

Student: \_\_\_\_\_

1. The electrons in an atom
  - A. have less energy the further they are away from the nucleus.
  - B. move to a higher orbital when they lose energy.
  - C. move to a higher orbital when they gain energy.
  - D. are found in the nucleus.
  - E. move freely between the orbitals.
2. When electrons in excited orbitals lose energy, that energy can
  - A. be used to drive another chemical process.
  - B. emit light.
  - C. be passed on to a neighbouring atom.
  - D. All of the answers are correct.
  - E. be used to drive photosynthesis in a leaf cell in sunlight.
3. An oxygen atom has 8 protons, 8 neutrons and 8 electrons.
  - A. Its atomic number is 16.
  - B. Its mass number is 8.
  - C. It has 4 electrons in the first energy level (electron shell).
  - D. It has 6 electrons in the outermost energy level (electron shell).
  - E. It has 8 electrons in the outermost energy level (electron shell).
4. Atoms of the same element can exist in different forms called isotopes. The most common isotope of carbon is carbon-12 but it has two less-common isotopes, carbon-13 and carbon-14. The less-common isotopes have
  - A. the same number of electrons but more protons.
  - B. the same number of protons but more neutrons.
  - C. the same number of neutrons but more protons.
  - D. the same number of protons but more electrons.
  - E. the same number of neutrons but more electrons.
5. Covalent bonds
  - A. only form between atoms of the same element.
  - B. form by the loss of an electron from the outer electron shell.
  - C. are formed by sharing electrons between two atoms.
  - D. form between positively and negatively charged ions.
  - E. form by the loss of an electron from the outer electron shell.
6. Ionic bonds are formed by the
  - A. attraction between atoms with opposite polarity.
  - B. transfer of electrons from one atom to another.
  - C. sharing of electrons between oppositely charged ions.
  - D. attraction between positively and negatively charged ions of the same element.
  - E. sharing of electrons in the outer electron orbital of an atom.
7. Hydrogen bonds can form between
  - A. carbon and hydrogen atoms.
  - B. oxygen and hydrogen atoms in the same water molecule.
  - C. oxygen and hydrogen atoms in adjacent molecules.
  - D. hydrogen atoms in adjacent molecules.
  - E. hydrogen atoms within the same molecule.

8. In living organisms, most of the strongest chemical bonds are the result of
- electrical attraction between oppositely charged ions.
  - hydrogen bonding between positively and negatively charged regions of polar molecules.
  - the transfer of electrons from one atom to another.
  - the sharing of electrons between two atoms.
  - van der Waals forces between two atoms.
9. One of the properties that make water an ideal medium for living organisms is that water
- can absorb considerable amounts of heat with little change in temperature.
  - expands and becomes more dense as it changes from solid to liquid form.
  - releases heat when it evaporates.
  - is a universal solvent.
  - has a high boiling point.
10. Hydrogen bonding between water molecules gives water a high level of structural organisation. In ice, the maximum number of hydrogen bonds formed with one water molecule is
- 2.
  - 3.
  - 4.
  - 6.
  - 1.
11. Water is a versatile solvent because water molecules are
- small.
  - polar.
  - hydrophilic.
  - loosely connected by hydrogen bonds.
  - hydrophobic.
12. Which of the following statements is CORRECT?
- The internal pH of the cells of an organism is usually the same as the pH of the external environment.
  - The internal pH of the cells of an organism may be quite different to the pH of the external environment.
  - Regardless of the internal pH of their cells, most living organisms can only survive within a narrow range of environmental pH.
  - Regardless of the pH of the environment, most living organisms will not survive if the internal pH of their cells fluctuates.
  - The internal pH of a muscle cell may become more basic during exercise.
13. The interior of a lysosome in an animal cell has a pH of 5, while the cytosol of the cell has a pH of 7.4. This indicates that in comparison to the cytosol, the interior of the lysosome has a
- lower concentration of total dissolved ions.
  - lower concentration of hydrogen ions.
  - higher concentration of bicarbonate ions.
  - higher concentration of hydrogen ions.
  - higher concentration of hydroxyl ions.
14. Buffers are substances that assist cells and organisms to resist changes in pH by
- accepting  $H^+$  ions as pH rises and releasing  $H^+$  ions as pH falls.
  - accepting  $OH^-$  ions as pH rises and releasing  $H^+$  ions as pH falls.
  - accepting  $H^+$  ions as pH falls and releasing  $H^+$  ions as pH rises.
  - accepting  $OH^-$  ions as pH falls and releasing  $H^+$  ions as pH rises.
  - accepting  $OH^-$  ions as pH falls and releasing  $OH^-$  ions as pH rises.

