

Chapter 2 – The Molecules of Cells

Complete using BC Biology 12, pages 20 - 61

2.1 Basic Chemistry

pages 24 - 26

1. Only _____^(a) naturally occurring elements serve as the building blocks of all matter. Other elements have been “_____”^(b) and are not biologically important. Only six elements are basic to life and make up about _____^(c) of the body weight of organisms. The elements are _____^(d), _____^(e), _____^(f), _____^(g), _____^(h), and _____⁽ⁱ⁾ which can be remembered with the acronym _____^(j).
2. Of the top six elements, which element is the **most** prevalent in organisms? _____
3. Explain how radiation can be both beneficial and harmful to humans. _____

2.2 Molecules and Compounds

pages 26 - 29

4. Where do we get the energy to carry on our daily lives? _____

5. In biological systems, because they are _____^(a) % water, _____^(b) compounds exist primarily in a _____^(c) state (they are _____^(d)).

6. Molecules made up of only two atoms are always _____^(a) while molecules with more than two atoms have a _____^(b) shape. The shapes of molecules are related to the _____^(c) and _____^(d) roles they play in organisms.

7. Name three molecules that rely on their shape to function properly.
 - _____
 - _____
 - _____
8. Give an example of a(n)
 - non-polar covalent molecule: _____
 - polar covalent molecule: _____
9. Weaker than an ionic or covalent bond, a _____^(a) bond is represented by a dotted line. Hydrogen bonding is NOT unique to water. Many biological molecules have polar covalent bonds involving and _____^(b) hydrogen and an _____^(c) oxygen or nitrogen.

10. Using a specific example, explain how the weakness of an individual hydrogen bond and the strength of numerous hydrogen bonds are utilized by organisms. _____

11. Use three words or phrases to describe water:

- _____
- _____
- _____

12. Draw a picture showing the polarity of a water molecule and hydrogen bonding between water molecules.

Properties of Water

13. Name the six properties of water that make it essential to the existence of life. Then explain the importance of each of the properties as it relates to the survival of an organism.

- a) _____ : _____

- b) _____ : _____

- c) _____ : _____

- d) _____ : _____

- e) _____ : _____

- f) _____ : _____

14. Match the terms on the left to their correct description on the right.

- | | |
|----------------------|---|
| ____ calorie | A. result of cohesive forces |
| ____ solute | B. molecules that can attract water (“water loving”) |
| ____ hydrophilic | C. property of different molecules or surfaces clinging to each other |
| ____ hydrophobic | D. amount of heat energy needed to raise 1g of water by 1°C |
| ____ cohesive | E. the dissolved substances contained in a solution |
| ____ adhesive | F. like molecules sticking to each other |
| ____ surface tension | G. molecules that cannot attract water (“water fearing”) |

Acids and Bases

15. Acids are substances that _____ when they dissociate in water.
- Example: _____
16. Bases are substances that either _____ or _____.
- Example: _____
17. What would the pH be of the following $[H^+]$ (moles per litre)?
- $0.1 = 1 \times 10^{-} = \text{pH } \underline{\hspace{2cm}}$
 - $0.0001 = 1 \times 10^{-} = \text{pH } \underline{\hspace{2cm}}$
 - $0.000000001 = 1 \times 10^{-} = \text{pH } \underline{\hspace{2cm}}$
18. What is a **buffer**? _____
19. The pH of our blood when we are healthy is always about ____^(a). If the blood pH drops to about ____^(b) then ____^(c) results. If the blood pH rises to about ____^(d) then ____^(e) results. Both conditions can be ____^(f).
20. Show the formula for one of the buffer systems used by the body to keep blood pH in balance.

