4. Disulfide bonds are formed between two cysteine residue side chains. The formation of disulfide bonds increases the order and therefore decreases the entropy (S becomes more negative).

5. Stereoisomers are compounds that have the same molecular formula but are mirror images of each other. Many organic molecules can exist as stereoisomers because of two different possible orientations around an asymmetric carbon atom (e.g., amino acids). Because stereoisomers differ in their three-dimensional orientation and because biological molecules interact with one another based on precise molecular complementarity, stereoisomers often react with different molecules, or react differently with the same molecules. Therefore, they may have very distinct physiological effects in the cell.

6. The compound is guanosine triphosphate (GTP). Although the guanine base is found in both DNA and RNA, the sugar is a ribose sugar because of the 2′ hydroxyl group. Therefore, GTP is a component of RNA only. GTP is an important intracellular signaling molecule.

7. At least three properties contribute to this structural diversity. First, monosaccharides can be joined to one another at any of several hydroxyl groups. Second, the C-1 linkage can have either an α or a β configuration. Third, extensive branching of carbohydrate chains is possible.

8. What is the pH of 1 L of water? In all aqueous solutions, water spontaneously dissociates into hydrogen and hydroxide ions according to the equilibrium reaction $H_2O \rightleftharpoons H^+ + OH^-$. The ionization constant for aqueous solutions at 25°C is $K_w = [H^+][OH^-] = 1 \times 10^{-14}\ M^2$. In a solution of pure water, the production of one H^+ ion will always be accompanied by the production of one OH^- ion. In other words, $[H^+] = [OH^-]$.

$$K_w = [H^+][OH^-] = [H^+]^2 = 1 \times 10^{-14}\ M^2 [H^+] = 1 \times 10^{-7}\ M$$

$$pH = -\log_{10}[H^+] = -\log_{10}(1 \times 10^{-7}) = 7$$

What is the pH after 0.008 moles NaOH are added? NaOH (sodium hydroxide) is a strong base. This means all the added NaOH ionizes to increase the $[OH^-]$ concentration to 0.008 M.

$$[H^+] = K_w/[OH^-] = (1 \times 10^{-14}\ M^2)/(0.008\ M) = 1.25 \times 10^{-12}\ M$$
$$pH = -\log_{10}[H^+] = -\log_{10}(1.25 \times 10^{-12}) = 11.903$$

What is the pH of the solution of 50 mM MOPS? MOPS is a weak acid. As such, upon dissolving in water it will undergo partial dissociation yielding equal concentrations of hydrogen ions and MOPS conjugate base according to the equilibrium reaction:

$$\text{MOPS(weak acid form)} = H^+ + \text{MOPS(conjugate base form)}$$