

TEST BANK



Biology

LIFE ON EARTH

SEVENTH EDITION

HOUGHTON MIFFLIN HARCOURT

ALERTS

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

- 1) A substance with specific properties that cannot be broken down or converted to another substance is a(n) 1) _____
A) ion.
B) compound.
C) element.
D) mixture.
E) molecule.
- 2) If you examined the universe, the Earth, and the human body, which of the following combinations of elements would you find most common? 2) _____
A) C, Na, O, N, H, Mg
B) K, H, C, S, O, P
C) S, P, O, N, H, C
D) Cl, Ca, C, H, O, P
E) C, O, Na, He, P, S
- 3) What determines the atomic number of an atom? 3) _____
A) total number of energy shells
B) number of electrons in the outermost energy level
C) arrangement of neutrons in the atomic nucleus
D) the total number of electrons and neutrons
E) number of protons in the atomic nucleus
- 4) Which four elements make up approximately 96% of living matter? 4) _____
A) carbon, sodium, chlorine, magnesium
B) oxygen, hydrogen, calcium, sodium
C) carbon, sulfur, phosphorus, hydrogen
D) carbon, hydrogen, nitrogen, oxygen
E) carbon, oxygen, sulfur, calcium
- 5) You have been hired as a chemist. Your first task at your new job is to examine a newly discovered atom. The paperwork you are given states that its atomic number is 110. What does this mean? 5) _____
A) The atom is an isotope.
B) The atom contains 110 protons.
C) The atom contains 55 electrons.
D) The atom contains 55 protons and 55 neutrons.
- 6) Iron is an important trace element in human body cells. Imagine you are a biochemist trying to characterize what is known about iron atoms, in an effort to learn more about human physiology. You learn that iron has an atomic number of 26. What does this tell you about iron? 6) _____
A) An iron atom is unable to become an isotope.
B) An iron atom has 26 protons.
C) An iron atom has 13 protons and 13 neutrons.
D) An iron atom has 13 electrons and 13 protons.
- 7) Carbon-14 is often used for carbon dating, where scientists measure the rate of carbon-14 decay to determine the age of items. It contains six pr ns and otoeight

neutrons. 7)

During the process of carbon-14 decay, one of its eight neutrons becomes a proton and an electron is emitted. Which of the following is the BEST explanation of what has occurred?

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- A) The resulting atom is still has an unstable nucleus.
- B) An ionic bond has formed.
- C) The resulting atom is still carbon-14.
- D) The resulting atom is now a different element because the number of protons has changed.

8) Radioactive isotopes are useful biological tools that are often used to _____

- A) detect brain tumors.
- B) build up a store of calcium in a cell.
- C) measure the size of fossils.
- D) increase the pH of blood.

9) An isotope of the element fluorine is commonly used in positron emission tomography (PET) scans. The non-isotope form of fluorine has 9 electrons, 9 protons and 10 neutrons. Based on your knowledge of isotopes, which of the following could be true about the fluorine isotope used in PET scans? _____

- A) The isotope form has 9 neutrons.
- B) The isotope form can have 8 or 10 protons.
- C) The isotope form has only 8 electrons.
- D) The isotope form has the same number of protons, neutrons and electrons as the non-isotope form.

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

10) An element is the fundamental structural unit of matter. True or False? 10) _____

11) Isotopes are atoms of the same element that vary in the number of protons. True or False? 11) _____

12) Each atom has an equal number of electrons and protons. True or False? 12) _____

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

13) The chemical properties of an element are determined by the number of _____ its atoms contain. 13) _____

14) An isotope is atoms of the same element that have different numbers of _____. 14) _____

15) The second electron shell is considered to be full when it contains _____ electrons. 15) _____

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

16) Why is a helium atom (Atomic #2) more stable than a hydrogen atom (Atomic #1)? 16) _____

- A) The outermost electron shell is half-empty.
- B) Helium atoms react readily with oxygen.
- C) Hydrogen atoms react to form helium.
- D) Eight electrons completely fill its outermost electron shell.
- E) Two electrons completely fill its outermost electron shell.