15. Living organisms are composed of elements made of small units called
- atoms.
  - protons.
  - neutrons.
  - electrons.
  - ions.
16. Which one of the following is not one of the four most abundant atoms (>99%) found in living cells?
- carbon.
  - hydrogen.
  - oxygen.
  - nitrogen.
  - phosphorus.
17. Electrons exist in orbitals around the nucleus of an atom. Any orbital may contain
- only 2 electrons.
  - 4 electrons.
  - 6 electrons.
  - 8 electrons.
  - any number of electrons depending on the orbital.
18. Atoms in which the number of protons does not equal the number of electrons in the orbital are known as
- ions.
  - molecules.
  - elements.
  - isotopes.
  - radioactive.
19. Energy levels of electrons in their orbitals are determined by
- the distance of the orbital from the nucleus.
  - the number of electrons in the orbital.
  - the number of neutrons in the nucleus.
  - the number of protons in the orbital.
  - the distance of the electrons in the orbital from each other.
20. An element is a substance made up of
- one type of atom only.
  - one type of molecule only.
  - at least two different types of atoms.
  - one atom linked to a different atom by a covalent bond.
  - an atom with one neutron and one proton in the nucleus.
21. The small, negatively charged particles in an atom are called
- electrons.
  - protons.
  - neutrons.
  - ions.
  - isotopes.
22. The atomic number of an atom is
- the number of protons in the nucleus.
  - the number of protons in the orbitals.
  - the number of electrons in the nucleus.
  - the number of neutrons in the nucleus.
  - the number of ions in the nucleus.

23. The mass number of an atom is the number of
- protons in the nucleus of an atom.
  - protons and neutrons combined in the nucleus of an atom.
  - neutrons in the nucleus of an atom.
  - electrons in an atom.
  - protons and electrons combined in an atom.
24. Elements that have atoms with the same number of protons, but different numbers of neutrons, are called
- isotopes.
  - molecules.
  - electrons.
  - ions.
  - subatomic particles.
25. Living organisms are composed predominantly of which of the following groups of elements
- Hydrogen (H); oxygen (O); carbon (C).
  - Hydrogen (H); oxygen (O); phosphorus (P).
  - Hydrogen (H); phosphorus (P); carbon (C).
  - Hydrogen (H); sodium (Na); chloride (Cl).
  - Oxygen (O); sodium (Na); chloride (Cl).
26. The chemical properties of elements are determined primarily by
- the number and arrangement of electrons in the highest energy level of the atom (the outermost electron shell).
  - the number of neutrons in the nucleus.
  - the number and arrangement of electrons in the lowest energy level of the atom (the innermost electron shell).
  - the ability of the electrons to change to a different orbital.
  - the type of bonds formed in the electron orbitals.
27. Elements in living organisms are
- similar to those found generally in the biosphere.
  - not similar to those found in the biosphere.
  - mainly carbon (C) and sodium chloride (NaCl).
  - highly reactive.
  - mostly atoms with a high atomic mass.
28. Carbon has 4 electrons in its outer shell available for covalent bonding. Which of the following statements about carbon is INCORRECT?
- Carbon is able to share the electrons with 4 atoms of hydrogen.
  - Carbon is able to share the electrons with other carbon atoms to form biomolecules.
  - Carbon is able to share electrons with oxygen to form carbon dioxide.
  - Carbon is able to form stable molecules by gaining 4 electrons in its outer electron orbital.
  - Carbon is able to form highly reactive molecules by losing 2 of the 4 electrons in its outer electron orbital.
29. Nitrogen has 5 electrons in its outer orbital which allows it to share its electrons with
- 2 hydrogen atoms.
  - 3 hydrogen atoms.
  - 4 hydrogen atoms.
  - 5 hydrogen atoms.
  - 6 hydrogen atoms.

