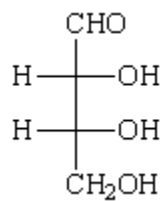
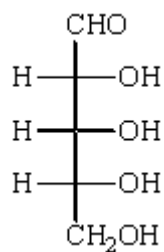


1. Which of the following compounds is both an aldose and a hexose?

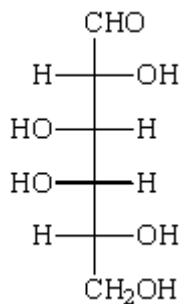
A)



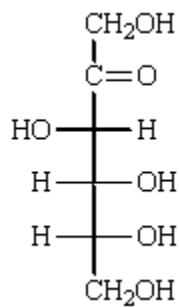
B)



C)

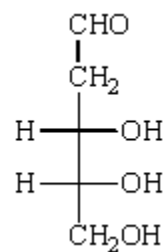


D)

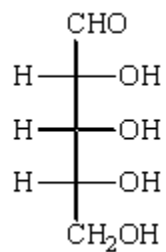


2. Which of the following structures is that of an L-monosaccharide?

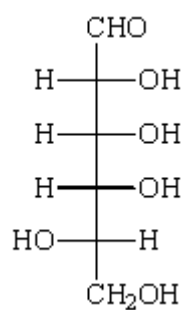
A)



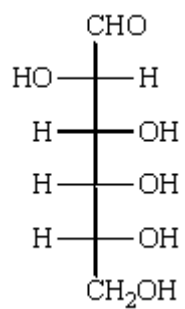
B)



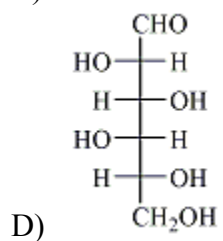
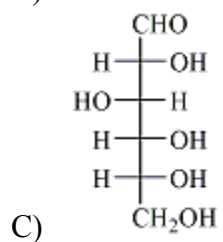
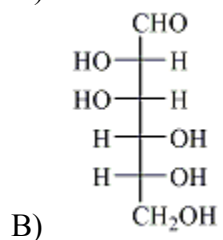
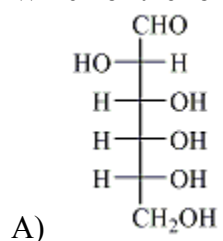
C)



D)



3. Which of the following structures is that of D-mannose?



4. The structure of D-allose differs from that of D-glucose at which carbon atom?

- A) carbon #2
- B) carbon #4
- C) carbon #3
- D) carbon #5

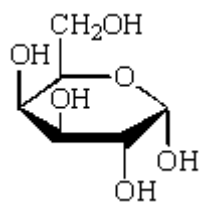
5. In which of the following pairs of monosaccharides do the members of the pair contain different numbers of carbon atoms?

- A) mannose and xylulose
- B) ribulose and arabinose
- C) mannose and galactose
- D) erythrose and threose

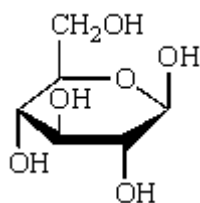
6. Which of the following statements concerning chiral centers in specific monosaccharides is *incorrect*?
- A) threose has two chiral centers
 - B) erythrose has one chiral center
 - C) tagatose has three chiral centers
 - D) talose has four chiral centers
7. Which of the following terms correctly describes the relationship between D-psicose and L-psicose?
- A) enantiomers
 - B) epimers
 - C) diastereomers
 - D) cis-trans isomers
8. Which of the following properties would be the *same* for D-lyxose and L-lyxose?
- A) interaction with plane polarized light
 - B) solubility in chiral solvent
 - C) freezing point
 - D) reaction with (+)-2,3-butanediol

9. Which of the following structures represents a β -monosaccharide?

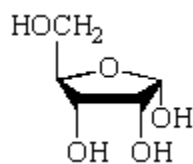
A)



