Campbell Biology in Focus 2nd edition Urry Test Bank

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Campbell Biology in Focus, 2e **(Urry)**
Chapter 2 The Chemical Context of Life

2.1 Multiple-Choice Questions

1) About 20-25% of the 92 natural elements are known to be essential to life. Which four of these elements make up approximately 96% of living matter?
A) carbon, sodium, hydrogen, nitrogen
B) carbon, oxygen, phosphorus, hydrogen
C) oxygen, hydrogen, calcium, nitrogen
D) carbon, hydrogen, nitrogen, oxygen
E) carbon, oxygen, nitrogen, calcium
Answer: D
Topic: Concept 2.1
Skill: Knowledge/Comprehension
Learning Outcome: 2.1

2) Trace elements are those required by an organism in only minute quantities. Which of the following is a trace element that is required by humans and other vertebrates?
A) nitrogen
B) calcium
C) iodine
D) sodium
E) phosphorus
Answer: C
Topic: Concept 2.1
Skill: Knowledge/Comprehension
Learning Outcome: 2.1

3) Trace elements are those required by an organism in only minute quantities. Which of the following is a trace element that is required by all organisms?
A) iron
B) calcium
C) iodine
D) sodium
E) potassium
Answer: A
Topic: Concept 2.1
Skill: Knowledge/Comprehension
Learning Outcome: 2.1

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4) Which of the following is primarily responsible for the unique chemical properties of each element?
A) Each element has a unique atomic mass.
B) Each element has a unique atomic number.
C) Each element has a unique number of protons.
D) Each element has a unique number of neutrons.
E) Each element has unique radioactive properties.
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

5) From the atomic mass, one can deduce the number of _____ in each atom of an element.
A) protons
B) neutrons
C) electrons
D) protons plus electrons
E) protons plus neutrons
Answer: E
Topic: Concept 2.2
Skill: Application/Analysis
Learning Outcome: 2.2

6) In what way are elements in the same column of the periodic table the same?
A) They have the same number of protons.
B) They have the same number of neutrons.
C) They have the same number of electrons.
D) They have the same number of electrons in their valence shell.
E) They have the same number of electron shells.
Answer: D
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

7) In what way are elements in the same row of the periodic table the same?
A) They have the same number of protons.
B) They have the same number of neutrons.
C) They have the same number of electrons.
D) They have the same number of electrons in their valence shell.
E) They have the same number of electron shells.
Answer: E
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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8) The nucleus of a nitrogen atom contains 7 neutrons and 7 protons. Which of the following is a correct statement concerning nitrogen?
A) The nitrogen atom has a mass number of 7 and an atomic number of 14.
B) The nitrogen atom has a mass number of 14 and an atomic number of 7.
C) The nitrogen atom has a mass number of 14 and an atomic number of 14.
D) The nitrogen atom has a mass number of 7 and an atomic number of 21.
E) The nitrogen atom has a mass number of 14 and an atomic number of 21.
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

9) For elements in the first three rows of the periodic table, the position of an element in the row indicates which of the following?
A) the total number of electrons in the element
B) the total number of protons in the element
C) the total number of neutrons in the element
D) the number of electron orbitals in the element
E) the number of electrons in the valence shell
Answer: E
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

10) The chemical behavior of an atom depends primarily upon which of the following?
A) the number of neutrons in the nucleus
B) the number of protons in the nucleus
C) the number of electrons in the valence shell
D) the total number of electrons contained by the atom
E) the number of electron shells contained by the atom
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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11) Molybdenum has an atomic number of 42. Several common isotopes exist, with mass numbers of 92, 94, 95, 96, 97, 98, and 100. Therefore, which of the following is true?
A) Molybdenum atoms can have between 50 and 58 neutrons.
B) The isotopes of molybdenum have different electron configurations.
C) The isotopes of molybdenum can have between 50 and 58 protons.
D) The isotopes of molybdenum have between 50 and 58 neutrons and have different electron configurations.
E) The isotopes of molybdenum have between 50 and 58 protons and have different electron configurations.
Answer: A
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

12) One difference between carbon-12 ($^{12}_{6}$C) and carbon-14 ($^{14}_{6}$C) is that carbon-14 has

A) two more protons than carbon-12.
B) two more electrons than carbon-12.
C) two more neutrons than carbon-12.
D) two more protons and two more neutrons than carbon-12.
E) two more electrons and two more protons than carbon-12.
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

13) An atom has 6 electrons in its outer shell. How many unpaired electrons does it have?
A) 0
B) 2
C) 4
D) 6
E) 2 or 4
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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14) The atomic number of nitrogen is 7. Nitrogen-15 is heavier than nitrogen-14 because the atomic nucleus of nitrogen-15 contains how many neutrons?
A) 6
B) 7
C) 8
D) 12
E) 14
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

15) Argon has atomic number 18. Which of the following statements about argon is true?
A) It has 10 electrons in its outer electron shell.
B) It is inert.
C) It has an atomic mass of 18 daltons.
D) It has six valence electrons.
E) It resides in the first column of the periodic table.
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

16) The atomic number of sulfur is 16, which indicates that a sulfur atom contains
A) 16 neutrons.
B) 16 protons.
C) 16 protons and 16 neutrons.
D) 8 electrons in its outermost electron shell.
E) 8 protons and 8 neutrons.
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

17) The atomic number of each atom is given to the left of each of the following elements. Which of the atoms has the same valence as carbon ($^{12}_{6}$C)?

A) $_{7}$N nitrogen
B) $_{9}$F fluorine
C) $_{10}$Ne neon
D) $_{12}$Mg magnesium
E) $_{14}$Si silicon
Answer: E
Topic: Concept 2.2
Skill: Application/Analysis
Learning Outcome: 2.2

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18) Two atoms that have the same mass number must have the same
A) atomic number.
B) number of electrons.
C) protons.
D) number of protons + neutrons.
E) chemical properties.
Answer: D
Topic: Concept 2.2
Skill: Evaluation/Synthesis
Learning Outcome: 2.2

19) Phosphorus-32, a radioactive isotope of phosphorus-31 (atomic number 15), undergoes a form of radioactive decay whereby a neutron turns into a proton, which is retained in the nucleus, and emits radiation in the form of an electron. What is the product of such radioactive decay of phosphorus-32?
A) phosphorus-31
B) a positively charged phosphorus-31 ion
C) a negatively charged phosphorus-32 ion
D) sulfur-32 (atomic number 16)
E) the conversion of the phosphorus-32 atom into pure energy
Answer: D
Topic: Concept 2.2
Skill: Application/Analysis
Learning Outcome: 2.2

20) 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?
A) 1
B) 3
C) 0
D) 7
E) 9
Answer: A
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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21) Oxygen has an atomic number of 8 and a mass number of 16. What is the atomic mass of an oxygen atom?
A) approximately 8 grams
B) approximately 8 daltons
C) approximately 16 grams
D) approximately 16 daltons
E) approximately 24 grams
Answer: D
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

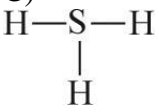
22) An atom with atomic number 12 would have what type of chemical behavior in bonding with other elements?
A) It would form ions with a +1 charge.
B) It would form ions with a +2 charge.
C) It would form ions with a -1 charge.
D) It would form ions with a -2 charge.
E) It would form two covalent bonds with other atoms.
Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

23) A covalent chemical bond is one in which
A) electrons are removed from one atom and transferred to another atom so that the two atoms become oppositely charged.
B) protons and neutrons are shared by two atoms so as to satisfy the requirements of both atoms.
C) outer-shell electrons of two atoms are shared so as to occupy the outer electron shells of both atoms.
D) outer-shell electrons of one atom are transferred to fill the inner electron shell of another atom.
E) an electron from a full outer electron shell of one atom is shared so as to occupy the outer electron shell of both atoms.
Answer: C
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

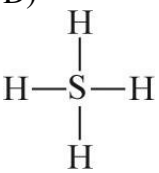
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24) If an atom of sulfur (atomic number 16) were allowed to react with atoms of hydrogen (atomic number 1), which of the following molecules would be formed?
A) S—H
B) H—S—H
C)



