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

1) Which of the following statements about the atom $^{12}_{6}C$ is FALSE? 1) _____
A) It has 12 neutrons in its nucleus.
B) It has 6 protons in its nucleus.
C) Its atomic weight is 12.
D) It has 6 electrons orbiting the nucleus.
E) Its atomic number is 6.

Table 2.1

$^{16}_{8}O$	$^{12}_{6}C$	$^{1}_{1}H$

2) Using the information in Table 2.1, calculate the molecular weight of ethanol, C_2H_5OH. 2) _____
A) 33
B) 96
C) 46
D) 34
E) The answer cannot be determined.

3) Antacids neutralize acid by the following reaction. Identify the salt in the following equation: 3) _____
$Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + H_2O$
A) H_2O
B) $MgCl_2$
C) HCl
D) $Mg(OH)_2$
E) None of the answers is correct.

4) Which of the following statements is FALSE? 4) _____
A) Water freezes from the top down.
B) Salts readily dissolve in water.
C) Water molecules are formed by hydrolysis.
D) Water is a part of a dehydration synthesis reaction.
E) Water is a polar molecule.

5) Which of the following is the type of bond holding K^+ and I^- ions in KI? 5) _____
A) hydrogen bond B) ionic bond C) covalent bond

6) Which of the following is the type of bond between molecules of water in a beaker of water? 6) _____
A) hydrogen bond B) covalent bond C) ionic bond

7) What is the type of bond holding hydrogen and oxygen atoms in the H_2O molecule? 7) _____
A) hydrogen bond B) ionic bond C) covalent bond

8) Identify the following reaction: Glucose + Fructose → Sucrose + Water 8) _____
A) reversible reaction
B) exchange reaction
C) dehydration synthesis reaction
D) hydrolysis reaction

E) ionic reaction

9) Identify the following reaction: Lactose + H_2O → Glucose + Galactose 9) _____
A) hydrolysis reaction
B) ionic reaction
C) exchange reaction
D) dehydration synthesis reaction
E) reversible reaction

10) Identify the following reaction: $HCl + NaHCO_3 \rightarrow NaCl + H_2CO_3$ 10) _____
A) reversible reaction
B) dehydration synthesis reaction
C) hydrolysis reaction
D) exchange reaction
E) ionic reaction

11) Identify the following reaction: $NH_4OH \rightleftharpoons NH_3 + H_2O$ 11) _____
A) reversible reaction
B) hydrolysis reaction
C) dehydration synthesis reaction
D) exchange reaction
E) ionic reaction

12) Which type of molecule contains the alcohol glycerol? 12) _____
A) protein B) carbohydrate C) DNA D) phospholipids

13) Which type of molecule is composed of (CH_2O) units? 13) _____
A) nucleic acid B) lipid C) protein D) carbohydrate

14) Which type of molecule contains -NH_2 groups? 14) _____
A) nucleic acid B) protein C) triglycerides D) carbohydrate

15) Which type of molecule NEVER contains a phosphate group? 15) _____
A) nucleic acid B) ATP C) triglycerides D) lipid

16) Based upon the valence numbers of the elements magnesium (2) and hydrogen (1), predict how many covalent bonds would form between these atoms to achieve the full complement of electrons in their outermost energy shells. 16) _____
A) one B) two C) three D) four

Table 2.1

$^{16}_{8}O$	$^{12}_{6}C$	$^{1}_{1}H$

17) Using the information in Table 2.1, calculate the number of moles in 92 grams of ethanol, C_2H_5OH. 17) _____
A) 1
B) 2
C) 3
D) 4

E) The answer cannot be determined.

18) Which of the following statements regarding protein structure is FALSE? 18) _____
A) Quaternary structures involved multiple polypeptides.
B) Tertiary structures are formed only from covalent bonds.
C) The primary structure is formed by covalent bonding between amino acid subunits.
D) Secondary structures are formed only from hydrogen bonds.

