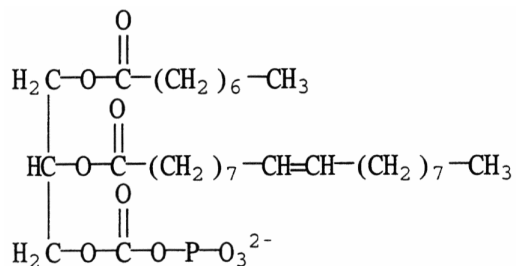


**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 1) Substances originating in plant or animal material and soluble in non-polar organic solvents are classified as 1) \_\_\_\_\_
- A) amino acids.
  - B) proteins.
  - C) nucleic acids
  - D) lipids.
  - E) carbohydrates.
- 2) The biochemical roles of lipids are 2) \_\_\_\_\_
- A) component of cell membranes, catalysis, and structural support.
  - B) short-term energy storage, transport of molecules, and structural support.
  - C) neurotransmitters, hormones, transport of molecules.
  - D) storage of excess energy, component of cell membranes, and chemical messengers.
  - E) catalysis, protection against outside invaders, motion.
- 3) Biomolecules classified as lipids are 3) \_\_\_\_\_
- A) polymers of  $\alpha$ -amino acids.
  - B) six-membered rings with delocalized electrons.
  - C) polyhydroxy aldehydes or ketones, or compounds which produce those when hydrolyzed
  - D) polymers of diacids and diamines.
  - E) soluble in non-polar solvents.
- 4) All of the following types of molecules can be classified as lipids **except** 4) \_\_\_\_\_
- A) triacylglycerols.
  - B) sphingomyelins.
  - C) glycoproteins.
  - D) eicosanoids.
  - E) steroids.
- 5) Biomolecules can be classified as lipids on the basis of 5) \_\_\_\_\_
- A) the presence of many hydroxyl groups and at least one carbonyl group.
  - B) the presence of at least one amine group and one carboxylic acid group on each molecule.
  - C) the physical properties of odor, color, and melting point within certain guidelines.
  - D) a common structure consisting of long hydrocarbon chains.
  - E) the physical property of solubility in nonpolar organic solvents.

6) The molecule shown can be classified as a(an)

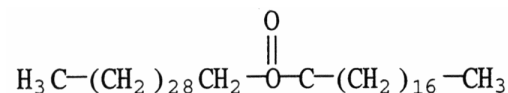
6) \_\_\_\_\_



- A) sphingolipid.
- B) wax.
- C) eicosanoid.
- D) glycerophospholipid.
- E) steroid.

7) The molecule shown can be classified as a(an)

7) \_\_\_\_\_



- A) eicosanoid.
- B) steroid.
- C) wax.
- D) sphingolipid.
- E) glycerophospholipid.

8) Most naturally occurring monounsaturated fatty acids can be classified as which of the following?

8) \_\_\_\_\_

- A) cis
- B) L
- C) D
- D) trans
- E) none of the above

9) Which molecule is a **saturated** fatty acid?

9) \_\_\_\_\_

- A) butyric acid
- B) oleic acid
- C) lauric acid
- D) arachidonic acid
- E) linoleic acid

10) Which molecule is a fatty acid?

10) \_\_\_\_\_

- A)  $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{COOH}$
- B)  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
- C)  $\text{CH}_2=\text{CHCOOH}$
- D)  $\text{CH}_3\text{COOH}$
- E) none of the above

- 11) Which molecule is **not** a fatty acid? 11) \_\_\_\_\_
- A)  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$   
 B)  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$   
 C)  $\text{CH}_3\text{CH}(\text{CH}=\text{CH}-\text{CH}_2)_3(\text{CH}_2)_6\text{COOH}$   
 D)  $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{COOH}$   
 E) none of the above
- 12) Which molecule is a **saturated** fatty acid? 12) \_\_\_\_\_
- A)  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$   
 B)  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$   
 C)  $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{COOH}$   
 D)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{COOH}$   
 E) none of the above
- 13) Which molecule is an **unsaturated** fatty acid? 13) \_\_\_\_\_
- A)  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$   
 B)  $\text{CH}_3\text{CH}=\text{CHCH}_2\text{COOH}$   
 C)  $(\text{CH}_3)_2\text{CH}(\text{CH}_2)_3\text{COOH}$   
 D)  $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$   
 E) none of the above
- 14) Which molecule is a **polyunsaturated** fatty acid? 14) \_\_\_\_\_
- A)  $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$   
 B)  $\text{HOOCCH}_2(\text{CH}=\text{CH}-\text{CH}_2)_3\text{CH}_2\text{COOH}$   
 C)  $\text{CH}_2=\text{CHCH}=\text{CHCOOH}$   
 D)  $\text{CH}_3\text{CH}_2(\text{CH}=\text{CH}-\text{CH}_2)_3(\text{CH}_2)_6\text{COOH}$   
 E) none of the above
- 15) Which molecule is an **unsaturated** fatty acid? 15) \_\_\_\_\_
- A) stearic acid  
 B) linoleic acid  
 C) butyric acid  
 D) lauric acid  
 E) myristic acid
- 16) Triglycerides belong to which general class of organic molecules. 16) \_\_\_\_\_
- A) ketones  
 B) esters  
 C) ethers  
 D) alcohols  
 E) carboxylic acids
- 17) Fats are generally \_\_\_\_\_ at room temperature and are obtained from \_\_\_\_\_. 17) \_\_\_\_\_
- A) solids; plants  
 B) liquids; plants  
 C) liquids; animals  
 D) solids; animals  
 E) none of the above