D)



E) H = S = H
Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

25) What is the maximum number of covalent bonds an element with atomic number 8 can make with hydrogen?
A) 1
B) 2
C) 3
D) 4
E) 6
Answer: B
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

26) Sulfur (atomic number 16) will have chemical properties most similar to
A) carbon (atomic number 6).
B) nitrogen (atomic number 7).
C) oxygen (atomic number 8).
D) phosphorous (atomic number 15).
E) chlorine (atomic number 17).
Answer: C
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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27) Nitrogen (N) is much more electronegative than hydrogen (H). Which of the following statements about the atoms in ammonia (NH_3) is correct?
A) Each hydrogen atom has a partial positive charge; the nitrogen atom has a partial negative charge.
B) The nitrogen atom has a full positive charge; each hydrogen atom has a full positive charge.
C) Each hydrogen atom has a partial negative charge; the nitrogen atom has a full positive charge.
D) The nitrogen atom has a partial positive charge; each hydrogen atom has a partial negative charge.
E) There are nonpolar covalent bonds between the hydrogen atoms and polar covalent bonds between each hydrogen atom and the nitrogen atom.
Answer: A
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

28) When two atoms are equally electronegative, they will interact to form
A) hydrogen bonds.
B) van der Waals interactions.
C) polar covalent bonds.
D) nonpolar covalent bonds.
E) ionic bonds.
Answer: D
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

29) What results from an unequal sharing of electrons between atoms?
A) a nonpolar covalent bond
B) a polar covalent bond
C) an ionic bond
D) a hydrophobic interaction
Answer: B
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

30) A covalent bond is likely to be polar when
A) one of the atoms sharing electrons is much more electronegative than the other atom.
B) the two atoms sharing electrons are equally electronegative.
C) oxygen is one of the two atoms sharing electrons.
D) the two atoms sharing electrons are the same element.
E) the two atoms sharing electrons are different elements.
Answer: A
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

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31) Which of the following molecules contains the most polar covalent bond?
A) H_2
B) O_2
C) CO_2
D) H_2O
E) CH_4
Answer: D
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

32) What is the difference between covalent bonds and ionic bonds?
A) Covalent bonds are formed between atoms to form molecules; ionic bonds are formed between atoms to form compounds.
B) Covalent bonds involve the sharing of pairs of electrons between atoms; ionic bonds involve the sharing of single electrons between atoms.
C) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the electrical attraction between atoms.
D) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the sharing of protons between atoms.
E) Covalent bonds involve the transfer of electrons between atoms; ionic bonds involve the sharing of electrons between atoms.
Answer: C
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

33) A covalent bond is formed by
A) sharing of a pair of electrons between two atoms.
B) sharing of a single electron between two atoms.
C) sharing of a pair of protons between two atoms.
D) transfer of an electron from one atom to another.
E) transfer of a proton from one atom to another.
Answer: A
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

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34) An ionic bond is formed by
A) sharing of a pair of electrons between two atoms.
B) sharing of a single electron between two atoms.
C) sharing of a pair of protons between two atoms.
D) transfer of an electron from one atom to another.
E) transfer of a proton from one atom to another.
Answer: D
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

35) The most stable interaction between magnesium (atomic number 12) and chlorine (atomic number 17) forms
A) MgCl, in which atoms are joined by covalent bonds.
B) MgCl, in which atoms are joined by ionic bonds.
C) Mg_2Cl, in which atoms are joined by ionic bonds.
D) $MgCl_2$, in which atoms are joined by covalent bonds.
E) $MgCl_2$, in which atoms are joined by ionic bonds.
Answer: E
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

36) In ammonium chloride salt (NH_4Cl), the anion is a single chloride ion, Cl. What is the cation of NH_4Cl?
A) N, with a charge of +1
B) NH, with a charge of +1
C) H_3, with a charge of +1
D) NH_4, with a charge of +1
E) NH_4, with a charge of +4
Answer: D
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

37) The atomic number of chlorine is 17. The atomic number of calcium is 20. What is the chemical formula for calcium chloride?
A) CaCl
B) $CaCl_2$
C) Ca_2Cl
D) Ca_2Cl_2
E) $CaCl_3$
Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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38) How many electron pairs are shared between carbon atoms in a molecule that has the formula C_2H_4?
A) 0
B) 1
C) 2
D) 3
E) 4
Answer: C
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

39) How many electron pairs are shared between carbon atoms in a molecule that has the formula C_2H_6?
A) 0
B) 1
C) 2
D) 3
E) 4
Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

40) Which bond or interaction would be most difficult to disrupt when compounds are put into water?
A) covalent bond
B) hydrogen bond
C) van der Waals interaction
D) ionic bond
Answer: A
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

41) What type of bonding or interaction is most likely to occur among a broad array of molecules with various physical properties (polar, nonpolar, hydrophilic, hydrophobic)?
A) covalent bonding
B) polar covalent bonding
C) ionic bonding
D) hydrogen bonding
E) van der Waals interactions
Answer: E
Topic: Concept 2.3
Skill: Evaluation/Synthesis
Learning Outcome: 2.3

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42) Which of the following are the strongest molecular interactions?
A) van der Waals interactions
B) van der Waals interactions in a nonpolar environment
C) ionic bonds in an aqueous environment
D) covalent bonds
E) hydrogen bonds
Answer: D
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

43) Which of the following are considered compounds?
A) H_2O, O_2, and CH_4
B) H_2O and O_2
C) O_2 and CH_4
D) CH_4 and O_2, but not H_2O
E) H_2O and CH_4, but not O_2
Answer: E
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

44) What is the maximum number of hydrogen atoms that can be covalently bonded in a molecule containing two carbon atoms?
A) 2
B) 3
C) 4
D) 6
E) 8
Answer: D
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

45) Which of the following correctly describes chemical equilibrium?
A) Forward and reverse reactions continue with no effect on the concentrations of the reactants and products.
B) The concentrations of the products are higher than the concentrations of the reactants.
C) Forward and reverse reactions have stopped so that the concentrations of the reactants and products remain constant.
D) Reactions stop only when all reactants have been converted to products.
Answer: A
Topic: Concept 2.4
Skill: Knowledge/Comprehension
Learning Outcome: 2.4

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46) Which of the following correctly describes any reaction that has reached chemical equilibrium?
A) The concentration of the reactants equals the concentration of the products.
B) The rate of the forward reaction is equal to the rate of the reverse reaction.
C) All of the reactants have been converted to the products of the reaction.
D) All of the products have been converted to the reactants of the reaction.
Answer: B
Topic: Concept 2.4
Skill: Knowledge/Comprehension
Learning Outcome: 2.4

47) In an aqueous solution, water molecules associate with one another through which of the following?
A) hydrogen bonds
B) ionic bonds
C) polar covalent bonds
D) covalent bonds
E) hydrophobic interaction
Answer: A
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

48) If a salamander clings to surfaces through hydrogen bonds, it would have the most difficulty clinging to which of the following surfaces?
A) a surface coated with a thin film of water
B) a surface coated with a thin film of vinegar (acetic acid)
C) a surface coated with a thin film of vegetable oil
D) a surface coated with a thin film of ammonia (NH_3)
Answer: B
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

49) In a single molecule of water, two hydrogen atoms are bonded to a single oxygen atom by
A) hydrogen bonds.
B) nonpolar covalent bonds.
C) polar covalent bonds.
D) ionic bonds.
E) van der Waals interactions.
Answer: C
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

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50) The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called?
A) a covalent bond
B) a hydrogen bond
C) an ionic bond
D) a hydrophilic bond
E) a van der Waals interaction
Answer: B
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

51) Sulfur is in the same column of the periodic table as oxygen but has electronegativity similar to carbon. Compared to water molecules, molecules of H_2S will
A) ionize more readily.
B) have greater cohesion to other molecules of H_2S.
C) have a greater tendency to form hydrogen bonds with each other.
D) have a higher capacity to absorb heat for the same change in temperature.
E) not form hydrogen bonds with each other.
Answer: E
Topic: Concept 2.3
Skill: Evaluation/Synthesis
Learning Outcome: 2.3
Global L.O.: G2

