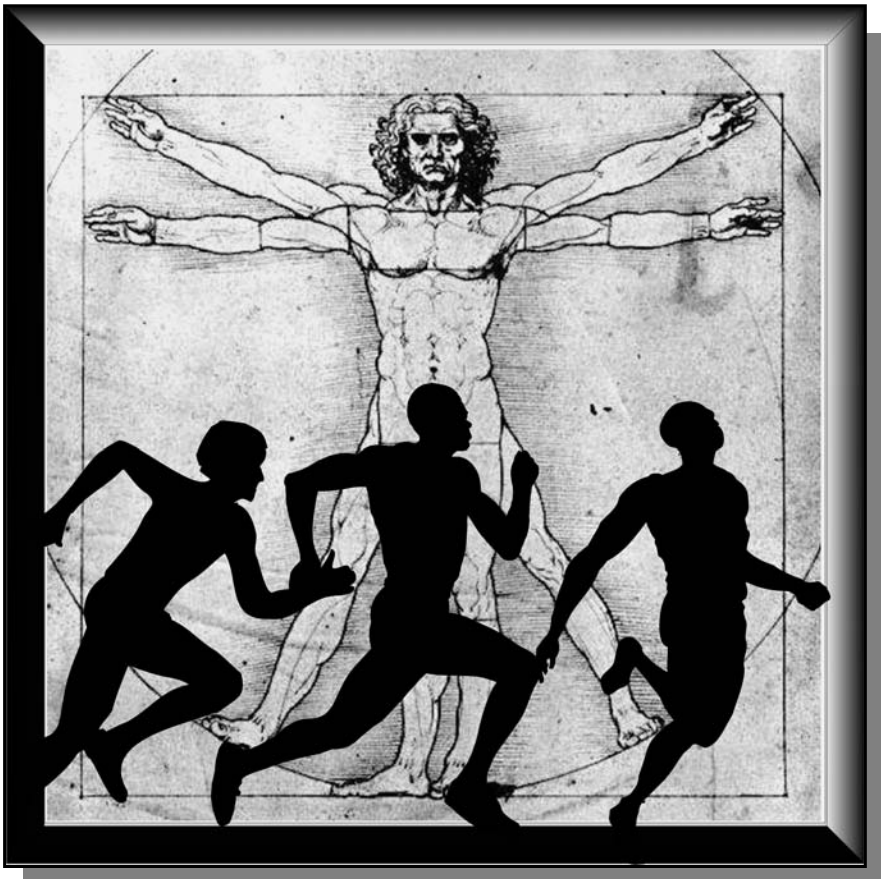
The Principles, Theories & Precepts of Biology

ACTIVITIES



Chapter 1

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The Principles, Theories & Precepts of Biology

Chapter 1, Activities

Publishers
Gene Hood
Ronald E. Johnson, C.Ph.D.

Managing Editor
Ronald E. Johnson, C.Ph.D.

Writer
Mary Ames

Editor
Nancy Johnson

Consulting Editor
Mindi Tapp

Activities, Lessons, Quizzes & Tests
Mindi Tapp

Page Composition
Jeff Carr
Lydia J. Seals

Graphics
Lydia J. Seals
Jeff Carr

Quality Assurance
Carolyn Hood
Nancy Johnson
Nora Young

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Name: _____

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ACTIVITIES
Lesson 1:

A LOOK AT LIFE—THE STUDY OF BIOLOGY

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Some non-living things, such as crystals, can reproduce themselves._____
   (a) True or (b) False

2. All living things breath and move._____ (a) True or (b) False

3. A flame of fire has many properties which living things also possess, therefore it can be categorized as a living thing._____ (a) True or (b) False

4. Which of the following naturally occurring elements is not of particular importance to living organisms? _____
   (a) hydrogen (b) carbon (c) phosphorus (d) neon