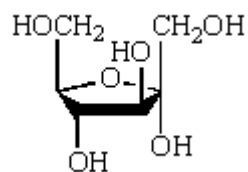
B)



C)

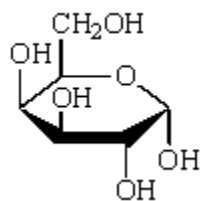


D)

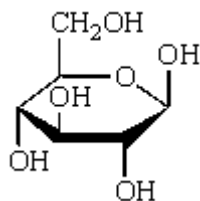


10. Which of the following monosaccharides has an open chain form that is a ketose?

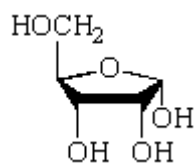
A)



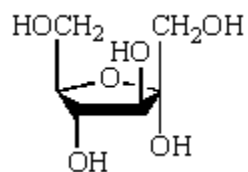
B)



C)

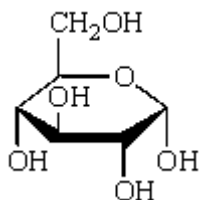


D)

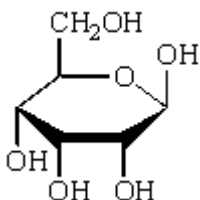


11. Which of the following structures is a representation of a cyclic form of D-glucose?

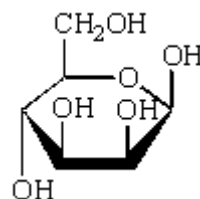
A)



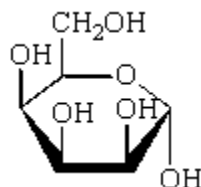
B)



C)



D)



12. Which of the following types of monosaccharides have cyclic forms that involve a 5-membered ring?

A) ketopentoses and aldopentoses

B) aldopentoses and ketohexoses

C) ketopentoses and aldohexoses

D) ketohexoses and aldohexoses

13. In which of the following pairs of carbohydrates are both members of the pair disaccharides?

A) mannose and galactose

B) maltose and glycogen

C) sucrose and maltose

D) cellobiose and cellulose

14. Which of the following substances will produce both galactose and glucose when it is hydrolyzed?
- A) sucrose
 - B) maltose
 - C) lactose
 - D) amylose
15. In which of the following sugars is the bonding between monosaccharide units “head-to-head” rather than “head-to-tail”?
- A) cellobiose
 - B) maltose
 - C) lactose
 - D) sucrose
16. Which of the following is *not* a reducing sugar?
- A) psicose
 - B) mannose
 - C) cellulose
 - D) cellobiose
17. The major structural difference between cellulose and starch is found in the
- A) identity of the monosaccharide units present.
 - B) ring size of the monosaccharide units present.
 - C) linkages between the monosaccharide units present.
 - D) handedness of the monosaccharide units present.
18. Which of the following is a correct pairing of terms?
- A) heteropolysaccharide and starch
 - B) homopolysaccharide and chitin
 - C) branch-chain polysaccharide and cellulose
 - D) unbranched-chain polysaccharide and glycogen
19. In which of the following polysaccharides are all glycosidic linkages of the β (1 \rightarrow 4) type?
- A) starch
 - B) cellulose
 - C) glycogen
 - D) amylopectin

20. Which of the following statements concerning carbohydrates is *correct*?
- A) They are the most abundant type of biochemical substance in the human body.
 - B) They are all polyhydroxy aldehydes, polyhydroxyketones, or substances that yield such upon hydrolysis.
 - C) They can exist in left-handed and right-handed forms, with the left-handed form being dominant in nature.
 - D) They all have a sweet taste and therefore are also called sugars.
21. Which of the following monosaccharides are aldohexoses?
- A) glucose
 - B) fructose
 - C) ribose
 - D) more than one correct response
 - E) no correct response
22. Which of the following statements concerning the D- and L- forms of a monosaccharide is *incorrect*?
- A) They have structures that are nonsuperimposable mirror images of each other.
 - B) They must contain the same number of chiral centers.
 - C) They are enantiomers.
 - D) more than one correct response
 - E) no correct response
23. Which of the following monosaccharides has a structure in which two or more chiral centers are present?
- A) glyceraldehyde
 - B) dihydroxyacetone
 - C) glucose
 - D) more than one correct response
 - E) no correct response
24. The left- and right-handed forms of a monosaccharide with a single chiral center are
- A) enantiomers.
 - B) diastereomers.
 - C) epimers.
 - D) more than one correct response
 - E) no correct response

