

AP Biology Chapter 2 assessment**Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- _____ 1. Which of the following statements correctly describes any chemical reaction that has reached equilibrium?
- The concentrations of products and reactants are equal.
 - The reaction is now irreversible.
 - Both forward and reverse reactions have halted.
 - The rates of the forward and reverse reactions are equal.
 - No reactants remain.
- _____ 2. We can be sure that a mole of table sugar and a mole of vitamin C are equal in their
- mass in daltons.
 - mass in grams.
 - volume.
 - number of atoms.
 - number of molecules.
- _____ 3. What coefficients must be placed in the following blanks so that all atoms are accounted for in the products?
- $$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow \text{ ______ } \text{C}_2\text{H}_6\text{O} + \text{ ______ } \text{CO}_2$$
- 1; 2
 - 3; 1
 - 1; 3
 - 1; 1
 - 2; 2
- _____ 4. Which of the following statements is *false*?
- Carbon, hydrogen, oxygen, and nitrogen are the most abundant elements of living matter.
 - Some naturally occurring elements are toxic to organisms.
 - All organisms require the same elements in the same quantities.
 - Iron is an example of an element needed by all organisms.
 - Approximately one-quarter of the natural elements are essential elements.
- _____ 5. Why is each element unique and different from other elements with respect to its chemical properties?
- Each element has a unique atomic mass.
 - Each element has a unique atomic number.
 - Each element has a unique number of protons.
 - Each element has a unique number of neutrons.
 - Each element has different radioactive properties.

- _____ 6. Knowing just the atomic mass of an element allows inferences about which of the following?
- the number of electrons in the element
 - the number of protons in the element
 - the number of neutrons in the element
 - the number of protons plus neutrons in the element
 - the number of protons plus electrons in the element
- _____ 7. In what way are elements in the same column of the periodic table the same?
- They have the same number of protons.
 - They have the same number of neutrons.
 - They have the same number of electrons.
 - They have the same number of electrons in their valence shell.
 - They have the same number of electron shells.
- _____ 8. The nucleus of a nitrogen atom contains 7 neutrons and 7 protons. Which of the following is a correct statement concerning nitrogen?
- The nitrogen atom has a mass number of approximately 7 and an atomic number of 14.
 - The nitrogen atom has a mass number of approximately 14 and an atomic number of 7.
 - The nitrogen atom has a mass number of approximately 14 and an atomic number of 14.
 - The nitrogen atom has a mass number of approximately 7 and an atomic number of 21.
 - The nitrogen atom has a mass number of approximately 14 and an atomic number of 21.
- _____ 9. One difference between carbon-12 ($^{12}_6\text{C}$) and carbon-14 ($^{14}_6\text{C}$) is that carbon-14 has
- two more protons than carbon-12.
 - two more electrons than carbon-12.
 - two more neutrons than carbon-12.
 - two more protons and two more neutrons than carbon-12.
 - two more electrons and two more neutrons than carbon-12.
- _____ 10. An atom has 6 electrons in its outer shell. How many unpaired electrons does it have?
- 0
 - 2
 - 4
 - 6
 - 2 or 4

- ___ 11. Electrons exist only at fixed levels of potential energy. However, if an atom absorbs sufficient energy, a possible result is that
- an electron may move to an electron shell farther away from the nucleus.
 - an electron may move to an electron shell closer to the nucleus.
 - the atom may become a radioactive isotope.
 - the atom would become a positively charged ion, or cation, and become a radioactive isotope.
 - the atom would become a negatively charged ion, or anion.
- ___ 12. From its atomic number of 15, it is possible to predict that the phosphorus atom has
- 15 neutrons.
 - 15 protons.
 - 15 electrons.
 - 8 electrons in its outermost electron shell.
 - 15 protons and 15 electrons.
- ___ 13. Fluorine has an atomic number of 9 and a mass number of 19. How many electrons are needed to complete the valence shell of a fluorine atom?
- 1
 - 3
 - 0
 - 7
 - 9
- ___ 14. An atom with atomic number 12 would have what type of chemical behavior in bonding with other elements?
- It would form ions with a +1 charge.
 - It would form ions with a +2 charge.
 - It would form ions with a -1 charge.
 - It would form ions with a -2 charge.
 - It would form two covalent bonds with other atoms.
- ___ 15. A covalent chemical bond is one in which
- electrons are removed from one atom and transferred to another atom so that the two atoms become oppositely charged.
 - protons and neutrons are shared by two atoms so as to satisfy the requirements of both atoms.
 - outer-shell electrons of two atoms are shared so as to satisfactorily fill the outer electron shells of both atoms.
 - outer-shell electrons of one atom are transferred to fill the inner electron shell of another atom.
 - an electron occupies a hybrid orbital located between the nuclei of two atoms.