30. The pH of blood is 7.4. The pH of a vinegar is 1.4. The blood sample has
- 6 times lower  $[H^+]$  than the vinegar.
  - 6,000 times higher  $[H^+]$  than the vinegar.
  - 6,000 times lower  $[H^+]$  than the vinegar.
  - 5.3 times lower  $[H^+]$  than the vinegar.
  - a million times lower  $[H^+]$  than the vinegar.
31. When two atoms share a pair of electrons, the type of bonding is termed
- ionic.
  - hydrogen.
  - covalent.
  - non-covalent.
  - unstable.
32. When atoms gain or lose electrons from their orbital and so become charged, they are called
- unstable.
  - non-covalent.
  - isotopes.
  - radioactive.
  - ions.
33. In a molecule of water, the electrons are not equally shared between the atoms. This makes the molecule polar and interaction with other polar molecules allows the formation of
- covalent bonds.
  - van der Waals interactions.
  - hydrogen bonds.
  - ionic bonds.
  - stable bonds.
34. Which of the following statements about chemical bonds is CORRECT?
- Van der Waals forces allow temporary associations between molecules but the bonds are 100 times weaker than covalent bonds.
  - Covalent bonds involve the attraction between two ions of opposite charge.
  - Hydrogen bonds formed between hydrogen and oxygen atoms are strong, stable bonds.
  - In a molecule of water, the electrons are shared equally between the hydrogen and the oxygen molecule. This is the reason for the stability of water.
  - Ionic compounds result from the attraction between anions (positively charged ions) and cations (negatively charged ions).
35. Water molecules tend to stick to other water molecules. This is known as
- cohesion.
  - adhesion.
  - ionic bonding.
  - covalent bonding.
  - van der Waals forces.
36. Which of the following statements about water is INCORRECT?
- Water molecules tend to stick to one another (cohesion) and to other molecules that have charged surface groups to which water can hydrogen bond (adhesion).
  - The cohesive forces between water molecules are stronger between water molecules than between water and air molecules. This results in surface tension.
  - Both cohesive and adhesive forces are together responsible for the capillary action of water.
  - Only adhesive forces are responsible for the capillary action that causes water to rise through plant stems.
  - Heat is liberated when liquid water is turned to ice. This property of water is called the heat of fusion.

37. Water is extremely important in all living things because of its properties. Which of the following is not a property of water?
- A. Water is a polar molecule because of the unequal sharing of the electrons between hydrogen and oxygen.
  - B. Water molecules form hydrogen bonds with each other and with other polar molecules.
  - C. Hydrogen bonding makes water molecules cohesive. This cohesiveness results in surface tension.
  - D. Water repels non-polar molecules.
  - E. Water is an excellent buffer and maintains the intracellular pH in a cell.
38. Compared with a pH of 7, a solution with a pH of 9 has
- A. 2 times higher  $[H^+]$  concentration.
  - B. 2 times lower  $[H^+]$  concentration.
  - C. 1/100 the  $[H^+]$  concentration.
  - D. 100 times the  $[H^+]$  concentration.
  - E. 20 times lower  $[H^+]$  concentration.
39. Substances that release hydrogen ions ( $H^+$ ) into solution are
- A. acids.
  - B. bases.
  - C. buffers.
  - D. hydrophobic.
  - E. carbon containing molecules.
40. Which of the following statements is INCORRECT?
- A. A buffer solution maintains a relatively constant pH either by removing hydrogen ions or by releasing them.
  - B. Water molecules ionise and dissociate forming both hydrogen ( $H^+$ ) and hydroxyl ions ( $OH^-$ ).
  - C. The pH is the concentration of hydrogen ions in the solution.
  - D. The pH is the concentration of hydroxyl ions in the solution.
  - E. The pH scale is logarithmic.

# 1 Key

1. The electrons in an atom
- A. have less energy the further they are away from the nucleus.
  - B. move to a higher orbital when they lose energy.
  - C.** move to a higher orbital when they gain energy.
  - D. are found in the nucleus.
  - E. move freely between the orbitals.

Blooms: Knowledge  
Difficulty: Medium  
Graduate Attribute: In-depth knowledge of subject material  
Knox - Chapter 01 #1  
Knox - Chapter 1  
Knox - Part 1  
Learning Objective: 2  
Section: All life is composed of the same few elements

2. When electrons in excited orbitals lose energy, that energy can
- A. be used to drive another chemical process.
  - B. emit light.
  - C. be passed on to a neighbouring atom.
  - D.** All of the answers are correct.
  - E. be used to drive photosynthesis in a leaf cell in sunlight.