17) Which of the following factors is the most significant when considering the reactivity of an atom? 17) _____

- A) An atom is the smallest particle of an element.
- B) Atoms with many neutrons may be radioactive.
- C) The number of protons affects the size of the atom.
- D) A molecule is the smallest unit of a compound.
- E) Atoms are held together by interactions between electrons.

18) Sodium (Na), atomic number 11, has a tendency to lose an electron in the presence of chlorine. After losing the electron, Na will have _____ protons in its nucleus. 18) _____

- A) 22 B) 11 C) 21 D) 10 E) 12

19) For an atom to achieve maximum stability and become chemically inert, what must occur? 19) _____

- A) Ionization is required.
- B) Its outermost energy shell must be filled with electrons.
- C) It must be inert.
- D) The number of electrons must equal the number of protons.
- E) Sharing of electron pairs is necessary.

20) An atom's nucleus is composed of 20) _____

- A) protons and electrons.
- B) protons.
- C) neutrons and electrons.
- D) neutrons.

E) protons and neutrons.

- 21) How does one explain the formation of ions? 21) _____
A) sharing of protons
B) sharing of electrons
C) gain or loss of neutrons
D) gain or loss of electrons
E) gain or loss of protons
- 22) You have been hired as a chemist and are examining the paperwork of a newly discovered atom. You read that this atom has a tendency to lose 2 electrons. Based on what you know, this would result in the formation of 22) _____
A) a water molecule. B) an ion.
C) an isotope. D) a polar molecule.
- 23) The formation of sodium chloride (NaCl) is the result of 23) _____
A) covalent bonding.
B) the lack of chemical attraction.
C) chemical unreactivity.
D) attraction between opposite charges.
E) both A and C
- 24) Atoms or molecules which have gained or lost electrons are termed 24) _____
A) polymers.
B) buffers.
C) bases.
D) acids.
E) ions.
- 25) Biological molecules primarily are joined by 25) _____
A) ionic bonds.
B) disulfide bonds.
C) covalent bonds.
D) peptide bonds.
E) hydrogen bonds.
- 26) Phosphorus has an atomic number of fifteen, so what will be the distribution of its electrons? 26) _____
A) The first energy level will have eight and the second will have seven.
B) The first energy level will have two, the second will have eight, and the third will have five.
C) The first, second, and third energy levels will each have five electrons.
D) The first energy level will have two and the second will have thirteen.
E) Electron arrangement cannot be determined from the atomic number.
- 27) Sulfur is an essential element in the human body and studying its characteristics is important in understanding human physiology. Sulfatoms
ur have 6

electrons 27)
in their
outer
shell.
Based on
this
informati
on,
which of
the
followin
g may be
true?

- A) Sulfur is an important isotope of hydrogen.
- B) Sulfur is inert.
- C) Sulfur has 8 electrons in its outer shell and forms ions.
- D) Sulfur can form important molecules using covalent bonds.

28) Which of the following could potentially be a free radical? 28) _____

- A) helium (atomic number = 2)
- B) oxygen (atomic number = 8)
- C) argon (atomic number = 9)
- D) neon (atomic number = 10)

29) Free radicals are considered dangerous because 29) _____

- A) they emit dangerous radiation.
- B) they attack the atomic nucleus.
- C) they damage oxygen and cause it to become an antioxidant.
- D) they steal electrons from other atoms causing them to become free radicals.

30) Scientists now recommend a diet rich in antioxidants to stay healthy. 30) _____

What occurs at the atomic level to explain the reasoning behind this recommendation?

- A) Antioxidants are inert and do not interact with free radicals.
- B) Antioxidants steal electrons which gives cells extra energy.
- C) Antioxidants stop the chain reaction of cellular damage caused by free radicals.
- D) Antioxidants cause an increase in pH which is necessary.

31) Which of the following BEST explains why an atom may not form 31) _____
compounds readily?

- A) The atom has an uneven number of protons.
- B) The atom's outer energy levels are completely full.
- C) The atom has no electrons.
- D) The atom has seven electrons in its outer shells.