- ___ 16. What is the maximum number of covalent bonds an element with atomic number 8 can make with hydrogen?
- 1
 - 2
 - 3
 - 4
 - 6
- ___ 17. When two atoms are equally electronegative, they will interact to form
- hydrogen bonds.
 - van der Waals interactions.
 - polar covalent bonds.
 - nonpolar covalent bonds.
 - ionic bonds.
- ___ 18. What results from an unequal sharing of electrons between atoms?
- a nonpolar covalent bond
 - a polar covalent bond
 - an ionic bond
 - radioactive decay
 - a hydrophobic interaction
- ___ 19. A covalent bond is likely to be polar when
- one of the atoms sharing electrons is much more electronegative than the other atom.
 - the two atoms sharing electrons are equally electronegative.
 - oxygen is one of the two atoms sharing electrons.
 - one of the atoms has absorbed more energy than the other atom.
 - the two atoms sharing electrons are different elements.
- ___ 20. What is the difference between covalent bonds and ionic bonds?
- Covalent bonds are formed between atoms to form molecules; ionic bonds are formed between atoms to form compounds.
 - Covalent bonds involve the sharing of pairs of electrons between atoms; ionic bonds involve the sharing of single electrons between atoms.
 - Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the electrical attraction between atoms.
 - Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the sharing of protons between atoms.
 - Covalent bonds involve the transfer of electrons between atoms; ionic bonds involve the sharing of electrons between atoms.

- _____ 21. Which of the following would be regarded as compounds?
- H₂O, O₂, and CH₄
 - H₂O and O₂
 - O₂ and CH₄
 - CH₄ and O₂, but not H₂O
 - H₂O and CH₄, but not O₂
- _____ 22. What is the maximum number of hydrogen atoms that can be covalently bonded in a molecule containing two carbon atoms?
- 2
 - 3
 - 4
 - 6
 - 8
- _____ 23. Which of the following is true for this reaction?
- $$3 \text{H}_2 + \text{N}_2 \leftrightarrow 2 \text{NH}_3$$
- The reaction is nonreversible.
 - Hydrogen and nitrogen are the reactants of the reverse reaction.
 - Hydrogen and nitrogen are the products of the forward reaction.
 - Ammonia is being formed and decomposed.
 - Hydrogen and nitrogen are being decomposed.
- _____ 24. Which of the following correctly describes any reaction that has reached chemical equilibrium?
- The concentration of the reactants equals the concentration of the products.
 - The rate of the forward reaction is equal to the rate of the reverse reaction.
 - All of the reactants have been converted to the products of the reaction.
 - All of the products have been converted to the reactants of the reaction.
 - Both the forward and the reverse reactions have stopped with no net effect on the concentration of the reactants and the products.
- _____ 25. Which of the following explains most specifically the attraction of water molecules to one another?
- nonpolar covalent bond
 - polar covalent bond
 - ionic bond
 - hydrogen bond
 - hydrophobic interaction

