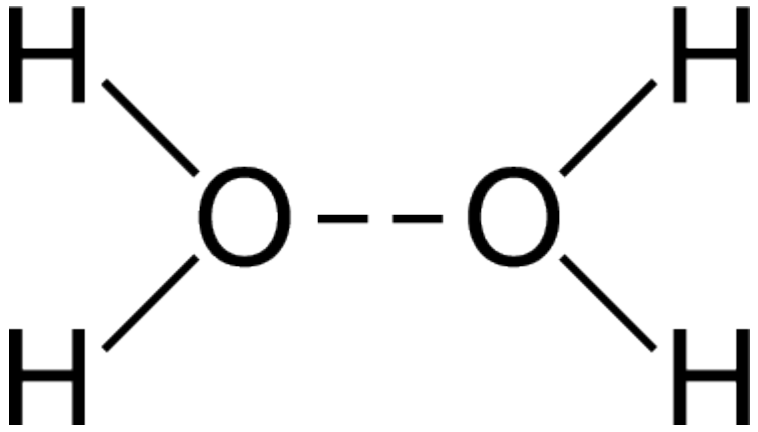
Which of the following models best demonstrates the arrangement of hydrogen bonds between adjacent water molecules?

Unit 1 Progress Check: MCQ

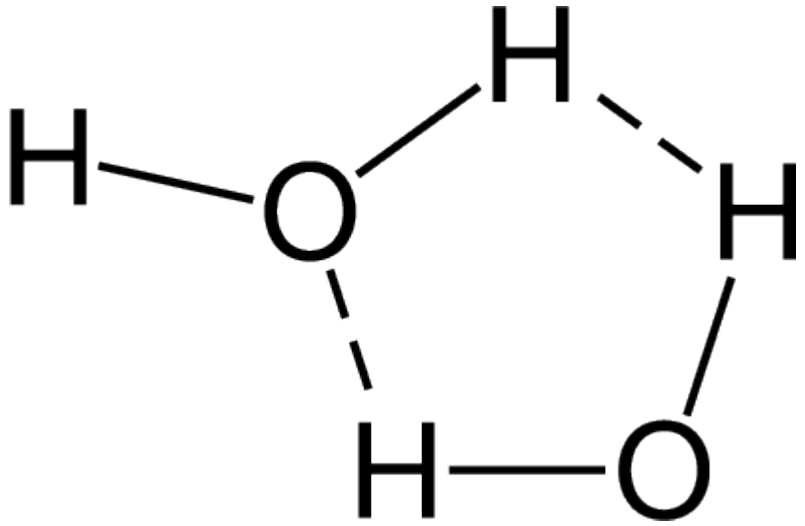
(A)



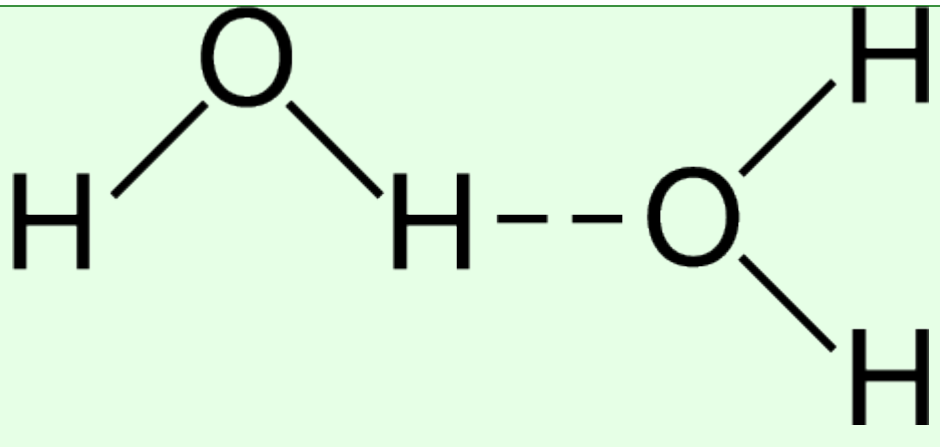
(B)



(C)



(D) ✓



Unit 1 Progress Check: MCQ

10. In vascular plants, water flows from root to leaf via specialized cells called xylem. Xylem cells are hollow cells stacked together like a straw. A student explains that evaporation of water from the leaf pulls water up from the roots through the xylem, as shown in Figure 1.