Blooms: Knowledge  
Difficulty: Medium  
Graduate Attribute: In-depth knowledge of subject material  
Knox - Chapter 01 #2  
Knox - Chapter 1  
Knox - Part 1  
Learning Objective: 2  
Section: All life is composed of the same few elements

3. An oxygen atom has 8 protons, 8 neutrons and 8 electrons.
- A. Its atomic number is 16.
  - B. Its mass number is 8.
  - C. It has 4 electrons in the first energy level (electron shell).
  - D.** It has 6 electrons in the outermost energy level (electron shell).
  - E. It has 8 electrons in the outermost energy level (electron shell).

Blooms: Knowledge  
Difficulty: Medium  
Graduate Attribute: In-depth knowledge of subject material  
Knox - Chapter 01 #3  
Knox - Chapter 1  
Knox - Part 1  
Learning Objective: 2  
Section: All life is composed of the same few elements

4. Atoms of the same element can exist in different forms called isotopes. The most common isotope of carbon is carbon-12 but it has two less-common isotopes, carbon-13 and carbon-14. The less-common isotopes have
- A. the same number of electrons but more protons.
  - B.** the same number of protons but more neutrons.
  - C. the same number of neutrons but more protons.
  - D. the same number of protons but more electrons.
  - E. the same number of neutrons but more electrons.

Blooms: Knowledge  
Difficulty: Medium  
Graduate Attribute: In-depth knowledge of subject material  
Knox - Chapter 01 #4  
Knox - Chapter 1  
Knox - Part 1  
Learning Objective: 2  
Section: All life is composed of the same few elements

5. Covalent bonds
- A. only form between atoms of the same element.
  - B. form by the loss of an electron from the outer electron shell.
  - C.** are formed by sharing electrons between two atoms.
  - D. form between positively and negatively charged ions.
  - E. form by the loss of an electron from the outer electron shell.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #5*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

6. Ionic bonds are formed by the
- A. attraction between atoms with opposite polarity.
  - B.** transfer of electrons from one atom to another.
  - C. sharing of electrons between oppositely charged ions.
  - D. attraction between positively and negatively charged ions of the same element.
  - E. sharing of electrons in the outer electron orbital of an atom.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #6*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

7. Hydrogen bonds can form between
- A. carbon and hydrogen atoms.
  - B. oxygen and hydrogen atoms in the same water molecule.
  - C.** oxygen and hydrogen atoms in adjacent molecules.
  - D. hydrogen atoms in adjacent molecules.
  - E. hydrogen atoms within the same molecule.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #7*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

8. In living organisms, most of the strongest chemical bonds are the result of
- A. electrical attraction between oppositely charged ions.
  - B. hydrogen bonding between positively and negatively charged regions of polar molecules.
  - C. the transfer of electrons from one atom to another.
  - D.** the sharing of electrons between two atoms.
  - E. van der Waals forces between two atoms.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #8*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*



9. One of the properties that make water an ideal medium for living organisms is that water A. can absorb considerable amounts of heat with little change in temperature.  
 B. expands and becomes more dense as it changes from solid to liquid form.  
 C. releases heat when it evaporates.  
 D. is a universal solvent.  
 E. has a high boiling point.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #9*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 4*  
*Section: Water is the medium of life*

10. Hydrogen bonding between water molecules gives water a high level of structural organisation. In ice, the maximum number of hydrogen bonds formed with one water molecule is  
 A. 2.  
 B. 3.  
C. 4.  
 D. 6.  
 E. 1.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #10*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 4*  
*Section: Water is the medium of life*

11. Water is a versatile solvent because water molecules are  
 A. small.  
B. polar.  
 C. hydrophilic.  
 D. loosely connected by hydrogen bonds.  
 E. hydrophobic.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #11*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 4*  
*Section: Water is the medium of life*

12. Which of the following statements is CORRECT?  
 A. The internal pH of the cells of an organism is usually the same as the pH of the external environment.  
B. The internal pH of the cells of an organism may be quite different to the pH of the external environment.  
 C. Regardless of the internal pH of their cells, most living organisms can only survive within a narrow range of environmental pH.  
 D. Regardless of the pH of the environment, most living organisms will not survive if the internal pH of their cells fluctuates.  
 E. The internal pH of a muscle cell may become more basic during exercise.