32) NASA's Deep Space 1 probe used ion propulsion technology to propel it 32) _____

into outer space. Ion propulsion uses an electrical charge to ionize atoms such as xenon. These ions are funneled from the exhaust of the craft at such high speeds that it is pushed in the opposite direction and propelled into space. The electrical charge that is used to ionize xenon atoms most likely

- A) cause protons to become neutrons.

- B) cause neutrons to be released from the atoms.
- C) cause electrons to be released from the atoms.
- D) change the atoms into radioactive isotopes.

- 33) The element carbon has an atomic number of six. Carbon would most likely _____
likely
- A) donate two electrons to another atom.
 - B) form four covalent bonds.
 - C) form an ionic bond.
 - D) form two covalent bonds.
- 34) Calcium has an atomic number of 20. A calcium ion could have _____
- A) 18 electrons.
 - B) 10 electrons.
 - C) 20 electrons.
 - D) cannot be determined
- 35) Carbon has an atomic number of six. Carbon would most likely _____
- A) gain electrons.
 - B) lose protons.
 - C) share electrons.
 - D) lose electrons.
 - E) share protons.
- 36) What does $\text{H}^1\text{O}^1\text{H}$ represent? _____
- A) molecule of water
 - B) ionic bonding of water
 - C) planetary model of water
 - D) mixture including water
 - E) atom of water
- 37) All the following are true of hydrogen gas, H_2 , EXCEPT (H atomic number = 1) _____
- A) H_2 shares one pair of electrons.
 - B) H_2 is stable.
 - C) H_2 is covalently bonded.
 - D) H_2 is polar.
 - E) All of the above are true.
- 38) Polar covalent bonds form when _____
- A) an acid and base are combined.
 - B) electrons are shared unequally between atoms.
 - C) atoms from two molecules are attracted to each other.
 - D) more than one pair of electrons is shared.
 - E) ions are formed.
- 39) Which of these bonds is characterized by equal sharing of electrons? _____
- A) $\text{C}=\text{O}$
 - B) $\text{N}-\text{H}$
 - C) $\text{O}-\text{H}$
 - D) $\text{C}-\text{H}$
 - E) $\text{H}-\text{Cl}$

- 40) Which of the following represents a molecule characterized by polar covalent bonding? 40) _____
A) NaCl B) H₂ C) H₂O D) CH₄ E) C-C
- 41) What bond(s) is(are) easily disrupted in aqueous (water) solutions? 41) _____
A) polar covalent
B) covalent
C) ionic
D) A and B are correct.
E) A, B, and C are correct.
- 42) If sulfur has an atomic number of 16, how many covalent bonds does it form? 42) _____
A) 0 B) 2 C) 8 D) 6 E) 4
- 43) The part of the atom of greatest biological interest is the 43) _____
A) proton.
B) neutron.
C) electron.
D) innermost electron shell.
E) none of the above
- 44) Which pair has similar chemical properties? 44) _____
A) ¹⁶O and ³²S
B) ¹H and ²²Na
C) ¹²C and ¹⁴C
D) ¹H and ²He
E) ¹²C and ²⁸Si
- 45) A single covalent chemical bond represents the sharing of how many electrons? 45) _____
A) 1 B) 2 C) 3 D) 4 E) 6
- 46) Polar molecules 46) _____
A) are ions.
B) have an unequal distribution of electric charge.
C) have an equal distribution of electric charge.
D) have an overall positive electric charge.
E) have an overall negative electric charge.
- 47) The hydrogen bond between two water molecules arises because water is 47) _____
A) a small molecule.
B) polar.
C) nonpolar.
D) a liquid.
E) hydrophobic.
- 48) _____ often form(s) as a result of polar bonds. 48) _____
A) Water
B) Hydrogen bonds