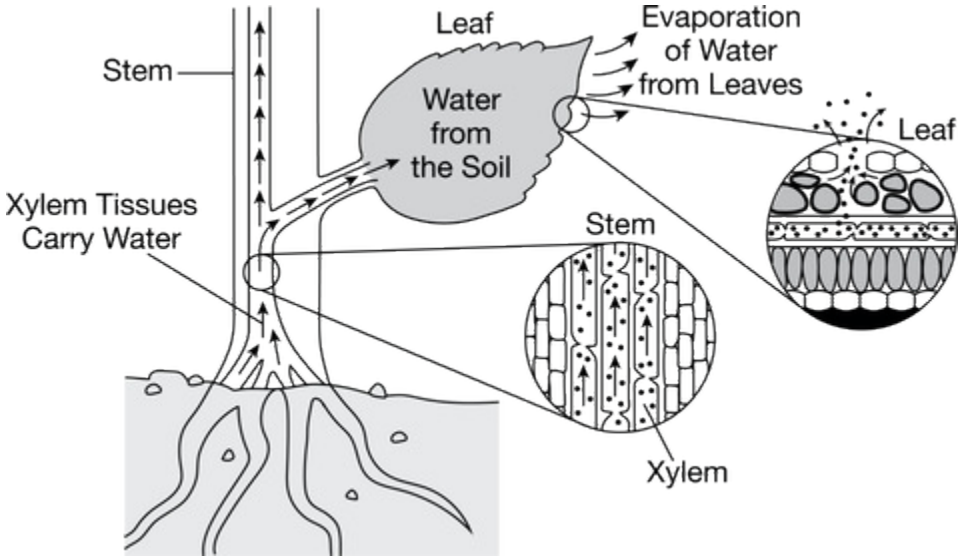


Figure 1. Model of water movement through the xylem, with magnified models of water movement in the stem and leaf.

Which statement describes how water is pulled up through the xylem to the leaves of the plant?

(A) As water exits the leaf, hydrogen bonding between water molecules pulls more water up from below. ✓

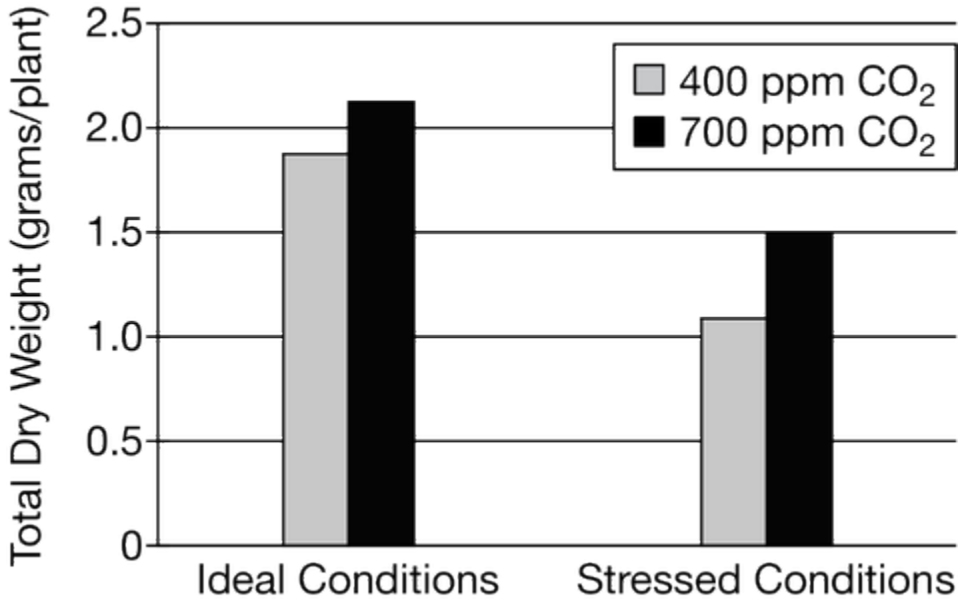
(B) As water exits the leaf, signals are sent to the roots to pump more water up to the leaves through the xylem by adhesion.