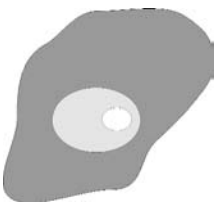
5. List the six elements that occur in all living creatures and are absolutely necessary for life.
   _____
   _____

6. We can begin to define life by the type of _____ present in living organisms.

7. Although a dead frog contains all of the chemicals necessary for life, it is not alive. What is missing? _____
   (a) food (c) the breath of life
   (b) water (d) the six basic elements

8. No human has succeeded in creating life from the six basic elements._____
   (a) True or (b) False

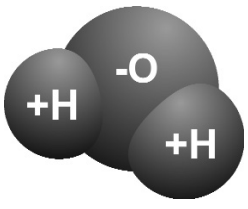
9. Which of the following represents the smallest unit of life?_____



(a) cell



(b) heart



(c) water molecule



(d) DNA

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10. The study of living beings and life processes is known as: _____.
    (a) chemistry (c) zoology
    (b) biology (d) evolution
11. The remarkable secret coding of _____ defines who you are.
12. Write the **Life Principle**:
    "_____
    _____
    _____
    _____**."**

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SCIENTIFIC METHOD



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The process by which a general statement (hypothesis) is written and tested through experimentation in order to reach a conclusion regarding a hypothesis is known as the _____.

2. A ***hypothesis*** is best defined as:_____ _____.
   (a) a theory supported by many lines of evidence and years of successful experiments
   (b) a scientific law
   (c) an assumption made to test and prove a logical conclusion
   (d) an opinion based on hypothetical information

3. According to the ***scientific method***, a hypothesis becomes a theory based on which of the following? _____
   (a) test evidence (b) opinion
   (c) popularity (d) evolution

4. A ***theory*** becomes a(n) _____ when it is supported by many lines of evidence and many years of successful experiments and observations.

5. The scientific method requires scientists to ask what important question?_____ _____.

6. When considering a scientific theory, it is best to:_____ _____.
   (a) accept those theories that are widely accepted
   (b) invest heavily in new theories
   (c) wait to accept a theory until it withstands the test of time
   (d) reject radically new ideas

7. Cigarettes and alcohol are examples of:_____ _____.
   (a) products accepted without thorough testing
   (b) habits proven to enhance human health
   (c) products that were thoroughly tested before promoted to the public
   (d) prescription drugs

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8. The drug *Thalidomide*:_____.
   (a) was never administered because it was found to cause birth defects
   (b) was prescribed without thorough testing
   (c) is used in the United States to treat morning sickness in pregnant women
   (d) was not prescribed in Europe

9. Although the scientific method is often ignored for the sake of convenience and profit, the public is encouraged to apply their own method of scientific reasoning. _____
   (a) True or (b) False

10. Germs from a dead human body are more dangerous to another human than the germs from an animal's body because:_____.
   (a) human germs are more aggressive
   (b) animal germs cannot infect humans
   (c) human germs are more easily transmitted to humans
   (d) human germs cannot be destroyed

11. Dr. Ignaz Semmelweis encouraged young medical interns to:_____
_____.
   (a) ignore conventional sanitation practices
   (b) examine the bodies of persons who had died and proceed to examine expectant mothers without washing their hands
   (c) vigorously wash their hands in water and chlorinated lime prior to examining living patients
   (d) follow normal hospital practices of the 1800s

12. Why were Dr. Semmelweis' ideas of good hygiene rejected by his colleagues?_____
_____.
   (a) They were jealous of him.
   (b) They accused him of not following the scientific method.
   (c) They refused to believe that infections could result from invisible things.
   (d) They did not like him personally.

13. Which of the following *cannot* be evaluated by laboratory experiment?_____
   (a) intensity of a storm (c) gravity
   (b) existence of God (d) speed of light

14. Which of the following judgements *can* science make?_____
_____
   (a) A painting is beautiful.
   (b) A person is attractive.
   (c) A person reacts to something.
   (d) War is immoral.

