

1. A lipid is any substance of biochemical origin that is
 - A) soluble in water but insoluble in nonpolar solvents
 - B) insoluble in both water and nonpolar solvents
 - C) insoluble in water but soluble in nonpolar solvents
 - D) soluble in both nonpolar solvents and water
2. In which of the following pairs of fatty acids does the first listed have a higher melting point than the second listed acid?
 - A) 17:1 acid and 17:0 acid
 - B) 24:0 acid and 19:0 acid
 - C) 18:2 acid and 18:1 acid
 - D) 17:1 acid and 18:0 acid
3. Which of the following fatty acids is both polyunsaturated and an omega-6 fatty acid?
 - A) $\text{CH}_3-(\text{CH}_2)_{18}-\text{COOH}$
 - B) $\text{CH}_3-(\text{CH}_2)_7-\text{CH}=\text{CH}-(\text{CH}_2)_7-\text{COOH}$
 - C) $\text{CH}_3-(\text{CH}_2)_4-\text{CH}=\text{CH}-(\text{CH}_2)_2-(\text{CH}_2)_6-\text{COOH}$
 - D) $\text{CH}_3-\text{CH}_2-(\text{CH}=\text{CH}-\text{CH}_2)_4-(\text{CH}_2)_2-\text{COOH}$
4. Which of the following statements concerning fats and oils is *incorrect*?
 - A) They are also called triacylglycerols.
 - B) They are also called triglycerides.
 - C) They are glycerol triesters.
 - D) They are fatty acid salts.
5. Unsaturated fatty acids are structural components of
 - A) both fats and oils.
 - B) neither fats nor oils.
 - C) fats but not oils.
 - D) oils but not fats.
6. How do simple triacylglycerols (STAGs) differ from mixed triacylglycerols (MTAGs)?
 - A) STAGs contain short-chain fatty acids and MTAGs contain long-chain fatty acids.
 - B) STAGs contain unbranched fatty acids and MTAGs contain branched fatty acids.
 - C) STAGs contain saturated fatty acids and MTAGs contain unsaturated fatty acids.
 - D) STAGs contain only one kind of fatty acid and MTAGs contain more than one kind of fatty acid.

7. How many different triglyceride molecules can be produced that contain glycerol, palmitic acid, arachidic acid, and linoleic acid residues?
- A) two
 - B) three
 - C) four
 - D) five
8. The products of the hydrolysis of an oil are three fatty acids and
- A) a long-chain alcohol.
 - B) glycerol.
 - C) phosphoric acid.
 - D) an amino alcohol.
9. Which of the following types of compounds are expected products from the saponification of a fat?
- A) glycerol and fatty acids
 - B) glycerol and fatty acid salts
 - C) fatty acid salts and fatty acids
 - D) glycerol, fatty acid salts and fatty acids
10. Which of the following statements concerning fatty acids is *incorrect*?
- A) fatty acids are rarely found in the free state in nature
 - B) double bonds present in fatty acids are almost always in a cis-configuration
 - C) at least 20 carbon atoms must be present in the carbon chain of a fatty acid
 - D) some fatty acids needed in the human body must be obtained from food because they cannot be synthesized with the body
11. In a glycerophospholipid, glycerin's three –OH groups are esterified, respectively, with
- A) one fatty acid and two phosphoric acid molecules.
 - B) two fatty acid and one phosphoric acid molecules.
 - C) three phosphoric acid molecules.
 - D) one fatty acid, one phosphoric acid and one amino alcohol molecule.
12. Based on function, cholesterol is
- A) energy-storage lipids
 - B) membrane lipids
 - C) emulsification lipids
 - D) messenger lipids

13. Which of the following statements concerning the molecule sphingosine is *correct*?
- A) Its carbon chain is saturated.
 - B) Its carbon chain contains 20 carbon atoms.
 - C) Two amino groups and one hydroxyl group are present.
 - D) One amino group and two hydroxyl groups are present.
14. In which of the following types of lipids are two ester linkages and one amide linkage present?
- A) glycerophospholipids
 - B) sphingophospholipids
 - C) sphingoglycolipids
 - D) triacylglycerols
15. Which of the following lipids is classified as a sphingoglycolipid?
- A) cephalin
 - B) lecithin
 - C) sphingomyelin
 - D) cerebroside
16. The most abundant steroid in the human body is
- A) progesterone.
 - B) testosterone.
 - C) estradiol.
 - D) cholesterol.
17. The “steroid nucleus” common to all steroid structures involves a fused-ring system involving
- A) four six-membered rings.
 - B) four five-membered rings.
 - C) three six-membered rings and one five-membered ring.
 - D) two six-membered rings and two five-membered rings.
18. Which of the following types of lipids is a steroid?
- A) bile acids
 - B) prostaglandins
 - C) thromboxanes
 - D) leukotrienes

19. Eicosanoids are oxygenated derivatives of

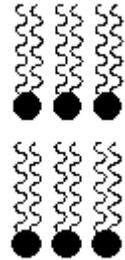
- A) cholesterol.
- B) glycerophospholipids.
- C) polyunsaturated 20-carbon fatty acids.
- D) saturated fatty acids with less than 18 carbon atoms.