- 18) Oils are generally \_\_\_\_\_ at room temperature and are obtained from \_\_\_\_\_. 18) \_\_\_\_\_  
A) solids; animals  
B) liquids; plants  
C) liquids; animals  
D) solids; plants  
E) none of the above
- 19) The chemical makeup of a wax is 19) \_\_\_\_\_  
A) an ester of glycerol with three predominantly saturated fatty acids.  
B) an ester of glycerol with three identical saturated fatty acids.  
C) an ester of glycerol with three predominantly unsaturated fatty acids.  
D) a simple ester of a long chain alcohol and a fatty acid.  
E) an ester of glycerol with three identical unsaturated fatty acids.
- 20) Which of the following is **not** a biochemical function of waxes? 20) \_\_\_\_\_  
A) Energy storage for animals  
B) Physical protection of mammalian ears  
C) Waterproofing of feathers in shore birds  
D) Prevention of water loss by leaves  
E) Structural materials in beehives
- 21) The chemical makeup of fats is 21) \_\_\_\_\_  
A) esters of glycerol with three identical saturated fatty acids.  
B) esters of glycerol with three predominantly saturated fatty acids.  
C) esters of glycerol with three predominantly unsaturated fatty acids.  
D) simple esters of long chain alcohols and fatty acids.  
E) esters of glycerol with three identical unsaturated fatty acids.
- 22) The chemical makeup of oils is 22) \_\_\_\_\_  
A) simple esters of long chain alcohols and fatty acids.  
B) esters of glycerol with three identical saturated fatty acids.  
C) esters of glycerol with three predominantly saturated fatty acids.  
D) esters of glycerol with three predominantly unsaturated fatty acids.  
E) esters of glycerol with three identical unsaturated fatty acids.
- 23) Unsaturated triacylglycerols are usually \_\_\_\_\_ because \_\_\_\_\_. 23) \_\_\_\_\_  
A) liquids; they contain impurities from their natural sources  
B) solids; the similar zig-zag shape of their fatty acid chains allows them to fit together closely  
C) liquids; the kinks in their fatty acid chains prevent their fitting together closely  
D) solids; they have relatively long fatty acid chains  
E) liquids; they have relatively short fatty acid chains
- 24) Saturated triacylglycerols are usually \_\_\_\_\_ because \_\_\_\_\_. 24) \_\_\_\_\_  
A) liquids; their rigid fatty acid chains do not fit together closely  
B) liquids; they have relatively short fatty acid chains  
C) liquids; they contain impurities from their natural sources  
D) solids; they have relatively long fatty acid chains  
E) solids; their flexible fatty acid chains allow the molecules to fit together closely

- 25) The product of an esterification reaction between which of the following molecules would be a fat? 25) \_\_\_\_\_
- $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
  - $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
  - $\text{HOCH}_2\text{CH}_2\text{OH}$
  - $\text{HOCH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$
- A) II and III      B) I and IV      C) I and II      D) I and III      E) II and IV
- 26) The product of an esterification reaction between which of the following molecules would be an oil? 26) \_\_\_\_\_
- $\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$
  - $\text{CH}_3(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{COOH}$
  - $\text{HOCH}_2\text{CH}_2\text{OH}$
  - $\text{HOCH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$
- A) I and IV      B) II and IV      C) II and III      D) I and II      E) I and III
- 27) Fats and oils can be referred to by the general term \_\_\_\_\_ because \_\_\_\_\_. 27) \_\_\_\_\_
- phospholipids; they are formed when any one of the three ester groups is replaced by a phosphate group
  - soaps; they can undergo saponification reactions
  - triglycerides; they are formed when any one of the three functional groups of glycerol reacts with a fatty acid
  - steroids; they have a specific tetracyclic ring structure
  - triacylglycerols; they are formed by reaction of 1,2,3-propanetriol with three fatty acids
- 28) Which reaction can be used to convert oils into fats? 28) \_\_\_\_\_
- esterification
  - saponification
  - dehydration
  - hydrogenation
  - hydrolysis
- 29) The saponification reaction used to form soaps can be more specifically described as 29) \_\_\_\_\_
- dehydration.
  - acid hydrolysis.
  - hydrogenation.
  - dehydrogenation.
  - basic hydrolysis.
- 30) In chemical terms, soaps can best be described as 30) \_\_\_\_\_
- mixed esters of fatty acids.
  - simple esters of fatty acids.
  - salts of carboxylic acids.
  - long chain acids.
  - bases formed from glycerol.