(C) Evaporation from the leaf decreases the hydrogen bonds that form between the water molecules in the xylem, which helps the water molecules to be pulled up the xylem.

(D) Evaporation of water from the leaf increases the hydrogen bonds that form between water molecules in the air, providing the energy for transport.

Unit 1 Progress Check: MCQ

11. The figure shows the results of an experiment to investigate the effects of an enriched CO_2 environment on plant growth. Identical plants were separated into different groups and grown either in a standard CO_2 environment (400 ppm CO_2) or in an enriched CO_2 environment (700 ppm CO_2). Of the plants in each environment, half were grown under ideal conditions and half were grown under stressed conditions.



Based on the figure, which statement best describes the observed relationship between atmospheric CO_2 enrichment and plant growth under ideal and stressed conditions?

(A) The increase in atmospheric CO_2 had no observable effect on plant growth under either ideal or stressed conditions.

(B) The increase in atmospheric CO_2 resulted in a greater increase in plant growth under ideal conditions than under stressed conditions.

(C) The increase in atmospheric CO_2 resulted in a greater increase in plant growth under stressed conditions than under ideal conditions. ✓

(D) The increase in atmospheric CO_2 resulted in an inhibition of plant growth under both ideal and stressed conditions.

Unit 1 Progress Check: MCQ

12. Phosphorous (P) is an important nutrient for plant growth. Figure 1 shows *Arabidopsis thaliana* plants grown under phosphorus-sufficient (left) and phosphorus-starved (right) conditions for six weeks.

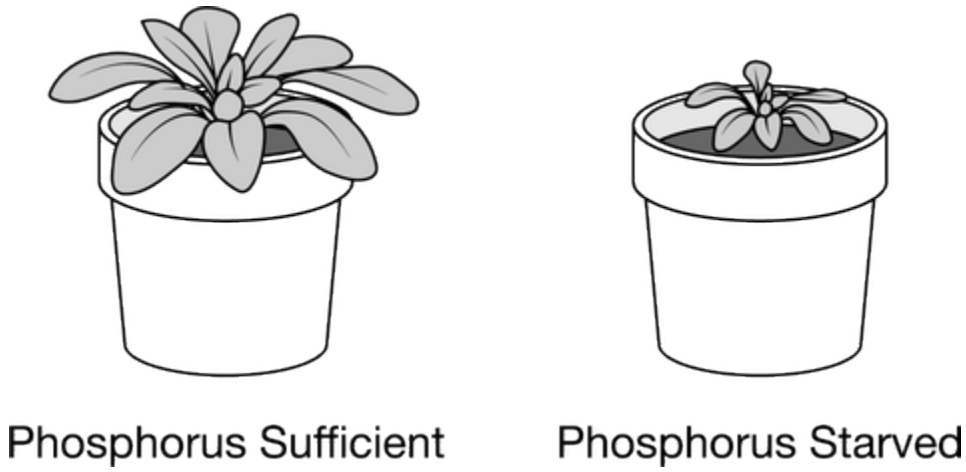


Figure 1. *Arabidopsis thaliana* plants grown for six weeks.

Which of the following is the most likely reason for the difference in leaf growth?

(A) The phosphorus-starved plant was unable to synthesize both the required proteins and lipids, limiting growth.

(B) The phosphorus-starved plant was unable to synthesize both the required proteins and carbohydrates, limiting growth.

(C) The phosphorus-starved plant was unable to synthesize both the required nucleic acids and lipids, limiting growth. ✓

(D) The phosphorus-starved plant was unable to synthesize both the required carbohydrates and nucleic acids, limiting growth.