- C) Ionic bonds
- D) Ice
- E) Peptide bonds

- 49) Which statement is an accurate description of water molecules? 49) _____
- A) They are charged and nonpolar.
 - B) They are ionically bonded.
 - C) They are uncharged and polar.
 - D) They are uncharged and nonpolar.
 - E) They are charged and polar.
- 50) Which of the following is an example of hydrogen bonding? 50) _____
- A) The bond between O and H in a single molecule of water.
 - B) The bond between O of one water molecule and H of a second water molecule.
 - C) The bond between the H of a water molecule and the H of a hydrogen molecule.
 - D) The bond between O of one water molecule and O of a second water molecule.
 - E) The bond between H of one water molecule and H of a second water molecule.
- 51) Which of the following results from a transfer of electron(s) between atoms? 51) _____
- A) ionic bond
 - B) nonpolar covalent bond
 - C) electron-proton interaction
 - D) hydrogen bond
 - E) polar covalent bond
- 52) Which of the following results from an unequal sharing of electrons between atoms? 52) _____
- A) nonpolar covalent bond
 - B) electron-proton interaction
 - C) ionic bond
 - D) hydrogen bond
 - E) polar covalent bond
- 53) Which of the following best explains the attraction of water molecules to each other? 53) _____
- A) nonpolar covalent bond
 - B) electron-proton interaction
 - C) polar covalent bond
 - D) ionic bond
 - E) hydrogen bond
- 54) Which of the following would be least affected by the presence of water? 54) _____
- A) ionic bond
 - B) electron-proton interaction
 - C) hydrogen bond
 - D) polar covalent bond

E) nonpolar covalent bond

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

55) What is the difference between covalent and ionic bonds? 55) _____

56) Which type of chemical bond is the most important for biological molecules? Why? 56) _____

57) Draw the following atoms: make sure that you clearly represent all three subatomic particles and show the electron shells for each: 57) _____

Nitrogen (atomic number = 7) Hydrogen (atomic number = 1)

58) Draw the following atoms: make sure that you clearly represent all three subatomic particles and show the electron shells for each: 58) _____

Nitrogen (atomic number = 7) Hydrogen (atomic number = 1)

Using the atoms drawn, draw the covalent bond(s) that would allow for the atoms to be most stable.

59) The attraction between a slight positive charge on a hydrogen atom and the slight negative charge of a nearby atom is a _____ 59) _____

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

60) What happens when hydrochloric acid (HCl) is added to pure water? 60) _____

- A) The concentration of OH^- ions increases.
- B) The water has a decrease of H^+ ions.
- C) The HCl molecules separate into H^+ and Cl^- ions.
- D) The pH of the solution increases.
- E) The HCl molecules float on top of the water.

61) An atom of nitrogen attracts electrons more strongly than an atom of hydrogen. Which of the following BEST describes ammonia (NH_3)? 61) _____

- A) The nitrogen is strongly negative.
- B) The hydrogens are strongly negative.
- C) The hydrogens are more slightly positive.
- D) The nitrogen is more slightly positive.
- E) Charges balance out and none of the atoms has any charge.

62) If a substance measures 7 on the pH scale, that substance 62) _____

- A) has greater concentration of OH^- than H^+ ions.
- B) probably lacks OH^- ions.
- C) may be lemon juice.
- D) is basic.
- E) has equal concentration of H^+ and OH^- ions.

- 63) A neutral solution _____
A) is hydrophobic.
B) has no H^+ .
C) has equal amounts of H^+ and OH^- .
D) has a pH of 0.
E) has no OH^- .
- 64) How do buffers work? _____
A) convert H^+ and OH^- to water
B) accept or release OH^-
C) accept or release H^+
D) soak up extra acid and base
E) monitor the blood pH
- 65) The human body must maintain a constant pH. In the blood, bicarbonate serves as a(n) _____ to help maintain the necessary pH. _____
A) buffer B) solvent C) base D) acid
- 66) Milk of magnesia is often used to treat stomach upset. It has a pH of 10. Based on this information, which of the following is true? _____
A) Milk of magnesia has the exact same pH as the stomach acid.
B) Milk of magnesia is a base.
C) Milk of magnesia is an acid.
D) Milk of magnesia is hydrophobic.
- 67) What is meant by saying water has a high specific heat? _____
A) Water can only heat up to a certain temperature.
B) It can absorb a lot of energy without changing temperature.
C) The boiling point of water is very low.
D) It grows hot very quickly.
E) Water freezes easily.
- 68) Which property (or properties) of water enables water to function as a moderator of temperature for living organisms? _____
A) high heat of vaporization
B) high specific heat
C) high heat of fusion
D) A and B
E) A, B, and C
- 69) The fact that salt dissolves in water is BEST explained by _____
A) the polar nature of water molecules.
B) the hydrophobic nature of the water.
C) the hydrophobic nature of salt.
D) the ionic nature of water molecules.
E) the charged nature of water molecules.
- 70) Hydrophilic molecules _____
A) are neutral and nonpolar.
B) readily dissolve in water.
C) form hydrogen bonds among themselves.
D) A and C