- _____ 26. If a salamander relied on hydrogen bonds to cling to surfaces, what type of surface would cause the most problems for this animal?
- a surface coated with a thin film of water
 - a surface made with carbon and hydrogen atoms covalently bonded together
 - a surface made with carbon, hydrogen, and oxygen atoms covalently bonded together
 - a surface made with carbon, hydrogen, nitrogen, and oxygen atoms covalently bonded together
 - a surface made with silicon and oxygen atoms covalently bonded together
- _____ 27. In a single molecule of water, two hydrogen atoms are bonded to a single oxygen atom by
- hydrogen bonds.
 - nonpolar covalent bonds.
 - polar covalent bonds.
 - ionic bonds.
 - van der Waals interactions.
- _____ 28. Hydrophobic substances such as vegetable oil are
- nonpolar substances that repel water molecules.
 - nonpolar substances that have an attraction for water molecules.
 - polar substances that repel water molecules.
 - polar substances that have an affinity for water.
 - charged molecules that hydrogen-bond with water molecules.
- _____ 29. Which of the following ionizes completely in solution and is considered to be a strong base (alkali)?
- NaCl
 - HCl
 - NH₃
 - H₂CO₃
 - NaOH
- _____ 30. Buffers are substances that help resist shifts in pH by
- releasing H⁺ to a solution when acids are added.
 - donating H⁺ to a solution when bases are added.
 - releasing OH⁻ to a solution when bases are added.
 - accepting H⁺ from a solution when acids are added.
 - both donating H⁺ to a solution when bases are added and accepting H⁺ when acids are added.

- ___ 31. Consider two solutions: solution X has a pH of 4; solution Y has a pH of 7. From this information, we can reasonably conclude that
- solution Y has no free hydrogen ions (H^+).
 - the concentration of hydrogen ions in solution X is 30 times as great as the concentration of hydrogen ions in solution Y.
 - the concentration of hydrogen ions in solution Y is 1,000 times as great as the concentration of hydrogen ions in solution X.
 - the concentration of hydrogen ions in solution X is 3 times as great as the concentration of hydrogen ions in solution Y.
 - the concentration of hydrogen ions in solution X is 1,000 times as great as the concentration of hydrogen ions in solution Y.
- ___ 32. If a solution has a pH of 7, this means that
- there are no H^+ ions in the water.
 - this is a solution of pure water.
 - the concentration of H^+ ions in the water equals the concentration of OH^- ions in the water.
 - this is a solution of pure water, and the concentration of H^+ ions in the water is $10^{-7} M$.
 - this is a solution of pure water, and the concentration of H^+ ions equals the concentration of OH^- ions in the water.
- ___ 33. Increased atmospheric CO_2 concentrations might have what effect on seawater?
- Seawater will become more acidic, and bicarbonate concentrations will decrease.
 - Seawater will become more alkaline, and carbonate concentrations will decrease.
 - There will be no change in the pH of seawater, because carbonate will turn to bicarbonate.
 - Seawater will become more acidic, and carbonate concentrations will decrease.
 - Seawater will become more acidic, and carbonate concentrations will increase.
- ___ 34. How would acidification of seawater affect marine organisms?
- Acidification would increase dissolved carbonate concentrations and promote faster growth of corals and shell-building animals.
 - Acidification would decrease dissolved carbonate concentrations and promote faster growth of corals and shell-building animals.
 - Acidification would increase dissolved carbonate concentrations and hinder growth of corals and shell-building animals.
 - Acidification would decrease dissolved carbonate concentrations and hinder growth of corals and shell-building animals.
 - Acidification would increase dissolved bicarbonate concentrations, and cause increased calcification of corals and shellfish.

- _____ 35. If the cytoplasm of a cell is at pH 7, and the mitochondrial matrix is at pH 8, this means that
- the concentration of H^+ ions is tenfold higher in the cytoplasm than in the mitochondrial matrix.
 - the concentration of H^+ ions is tenfold higher in the mitochondrial matrix than in the cytoplasm.
 - the concentration of H^+ ions in the cytoplasm is $7/8$ the concentration in the mitochondrial matrix.
 - the mitochondrial matrix is more acidic than the cytoplasm.
 - the concentration of H^+ ions in the cytoplasm is $8/7$ the concentration in the mitochondrial matrix.

