# Chapter 3 Exercises

## Review Questions

**1.** Dehydration synthesis leads to formation of _____.
- **a.** monomers
- **b.** polymers
- **c.** water and polymers
- **d.** none of these

**2.** During the breakdown of polymers, which of the following reactions takes place?
- **a.** hydrolysis
- **b.** dehydration
- **c.** condensation
- **d.** covalent bond

**3.** The following chemical reactants produce the ester ethyl ethanoate ($C_4H_8O_2$):

$$C_2H_6O + CH_3COOH$$

What type of reaction occurs to make ethyl ethanoate?
- **a.** condensation
- **b.** hydrolysis
- **c.** combustion
- **d.** acid-base reaction

**4.** An example of a monosaccharide is _____.
- **a.** fructose
- **b.** glucose
- **c.** galactose
- **d.** all of these

**5.** Cellulose and starch are examples of _____.
- **a.** monosaccharides
- **b.** disaccharides
- **c.** lipids
- **d.** polysaccharides

**6.** Plant cell walls contain which of the following in abundance?
- **a.** starch
- **b.** cellulose
- **c.** glycogen
- **d.** lactose

**7.** Lactose is a disaccharide formed by the formation of a _____ bond between glucose and _____.
- **a.** glycosidic; lactose
- **b.** glycosidic; galactose
- **c.** hydrogen; sucrose
- **d.** hydrogen; fructose

**8.** Which of the following is *not* an extracellular matrix role of carbohydrates?
- **a.** to protect an insect's internal organs from external trauma
- **b.** to prevent plant cells from lysing after the plant is watered
- **c.** to maintain the shape of a fungal spore
- **d.** to provide energy for muscle movement

**9.** Saturated fats have all of the following characteristics except:
- **a.** they are solid at room temperature
- **b.** they have single bonds within the carbon chain
- **c.** they are usually obtained from animal sources
- **d.** they tend to dissolve in water easily

**10.** Phospholipids are important components of _____.
- **a.** the plasma membrane of cells
- **b.** the ring structure of steroids
- **c.** the waxy covering on leaves
- **d.** the double bond in hydrocarbon chains

**11.** Cholesterol is an integral part of plasma membranes. Based on its structure, where is it found in the membrane?
- **a.** on the extracellular surface
- **b.** embedded with the phospholipid heads
- **c.** within the tail bilayer
- **d.** attached to the intracellular surface

**12.** The monomers that make up proteins are called _____.
- **a.** nucleotides
- **b.** disaccharides
- **c.** amino acids
- **d.** chaperones

**13.** The α helix and the β pleated sheet are part of which protein structure?
- **a.** primary
- **b.** secondary
- **c.** tertiary
- **d.** quaternary

**14.** Mad cow disease is an infectious disease where one misfolded protein causes all other copies of the protein to begin misfolding. This is an example of a disease impacting _____ structure.
- **a.** primary
- **b.** secondary
- **c.** tertiary
- **d.** quaternary

**15.** A nucleotide of DNA may contain _____.
- **a.** ribose, uracil, and a phosphate group
- **b.** deoxyribose, uracil, and a phosphate group
- **c.** deoxyribose, thymine, and a phosphate group
- **d.** ribose, thymine, and a phosphate group

**16.** The building blocks of nucleic acids are _____.
- **a.** sugars
- **b.** nitrogenous bases
- **c.** peptides
- **d.** nucleotides

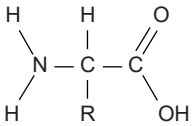
**17.** How does the double helix structure of DNA support its role in encoding the genome?
- **a.** The sugar-phosphate backbone provides a template for DNA replication.
- **b.** Transfer RNA pairing with the template strand creates proteins encoded by the genome.
- **c.** Complementary base pairing creates a very stable structure.
- **d.** Complementary base pairing allows for easy editing of both strands of DNA.

## Critical Thinking Questions

**18.** Why are biological macromolecules considered organic?

**19.** What role do electrons play in dehydration synthesis and hydrolysis?

**20.** Amino acids have the following generic structure, where R represents different carbon-based side chains.




Describe how the structure of amino acids allows them to be linked into long peptide chains to form proteins.

**21.** Describe the similarities and differences between glycogen and starch.

**22.** Why is it impossible for humans to digest foods that contain cellulose?

**23.** Draw the ketose and aldose forms of a monosaccharide with the chemical formula $C_3H_6O_3$. How is the structure of the monosaccharide changed from one form to the other in the human body?

**24.** Explain at least three functions that lipids serve in plants and/or animals.

**25.** Why have *trans* fats been banned from some restaurants? How are they created?

**26.** Why are fatty acids better than glycogen for storing large amounts of chemical energy?

**27.** Part of cortisol's role in the body involves passing through the plasma membrane to initiate signaling inside a cell. Describe how the structures of cortisol and the plasma membrane allow this to occur.

**28.** Explain what happens if even one amino acid is substituted for another in a polypeptide chain. Provide a specific example.

**29.** Describe the differences in the four protein structures.

**30.** Aquaporins are proteins embedded in the plasma membrane that allow water molecules to move between the extracellular matrix and the intracellular space. Based on its function and location, describe the key features of the protein's shape and the chemical characteristics of its amino acids.

**31.** What are the structural differences between RNA and DNA?

**32.** What are the four types of RNA and how do they function?