25. Which of the following properties would be the *same* for a pair of enantiomeric monosaccharides?
- A) interaction with plane-polarized light
 - B) boiling point
 - C) solubility in water
 - D) more than one correct response
 - E) no correct response
26. Which of the following monosaccharides has cyclic forms that involve a 6-membered ring?
- A) fructose
 - B) galactose
 - C) ribose
 - D) more than one correct response
 - E) no correct response
27. In which of the following disaccharides is a β (1 \rightarrow 4) glycosidic linkage present?
- A) lactose
 - B) sucrose
 - C) maltose
 - D) more than one correct response
 - E) no correct response
28. Which of the following disaccharides produces two different monosaccharides upon hydrolysis?
- A) maltose
 - B) sucrose
 - C) cellobiose
 - D) more than one correct response
 - E) no correct response
29. Which of the following disaccharides does *not* have two cyclic forms (alpha and beta)?
- A) sucrose
 - B) lactose
 - C) maltose
 - D) more than one correct response
 - E) no correct response

30. Which of the following carbohydrates will give a positive Benedict's test?
- A) galactose
 - B) sucrose
 - C) starch
 - D) more than one correct response
 - E) no correct response
31. In which of the following pairs of carbohydrates are both members of the pair polysaccharides?
- A) cellulose and cellobiose
 - B) starch and glycogen
 - C) amylose and lactose
 - D) more than one correct response
 - E) no correct response
32. In which of the following carbohydrates are two different types of glycosidic linkages present?
- A) glycogen
 - B) lactose
 - C) amylose
 - D) more than one correct response
 - E) no correct response
33. Which of the following is a correct pairing of terms?
- A) storage polysaccharide and cellulose
 - B) structural polysaccharide and starch
 - C) acidic polysaccharide and glycogen
 - D) more than one correct response
 - E) no correct response
34. Which of the following statements concerning the positioning of –OH groups in the Fischer projection for L-glucose is *correct*?
- A) right on both carbons 2 and 3
 - B) right on both carbons 3 and 4
 - C) left at carbon 3 and right at carbon 5
 - D) more than one correct response
 - E) no correct response

35. Which of the following statements concerning the positioning of –OH groups in the Haworth projection for α -D-glucose is *correct*?
- A) up at carbons 1, 3, and 5
 - B) down at carbons 2, 3, and 4
 - C) up at carbons 1 and 3 and down at carbons 2 and 4
 - D) more than one correct response
 - E) no correct response

Use the following to answer questions 36-45:

In each of the following multiple-choice questions, characterize EACH of the three given statements as being TRUE or FALSE and then indicate the collective true-false status of the statements using the choices

- a) All three statements are true.
- b) Two of the three statements are true.
- c) Only one of the statements is true.
- d) None of the statements is true.

36. Statements:

- (1) Glucose is both a hexose and a ketose.
 - (2) There can never be more than two enantiomers for a molecule.
 - (3) All common disaccharides have beta-one-four linkages.
- A) All three statements are true.
 - B) Two of the three statements are true.
 - C) Only one of the statements is true.
 - D) None of the statements is true.

37. Statements:

- (1) Complete hydrolysis of a oligosaccharide produces only monosaccharides.
 - (2) Fructose, galactose, and ribose are all hexoses.
 - (3) Both amylopectin and glycogen are branched glucose polymers.
- A) All three statements are true.
 - B) Two of the three statements are true.
 - C) Only one of the statements is true.
 - D) None of the statements is true.