52) Water molecules are able to form hydrogen bonds with
A) compounds that are not soluble in water.
B) compounds that have nonpolar covalent bonds.
C) oxygen gas (O_2) molecules.
D) methane gas (CH_4) molecules.
E) compounds that have polar covalent bonds.
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

53) Which of the following effects is produced by the high surface tension of water?
A) Lakes don't freeze solid in winter despite low temperatures.
B) A water strider can walk across the surface of a small pond.
C) Organisms resist temperature changes, although they give off heat due to chemical reactions.
D) Evaporation of sweat from the skin helps to keep people from overheating.
E) Water flows upward from the roots to the leaves in plants.
Answer: B
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

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54) Which of the following takes place as an ice cube cools a drink?
A) Molecular collisions in the drink increase.
B) Kinetic energy in the drink decreases.
C) A calorie of heat energy is transferred from the ice to the water of the drink.
D) The specific heat of the water in the drink decreases.
E) Evaporation of the water in the drink increases.
Answer: B
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

55) A dietary Calorie equals 1 kilocalorie. Which of the following statements correctly defines 1 kilocalorie?
A) 1,000 calories, or the amount of heat required to raise the temperature of 1 g of water by 1,000°C
B) 100 calories, or the amount of heat required to raise the temperature of 100 g of water by 1°C
C) 10,000 calories, or the amount of heat required to raise the temperature of 1 kg of water by 1°F
D) 1,000 calories, or the amount of heat required to raise the temperature of 1 kg of water by 1°C
E) 1,000 calories, or the amount of heat required to raise the temperature of 100 g of water by 100°C
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

56) The nutritional information on a cereal box shows that one serving of a dry cereal has 200 kilocalories. If a person were to ignite one serving of the cereal in a bowl, the amount of heat given off would be sufficient to raise the temperature of 20 kg of water how many degrees Celsius?
A) 0.2°C
B) 1.0°C
C) 2.0°C
D) 10.0°C
E) 20.0°C
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

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57) Which type of bond must be broken for water to vaporize?
A) ionic bonds
B) both hydrogen bonds and ionic bonds
C) polar covalent bonds
D) hydrogen bonds
E) both polar covalent bonds and hydrogen bonds
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

58) Why does ice float in liquid water?
A) The high surface tension of liquid water keeps the ice on top.
B) The ionic bonds between the molecules in ice prevent the ice from sinking.
C) Ice always has air bubbles that keep it afloat.
D) Hydrogen bonds stabilize and keep the molecules of ice farther apart than the water molecules of liquid water.
E) The crystalline lattice of ice causes it to be denser than liquid water.
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

59) Hydrophobic substances such as vegetable oil are
A) nonpolar substances that repel water molecules.
B) nonpolar substances that have an attraction for water molecules.
C) polar substances that repel water molecules.
D) polar substances that have an affinity for water.
E) charged molecules that hydrogen-bond with water molecules.
Answer: A
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

60) One mole (mol) of glucose (molecular mass = 180 daltons) is
A) 180×10^{23} molecules of glucose.
B) 1 kg of glucose dissolved in 1 L of solution.
C) the largest amount of glucose that can be dissolved in 1 L of solution.
D) 180 grams of glucose.
E) 180 grams of glucose dissolved in 1 L of solution.
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

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61) Glucose has a molecular mass of 180 g/mol. How many glucose molecules are present in 90 grams of glucose?
A) 90×10^{23}
B) $(6.02/180) \times 10^{23}$
C) $(6.02/90) \times 10^{23}$
D) $(90 \times 6.02) \times 10^{23}$
E) $(90/180) \times 6.02 \times 10^{23}$
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

62) How many molecules of glycerol ($C_3H_8O_3$; molecular mass = 92) are present in 1 L of a 0.5 *M* glycerol solution?
A) 1×10^{23}
B) $0.5 \times 6.02 \times 10^{23}$
C) $92/2 \times 6.02 \times 10^{23}$
D) $0.5 \times 6.02/92 \times 10^{23}$
E) 6.02×10^{23}
Answer: B
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5
Global L.O.: G4

63) How many molecules of glycerol ($C_3H_8O_3$; molecular mass = 92) are present in 0.5 L of a 1 *M* glycerol solution?
A) 1×10^{23}
B) $0.5 \times 6.02 \times 10^{23}$
C) $92/2 \times 6.02 \times 10^{23}$
D) $0.5 \times 6.02/92 \times 10^{23}$
E) 6.02×10^{23}
Answer: B
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5
Global L.O.: G4

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64) When an ionic compound such as sodium chloride (NaCl) is placed in water, the component atoms of the NaCl crystal dissociate into individual sodium ions (Na^+) and chloride ions (Cl^-). In contrast, the atoms of covalently bonded molecules (e.g., glucose, sucrose, glycerol) do not generally dissociate when placed in aqueous solution. Which of the following solutions would be expected to contain the greatest number of solute particles (molecules or ions)?
A) 1 L of 0.5 *M* NaCl
B) 1 L of 0.5 *M* glucose
C) 1 L of 1.0 *M* NaCl
D) 1 L of 1.0 *M* glucose
E) 2 L of 0.5 *M* glucose.
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

65) The molar mass of glucose is 180 g/mol. Which of the following procedures should you carry out to make a 1 *M* solution of glucose?
A) Dissolve 1 g of glucose in 1 L of water.
B) Dissolve 180 g of glucose in 1 L of water.
C) Dissolve 180 g of glucose in 180 g of water.
D) Dissolve 180 milligrams (mg) of glucose in 1 L of water.
E) Dissolve 180 g of glucose in 0.8 L of water, and then add more water until the total volume of the solution is 1 L.
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

66) The molar mass of glucose ($C_6H_{12}O_6$) is 180 g/mol. Which of the following procedures should you carry out to make a 0.5 *M* solution of glucose?
A) Dissolve 0.5 g of glucose in a small volume of water, and then add more water until the total volume of the solution is 1 L.
B) Dissolve 90 g of glucose in a small volume of water, and then add more water until the total volume of the solution is 1 L.
C) Dissolve 180 g of glucose in a small volume of water, and then add more water until the total volume of the solution is 1 L.
D) Dissolve 0.5 g of glucose in 1 L of water.
E) Dissolve 180 g of glucose in 0.5 L of water.
Answer: B
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

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67) How many glucose molecules are contained in one liter of a 0.1 *M* solution of glucose in water?
A) 6.02×10^{23}
B) 3.01×10^{23}
C) 6.02×10^{24}
D) 12.04×10^{23}
E) 6.02×10^{22}
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

68) How many glucose molecules are contained in 0.1 liter of a 10 *M* solution of glucose in water?
A) 6.02×10^{23}
B) 3.01×10^{23}
C) 6.02×10^{24}
D) 12.04×10^{23}
E) 6.02×10^{22}
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

69) How many glucose molecules are contained in 1 liter of a 10 *M* solution of glucose in water?
A) 6.02×10^{23}
B) 3.01×10^{23}
C) 6.02×10^{24}
D) 12.04×10^{23}
E) 6.02×10^{22}
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

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70) The molar mass of water is 18 g/mol. What is the molarity of 1 liter of pure water? (*Hint:* One liter of pure water has a mass of 1 kg.)
A) 55.6 *M*
B) 18 *M*
C) 37 *M*
D) 0.66 *M*
E) 1.0 *M*
Answer: A
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5

71) You have a freshly prepared 1 *M* solution of glucose in water. You carefully pour out a 100-mL sample of that solution. How many glucose molecules are included in that 100-mL sample?
A) 6.02×10^{23}
B) 3.01×10^{23}
C) 6.02×10^{24}
D) 12.04×10^{23}
E) 6.02×10^{22}
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

72) A strong acid like HCl
A) dissociates completely in an aqueous solution.
B) increases the pH when added to an aqueous solution.
C) reacts with strong bases to create a buffered solution.
D) is a strong buffer at low pH.
E) is a strong buffer at high pH.
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