21. Why is a weakly dissociating acid/base a better buffer than a strongly dissociating one? _____

2.4 Organic Molecules

pages 32 - 33

22. Organic molecules always contain _____ and _____. Carbon atom has _____ electrons in its outer shell which it can share _____ with as many as _____ other atoms.
23. Define the following:

- **functional group:** _____

- **macromolecule:** _____
- **monomer:** _____
- **polymer:** _____

24. Complete the table below.

Polymer	Monomer
carbohydrate	
lipid	
protein	
nucleic acid	

25. Diagram of **dehydration synthesis** and **hydrolysis** (*wait for simplified teacher diagram*)

2.5 Carbohydrates

pages 34 - 35

26. The main functions of carbohydrates:

- _____ fuel
- _____ energy storage
- _____ in woody plants, bacteria, and animals such as insects.
- _____ (some found on cell surface)

27. Characterized by the presence of atomic grouping _____^(a) and the empirical formula **CH₂O** which is why the term “_____”^(b) is often used.

28. Three ways to represent the structure of glucose (textbook figure 2.12)

29. If the number of carbon atoms in a molecule is low (from _____)^(a) then the carbohydrate is a _____^(b) which is also known as a _____^(c).

- 5-carbon sugar = _____
- 6-carbon sugar = _____
 1. _____ (C₆H₁₂O₆, blood sugar)
 2. _____ (found in fruits)
 3. _____ (found in milk)

30. A _____ contains two monosaccharides that have joined during a _____ reaction

1. glucose + glucose → _____
2. glucose + fructose → _____
3. glucose + galactose → _____

31. Diagram of two monosaccharides forming disaccharide (textbook figure 2.13)

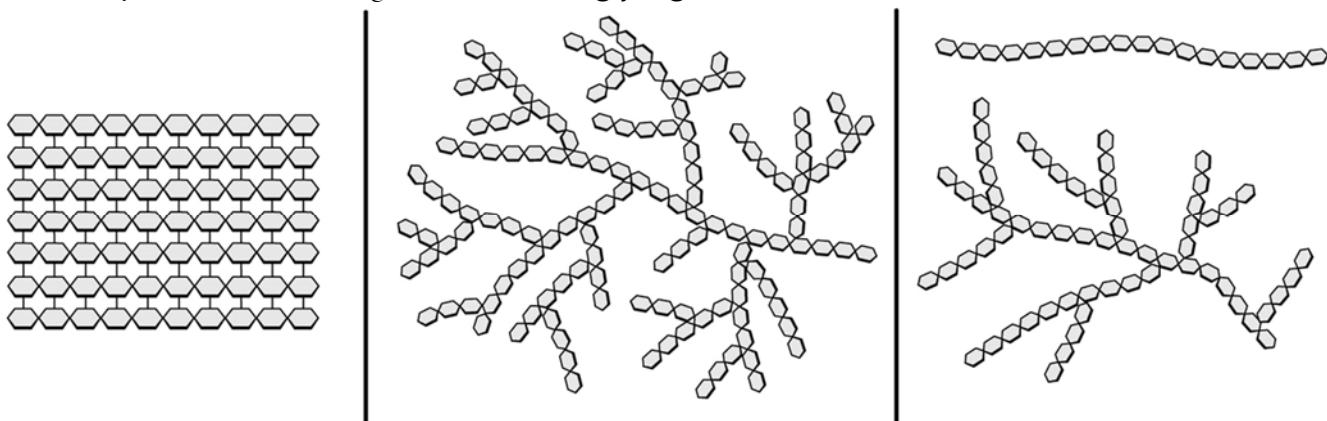
32. Carbohydrates that contain many glucose subunits are referred to as _____.

- _____ and _____ are large storage forms of glucose found in plants and animals.
- _____ is found in plant cell walls
- _____ is found in the exoskeleton of crustaceans and insects.

33. Match the terms on the left to their correct descriptions on the right.

- | | |
|-----------------------|--|
| ____ & ____ starch | A. indigestible by humans, often referred to as dietary fibre |
| ____ & ____ glycogen | B. non-branched or slightly branched |
| ____ & ____ cellulose | C. high amounts found in flour and potatoes |
| | D. alternating up/down pattern of oxygen atoms between the glucose molecules |
| | E. highly branched |
| | F. created by the liver when the blood glucose levels rise above 0.1% |

34. Identify each of the following as either **starch**, **glycogen**, or **cellulose**.



2.6 Lipids

pages 36 - 37

35. The main functions of lipids:

- Contain more _____ per gram (long term)
- _____ molecules
- _____ form the cell membrane
- _____, includes many types of hormones
- _____ against heat loss
- Forms a _____ around major organs

36. All lipids _____ ^(a) dissolve in water as they are _____ ^(b)

37. 1 _____ molecule + 3 _____ molecules = _____ (neutral fat)

38. What is the difference between...

a) fats and oils?