20. Which of the following is the correct representation for the structure of a lipid bilayer?

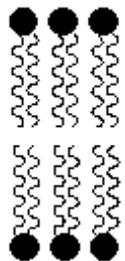
A)



B)



C)



D)



21. Which of the following types of lipids would be soluble in water?
- A) phospholipids
 - B) sphingolipids
 - C) steroids
 - D) more than one correct response
 - E) no correct response
22. Which of the following is a distinguishing characteristic between fats and oils?
- A) physical state at room temperature
 - B) alcohol component present in their structures
 - C) type of linkage between fatty acids and the alcohol present
 - D) more than one correct response
 - E) no correct response
23. The designation “polyunsaturated” applies to which of the following fatty acids?
- A) oleic acid (18:1)
 - B) palmitic acid (16:0)
 - C) arachidonic acid (20:4)
 - D) more than one correct response
 - E) no correct response
24. *Partial* hydrogenation of a fat or oil
- A) produces fatty acid salts.
 - B) increases the degree of fatty acid unsaturation.
 - C) increases the melting point.
 - D) more than one correct response
 - E) no correct response
25. Which of the following statements concerning the *complete* hydrolysis of fats and oils is *correct*?
- A) Fats produce more fatty acids per molecule than do oils.
 - B) Oils produce more glycerol per molecule than do fats.
 - C) Fats produce only saturated fatty acids and oils produce only unsaturated fatty acids.
 - D) more than one correct response
 - E) no correct response

26. In which of the following pairs of lipids are both members of the pair *membrane* lipids?
- A) triacylglycerols and glycerophospholipids
 - B) glycerophospholipids and sphingophospholipids
 - C) sphingophospholipids and sphingoglycolipids
 - D) more than one correct response
 - E) no correct response
27. Which of the following types of lipids contains a long-chain amino dialcohol as a component?
- A) sphingoglycolipids
 - B) glycerophospholipids
 - C) prostaglandins
 - D) more than one correct response
 - E) no correct response
28. In which of the following “head-and-two-tail” type lipids are both “tails” fatty acids?
- A) glycerophospholipid
 - B) sphingophospholipid
 - C) sphingoglycolipid
 - D) more than one correct response
 - E) no correct response
29. In which of the following types of lipids are both ester and amide linkages present?
- A) sphingophospholipids
 - B) glycerophospholipids
 - C) sphingoglycolipids
 - D) more than one correct response
 - E) no correct response
30. Which of the following statements concerning cholesterol is *correct*?
- A) Its core ring structure is based upon a set of four fused six-membered rings.
 - B) Its core ring structure contains 17 carbon atoms.
 - C) Attachments to the core ring structure are located on carbons 3, 10, 12 and 15.
 - D) more than one correct response
 - E) no correct response

31. Which of the following statements concerning lipid bilayers is *correct*?
- A) Both the exterior and interior surface of a lipid bilayer contain groups that are nonpolar.
 - B) The interior of a lipid bilayer is polar.
 - C) The two layers of molecules in a lipid bilayer are present in a “tail-to-tail” arrangement.
 - D) more than one correct response
 - E) no correct response
32. Which of the following types of lipids have structures that contain the fused-ring steroid nucleus?
- A) bile acids
 - B) estrogens
 - C) glucocorticoids
 - D) more than one correct response
 - E) no correct response
33. Which of the following types of lipids are fatty acid derivatives?
- A) estrogens
 - B) leukotrienes
 - C) prostaglandins
 - D) more than one correct response
 - E) no correct response
34. Which of the following statements concerning eicosanoids is *correct*?
- A) The precursor of most eicosanoids is cholesterol.
 - B) Eicosanoids are hormones transported in the blood to their site of action.
 - C) Both thromboxanes and leukotrienes are types of eicosanoids.
 - D) more than one correct response
 - E) no correct response
35. Which of the following types of lipids has a “block diagram” structure that involves five components?
- A) triacylglycerol
 - B) glycerophospholipid
 - C) biological wax
 - 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) Fats and oils have the same general chemical structure.
 - (2) Biological waxes have a three-component "block diagram."
 - (3) In facilitated transport a substance crosses a cell membrane with the help of a protein "pump."
- 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) Bile acids are cholesterol oxidation products.
 - (2) Glycerophospholipids differ structurally from fats in the number of ester linkages present.
 - (3) Stearic acid and linolenic acids are the two essential fatty acids.
- 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) Steroids have structures based on a fused-three-ring system.
 - (2) Glycerophospholipids and sphingophospholipids both have "head-and-two-tails" structures.
 - (3) Both fats and oils are TAG mixtures.
- 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) Triacylglycerols can be hydrolyzed under acidic conditions to produce salts of fatty acids.
 - (2) Hydrogenation of a fat or oil increases its degree of unsaturation.
 - (3) Eicosanoids are oxygenated derivatives of polyunsaturated 18-carbon fatty acids.
- 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) Cholesterol is both a steroid and a membrane lipid.
 - (2) Sphingoglycolipids are components of cell membranes.
 - (3) Sphingosine, the “platform” for sphingolipids, is an amino dialcohol.
- 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) Omega-3 fatty acids are unsaturated fatty acids containing three double bonds.
 - (2) Prostaglandins and thromboxanes are classes of eicosanoids.
 - (3) In general, lipids are substances that are only sparingly soluble in water.
- 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) In active transport, a substance crosses a cell membrane against a concentration gradient.
 - (2) Fatty acid melting point decreases with increasing degree of unsaturation.
 - (3) Complete hydrolysis of a TAG produces four product molecules all of which must be different from each other.
- 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) Structurally, fats contain three ester linkages and oils contain only two ester linkages.
 - (2) Hormones, many of which are steroids, are chemical messengers produced by ductless glands.
 - (3) The configuration about double bonds in naturally occurring unsaturated fatty acids is almost always *trans*.
- 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:

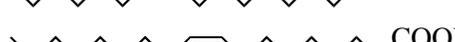
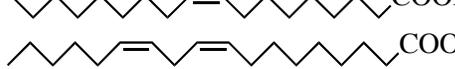
- (1) The “head group” of sphingolipids is often a small carbohydrate molecule.
 - (2) Biological waxes have structures in which an amide linkage is present.
 - (3) An 18:3 fatty acid contains more unsaturation than a 20:2 fatty acid.
- A) All three statements are true.
 - B) Two of the three statements are true.
 - C) Only one of the statements is true.
 - D) None of the statements is true.

45. Statements:

- (1) Olestra, a calorie-free fat substitute, is an undigestible sucrose polyester.
 - (2) “Trans-fats” affect blood cholesterol levels in a manner similar to that of unsaturated fatty acids.
 - (3) Anabolic steroids, banned by many sports organizations, have several important medical uses.
- 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 fatty acid characterizations, select from the response list the structure of the correct fatty acid. Responses may be used more than once or need not be used at all.

- a)  CCCCCCCCCCCCCCCCCC(=O)O
- b)  CCCCC=CCCCCCCC(=O)O
- c)  CCCCC=CCCCCCCC(=O)O
- d)  CCCC=CC=CCCCCCCC(=O)O

46. Polyunsaturated fatty acid

47. Saturated fatty acid

48. Omega-6 fatty acid

49. An 18:1 fatty acid

50. Cis-9-octadecenoic acid

Use the following to answer questions 51-55:

For each of the structural characterizations, select a correct response from the response list.

Responses may be used more than once or need not be used at all.

- a) fats but not oils
- b) oils but not fats
- c) both fats and oils
- d) neither fats nor oils

51. Glycerol is a structural component.

52. Saturated fatty acids may be structural components.

53. Unsaturated fatty acids may be structural components.

54. Three ester linkages are present in the molecule.

55. Are also known as triacylglycerols and triglycerides.

Use the following to answer questions 56-60:

For each of the reaction characterizations, select from the response list the type of reaction of fats and oils that will produce the indicated effect. Responses may be used more than once or need not be used at all.

- a) hydrogenation
- b) rancidity
- c) saponification
- d) hydrolysis

56. Conversion of some cis double bonds to trans double bonds

57. Produces fatty acid salts

58. Increases the melting point of the fat or oil

59. Produces short chain fatty acids

60. Decreases the degree of fatty acid unsaturation

Use the following to answer questions 61-65:

Classify each of the lipid types in terms of its biochemical function using the response list. Responses may be used more than once or need not be used at all.

- a) energy-storage lipid
- b) membrane lipid
- c) emulsification lipid
- d) messenger lipid

61. Triacylglycerols

62. Glycerophospholipids

63. Eicosanoids

64. Bile acids

65. Sphingoglycolipids

Use the following to answer questions 66-70:

For each of the classes of lipids, select from the response list the number of “structural components” that are present in molecules of the lipid. Responses may be used more than once or need not be used at all.

- a) two
- b) three
- c) four
- d) five

66. Biological waxes

67. Triacylglycerols

68. Glycerophospholipids

69. Sphingomyelins

70. Cerebrosides

Answer Key

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

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