- 31) The hydrocarbon end of a soap molecule is 31) \_\_\_\_\_  
A) hydrophobic and attracted to grease.  
B) hydrophilic and attracted to water.  
C) hydrophobic and attracted to water.  
D) hydrophilic and attracted to grease.  
E) neither hydrophobic nor hydrophilic.

- 32) Soaps are \_\_\_\_\_. 32) \_\_\_\_\_  
A) alkali metal salts of long chain carboxylic acids  
B) alkali metal salts of glycerol  
C) esters of a long chain fatty alcohol with a long chain fatty acid  
D) long chain fatty alcohols  
E) B and D

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 33) Use the terms hydrophobic, hydrophilic, and micelle to explain how a soap removes grease from fabric. 33) \_\_\_\_\_

- 34) Describe the similarities and differences between soaps and emulsifying agents. 34) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 35) The type of lipid that is predominant in cell membranes is 35) \_\_\_\_\_  
A) waxes.  
B) phospholipids.  
C) fats.  
D) leukotrienes.  
E) steroids.

- 36) A phospholipid with the phosphate ester group bonded to choline would be classified as a 36) \_\_\_\_\_  
A) cerebroside.  
B) cephalin.  
C) lecithin.  
D) sphingomyelin.  
E) ganglioside.

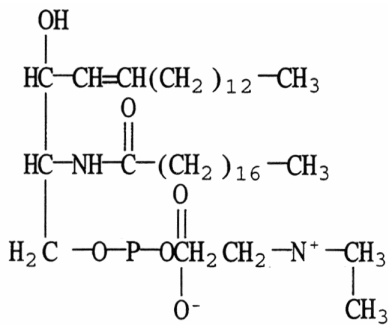
- 37) Sphingomyelins are composed of sphingosine, a fatty acid, phosphoric acid, and 37) \_\_\_\_\_  
A) inositol.  
B) glucose.  
C) choline.  
D) galactose.  
E) none of the above

- 38) A sphingomyelin includes all of the following components **except** 38) \_\_\_\_\_  
A) amino alcohol.  
B) phosphate group.  
C) fatty acid.  
D) glycerol.  
E) sphingosine.

39) Glycolipids are similar in structure to sphingomyelins, except that the phosphate group has been replaced by a(an) \_\_\_\_\_ 39) \_\_\_\_\_  
 A) nucleic acid.  
 B) choline derivative.  
 C) fatty acid.  
 D) carbohydrate.  
 E) amino acid.

40) The carbohydrate portion of a glycolipid extends \_\_\_\_\_ in order to allow the molecule to function as a \_\_\_\_\_. 40) \_\_\_\_\_  
 A) into the intracellular fluid; transport channel  
 B) into the extracellular fluid; receptor site  
 C) into the intracellular fluid; receptor site  
 D) laterally within the bilayer; fluid membrane  
 E) into the extracellular fluid; transport channel

41) The molecule shown can be classified as a(an) \_\_\_\_\_ 41) \_\_\_\_\_



- A) triacylglycerol.  
 B) glycolipid.  
 C) glycerophospholipid.  
 D) sphingolipid.  
 E) wax.

42) The basic structure of cell membranes consists of \_\_\_\_\_ 42) \_\_\_\_\_  
 A) phospholipid micelles studded with proteins.  
 B) protein micelles studded with phospholipids.  
 C) protein bilayers studded with phospholipids.  
 D) one protein layer and one phospholipid layer.  
 E) phospholipid bilayers studded with proteins.