Unit 1 Progress Check: MCQ

13. A polypeptide is polymer of amino acids held together by peptide bonds. The process of dehydration synthesis creates these peptide bonds, as shown in Figure 1.

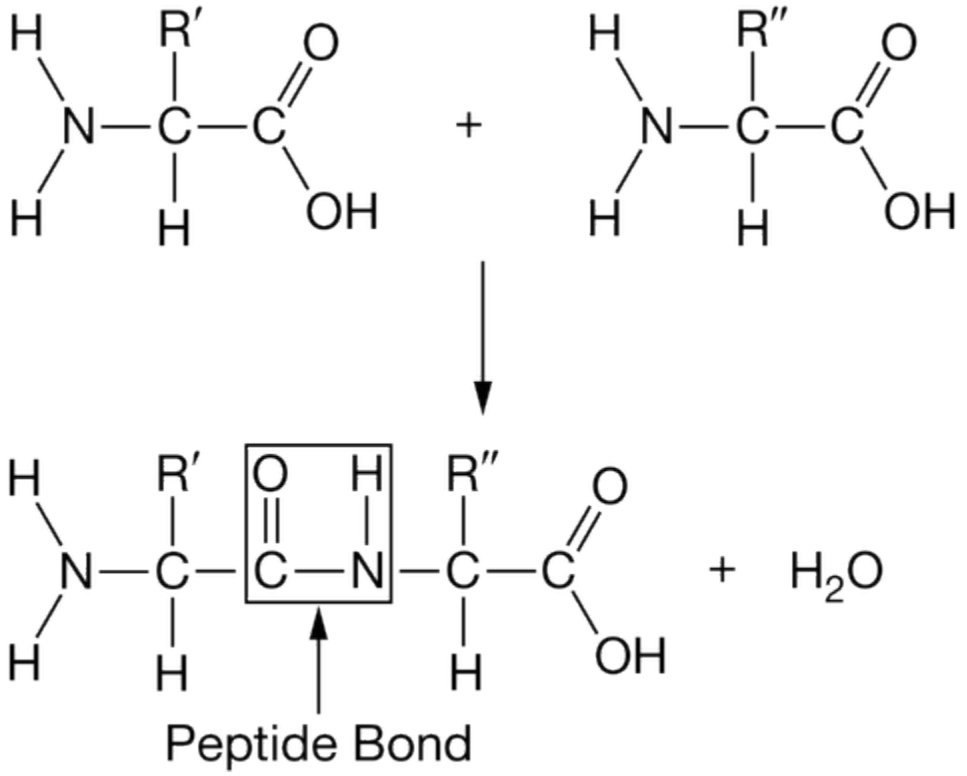


Figure 1. Amino acids are linked through the formation of peptide bonds.

As shown in Figure 1, an amino acid must have which of the following properties in order to be incorporated into a polypeptide?

(A) The ability to remain stable in the presence of water molecules

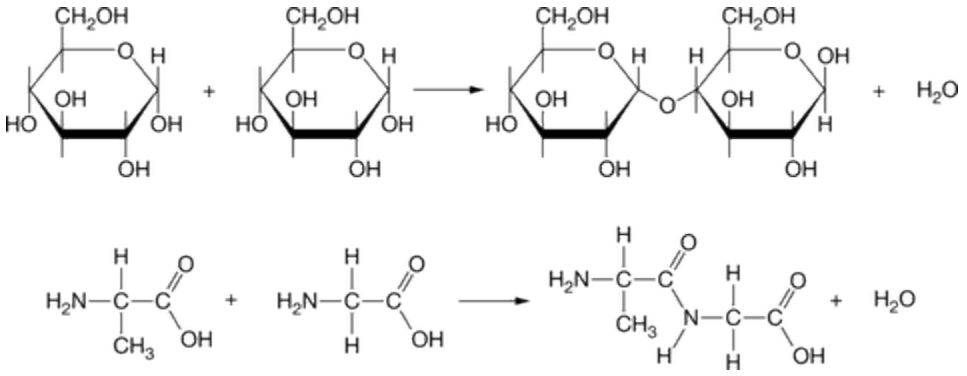
(B) An R-group that is compatible with the R-group of the last amino acid incorporated

(C) A central carbon atom that reacts with a nitrogen atom to form the peptide bond

(D) The ability to form a covalent bond with both its NH_2 group and its COOH group ✓

Unit 1 Progress Check: MCQ

14.