38. Statements:

- (1) Diastereomers are stereoisomers whose molecules are mirror images of each other.
 - (2) Both cyclic forms of glucose contain a six-membered carbon ring.
 - (3) Complete hydrolysis of both maltose and cellobiose produce the same molecule.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.

39. Statements:

- (1) A Fischer projection is a three-dimensional notation for showing the spatial arrangements of groups of atoms about chiral centers in a molecule.
 - (2) Cyclic forms of aldoses result from intermolecular hemiacetal formation.
 - (3) All physical properties of enantiomers are the same.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.

40. Statements:

- (1) A positive Tollen's test classifies a monosaccharide as a reducing sugar.
 - (2) The bond which links the two monosaccharides of a disaccharide together is a carbon-oxygen-carbon bond.
 - (3) Monosaccharides cannot be broken down into simpler units by hydrolysis reactions.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.

41. Statements:

- (1) Enantiomers with more than three carbon atoms must have the same handedness.
 - (2) The molecules glyceraldehyde and dihydroxyketone each contain one chiral center.
 - (3) Glucose contain one more -OH group than does galactose.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.

42. Statements:
- (1) Cellulose and amylose are glucose polymers which differ in the type of glycosidic linkage present.
 - (2) All monosaccharides are either aldoses and ketoses.
 - (3) Enantiomers can never be epimers.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.
43. Statements:
- (1) The term sugar is a general designation for both monosaccharides and disaccharides.
 - (2) The “highest-numbered” chiral center in a monosaccharide is used to determine D- or L-configuration.
 - (3) Sucrose is a reducing sugar and lactose is a nonreducing sugar.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.
44. Statements:
- (1) Mirror images of an achiral molecule are identical.
 - (2) All cyclic monosaccharides can exist in alpha- and beta-configurations.
 - (3) Reaction of an alcohol with a cyclic monosaccharide produces a glycoside.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.
45. Statements:
- (1) The biochemical basis for different types of blood is a system of polysaccharide markers attached to red blood cell membranes.
 - (2) Lactose intolerance is a genetic condition caused by excessive amounts of the enzyme lactase.
 - (3) Aspartame, the most used artificial sweetener, is an undigestible trisaccharide.
- A) All three statements are true.
B) Two of the three statements are true.
C) Only one of the statements is true.
D) None of the statements is true.

Use the following to answer questions 46-50:

For each of the compound characterizations, select from the response list an appropriate structural formula. Responses may be used more than once or need not be used at all.

- a) $\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CHO} \\ | \quad | \\ \text{OH} \quad \text{OH} \end{array}$
- b) $\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH}_2 \\ | \quad | \quad | \\ \text{OH} \quad \text{OH} \quad \text{OH} \end{array}$
- c) $\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH} - \text{CH} - \text{CHO} \\ | \quad | \quad | \quad | \\ \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \end{array}$
- d) $\begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH} - \text{CH} - \text{CH}_2 \\ | \quad | \quad | \quad | \quad | \\ \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \quad \text{OH} \end{array}$

46. An achiral compound

47. A chiral compound with one chiral center

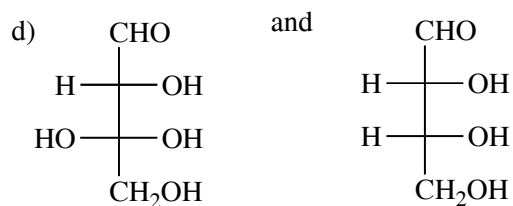
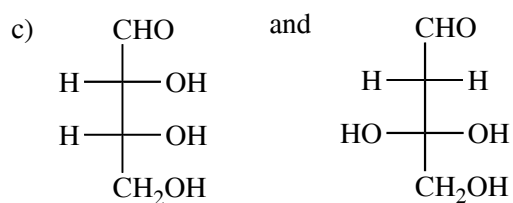
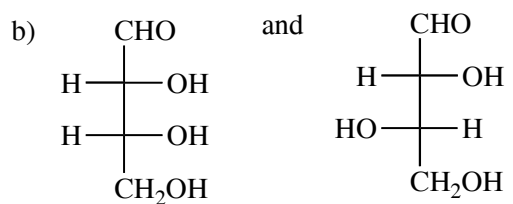
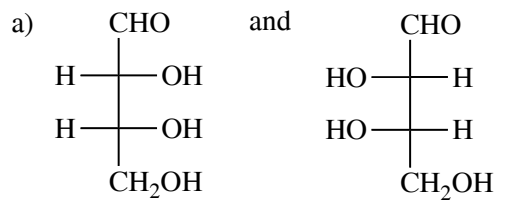
48. A chiral compound with two chiral centers