43) Lecithin is commonly used as a(n) \_\_\_\_\_ 43) \_\_\_\_\_  
 A) dispersant  
 B) lubricant  
 C) emulsifying agent  
 D) precipitating agent  
 E) drying agent

- 44) Phospholipids differ from fats and oils by having 44) \_\_\_\_\_  
A) one of the fatty acid ester linkages replaced by an amine group.  
B) a molecule of galactose bonded to the three-carbon backbone.  
C) cyclic ester structures instead of the three-carbon backbone.  
D) a molecule of glucose bonded to the three-carbon backbone.  
E) one of the fatty acid ester linkages replaced by a phosphate ester linkage.
- 45) The difference in chemical structure between cerebrosides and gangliosides is that gangliosides 45) \_\_\_\_\_  
A) have larger fatty acid molecules than cerebrosides.  
B) contain more complex carbohydrates than cerebrosides.  
C) are based on sphingosine and cerebrosides on glycerol.  
D) are found in many kinds of cells, but cerebrosides mainly in brain cells.  
E) are based on glycerol and cerebrosides on sphingosine.

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 46) Sketch a lipid bilayer and identify its hydrophobic and hydrophilic portions. 46) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 47) The function of cholesterol in a cell membrane is to 47) \_\_\_\_\_  
A) maintain structure because of its flat rigid characteristics.  
B) act as a precursor to steroid hormones.  
C) attract hydrophobic molecules to form solid deposits.  
D) take part in the reactions that produce bile acids.  
E) none of the above
- 48) Which statement about cholesterol is **not** correct? 48) \_\_\_\_\_  
A) It is an essential component of cell membranes.  
B) It is soluble in non-polar solvents.  
C) It is the precursor for bile acids and salts.  
D) It cannot be synthesized by the body.  
E) It is the precursor for steroid hormones.
- 49) Cholesterol is implicated as a potential cause of arteriosclerosis because it 49) \_\_\_\_\_  
A) maintains structure because of its flat rigid characteristics.  
B) attracts hydrophobic molecules to form solid deposits.  
C) takes part in the reactions that produce bile acids.  
D) acts as a precursor to steroid hormones.  
E) none of the above
- 50) Steroids are 50) \_\_\_\_\_  
A) based on a tetracyclic ring system with substituents at various positions.  
B) esters of glycerol with three predominantly saturated fatty acids.  
C) simple esters of long chain alcohols and fatty acids.  
D) based on a system composed of four adjacent aromatic rings with substituents at various positions.  
E) esters of glycerol with three predominantly unsaturated fatty acids.



- 51) All of the following are components of a cell membrane **except** 51) \_\_\_\_\_  
A) integral proteins.  
B) glycoproteins.  
C) peripheral proteins.  
D) liposomes.  
E) cholesterol.
- 52) The function of glycoproteins and glycolipids in cell membranes is to 52) \_\_\_\_\_  
A) provide channels for facilitated diffusion.  
B) provide channels for active transport.  
C) mediate interactions between the cell and outside agents.  
D) act as energy sources for active transport.  
E) vary the fluidity of the membrane as needed.
- 53) A protein which extends completely through the cell membrane is referred to as a(an) 53) \_\_\_\_\_  
A) glycoprotein.  
B) liposome.  
C) peripheral protein.  
D) cholesterol.  
E) integral protein.
- 54) Which choice is an example of a material that is transported across cell membranes by active transport? 54) \_\_\_\_\_  
A) oxygen  
B) glucose  
C) K<sup>+</sup>  
D) cholesterol  
E) carbon dioxide
- 55) The process of transport across cell membranes which costs biochemical energy is 55) \_\_\_\_\_  
A) facilitated diffusion.  
B) osmosis.  
C) simple diffusion.  
D) active transport.  
E) none of the above
- 56) The process of moving solutes into or out of a cell against the natural concentration gradient is called? 56) \_\_\_\_\_  
A) allotropic migration  
B) active transport  
C) passive transport  
D) diffusive transport  
E) facilitated diffusion
- 57) Which substance will **not** be transported into a cell by simple diffusion? 57) \_\_\_\_\_  
A) cortisone  
B) O<sub>2</sub>  
C) epinephrine  
D) CO<sub>2</sub>  
E) estrogen

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 58) Compare the three mechanisms for moving materials across cell membranes. Be sure to mention gradients, energy considerations, actual method of transport, and types of materials transported in your answer. 58) \_\_\_\_\_

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 59) Eicosanoids function as \_\_\_\_\_  
A) thyroid hormones.  
B) membrane components.  
C) local hormones.  
D) neurotransmitters.  
E) sex hormones.
- 60) Which statement about eicosanoids is **not** correct? \_\_\_\_\_  
A) Linolenic acid is a precursor to arachidonic acid.  
B) All of the molecules in this category are unsaturated.  
C) The parent molecule, arachidonic acid, contains 20 carbon atoms.  
D) Eicosanoids function as "local hormones," acting as short-term chemical messengers.  
E) none of the above
- 61) The compound that is the immediate precursor to the prostaglandins is \_\_\_\_\_  
A) oleic acid.  
B) leukotriene.  
C) stearic acid.  
D) cholesterol.  
E) arachidonic acid.
- 62) Local hormones are \_\_\_\_\_. \_\_\_\_\_  
A) short-lived  
B) prostaglandins  
C) act near their point of synthesis  
D) leukotrienes  
E) all of the above