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73) Which of the following dissociates completely in aqueous solution and is therefore considered to be a strong base (alkali)?
A) NaCl
B) HCl
C) NH_3
D) H_2CO_3
E) NaOH
Answer: E
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

74) A 0.01 *M* solution of a substance has a pH of 2. What can you conclude about this substance?
A) It is a strong acid that ionizes completely in water.
B) It is a strong base that ionizes completely in water.
C) It is a weak acid.
D) It is a weak base.
E) It is a buffer.
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

75) A solution contains $0.0000001(10^{-7})$ moles of hydroxyl ions (OH^-) per liter. Which of the following best describes this solution?
A) acidic: H^+ acceptor
B) basic: H^+ acceptor
C) acidic: H^+ donor
D) basic: H^+ donor
E) neutral
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

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76) What is the pH of a solution with a hydroxyl ion (OH^-) concentration of 10^{-12} *M*?
A) pH 2
B) pH 4
C) pH 10
D) pH 12
E) pH 14
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

77) What is the pH of a 1-millimolar NaOH solution?
A) pH 3
B) pH 8
C) pH 9
D) pH 10
E) pH 11
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

78) Which of the following solutions would require the greatest amount of base to be added to bring the solution to neutral pH?
A) gastric juice at pH 2
B) vinegar at pH 3
C) tomato juice at pH 4
D) black coffee at pH 5
E) household bleach at pH 12
Answer: A
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

79) What is the hydrogen ion (H^+) concentration of a solution of pH 8?
A) 8 *M*
B) 8×10^{-6} *M*
C) 0.01 *M*
D) 10^{-8} *M*
E) 10^{-6} *M*
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

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80) What is the hydroxyl ion (OH^-) concentration of a solution of pH 8?
A) 8 *M*
B) 8×10^{-6} *M*
C) 0.01 *M*
D) 10^{-8} *M*
E) 10^{-6} *M*
Answer: E
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

81) If the pH of a solution is increased from pH 5 to pH 7, it means that the
A) concentration of H^+ is twice (2×) what it was at pH 5.
B) concentration of H^+ is one-half (1/2) what it was at pH 5.
C) concentration of OH^- is 100 times greater than what it was at pH 5.
D) concentration of OH^- is one-hundredth (0.01×) what it was at pH 5.
E) concentration of H^+ is 100 times greater than what it was at pH 5.
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

82) If the pH of a solution is decreased from pH 8 to pH 6, it means that the
A) concentration of H^+ is twice (2×) what it was at pH 8.
B) concentration of H^+ is one-half (1/2) what it was at pH 8.
C) concentration of OH^- is 100 times greater than what it was at pH 8.
D) concentration of OH^- is one-hundredth (0.01×) what it was at pH 8.
E) concentration of H^+ is one-hundredth (0.01×) what it was at pH 8.
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

83) One liter of a solution of pH 4 has how many more hydrogen ions (H^+) than 1 L of a solution of pH 9?
A) 4 times more
B) 16 times more
C) 40,000 times more
D) 10,000 times more
E) 100,000 times more
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

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84) One liter of a solution of pH 8 has how many more hydroxyl ions (OH^-) than 1 L of a solution of pH 4?
A) 5 times more
B) 32 times more
C) 50,000 times more
D) 10,000 times more
E) 100,000 times more
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

85) Which of the following statements about buffer solutions is true?
A) They maintain a constant pH when bases are added to them but not when acids are added to them.
B) They maintain a constant pH when acids are added to them but not when bases are added to them.
C) They maintain a relatively constant pH of approximately 7 when either acids or bases are added to them.
D) They maintain a relatively constant pH when either acids or bases are added to them.
E) They are found only in living systems and biological fluids.
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

86) Buffers are substances that help resist shifts in pH by
A) releasing H^+ to a solution when acids are added.
B) accepting OH^- to a solution when bases are added.
C) releasing OH^- to a solution when bases are added.
D) accepting H^+ from a solution when acids are added.
E) accepting OH^- from a solution when acids are added.
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

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87) Carbonic acid (H_2CO_3) serves as a buffer in human blood. Carbonic acid is a weak acid that dissociates into a bicarbonate ion (HCO_3^-) and a hydrogen ion (H^+). Thus,

$H_2CO_3 \leftrightarrow HCO_3^- + H^+$

A decrease in blood pH would result in

A) a decrease in the concentration of H_2CO_3 and an increase in the concentration of HCO_3^-.

B) a decrease in the concentrations of H_2CO_3 and HCO_3^-.

C) an increase in the concentration of H_2CO_3 and a decrease in the concentration of HCO_3^-.

D) an increase in the concentrations of H_2CO_3 and HCO_3^-.

E) an increase in the concentrations of H_2CO_3, HCO_3^-, and OH^-.

Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

88) One of the buffers that contributes to pH stability in human blood is carbonic acid (H_2CO_3). Carbonic acid is a weak acid that, when placed in an aqueous solution, dissociates into a bicarbonate ion (HCO_3^-) and a hydrogen ion (H^+). Thus,

$H_2CO_3 \leftrightarrow HCO_3^- + H^+$

If the pH of the blood increases, one would expect

A) a decrease in the concentration of H_2CO_3 and an increase in the concentration of HCO_3^-.

B) an increase in the concentration of H_2CO_3 and a decrease in the concentration of HCO_3^-.

C) a decrease in the concentration of HCO_3^- and an increase in the concentration of H^+.

D) an increase in the concentration of HCO_3^- and a decrease in the concentration of OH^-.

E) a decrease in the concentration of HCO_3^- and an increase in the concentration of both H_2CO_3 and H^+.

Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

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89) If acid rain has lowered the pH of a particular lake to pH 4.0, which of the following statements about this lake is true?
A) The hydrogen ion concentration is 1×10^{-10} moles per liter of lake water.
B) The hydrogen ion concentration is 4.0 moles per liter of lake water.
C) The hydrogen ion concentration is 1×10^{4} moles per liter of lake water.
D) The hydroxyl ion concentration is 1×10^{-10} moles per liter of lake water.
E) The hydroxyl ion concentration is 1×10^{-4} moles per liter of lake water.
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

90) Research indicates that acid precipitation can damage marine corals by
A) buffering ocean waters.
B) decreasing the H^+ concentration in oceans.
C) increasing the OH^- concentration in oceans.
D) decreasing the concentration of carbonate ions in oceans.
E) decreasing the calcium ion concentration in oceans.
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

91) Approximately what percentage of human-generated atmospheric CO_2 is absorbed by the oceans?
A) 1%
B) 5%
C) 25%
D) 60%
E) 95%
Answer: C
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

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92) CO_2 absorbed by the oceans combines with water to form H_2CO_3. Which of the following will result from increasing the concentration of H_2CO_3 in the oceans?
A) Ocean pH will be stabilized by the buffering capacity of H_2CO_3.
B) Ocean pH will increase.
C) Ocean pH will decrease.
D) The concentration of carbonate ions (CO_3^{2-}) in the ocean will increase.
E) The concentration of bicarbonate ions (HCO_3^-) in the ocean will decrease.
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

93) 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
A) solution Y has no free hydrogen ions (H^+) because the solution is neutral.
B) the concentration of hydrogen ions in solution X is 30 times greater than the concentration of hydrogen ions in solution Y.
C) the concentration of hydrogen ions in solution Y is 1,000 times greater than the concentration of hydrogen ions in solution X.
D) the concentration of hydrogen ions in solution X is 3 times greater than the concentration of hydrogen ions in solution Y.
E) the concentration of hydrogen ions in solution X is 1,000 times greater than the concentration of hydrogen ions in solution Y.
Answer: E
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

94) Carbon dioxide (CO_2) is readily soluble in water, according to the equation $CO_2 + H_2O \leftrightarrow H_2CO_3$. Carbonic acid ($H_2CO_3$) is a weak acid. Respiring cells release CO_2 into the bloodstream. What will be the effect on the pH of blood as that blood first comes in contact with respiring cells?
A) Blood pH will decrease slightly.
B) Blood pH will increase slightly.
C) Blood pH will remain unchanged.
D) Blood pH will first increase, then decrease as CO_2 combines with hemoglobin.
Answer: A
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

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95) A beaker contains 100 mL of NaOH solution at pH = 13. A technician carefully pours into the beaker 10 mL of HCl at pH = 1. Which of the following statements correctly describes the results of this mixing?