19) Which of the following pairs is mismatched? 19) _____
A) $NaOH \rightleftharpoons Na^+ + OH^-$ — base
B) $KH_2PO_4 \rightleftharpoons K^+ + H_2PO_4^-$ — acid
C) $HF \rightleftharpoons H^+ + F^-$ — acid
D) $MgSO_4 \rightleftharpoons Mg^{2+} + SO_4^{2-}$ — salt
E) $H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{2-}$ — acid

Table 2.2

$NaOH \rightleftharpoons Na^+ + OH^-$ — base
$HF \rightleftharpoons H^+ + F^-$ — acid
$MgSO_4 \rightleftharpoons Mg^{2+} + SO_4^{2-}$ —
$KH_2PO_4 \rightleftharpoons K^+ H_2PO_4^-$ — a
$H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{2-}$ — sa

20) Which of the following statements about the reactions in Table 2.2 is FALSE? 20) _____
A) They are reversible reactions.
B) They are ionization reactions.
C) They are exchange reactions.
D) They are dissociation reactions.
E) They occur when the reactants are dissolved in water.

21) What is the type of bond between the hydrogen of one molecule and the nitrogen of another molecule? 21) _____
A) covalent bond
B) hydrophobic bond
C) hydrogen bond
D) disulfide bond
E) ionic bond

22) What is the type of bond between carbon, hydrogen, and oxygen atoms in organic molecules? 22) _____
A) ionic bond B) hydrogen bond C) covalent bond

23) What is the type of bond between ions in salt? 23) _____
A) ionic bond B) hydrogen bond C) covalent bond

24) A scientist wants to perform a test that will indicate whether a nucleic acid sample is composed of RNA or DNA. Testing for the presence of which of the following is most appropriate in this situation? 24) _____
A) guanine B) phosphate C) thymine D) uracil E) nitrogen

25) If you viewed one single protein using a microscope, you would observe multiple _____ structures. 25) _____

A) primary
B) tertiary
C) secondary
D) primary and secondary
E) secondary and tertiary

26) Two antiparallel strands of DNA combine to form a double helix. The specific interactions that permit this phenomenon occur by way of _____ bonds between _____. 26) _____
A) hydrogen; deoxyriboses
B) ionic; phosphate groups
C) hydrogen; nitrogenous bases
D) ionic; deoxyriboses
E) ionic; nitrogenous bases

27) Structurally, ATP is most like which type of molecule? 27) _____
A) lipid B) nucleic acid C) protein D) carbohydrate

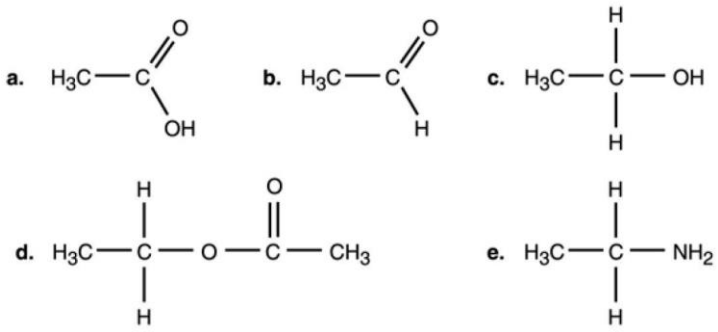
28) What do genes consist of? 28) _____
A) proteins B) lipids C) nucleic acids D) carbohydrates

29) Which molecule is composed of a chain of amino acids? 29) _____
A) protein B) lipid C) carbohydrate D) nucleic acid

30) Which are the primary molecules making up plasma membranes in cells? 30) _____
A) proteins B) lipids C) nucleic acids D) carbohydrates

31) The antimicrobial drug imidazole inhibits sterol synthesis. This would most likely interfere with 31) _____
A) prokaryotic plasma membranes.
B) eukaryotic plasma membranes.
C) fungal cell walls.
D) bacterial cell walls.
E) genes.