49. 8 stereoisomers exist for this compound

50. 4 different L-stereoisomers exist for this compound

Use the following to answer questions 51-55:

For each of the stereochemical descriptions, select from the response list an appropriate set of structural formulas. Responses may be used more than once or need not be used at all.



51. Enantiomers

52. Mirror images

53. Diastereomers

54. Optical isomers

55. Epimers

Use the following to answer questions 56-60:

For each of the disaccharides or polysaccharides, select from the response list the correct hydrolysis products. Responses may be used more than once or need not be used at all.

- a) glucose only
- b) glucose and galactose
- c) glucose and fructose
- d) glucose and ribose

56. Sucrose

57. Lactose

58. Cellulose

59. Starch

60. Glycogen

Use the following to answer questions 61-65:

For each of the disaccharides or polysaccharides, select from the response list the correct characterization of the type of glycosidic linkages present in the compound. Responses may be used more than once or need not be used at all.

- a) $\alpha(1 \rightarrow 4)$ only
- b) $\beta(1 \rightarrow 4)$ only
- c) $\alpha(1 \rightarrow 4)$ and $\alpha(1 \rightarrow 6)$
- d) $\alpha, \beta(1 \rightarrow 2)$ only

61. Sucrose

62. Lactose

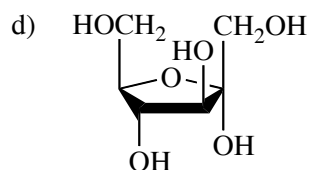
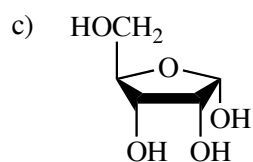
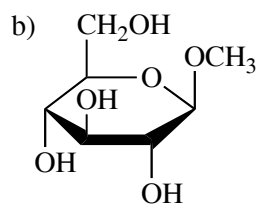
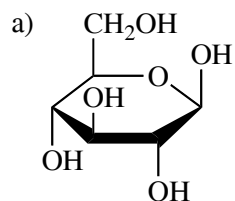
63. Cellulose

64. Amylopectin

65. Chitin

Use the following to answer questions 66-70:

For each of the compound characterizations, select an appropriate structural formula from the response list. Responses may be used more than once or need not be used at all.



66. D-glucose

67. A beta monosaccharide

68. A glycoside

69. Open-chain form is an aldopentose

70. Open-chain form is a ketohexose

Answer Key

1. C
2. C
3. B
4. C
5. A
6. B
7. A
8. C
9. B
10. D
11. A
12. B
13. C
14. C
15. D
16. C
17. C
18. B
19. B
20. B
21. A
22. E
23. C
24. D
25. D
26. B
27. A
28. B
29. A
30. A
31. B
32. A
33. E
34. E
35. E
36. C
37. B
38. C
39. C
40. A
41. D
42. A
43. B
44. A

- 45. D
- 46. d
- 47. a
- 48. d
- 49. c
- 50. c
- 51. a
- 52. a
- 53. b
- 54. a
- 55. b
- 56. c
- 57. b
- 58. a
- 59. a
- 60. a
- 61. d
- 62. b
- 63. b
- 64. c
- 65. b
- 66. a
- 67. a
- 68. b
- 69. c
- 70. d