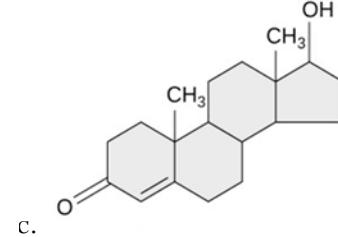
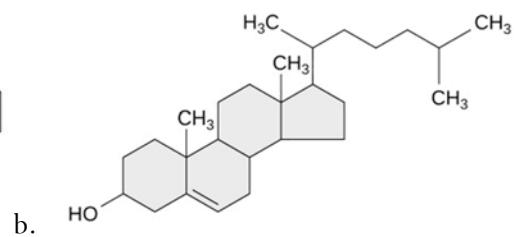
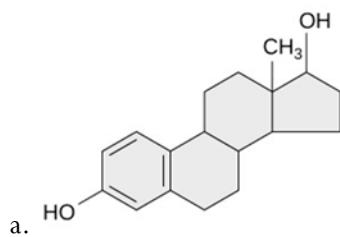
b) saturated, unsaturated, and trans fats?

39. In a **phospholipid**, the third fatty acid is replaced by a _____^(a).

They differ from fats as they form a polar (_____^(b)) head and a nonpolar (_____^(c)) tail.

40. How are all types of steroids the same? different? _____

41. Identify the following steroids.



42. Though we often think that cholesterol is “bad” for us in our diet, our bodies require it in a balanced quantity.

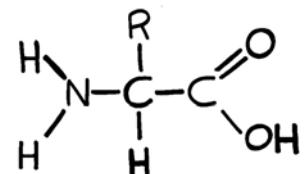
What important functions does cholesterol serve?

2.7 Proteins

pages 37 - 41

43. Central _____ atom bonded to _____ atom and three functional groups:

- _____ (-NH₂)
- _____ (-COOH)
- _____ (differs by amino acid, 20 possibilities)

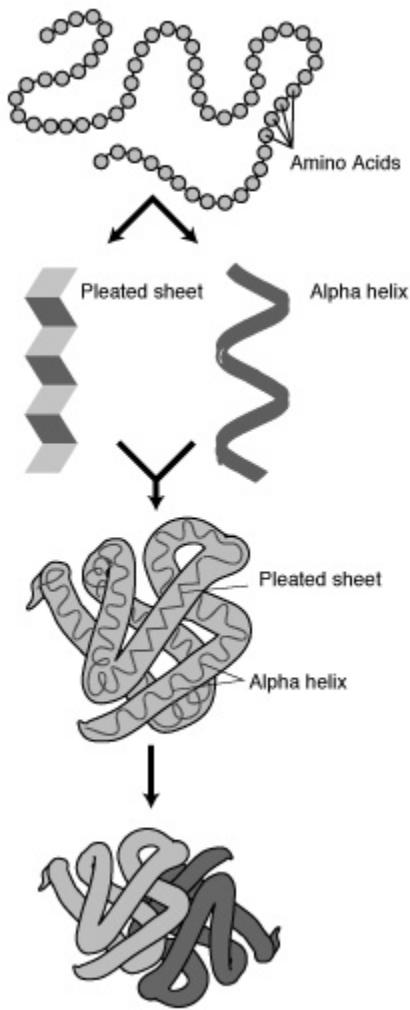


44. The main functions of proteins (the table on page 54 is very helpful)

- **Structural:** _____ (makes hair and nails) and _____ (lends support to ligaments, tendons, and skin)
- **Movement:** _____ & _____ (movement of cells and muscle contractions)
- **Transport:** in the plasma membrane they act as _____ or _____ to allow substances to cross. _____ (transports oxygen in red blood cells)
- **Catalytic:** _____ (speed up chemical reactions in the body)
- **Regulatory:** _____ (chemical messengers)
- **Defense:** _____ (prevent infections and therefore maintain homeostasis)

45. What characteristic influences the structure, or shape, of a protein? _____

46. Proteins can have up to four levels of structural organization.



Primary structure: simple sequence of amino acids joined together by _____ bonds.