Figure 2.1

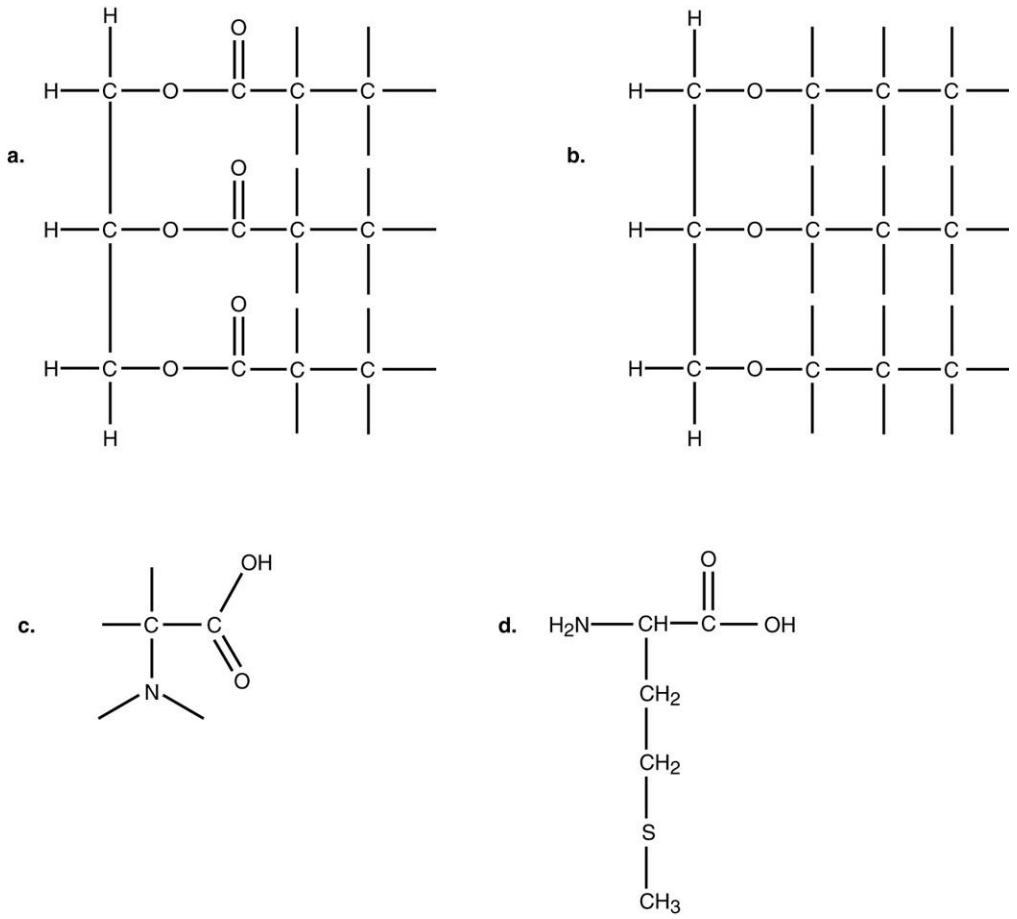


32) In Figure 2.1, which is an alcohol? 32) _____
A) a B) b C) c D) d E) e

33) Which compound in Figure 2.1 is an ester? 33) _____
A) a B) b C) c D) d E) e

34) Which compound in Figure 2.1 is an organic acid? 34) _____
A) a B) b C) c D) d E) e

Figure 2.2



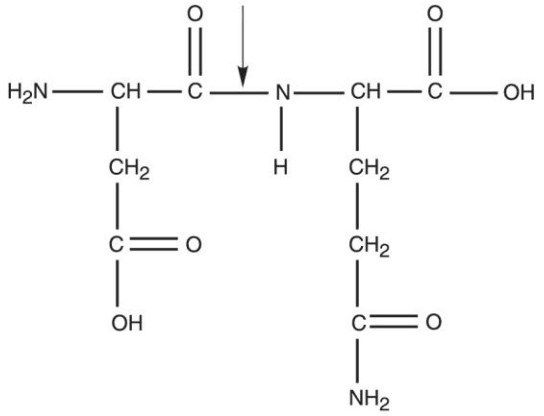
35) Archaea differ from bacteria in the composition of the cell membrane lipids. Archaea have ether-bonded lipids, shown in part _____ of Figure 2.2, and bacteria have ester-bonded lipids, shown in part _____ of Figure 2.2. 35) _____