*Blooms: Comprehension*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #12*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 6*  
*Section: Acids, bases and buffers*

13. The interior of a lysosome in an animal cell has a pH of 5, while the cytosol of the cell has a pH of 7.4. This indicates that in comparison to the cytosol, the interior of the lysosome has a
- A. lower concentration of total dissolved ions.
  - B. lower concentration of hydrogen ions.
  - C. higher concentration of bicarbonate ions.
  - D. higher concentration of hydrogen ions.**
  - E. higher concentration of hydroxyl ions.

*Blooms: Application*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #13*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 6*  
*Section: Acids, bases and buffers*

14. Buffers are substances that assist cells and organisms to resist changes in pH by
- A. accepting  $\text{H}^+$  ions as pH rises and releasing  $\text{H}^+$  ions as pH falls.
  - B. accepting  $\text{OH}^-$  ions as pH rises and releasing  $\text{H}^+$  ions as pH falls.
  - C. accepting  $\text{H}^+$  ions as pH falls and releasing  $\text{H}^+$  ions as pH rises.**
  - D. accepting  $\text{OH}^-$  ions as pH falls and releasing  $\text{H}^+$  ions as pH rises.
  - E. accepting  $\text{OH}^-$  ions as pH falls and releasing  $\text{OH}^-$  ions as pH rises.

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #14*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 5*  
*Section: Acids, bases and buffers*

15. Living organisms are composed of elements made of small units called
- A. atoms.**
  - B. protons.
  - C. neutrons.
  - D. electrons.
  - E. ions.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #15*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 1*  
*Section: All life is composed of the same few elements*

16. Which one of the following is not one of the four most abundant atoms (>99%) found in living cells?
- A. carbon.
  - B. hydrogen.
  - C. oxygen.
  - D. nitrogen.
  - E. phosphorus.**

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #16*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 1*  
*Section: All life is composed of the same few elements*

17. Electrons exist in orbitals around the nucleus of an atom. Any orbital may contain  
A. only 2 electrons.  
B. 4 electrons.  
C. 6 electrons.  
D. 8 electrons.  
E. any number of electrons depending on the orbital.

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #17*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 1*  
*Section: All life is composed of the same few elements*

18. Atoms in which the number of protons does not equal the number of electrons in the orbital are known as  
A. ions.  
B. molecules.  
C. elements.  
D. isotopes.  
E. radioactive.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #18*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

19. Energy levels of electrons in their orbitals are determined by  
A. the distance of the orbital from the nucleus.  
B. the number of electrons in the orbital.  
C. the number of neutrons in the nucleus.  
D. the number of protons in the orbital.  
E. the distance of the electrons in the orbital from each other.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #19*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

20. An element is a substance made up of  
A. one type of atom only.  
B. one type of molecule only.  
C. at least two different types of atoms.  
D. one atom linked to a different atom by a covalent bond.  
E. an atom with one neutron and one proton in the nucleus.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #20*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 1*

21. The small, negatively charged particles in an atom are called  
**A.** electrons.  
B. protons.  
C. neutrons.  
D. ions.  
E. isotopes.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #21*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

22. The atomic number of an atom is  
**A.** the number of protons in the nucleus.  
B. the number of protons in the orbitals.  
C. the number of electrons in the nucleus.  
D. the number of neutrons in the nucleus.  
E. the number of ions in the nucleus.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #22*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

23. The mass number of an atom is the number of  
A. protons in the nucleus of an atom.  
**B.** protons and neutrons combined in the nucleus of an atom.  
C. neutrons in the nucleus of an atom.  
D. electrons in an atom.  
E. protons and electrons combined in an atom.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #23*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

24. Elements that have atoms with the same number of protons, but different numbers of neutrons, are called  
**A.** isotopes.  
B. molecules.  
C. electrons.  
D. ions.  
E. subatomic particles.