Atom 1	Atom 2
1_1H	3_1H

Figure 2.1

- _____ 36. Which of the following best describes the relationship between the atoms described in Figure 2.1?
- They are isomers.
 - They are polymers.
 - They are isotopes.
 - They contain 1 and 3 protons, respectively.
 - They each contain 1 neutron.

First shell	Hydrogen ${}^1_1\text{H}$	<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> ${}^4_{2}\text{He}$ </div> <div style="margin-right: 10px;"> Atomic number Element symbol Mass number </div> <div style="margin-right: 10px;"> Helium ${}^4_2\text{He}$ </div> <div style="margin-left: 10px;"> Electron distribution diagram </div> </div>						Helium ${}^4_2\text{He}$
Second shell	Lithium ${}^7_3\text{Li}$	Beryllium ${}^9_4\text{Be}$	Boron ${}^{11}_5\text{B}$	Carbon ${}^{12}_6\text{C}$	Nitrogen ${}^{14}_7\text{N}$	Oxygen ${}^{16}_8\text{O}$	Fluorine ${}^{19}_9\text{F}$	Neon ${}^{20}_{10}\text{Ne}$
Third shell	Sodium ${}^{23}_{11}\text{Na}$	Magnesium ${}^{24}_{12}\text{Mg}$	Aluminum ${}^{27}_{13}\text{Al}$	Silicon ${}^{28}_{14}\text{Si}$	Phosphorus ${}^{31}_{15}\text{P}$	Sulfur ${}^{32}_{16}\text{S}$	Chlorine ${}^{35}_{17}\text{Cl}$	Argon ${}^{40}_{18}\text{Ar}$

Figure 2.2

37. Refer to Figure 2.2 (first three rows of the periodic table). If life arose on a planet where carbon is absent, which element might fill the role of carbon?
- boron
 - silicon
 - nitrogen
 - aluminum
 - phosphorus

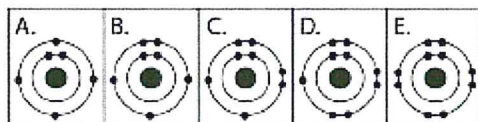


Figure 2.3

38. Which drawing in Figure 2.3 depicts the electron configuration of an element with chemical properties most similar to those of helium (${}^4_2\text{He}$)?
- A
 - B
 - C
 - D
 - E

- ___ 39. Which drawing in Figure 2.3 depicts the electron configuration of an atom that can form covalent bonds with two hydrogen atoms?
- A
 - B
 - C
 - D
 - E

- ___ 40. Which drawing in Figure 2.3 depicts an atom with a valence of 2?
- A
 - B
 - C
 - D
 - E

Atomic mass →	12 C	16 O	1 H	14 N	32 S	31 P
Atomic number →	6	8	1	7	16	15

Figure 2.4

- ___ 41. In Figure 2.4, how many electrons does nitrogen have in its valence shell?
- 2
 - 5
 - 7
 - 8
 - 14
- ___ 42. How many neutrons are present in the nucleus of a phosphorus-32 (^{32}P) atom (see Figure 2.4)?
- 5
 - 15
 - 16
 - 17
 - 32
- ___ 43. How many electrons does an atom of sulfur have in its valence shell (see Figure 2.4)?
- 4
 - 6
 - 8
 - 16
 - 32

- ___ 44. Based on electron configuration, which of these elements in Figure 2.4 would exhibit a chemical behavior most like that of oxygen?
- carbon
 - hydrogen
 - nitrogen
 - sulfur
 - phosphorus