Which of the following is common feature of the illustrated reactions showing the linking of monomers to form macromolecules?

(A) Two identical monomers are joined by a covalent bond.

(B) Two different monomers are joined by a covalent bond.

(C) Monomers are joined by a covalent bond, and a water molecule is produced. ✓

(D) Monomers are joined by ionic bonds, and a water molecule is produced.

15. Which of the following describes a key difference among the 20 amino acids that are used to make proteins?

(A) Only some amino acids have an R-group.

(B) Only some amino acids have a carboxyl group (COOH).

(C) Some amino acids are hydrophobic. ✓

(D) Some amino acids contain the element phosphorus.

16. Figure 1 shows three amino acids that are part of a polypeptide chain. Figure 2 shows the same section of the chain after a mutation has occurred.

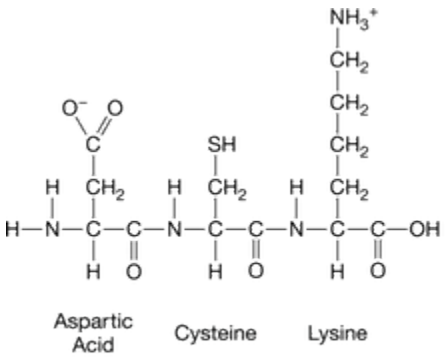


Figure 1: Original Amino Acid Chain

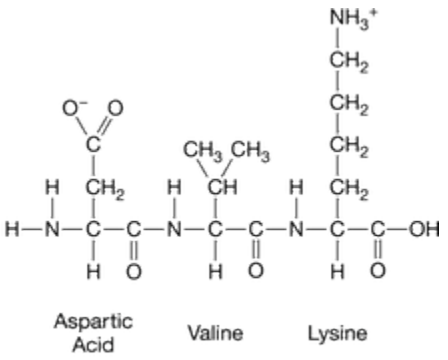


Figure 2: Mutated Amino Acid Chain

How might this change affect the structure and function of the protein?

Unit 1 Progress Check: MCQ

(A) The R-group of the new amino acid, valine, has different chemical properties than the R-group of cysteine. This will cause the protein to misfold and not function properly in the cell. ✓

(B) The new amino acid, valine, has replaced cysteine in the new protein. Since the number of amino acids has remained the same, there will be no change in the three-dimensional folding, or function, of the protein.

(C) Since this is a linear section, it does not influence protein folding. Thus, there will be no change in protein structure or function.

(D) Since the new amino acid is bounded on one side by an amino acid with a negatively charged R-group and by an amino acid on the other side with a positively charged R-group, the charges will balance and the protein will fold as usual.