E) A, B, and C

- 71) Water will dissolve all of these EXCEPT 71) _____
A) CH₃-CH₂-CH₂-CH₃.
B) salt.
C) CH₃-COOH.
D) CH₃-CH₂-OH.
E) sugar.
- 72) Water is considered a good solvent because 72) _____
A) it dissolves ionically bonded molecules.
B) it can hydrogen bond with other polar molecules.
C) it dissolves all organic molecules.
D) A and B
E) all of these
- 73) Water moves through a plant because of the property of 73) _____
A) cohesion.
B) high heat of fusion.
C) high specific heat.
D) high heat of vaporization.
E) adhesion.
- 74) Why are water molecules cohesive? 74) _____
A) because they form hydrogen bonds
B) because they create surface tension
C) because they contain hydrogen
D) because they are repelled by nonpolar molecules
E) because they stick to other polar molecules
- 75) If the acidic level of human blood increases, how is homeostasis 75) _____
maintained?
A) H⁺ ion-donor levels increase.
B) Bicarbonate (HCO₃⁻) releases H⁺ ions that combine with excess
OH⁻ ions to form H₂O.
C) Bicarbonate (HCO₃⁻) accepts H⁺ and forms carbonic acid.
D) Answers A, B, and C all are correct.
- 76) As ice melts, it 76) _____
A) increases its property of cohesion.
B) absorbs heat from its surroundings.
C) increases its heat of vaporization.
D) becomes less dense.
- 77) What determines the cohesiveness of water molecules? 77) _____
A) covalent bonds
B) hydrophobic interactions
C) ionic bonds
D) hydrogen bonds
E) All of the above are correct.

- 78) If you place a paper towel in a dish of water, the water will move up the towel by capillary action. What property of water gives rise to capillary action? 78) _____
- A) Water molecules separate into H^+ and OH^- ions.
 - B) Water can form hydrogen bonds.
 - C) Water is a good solvent.
 - D) Water molecules have hydrophobic interactions.
 - E) Water takes up large amounts of heat when it vaporizes.
- 79) Sweating is a useful cooling device for humans because 79) _____
- A) water can exist in three states at temperatures common on Earth.
 - B) water ionizes readily.
 - C) water is an outstanding solvent.
 - D) water takes up a great deal of heat in changing from its solid state to its liquid state.
 - E) water takes up a great deal of heat in changing from its liquid state to its gaseous state.
- 80) In general, a substance that carries an electrical charge can dissolve in water. Given this fact, which of the following would most likely NOT dissolve in water? 80) _____
- A) polar covalent molecules
 - B) ionic compounds
 - C) NaCl
 - D) nonpolar molecules
- 81) You place a paper clip on the surface of a bowl of water. You observe that the paper clip remains suspended on the surface. This is due to the 81) _____
- A) density of the water.
 - B) fact the water is a good solvent.
 - C) surface tension of the water.
 - D) polarity of the water.
- 82) The specific heat of water is ten times greater than that of iron. You place a metal pot full of water on the stove to heat it up. You touch the metal handle of the pot of when the water is still only lukewarm. Which of the following BEST describes what will happen? 82) _____
- A) You find that both the water and the handle are the same temperature.
 - B) You burn your finger and pull your hand away from the very hot handle.
 - C) You determine that metal pots full of water produce acids and bases.
 - D) You find that the handle is cooler than the water in the pot.
- 83) You place a beaker of turpentine on a hot plate next to a beaker of water. Which of the following pieces of information do you need to know in order to hypothesize which will heat up faster? 83) _____
- A) the specific heat of each liquid
 - B) the number of hydroxide ions in each liquid
 - C) the pH of each liquid
 - D) the heat of vaporization of each liquid
- 84) You drop a handful of salt into a glass of water. Which of the following BEST

describes 84)
what is
happeni
ng inside
the glass
at the
molecula
r level?