*Difficulty: Easy*  
*Knox - Chapter 01 #24*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

25. Living organisms are composed predominantly of which of the following groups of elements
- A.** Hydrogen (H); oxygen (O); carbon (C).
  - B. Hydrogen (H); oxygen (O); phosphorus (P).
  - C. Hydrogen (H); phosphorus (P); carbon (C).
  - D. Hydrogen (H); sodium (Na); chloride (Cl).
  - E. Oxygen (O); sodium (Na); chloride (Cl).

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #25*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 1*  
*Section: All life is composed of the same few elements*

26. The chemical properties of elements are determined primarily by
- A.** the number and arrangement of electrons in the highest energy level of the atom (the outermost electron shell).
  - B. the number of neutrons in the nucleus.
  - C. the number and arrangement of electrons in the lowest energy level of the atom (the innermost electron shell).
  - D. the ability of the electrons to change to a different orbital.
  - E. the type of bonds formed in the electron orbitals.

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #26*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

27. Elements in living organisms are
- A. similar to those found generally in the biosphere.
  - B.** not similar to those found in the biosphere.
  - C. mainly carbon (C) and sodium chloride (NaCl).
  - D. highly reactive.
  - E. mostly atoms with a high atomic mass.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #27*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

28. Carbon has 4 electrons in its outer shell available for covalent bonding. Which of the following statements about carbon is INCORRECT?
- A. Carbon is able to share the electrons with 4 atoms of hydrogen.
  - B. Carbon is able to share the electrons with other carbon atoms to form biomolecules.
  - C. Carbon is able to share electrons with oxygen to form carbon dioxide.
  - D. Carbon is able to form stable molecules by gaining 4 electrons in its outer electron orbital.
  - E.** Carbon is able to form highly reactive molecules by losing 2 of the 4 electrons in its outer electron orbital.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #28*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

29. Nitrogen has 5 electrons in its outer orbital which allows it to share its electrons with
- A. 2 hydrogen atoms.
  - B.** 3 hydrogen atoms.
  - C. 4 hydrogen atoms.
  - D. 5 hydrogen atoms.
  - E. 6 hydrogen atoms.

*Blooms: Knowledge*  
*Difficulty: Medium*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #29*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 2*  
*Section: All life is composed of the same few elements*

30. The pH of blood is 7.4. The pH of a vinegar is 1.4. The blood sample has
- A. 6 times lower  $[H^+]$  than the vinegar.
  - B. 6,000 times higher  $[H^+]$  than the vinegar.
  - C. 6,000 times lower  $[H^+]$  than the vinegar.
  - D. 5.3 times lower  $[H^+]$  than the vinegar.
  - E.** a million times lower  $[H^+]$  than the vinegar.

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #30*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 6*  
*Section: Acids, bases and buffers*

31. When two atoms share a pair of electrons, the type of bonding is termed
- A. ionic.
  - B. hydrogen.
  - C.** covalent.
  - D. non-covalent.
  - E. unstable.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #31*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

32. When atoms gain or lose electrons from their orbital and so become charged, they are called
- A. unstable.
  - B. non-covalent.
  - C. isotopes.
  - D. radioactive.
  - E.** ions.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #32*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

33. In a molecule of water, the electrons are not equally shared between the atoms. This makes the molecule polar and interaction with other polar molecules allows the formation of
- covalent bonds.
  - van der Waals interactions.
  - C.** hydrogen bonds.
  - ionic bonds.
  - stable bonds.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #33*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

34. Which of the following statements about chemical bonds is **CORRECT**?
- A.** Van der Waals forces allow temporary associations between molecules but the bonds are 100 times weaker than covalent bonds.
  - Covalent bonds involve the attraction between two ions of opposite charge.
  - Hydrogen bonds formed between hydrogen and oxygen atoms are strong, stable bonds.
  - In a molecule of water, the electrons are shared equally between the hydrogen and the oxygen molecule. This is the reason for the stability of water.
  - Ionic compounds result from the attraction between anions (positively charged ions) and cations (negatively charged ions).

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #34*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 3*  
*Section: Chemical bonding of atoms makes molecules*

35. Water molecules tend to stick to other water molecules. This is known as
- A.** cohesion.
  - adhesion.
  - ionic bonding.
  - covalent bonding.
  - van der Waals forces.