17. Figure 1 shows a short segment of a double-stranded nucleic acid molecule.

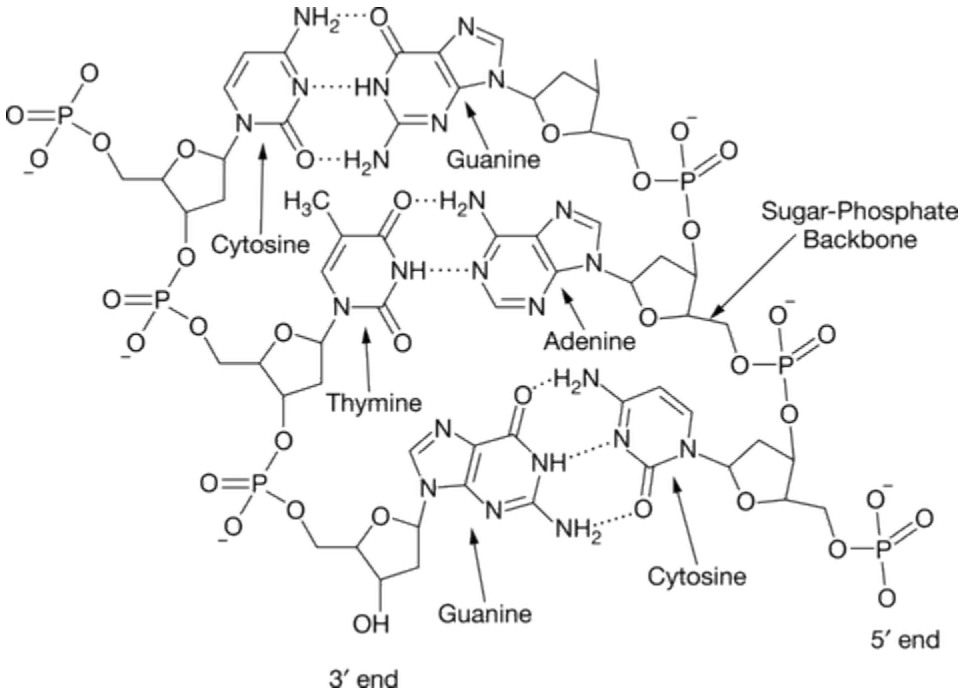


Figure 1. A short segment of a double-stranded nucleic acid molecule

Which of the following statements is correct about the molecule shown in Figure 1 ?

(A) It is RNA because of the relative direction of the two strands.

(B) It is RNA because of the number of different nucleotides found in the molecule.

(C) It is DNA because of the nature of the hydrogen bonds between guanine and cytosine.

(D) It is DNA because of the nucleotides present. ✓

Unit 1 Progress Check: MCQ

18.

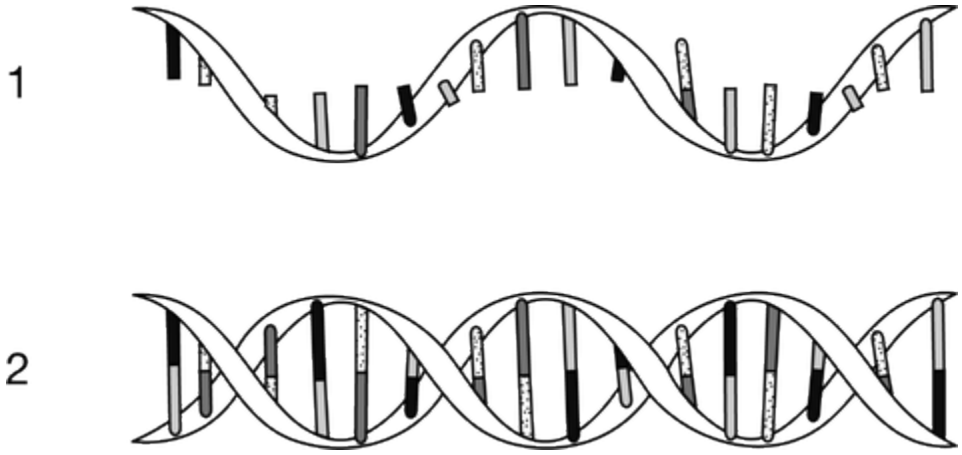


Figure 1. Molecule 1 represents RNA, and molecule 2 represents DNA.

Which of the following best describes a structural similarity between the two molecules shown in Figure 1 that is relevant to their function?

(A) Both molecules are composed of the same four nucleotides, which allows each molecule to be produced from the same pool of available nucleotides.

(B) Both molecules are composed of the same type of five-carbon sugar, which allows each molecule to act as a building block for the production of polysaccharides.

(C) Both molecules contain nucleotides that form base pairs with other nucleotides, which allows each molecule to act as a template in the synthesis of other nucleic acid molecules. ✓

(D) Both molecules contain nitrogenous bases and phosphate groups, which allows each molecule to be used as a monomer in the synthesis of proteins and lipids.