A) a; d B) c; d C) b; c D) d; c E) b; a

36) Most amino acids found in cells demonstrate what type of chirality? 36) _____

A) B-isomers
B) L-iosmers
C) C-isomers
D) A-isomers
E) D-isomers

Figure 2.3



37) What kind of bond is at the arrow in Figure 2.3? 37) _____
A) ionic bond
B) hydrogen bond
C) double covalent bond
D) disulfide bridge
E) peptide bond

38) An *E. coli* culture that has been growing at 37°C is moved to 25°C. Which of the following changes must be made in its plasma membrane? 38) _____
A) The viscosity must increase.
B) The number of unsaturated chains must increase.
C) The number of phosphate groups must increase.
D) The number of saturated chains must increase.
E) No changes are necessary.

39) Radioisotopes are frequently used to label molecules in a cell. The fate of atoms and molecules in a cell can then be followed. Assume *Saccharomyces cerevisiae* is grown in a nutrient medium containing the radioisotope ^{35}S. After a 48-hour incubation, the ^{35}S would most likely be found in the *S. cerevisiae's* 39) _____
A) proteins.
B) carbohydrates.
C) nucleic acids.
D) lipids.
E) water.

40) Radioisotopes are frequently used to label molecules in a cell. The fate of atoms and molecules in a cell can then be followed. Assume *Saccharomyces cerevisiae* is grown in a nutrient medium containing the radioisotope ^{32}P. After a 48-hour incubation, the majority of the ^{32}P would be found in the *S. cerevisiae's* 40) _____
A) proteins.
B) cell wall.
C) carbohydrates.
D) plasma membrane.
E) water.

41) Starch, dextran, glycogen, and cellulose are polymers of 41) _____
A) glucose.
B) acids.
C) fatty acids.
D) nucleic acids.

E) amino acids.

42) Which of the following is a base? 42) _____
A) C_2H_5OH
B) $NaOH \rightarrow Na^+ + OH^-$
C) $C_2H_5OCOOH \rightarrow H^+ + C_2H_5OCOO^-$
D) H_2CO
E) $H_2O \rightarrow H^+ + OH^-$

43) Two glucose molecules are combined to make a maltose molecule. What is the chemical formula for maltose? 43) _____
A) $C_6H_{12}O_6$
B) $C_{12}H_{23}O_{10}$
C) $C_{12}H_{24}O_{12}$
D) $C_3H_6O_3$
E) $C_{12}H_{22}O_{11}$

44) *Desulfovibrio* bacteria can perform the following reaction: $S^{6-} \rightarrow S^{2-}$. These bacteria are 44) _____
A) synthesizing sulfur.
B) reducing sulfur.
C) oxidizing sulfur.
D) hydrolyzing sulfur.

45) If an amino acid contained a hydrocarbon as its side group, in which of the following categories could it be appropriately designated? 45) _____
A) acidic
B) hydrophilic
C) nonpolar
D) basic
E) polar

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

46) Elements only achieve the full complement of electrons in outermost energy cells by donating or sharing electrons. 46) _____

47) Covalent bonds are always shared equally. 47) _____

48) Individual covalent bonds are stronger than individual ionic bonds. 48) _____

49) All chemical reactions are, in theory, reversible. 49) _____

50) The formation of ADP from ATP can be defined as a hydrolytic reaction. 50) _____

51) The density of liquid water is greater than the density of ice. 51) _____

52) A basic solution is expected to contain more hydrogen ions than hydroxyl ions. 52) _____