Secondary structure: _____ bonds pull amino acid chains into either **alpha helix** or **beta-pleated sheet**

Tertiary structure: is maintained by various types of bonding (hydrogen, ionic and covalent) among the _____. By virtue of the unique chemistry of each amino acid chain, kinks or bends occur and new bonds form holding into a specific 3D shape.

Quaternary structure: two or more tertiary structures associate together and function as a single unit.

Examples include _____ and most _____

47. Proteins can differ in many ways including _____^(a), _____^(b), and _____^(c) and chemical composition.

48. Define **denatured**: _____

- Possible causes: _____
- *Prion?* _____

2.8 Nucleic Acids

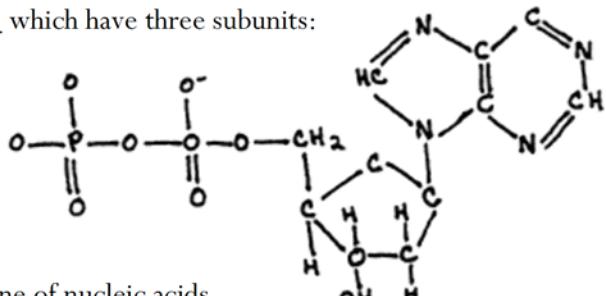
pages 41 - 45

49. The main functions of nucleic acids:

- _____
- _____

50. Nucleic acids are made up of _____ which have three subunits:

- _____
- _____
- _____



51. Write a **(B)** next to the two subunits that make up the backbone of nucleic acids.

52. Complete the table.

	DNA	RNA
Full name		
Sugar		
Bases		
Strands		
Helix		
Function		

53. Why are A, T, C, G, and U called “bases”? _____

54. Explain the term **complementary base pairing** and why it is important. _____

55. Draw two different complementary base pairs. (textbook Figure 2.25c)

56. ATP or _____ is known as the universal energy currency of the cells of living systems and can be used for the following types of work.

Type	Example
------	---------

- _____ : _____
- _____ : _____
- _____ : _____

57. ATP is composed of

- _____
- _____
- _____

58. An input of energy is required to create ATP.

- Where does it come from? _____
- What is the reaction called? _____
- What percentage of the free energy is transformed into ATP? _____

59. Distinguish between an **endergonic** and an **exergonic reaction**. Use a diagram to help if needed.

Chapter 2 Review Questions	pages 56 - 61
-----------------------------------	---------------

1. _____	11. _____	21. _____	31. _____
2. _____	12. _____	22. _____	32. _____
3. _____	13. _____	23. _____	33. _____
4. _____	14. _____	24. _____	34. _____
5. _____	15. _____	25. _____	35. _____
6. _____	16. _____	26. _____	36. _____
7. _____	17. _____	27. _____	37. _____
8. _____	18. _____	28. _____	38. _____
9. _____	19. _____	29. _____	39. _____
10. _____	20. _____	30. _____	

40. (a) _____ (b) _____ (c) _____ (d) _____ (e) _____ (f) _____
(g) _____ (h) _____ (i) _____ (j) _____ (k) _____ (l) _____
(m) _____ (n) _____ (o) _____ (p) _____

44. _____

45. _____

47. _____

49. _____

50. _____

51. _____

52. _____

53. _____

54. _____

55. _____

56. _____

57. _____

59. (a) _____

(c) _____

(f) _____

63. _____

66. (b) _____

72. _____

90. (a) _____

(b) _____

91. _____

93.

You must now MARK the review questions using the answer key on pages 524 – 526!