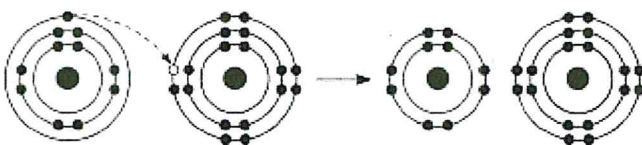


Figure 2.6

- ___ 45. What results from the chemical reaction illustrated in Figure 2.6?
- a cation with a net charge of +1
 - a cation with a net charge of -1
 - an anion with a net charge of +1
 - an anion with a net charge of -1
 - a cation with a net charge of +1 and an anion with a net charge of -1
- ___ 46. What is the atomic number of the cation formed in the reaction illustrated in Figure 2.6?
- 1
 - 8
 - 10
 - 11
 - 16

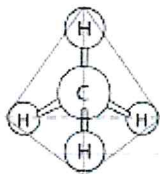
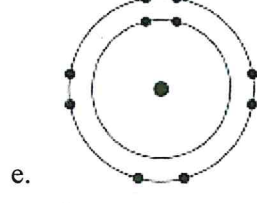
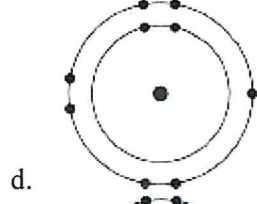
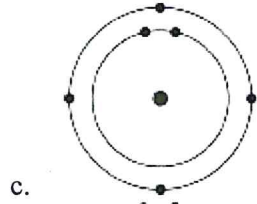
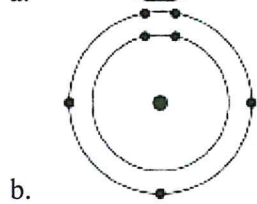
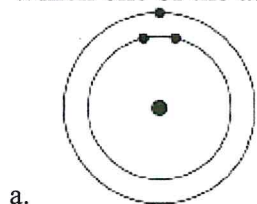
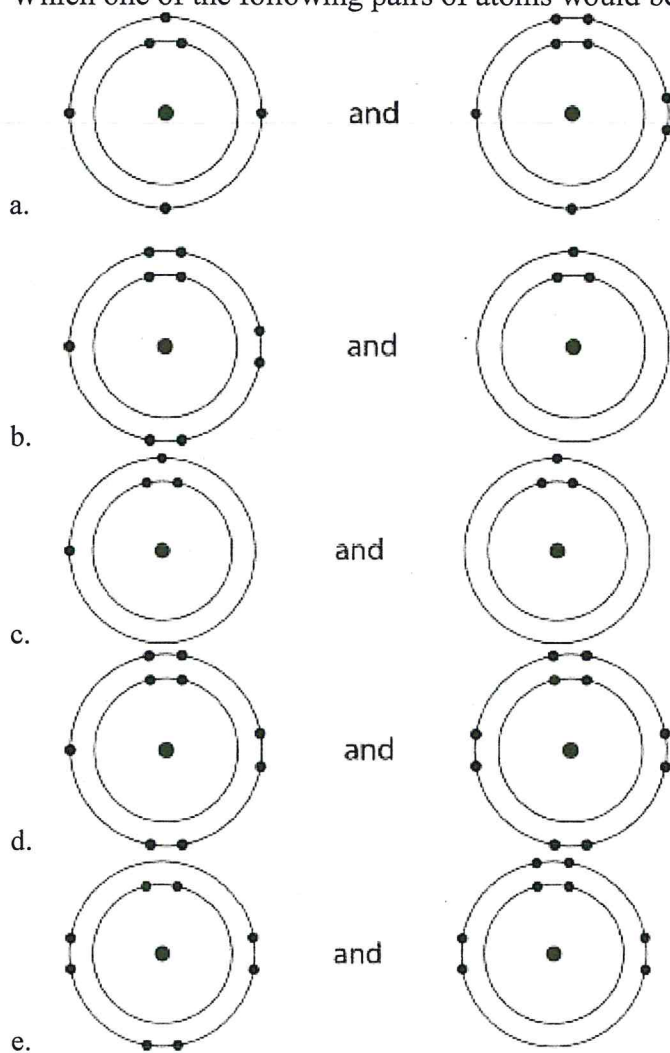