**MATCHING. Choose the item in column 2 that best matches each item in column 1.**

*Match the following.*

- |                           |   |           |
|---------------------------|---|-----------|
| 63) polyunsaturated       | A) describes fatty acids that have mostly single but more than one double carbon-carbon bond  | 63) _____ |
| 64) saturated             |   | 64) _____ |
| 65) unsaturated           | B) a process of transport in which substances cross a membrane based on concentration differences without the expenditure of energy | 65) _____ |
| 66) hydrophobic           |   | 66) _____ |
| 67) facilitated diffusion | C) describes the polar portion of a molecule that interacts readily with water or other polar substances                            | 67) _____ |
| 68) active transport      |   | 68) _____ |
| 69) simple diffusion      | D) a process of transport in which integral proteins change shape to allow a substance to cross a cell membrane                     | 69) _____ |
| 70) hydrophilic           |   | 70) _____ |
|                           | E) describes fatty acids that do not have any carbon-carbon double bonds  |           |
|                           | F) describes fatty acids that have mostly single but at least one double carbon-carbon bond   |           |
|                           | G) describes the non-polar portion of a molecule that does not interact with water or other polar substances                        |           |
|                           | H) a process of transport that costs energy because the flow is against the concentration gradient                                  |           |

## Answer Key

Testname: UNTITLED1

- 1) D
- 2) D
- 3) E
- 4) C
- 5) E
- 6) D
- 7) C
- 8) A
- 9) C
- 10) B
- 11) D
- 12) A
- 13) A
- 14) D
- 15) B
- 16) B
- 17) D
- 18) B
- 19) D
- 20) A
- 21) B
- 22) D
- 23) C
- 24) E
- 25) B
- 26) B
- 27) E
- 28) D
- 29) E
- 30) C
- 31) A
- 32) A
- 33) Soap molecules are salts of fatty acids, which are long-chain carboxylic acids. The hydrocarbon part of the molecule is non-polar, making it hydrophobic, or water fearing. This part of the molecule interacts readily with grease but not with water. The end of the molecule containing the carboxylate anion is very polar because of its two oxygen atoms and its negative charge. Therefore this part of the molecule is hydrophilic, or water loving. It does not interact with grease, but does interact with water. When a soap removes a grease spot, its hydrophobic portion interacts with the grease and breaks it into small droplets. Many of these grease/soap units self-assemble into a micelle, consisting of a grease droplet surrounded by soap molecules with the polar carboxylate groups facing outward. Because these groups interact with water, the droplet is easily rinsed away.
- 34) Both soaps and emulsifiers work in the same manner, where the hydrophobic portion of the molecule interacts with a non-polar substance and the hydrophilic portion interacts with the aqueous surroundings. The major differences between them are that soaps contain only one non-polar tail group, but emulsifiers have two non-polar tail groups. Also, soaps consist of only one fatty acid chain, where emulsifiers are esters of glycerol and contain two fatty acids and a polar head group linked to the glycerol by an ester linkage.
- 35) B
- 36) C
- 37) C
- 38) D
- 39) D

Answer Key

Testname: UNTITLED1

- 40) B
- 41) D
- 42) E
- 43) C
- 44) E
- 45) B
- 46)

```

OOOOOOOOOOOOOOOO hydrophilic
|| || || || || || || || hydrophobic
|| || || || || || || || hydrophobic
OOOOOOOOOOOOOOOO hydrophilic
    
```

- 47) A
- 48) D
- 49) B
- 50) A
- 51) D
- 52) C
- 53) E
- 54) C
- 55) D
- 56) B
- 57) C
- 58)

	Gradient	Energy	Actual method	Materials
Simple diffusion	With the normal flow	No cost	Random motion	Small non-polar materials
Facilitated diffusion	With the normal flow	No cost	Protein channel	Non-polar materials
Active transport	Against the normal flow	Cost	Transport protein	Usually ions, such as Na <sup>+</sup> , K <sup>+</sup> or H <sup>+</sup>

- 59) C
- 60) E
- 61) E
- 62) E
- 63) A
- 64) E
- 65) F
- 66) G
- 67) D
- 68) H
- 69) B
- 70) C