53) All forms of life function optimally at a pH of 7. 53) _____

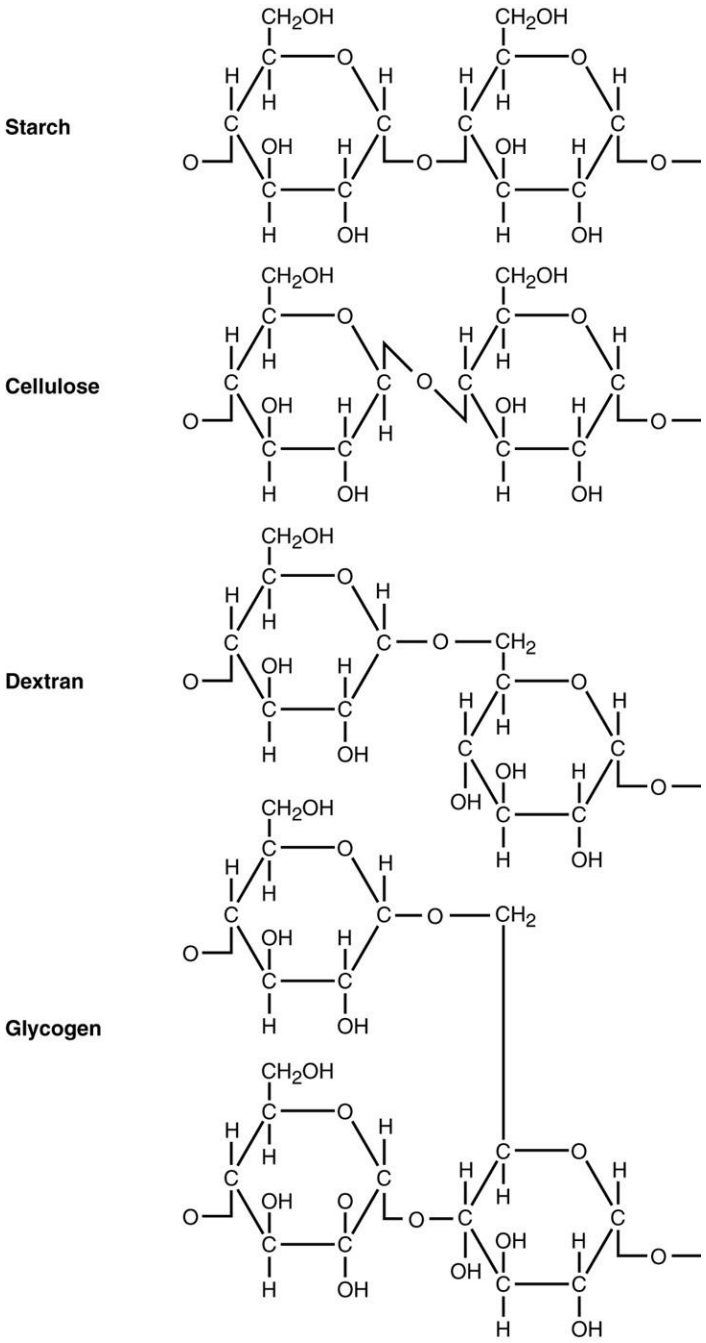
54) There are some forms of life on Earth that can survive without water. 54) _____

55) Any compound that contains carbon is only considered to be organic. 55) _____

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

56) Describe how the properties of phospholipids make these molecules well suited for plasma membranes.

Figure 2.5



57) Use Figure 2.5 to answer the following. Starch, cellulose, dextran, and glycogen are polysaccharides. How are they similar? To what are their different properties due? Why can't an enzyme that hydrolyzes starch degrade cellulose?

58) Compare a molecule of a nucleotide to ATP. Could a cell simply insert ATP into DNA without altering it? Explain.

59) A scientist claims that when a protein is denatured, it can be expected that its secondary structure will more likely be retained when compared to all other levels of protein structure structures. Do you agree? Explain.

60) A bacterium that grows at a temperature of 37°C transports both glucose and NaCl into its cytoplasm. Which is most easily dissolved in the cytoplasm? Explain how the bonds of these molecules impact disassociation rate.

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

52) FALSE
53) FALSE
54) FALSE
55) FALSE
56)
57)
58)
59)
60)