Figure 2.8

47. Which one of the atoms shown would be most likely to form an anion with a charge of -1?



48. Which one of the following pairs of atoms would be most likely to form ions and thus an ionic bond?



AP Biology Chapter 2 assessment Answer Section

MULTIPLE CHOICE

- | | | | |
|-----|------------------------|------------------|-------------------------------|
| 1. | ANS: D | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: No L.O. Specified | | TOP: End-of-Chapter Questions |
| 2. | ANS: E | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: No L.O. Specified | | TOP: End-of-Chapter Questions |
| 3. | ANS: E | PTS: 1 | REF: Application/Analysis |
| | OBJ: No L.O. Specified | | TOP: End-of-Chapter Questions |
| 4. | ANS: C | PTS: 1 | REF: Application/Analysis |
| | OBJ: 2.1 | TOP: Concept 2.1 | |
| 5. | ANS: C | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 6. | ANS: D | PTS: 1 | REF: Application/Analysis |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 7. | ANS: D | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 8. | ANS: B | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 9. | ANS: C | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 10. | ANS: B | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 11. | ANS: A | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 12. | ANS: E | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 13. | ANS: A | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.2 | TOP: Concept 2.2 | |
| 14. | ANS: B | PTS: 1 | REF: Application/Analysis |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 15. | ANS: C | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 16. | ANS: B | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 17. | ANS: D | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 18. | ANS: B | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 19. | ANS: A | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |
| 20. | ANS: C | PTS: 1 | REF: Knowledge/Comprehension |
| | OBJ: 2.3 | TOP: Concept 2.3 | |

21.	ANS: E OBJ: 2.3	PTS: 1 TOP: Concept 2.3	REF: Application/Analysis
22.	ANS: D OBJ: 2.3	PTS: 1 TOP: Concept 2.3	REF: Application/Analysis
23.	ANS: D OBJ: 2.4	PTS: 1 TOP: Concept 2.4	REF: Knowledge/Comprehension
24.	ANS: B OBJ: 2.4	PTS: 1 TOP: Concept 2.4	REF: Knowledge/Comprehension
25.	ANS: D OBJ: 2.3 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
26.	ANS: B OBJ: 2.3 2.5	PTS: 1 TOP: Concept 2.5	REF: Synthesis/Evaluation
27.	ANS: C OBJ: 2.3 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
28.	ANS: A OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
29.	ANS: E OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
30.	ANS: E OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
31.	ANS: E OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Application/Analysis
32.	ANS: C OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
33.	ANS: D OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
34.	ANS: D OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Knowledge/Comprehension
35.	ANS: A OBJ: 2.5	PTS: 1 TOP: Concept 2.5	REF: Application/Analysis
36.	ANS: C OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Knowledge/Comprehension
37.	ANS: B OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Synthesis/Evaluation
38.	ANS: E OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Application/Analysis
39.	ANS: C OBJ: 2.3	PTS: 1 TOP: Concept 2.3	REF: Application/Analysis
40.	ANS: C OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Knowledge/Comprehension
41.	ANS: B OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Knowledge/Comprehension
42.	ANS: D OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Knowledge/Comprehension
43.	ANS: B OBJ: 2.2	PTS: 1 TOP: Concept 2.2	REF: Knowledge/Comprehension

44. ANS: D	PTS: 1	REF: Application/Analysis
OBJ: 2.2	TOP: Concept 2.2	
45. ANS: E	PTS: 1	REF: Knowledge/Comprehension
OBJ: 2.3	TOP: Concept 2.3	
46. ANS: D	PTS: 1	REF: Application/Analysis
OBJ: 2.3	TOP: Concept 2.3	
47. ANS: D	PTS: 1	REF: Application/Analysis
OBJ: 2.3	TOP: Concept 2.3	
48. ANS: B	PTS: 1	REF: Application/Analysis
OBJ: 2.3	TOP: Concept 2.3	