A) The concentration of Na^+ ion will rise.

B) The concentration of Cl^- ion will be 0.1 *M*.

C) The concentration of undissociated H_2O molecules will remain unchanged.

D) The pH of the beaker's contents will be neutral.

E) The pH of the beaker's contents will decrease.

Answer: E
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

96) An equal volume (5 mL) of vinegar from a freshly opened bottle is added to each of the following solutions. After complete mixing, which of the mixtures will have the highest pH?

A) 100 mL of pure water

B) 100 mL of freshly brewed coffee

C) 100 mL of household cleanser containing 0.5 *M* ammonia

D) 100 mL of freshly squeezed lemon juice

E) 100 mL of tomato juice

Answer: C
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

97) An equal volume (5 mL) of milk of magnesia from a freshly opened bottle is added to each of the following solutions. After complete mixing, which of the mixtures will have the lowest pH?

A) 100 mL of pure water

B) 100 mL of freshly brewed coffee

C) 100 mL of household cleanser containing 0.5 *M* ammonia

D) 100 mL of freshly squeezed lemon juice

E) 100 mL of household cleanser containing 0.5 *M* bleach

Answer: D
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

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98) Increased atmospheric CO_2 concentrations will have what effect on seawater?
A) Seawater will become more acidic, and bicarbonate concentrations will decrease.
B) Seawater will become more alkaline, and carbonate concentrations will decrease.
C) There will be no change in the pH of seawater because carbonate will turn to bicarbonate.
D) Seawater will become more acidic, and carbonate concentrations will decrease.
E) Seawater will become more acidic, and carbonate concentrations will increase.
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

99) How would acidification of seawater affect marine organisms?
A) Acidification would increase dissolved carbonate concentrations and promote faster growth of corals and shell-building animals.
B) Acidification would decrease dissolved carbonate concentrations and promote faster growth of corals and shell-building animals.
C) Acidification would increase dissolved carbonate concentrations and hinder growth of corals and shell-building animals.
D) Acidification would decrease dissolved carbonate concentrations and hinder growth of corals and shell-building animals.
E) Acidification would increase dissolved bicarbonate concentrations and cause increased calcification of corals and shellfish.
Answer: D
Topic: Concept 2.5
Skill: Knowledge/Comprehension
Learning Outcome: 2.5

100) One proposal to mitigate the effects of burning fossil fuels on atmospheric CO_2 concentrations is to pipe liquid CO_2 into the ocean at depths of 2,500 feet or greater. At the high pressures at such depths, CO_2 is heavier than water. What potential effects might result from implementing such a scheme?
A) increased photosynthetic carbon fixation because of the increased dissolved carbon dioxide in the deep water
B) increased carbonate concentrations in the deep waters
C) increased growth of corals from a change in the carbonate-bicarbonate equilibrium
D) no effect because carbon dioxide is not soluble in water
E) changes in the growth of deep sea-dwelling organisms with calcium carbonate shells
Answer: E
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

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101) If the cytoplasm of a cell is at pH 7, and the mitochondrial matrix is at pH 8, this means that
A) the concentration of hydrogen ions is tenfold higher in the cytoplasm than in the mitochondrial matrix.
B) the concentration of hydrogen ions is tenfold higher in the mitochondrial matrix than in the cytoplasm.
C) the concentration of hydrogen ions in the cytoplasm is 7/8 the concentration in the mitochondrial matrix.
D) the mitochondrial matrix is more acidic than the cytoplasm.
E) the concentration of hydrogen ions in the cytoplasm is 8/7 the concentration in the mitochondrial matrix.
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

2.2 Art Questions

1)

Atom 1	Atom 2
$^{1}_{1}H$	$^{3}_{1}H$

Figure 2.1

Which of the following best describes the relationship between the atoms described in Figure 2.1?
A) They are compounds.
B) They are polymers.
C) They are isotopes.
D) They contain 1 and 3 protons, respectively.
E) They each contain 1 neutron.
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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2)

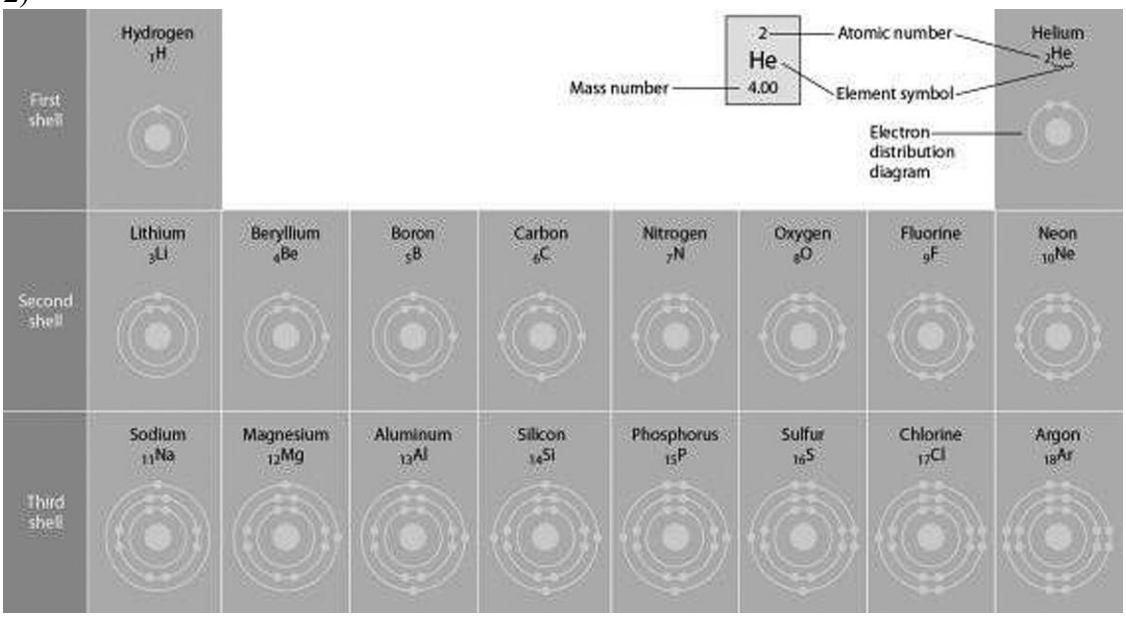


Figure 2.2

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?
A) boron
B) silicon
C) nitrogen
D) aluminum
E) phosphorus
Answer: B
Topic: Concept 2.2
Skill: Evaluation/Synthesis
Learning Outcome: 2.2
Global L.O.: G4

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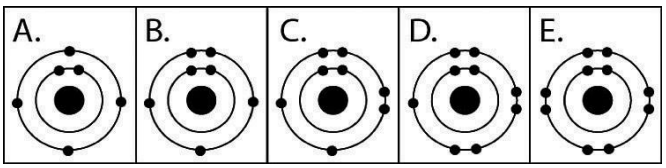


Figure 2.3

3) Which drawing in Figure 2.3 depicts the electron configuration of an element with chemical properties most similar to those of helium ($_2$He)?
A) A
B) B
C) C
D) D
E) E
Answer: E
Topic: Concept 2.2
Skill: Application/Analysis
Learning Outcome: 2.2

4) Which drawing in Figure 2.3 depicts the electron configuration of an atom that can form covalent bonds with two hydrogen atoms?
A) A
B) B
C) C
D) D
E) E
Answer: C
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

5) Which drawing in Figure 2.3 depicts the electron configuration of an atom capable of forming three covalent bonds with other atoms?
A) A
B) B
C) C
D) D
E) E
Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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6) Which drawing in Figure 2.3 is of the electron configuration of a sodium $_{11}Na^+$ ion?
A) A
B) B
C) C
D) D
E) E
Answer: E
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