*Blooms: Knowledge*  
*Difficulty: Easy*  
*Graduate Attribute: In-depth knowledge of subject material*  
*Knox - Chapter 01 #35*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 4*  
*Section: Water is the medium of life*

36. Which of the following statements about water is **INCORRECT**?
- Water molecules tend to stick to one another (cohesion) and to other molecules that have charged surface groups to which water can hydrogen bond (adhesion).
  - The cohesive forces between water molecules are stronger between water molecules than between water and air molecules. This results in surface tension.
  - Both cohesive and adhesive forces are together responsible for the capillary action of water.
  - D.** Only adhesive forces are responsible for the capillary action that causes water to rise through plant stems.
  - Heat is liberated when liquid water is turned to ice. This property of water is called the heat of fusion.

*Blooms: Knowledge*  
*Difficulty: Hard*  
*Knox - Chapter 01 #36*  
*Knox - Chapter 1*  
*Knox - Part 1*  
*Learning Objective: 4*  
*Section: Water is the medium of life*

37. Water is extremely important in all living things because of its properties. Which of the following is not a property of water?
- A. Water is a polar molecule because of the unequal sharing of the electrons between hydrogen and oxygen.
  - B. Water molecules form hydrogen bonds with each other and with other polar molecules.
  - C. Hydrogen bonding makes water molecules cohesive. This cohesiveness results in surface tension.
  - D. Water repels non-polar molecules.
  - E.** Water is an excellent buffer and maintains the intracellular pH in a cell.

*Blooms: Knowledge*

*Difficulty: Hard*

*Graduate Attribute: In-depth knowledge of subject material*

*Knox - Chapter 01 #37*

*Knox - Chapter 1*

*Knox - Part 1*

*Learning Objective: 4*

*Section: Water is the medium of life*

38. Compared with a pH of 7, a solution with a pH of 9 has
- A. 2 times higher  $[H^+]$  concentration.
  - B. 2 times lower  $[H^+]$  concentration.
  - C.** 1/100 the  $[H^+]$  concentration.
  - D. 100 times the  $[H^+]$  concentration.
  - E. 20 times lower  $[H^+]$  concentration.

*Blooms: Knowledge*

*Difficulty: Hard*

*Graduate Attribute: In-depth knowledge of subject material*

*Knox - Chapter 01 #38*

*Knox - Chapter 1*

*Knox - Part 1*

*Learning Objective: 6*

*Section: Acids, bases and buffers*

39. Substances that release hydrogen ions ( $H^+$ ) into solution are
- A.** acids.
  - B. bases.
  - C. buffers.
  - D. hydrophobic.
  - E. carbon containing molecules.

*Blooms: Knowledge*

*Difficulty: Medium*

*Graduate Attribute: In-depth knowledge of subject material*

*Knox - Chapter 01 #39*

*Knox - Chapter 1*

*Knox - Part 1*

*Learning Objective: 5*

*Section: Acids, bases and buffers*



40. Which of the following statements is INCORRECT?
- A. A buffer solution maintains a relatively constant pH either by removing hydrogen ions or by releasing them.
  - B. Water molecules ionise and dissociate forming both hydrogen ( $\text{H}^+$ ) and hydroxyl ions ( $\text{OH}^-$ ).
  - C. The pH is the concentration of hydrogen ions in the solution.
  - D.** The pH is the concentration of hydroxyl ions in the solution.
  - E. The pH scale is logarithmic.

*Blooms: Knowledge*

*Difficulty: Medium*

*Graduate Attribute: In-depth knowledge of subject material*

*Knox - Chapter 01 #40*

*Knox - Chapter 1*

*Knox - Part 1*

*Learning Objective: 6*

*Section: Acids, bases and buffers*

# 1 Summary

<u>Category</u>	<u># of Questions</u>
Blooms: Application	1
Blooms: Comprehension	1
Blooms: Knowledge	37
Difficulty: Easy	14
Difficulty: Hard	9
Difficulty: Medium	17
Graduate Attribute: In-depth knowledge of subject material	38
Knox - Chapter 01	40
Knox - Chapter 1	40
Knox - Part 1	40
Learning Objective: 1	5
Learning Objective: 2	14
Learning Objective: 3	8
Learning Objective: 4	6
Learning Objective: 5	2
Learning Objective: 6	5
Section: Acids, bases and buffers	7
Section: All life is composed of the same few elements	18
Section: Chemical bonding of atoms makes molecules	8
Section: Water is the medium of life	6