- A) The positively charged hydrogen ends of the water molecules are attracted to sodium ions.
- B) The positively charged hydrogen ends of the water molecules are attracted to chloride ions.
- C) Water and sodium form a covalent bond.
- D) Sodium and chloride ions form a covalent bond.

85) Your friend does a belly flop into the pool. The stinging pain he feels is most likely due to the 85) _____

- A) hydrophobicity of your friend's skin.
- B) surface tension of water.
- C) pH of the water.
- D) fact that water is a good solvent.

86) Which of the following is the most dense? 86) _____

- A) ice
- B) liquid water
- C) water vapor
- D) All of the above forms of water have the same density.

87) A living thing composed mostly of water can withstand sunny, hot weather without their body temperature soaring quickly. Which of the following BEST explains why? 87) _____

- A) Water is a poor solvent.
- B) Water has a high specific heat.
- C) Water is a good solvent.
- D) Water has a low specific heat.

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

88) Acids have pH values below 7, while bases have pH values above 7. True or False? 88) _____

89) Water molecules are held together by ionic bonds. True or False? 89) _____

90) Water surface tension is a result of the adhesive nature of water molecules. True or False? 90) _____

91) A buffer is essential in living systems to maintain a constant pH. True or False? 91) _____

92) Most liquids become less dense upon solidification, but water is different in that it becomes more dense when it solidifies. True or False? 92) _____

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

the question.

93) The water strider skates along the surface of water due to a property of liquids called _____.

93) _____

94) Molecules that are electrically attracted to water molecules are _____.

94) _____

95) What property of water is responsible for the ability of plants to get water from their roots up to their leaves?

95) _____

96) How does a base differ from an acid?

96) _____

97) Imagine you are trying to make a homemade salad dressing and place several drops of olive oil into a container of water. You stir the solution but the oil doesn't readily mix. Instead you continue to observe a glistening clump of oil that floats on the surface. Explain what is happening at the molecular level. (Your answer should include the term hydrophobic.)

97) _____

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

- 52) E
- 53) E
- 54) E
- 55) Covalent bonds are the sharing of electrons between atoms while ionic bonds are the electric charge attraction between two ions.
- 56) Covalent bonds are most important for biological molecules because they form the strongest types of bonds, especially in aqueous environments.
- 57) Nitrogen contains seven protons, seven neutrons and seven electrons; Hydrogen contains one proton, one neutron and one electron.
- 58) Nitrogen contains seven protons, seven neutrons and seven electrons; Hydrogen contains one proton, one neutron and one electron. Drawing should show hydrogens covalently bonded to nitrogen (NH₃).
- 59) hydrogen bond
- 60) C
- 61) C
- 62) E
- 63) C
- 64) C
- 65) A
- 66) B
- 67) B
- 68) E
- 69) A
- 70) D
- 71) A
- 72) D
- 73) A
- 74) A
- 75) C
- 76) B
- 77) D
- 78) B
- 79) E
- 80) D
- 81) C
- 82) B
- 83) A
- 84) B
- 85) B
- 86) B
- 87) B
- 88) TRUE
- 89) FALSE
- 90) FALSE
- 91) TRUE
- 92) FALSE
- 93) surface tension
- 94) hydrophilic
- 95) Cohesion
- 96) A base is a solution with a concentration of OH⁻ ions greater than H⁺ (pH greater than 7) and an acid has a H⁺ concentration that exceeds its OH⁻ ion concentration (pH less than 7).
- 97) When oil molecules are in together in water, their nonpolar surfaces are hydrophobic and

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