7) Which drawing in Figure 2.3 depicts an atom with a valence of 3?
A) A
B) B
C) C
D) D
E) E
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

8) Which drawing in Figure 2.3 depicts an atom with a valence of 2?
A) A
B) B
C) C
D) D
E) E
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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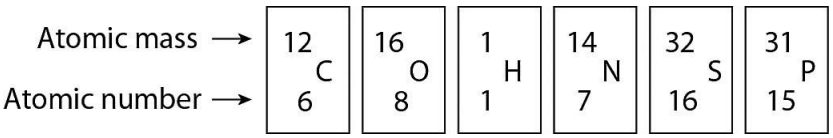


Figure 2.4

9) In Figure 2.4, how many electrons does nitrogen have in its valence shell?
A) 2
B) 5
C) 7
D) 8
E) 14
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

10) In Figure 2.4, how many unpaired electrons does phosphorus have in its valence shell?
A) 15
B) 2
C) 3
D) 7
E) 5
Answer: C
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

11) How many neutrons are present in the nucleus of a phosphorus-32 (^{32}P) atom (see Figure 2.4)?
A) 5
B) 15
C) 16
D) 17
E) 32
Answer: D
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

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12) How many electrons does an atom of sulfur have in its valence shell (see Figure 2.4)?
A) 4
B) 6
C) 8
D) 16
E) 32
Answer: B
Topic: Concept 2.2
Skill: Knowledge/Comprehension
Learning Outcome: 2.2

13) Based on electron configuration, which of the elements in Figure 2.4 would exhibit a chemical behavior most like that of oxygen?
A) carbon
B) hydrogen
C) nitrogen
D) sulfur
E) phosphorus
Answer: D
Topic: Concept 2.2
Skill: Application/Analysis
Learning Outcome: 2.2
Global L.O.: G2

14)

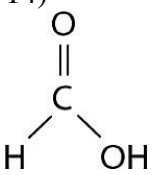


Figure 2.5

Figure 2.5 shows a representation of formic acid. A formic acid molecule
A) will dissociate in water, thus increasing the pH.
B) will dissociate in water, thus decreasing the pH.
C) contains primarily nonpolar covalent bonds.
D) is held together by hydrogen bonds.
E) has a tetrahedral shape.
Answer: A
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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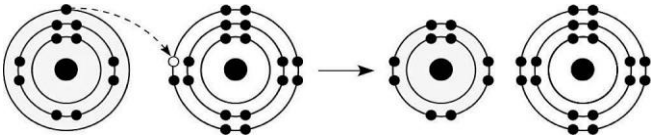


Figure 2.6

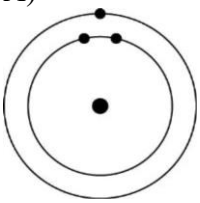
15) What results from the chemical reaction illustrated in Figure 2.6?
A) a cation with a net charge of +1
B) a cation with a net charge of -1
C) an anion with a net charge of +1
D) an anion with a net charge of -1
E) a cation with a net charge of +1 and an anion with a net charge of -1
Answer: E
Topic: Concept 2.3
Skill: Knowledge/Comprehension
Learning Outcome: 2.3

16) What is the atomic number of the cation formed in the reaction illustrated in Figure 2.6?
A) 1
B) 8
C) 10
D) 11
E) 16
Answer: D
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

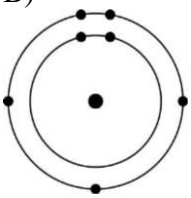
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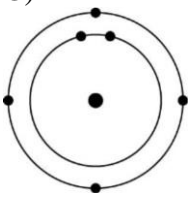
17) Which of the atoms shown would be most likely to form a cation with a charge of +1?
A)



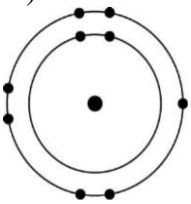
B)



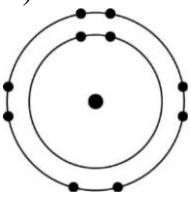
C)



D)



E)

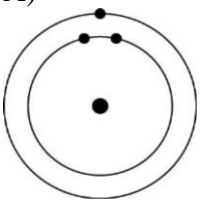


Answer: A
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

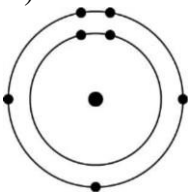
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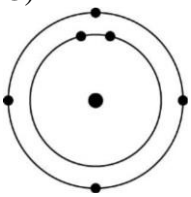
18) Which of the atoms shown would be most likely to form an anion with a charge of -1?
A)



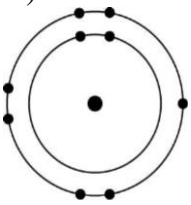
B)



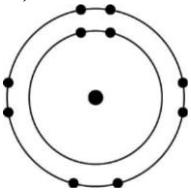
C)



D)



E)



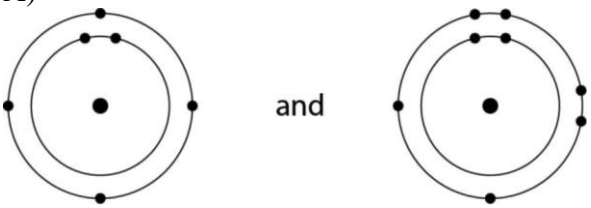
Answer: D
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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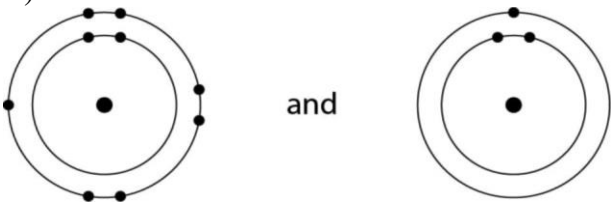
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19) Which of the following pairs of atoms would be most likely to form a polar covalent bond?

A)



B)



C)



D)



E)



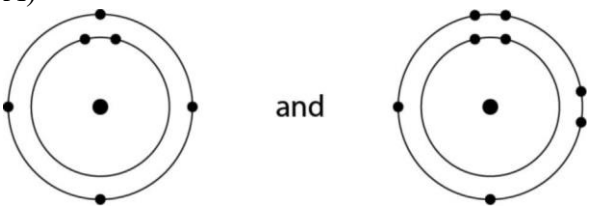
Answer: A
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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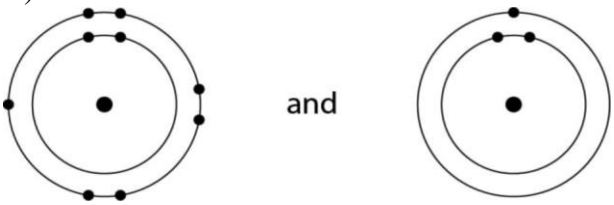
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20) Which of the following pairs of atoms would be most likely to form ions and thus an ionic bond?

A)



B)



C)



D)



E)



Answer: B
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3

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21)

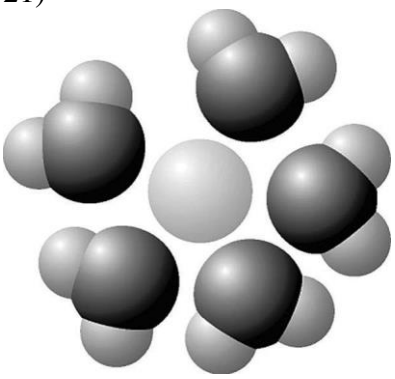


Figure 2.7

Based on your knowledge of the polarity of water molecules, the solute molecule depicted in Figure 2.7 is most likely
A) positively charged.
B) negatively charged.
C) without charge.
D) hydrophobic.
E) nonpolar.
Answer: A
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5

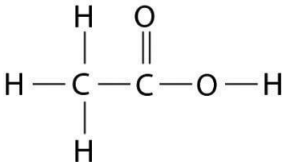


Figure 2.8

22) How many grams would be equal to 1 mol of the compound shown in Figure 2.8? (carbon = 12, oxygen = 16, hydrogen = 1)
A) 29
B) 30
C) 60
D) 150
E) 342
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

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23) How many grams of the compound in Figure 2.8 would be required to make 1 L of a 0.5 *M* solution?
(carbon = 12, oxygen = 16, hydrogen = 1)
A) 29
B) 30
C) 60
D) 150
E) 342
Answer: B
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

24) How many grams of the compound in Figure 2.8 would be required to make 2.5 L of a 1 *M* solution?
(carbon = 12, oxygen = 16, hydrogen = 1)
A) 29
B) 30
C) 60
D) 150
E) 342
Answer: D
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G4

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25) A small birthday candle is weighed. It is then lighted and placed beneath a metal can containing 100 mL of water. Careful records are kept as the temperature of the water rises. Data from this experiment are shown on the graph. What amount of heat energy is released in the burning of candle wax? (Note that 1 liter of pure water has a mass of 1 kg.)

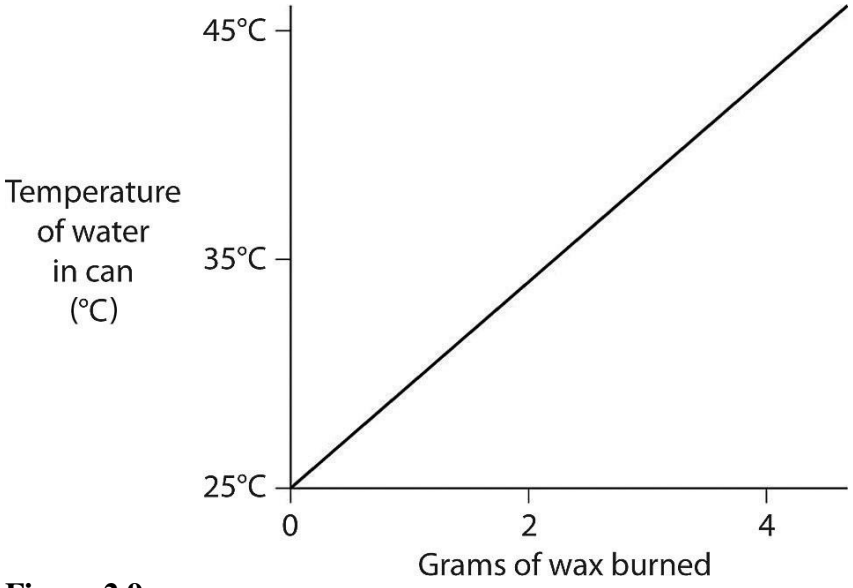


Figure 2.9

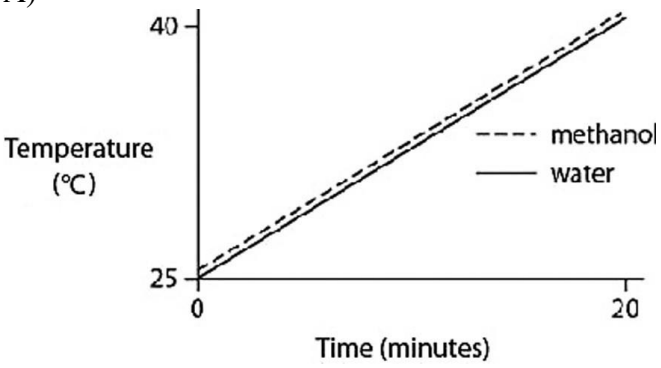
A) 0.5 kilocalorie per gram of wax burned
B) 5 kilocalories per gram of wax burned
C) 10 kilocalories per gram of wax burned
D) 20 kilocalories per gram of wax burned
E) 50 kilocalories per gram of wax burned
Answer: A
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G3

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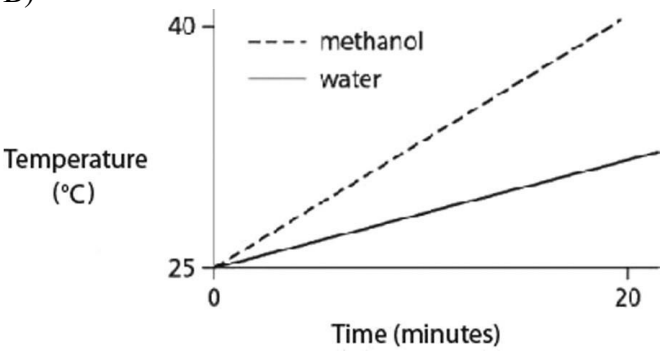
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26) Identical heat lamps are arranged to shine on identical containers of water and methanol (wood alcohol) so that each liquid absorbs the same amount of energy minute by minute. The covalent bonds of methanol molecules are nonpolar, so there are no hydrogen bonds among methanol molecules. Which of the following graphs correctly describes what will happen to the temperature of the water and the methanol?

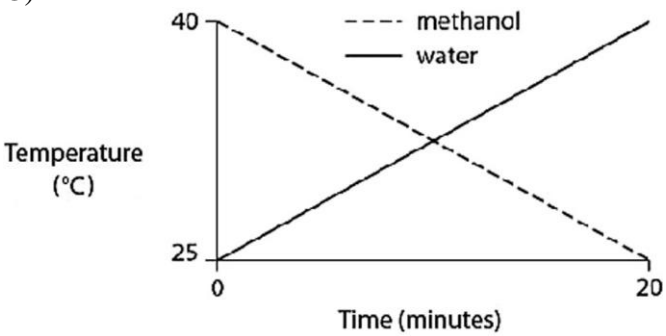
A)



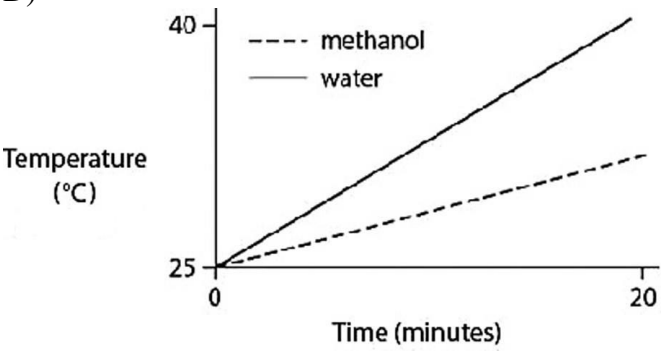
B)



C)



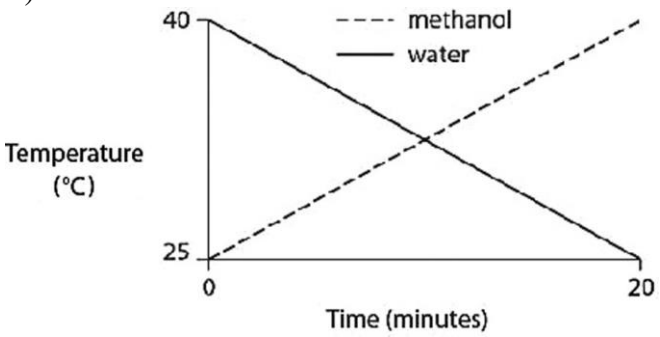
D)



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E)



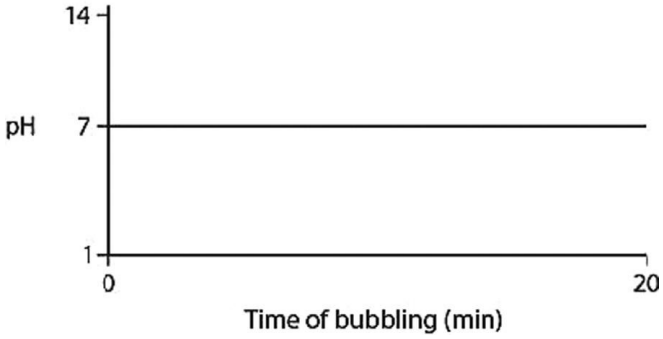
Answer: B
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G3

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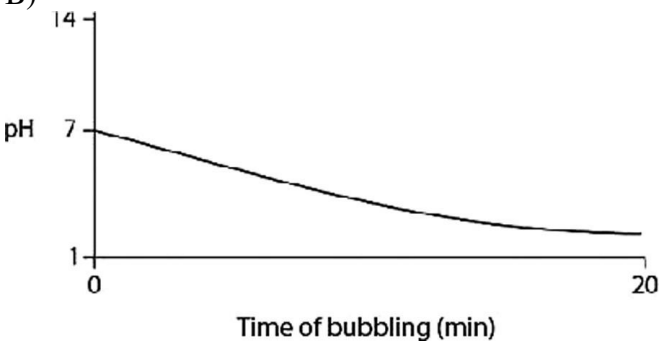
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27) Carbon dioxide (CO_2) is readily soluble in water, according to the equation $CO_2 + H_2O \leftrightarrow H_2CO_3$. Carbonic acid ($H_2CO_3$) is a weak acid. If CO_2 is bubbled into a beaker containing pure, freshly distilled water, which of the following graphs correctly describes the results?

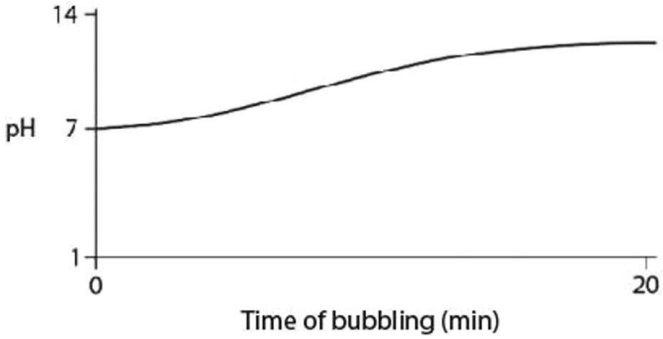
A)



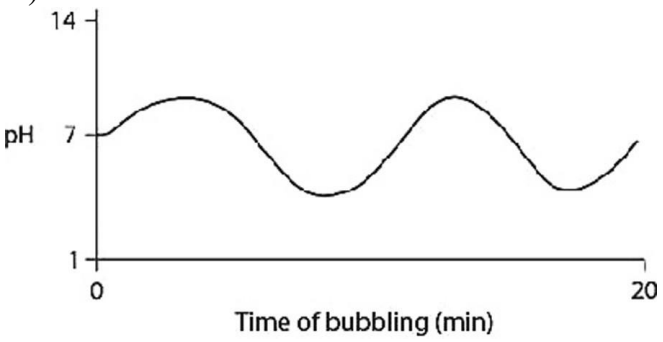
B)



C)



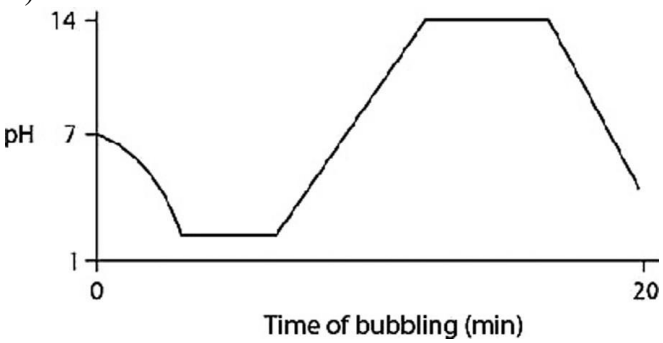
D)



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E)



Answer: B
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G3

2.3 Scenario Questions

1) A group of molecular biologists is trying to synthesize a new artificial compound to mimic the effects of a known hormone that influences sexual behavior. The biologists have turned to you for advice. Which of the following compounds is most likely to mimic the effects of the hormone?
A) a compound with the same number of carbon atoms as the hormone
B) a compound with the same molecular mass (measured in daltons) as the hormone
C) a compound with the same three-dimensional shape as part of the hormone
D) a compound with the same number of valence electrons as the hormone
E) a compound with the same number of hydrogen and nitrogen atoms as the hormone
Answer: C
Topic: Concept 2.3
Skill: Application/Analysis
Learning Outcome: 2.3
Global L.O.: G2

2) You have two beakers. One contains pure water; the other contains pure methanol (wood alcohol). The covalent bonds of methanol molecules are nonpolar, so there are no hydrogen bonds among methanol molecules. You pour crystals of table salt (NaCl) into each beaker. Predict what will happen.
A) Equal amounts of NaCl crystals will dissolve in both water and methanol.
B) NaCl crystals will *not* dissolve in either water or methanol.
C) NaCl crystals will dissolve readily in water but will not dissolve in methanol.
D) NaCl crystals will dissolve readily in methanol but will not dissolve in water.
Answer: C
Topic: Concept 2.5
Skill: Application/Analysis
Learning Outcome: 2.5
Global L.O.: G2

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3) You have two beakers. One contains a solution of HCl at pH = 1.0. The other contains a solution of NaOH at pH = 13. Into a third beaker, you slowly and cautiously pour 20 mL of the HCl and 20 mL of the NaOH. After complete stirring, the pH of the mixture will be
A) 2.0.
B) 12.0.
C) 7.0.
D) 5.0.
E) 9.0.
Answer: C
Topic: Concept 2.5
Skill: Evaluation/Synthesis
Learning Outcome: 2.5
Global L.O.: G2

2.4 End-of-Chapter Questions

1) The reactivity of an atom arises from
A) the average distance of the outermost electron shell from the nucleus.
B) the existence of unpaired electrons in the valence shell.
C) the sum of the potential energies of all the electron shells.
D) the potential energy of the valence shell.
Answer: B
Topic: End-of-Chapter Questions
Skill: Knowledge/Comprehension

2) Which of the following statements correctly describes any chemical reaction that has reached equilibrium?
A) The concentrations of products and reactants are equal.
B) The reaction is now irreversible.
C) Both forward and reverse reactions have halted.
D) The rates of the forward and reverse reactions are equal.
Answer: D
Topic: End-of-Chapter Questions
Skill: Knowledge/Comprehension

3) Many mammals control their body temperature by sweating. Which property of water is most directly responsible for the ability of sweat to lower body temperature?
A) water's change in density when it condenses
B) water's ability to dissolve molecules in the air
C) the release of heat by the formation of hydrogen bonds
D) the absorption of heat by the breaking of hydrogen bonds
Answer: D
Topic: End-of-Chapter Questions
Skill: Knowledge/Comprehension

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4) We can be sure that a mole of table sugar and a mole of vitamin C are equal in their
A) mass.
B) volume.
C) number of atoms.
D) number of molecules.
Answer: D
Topic: End-of-Chapter Questions
Skill: Knowledge/Comprehension

5) Measurements show that the pH of a particular lake is 4.0. What is the hydrogen ion concentration of the lake?
A) 4.0 M
B) 10^{-4} M
C) 10^{4} M
D) 10^{-10} M
Answer: B
Topic: End-of-Chapter Questions
Skill: Knowledge/Comprehension

6) The atomic number of sulfur is 16. Sulfur combines with hydrogen by covalent bonding to form a compound, hydrogen sulfide. Based on the number of valence electrons in a sulfur atom, predict the molecular formula of the compound.
A) HS
B) HS_2
C) H_2S
D) H_3S_2
Answer: C
Topic: End-of-Chapter Questions
Skill: Application/Analysis

7) What coefficients must be placed in the following blanks so that all atoms are accounted for in the products?
$C_6H_{12}O_6 \rightarrow$ _____ C_2H_6O + _____ CO_2
A) 1; 2
B) 3; 1
C) 1; 3
D) 2; 2
Answer: D
Topic: End-of-Chapter Questions
Skill: Application/Analysis

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8) A slice of pizza has 500 kcal. If we could burn the pizza and use all the heat to warm a 50-L container of cold water, what would be the approximate increase in the temperature of the water? (*Note*: A liter of cold water weighs about 1 kg.)
A) 50°C
B) 5°C
C) 1°C
D) 10°C
Answer: D
Topic: End-of-Chapter Questions
Skill: Application/Analysis

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