15. Society's decision of how to use science often has moral consequences. _____
   (a) True or (b) False

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16. Because of the many new discoveries being made – especially in the field of biology – scientists now feel that they must become involved in society's _____ decisions about science.

17. _____ is generally considered to have established the modern scientific method.

18. In Galileo's investigation of falling bodies at the Leaning Tower of Pisa, Italy, he found that:_____.
    (a) heavier objects fall faster
    (b) cannon balls bounce
    (c) shape influences falling speed
    (d) all objects fall at the same speed regardless of weight

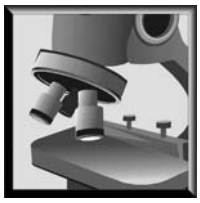
19. Galileo's emphasis on experimentation as the way to prove the validity of ideas was uncharacteristic of the European Renaissance. _____
    (a) True or (b) False

20. Write the **Life Principle**:
    "_____
    _____
    _____."

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EARLY HISTORY OF SCIENCE



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The great pyramids of the ancient Egyptians are evidence of:_____ _____.
   (a) their knowledge concerning biological and medical practices
   (b) their knowledge of astronomy and architectural engineering
   (c) the success of their medical remedies
   (d) their lack of knowledge of astronomy and architectural engineering

2. Ancient Egyptian medical procedures were:_____.
   (a) based largely on scientific research
   (b) sanitary
   (c) usually successful
   (d) based largely on superstition

3. For hundreds of years, most people believed that the Sun and other planetary bodies revolved around the _____.

4. The ***geocentric theory*** is a true scientific concept. _____
   (a) True or (b) False

5. The theory that every substance contained the "magical" ingredient, _____, which caused combustibility was known as the ***phlogiston theory***.
   (a) excreta
   (b) phlogiston
   (c) putrid meat
   (d) lizard's blood

6. The French chemist, Lavoisier, proved that _____ is the key element needed for combustion.

7. Scientists should be viewed as completely objective, detached, and impartial. _____
   (a) True or (b) False

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8. The ***Dark Ages*** were characterized by all of the following, **except**:_____
_____.
(a) a decline in scientific learning
(b) lost and forgotten discoveries
(c) superstition and reliance on church dogma
(d) many important discoveries

9. A "scholar" of the so-called Dark Ages would be most likely to:_____
_____.
(a) accept the teachings of earlier scholars
(b) question earlier theories
(c) design his or her own experiments
(d) discredit Aristotle

10. Which belief emerged from the period of intellectual awakening (the Renaissance) in Europe? _____
(a) Man has the ability to put scientific laws into existence.
(b) The universe is out of control.
(c) God established the universe and put certain laws into existence.
(d) Man should blindly accept traditional, scientific teachings.

11. Who said, "Cease to be ruled by dogmas and authorities; look at the world!"?
_____
(a) Francis Bacon
(b) Galileo Galilei
(c) Sir Isaac Newton
(d) Roger Bacon

12. Francis Bacon urged men to do all of the following, **except**:_____
_____.
(a) use the experimental approach to science
(b) faithfully accept traditional dogmas
(c) trust no statements without verification
(d) test all things with rigor

13. Nicolaus Copernicus announced that the Earth moves around the Sun rather than the Sun around the Earth. _____ (a) True or (b) False

14. Sir Isaac Newton's discovery of the _____ and the movements of the planets brought physical science into a new era.

15. Newton's works were based primarily on:_____.
(a) biblical concepts
(b) Galileo's discoveries
(c) the works of Aristotle
(d) tradition & dogma

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Matching:

16. _____Antoni van Leeuwenhoek	(a) discovered the presence of cells in biological material
17. _____Robert Hooke	(b) described the anatomy of the human body
18. _____Andreas Vesalius	(c) made contributions to understanding how the embryo develops
19. _____William Harvey	(d) published books on birds and a treatise on insects
20. _____John Ray	(e) described many microscopic organisms
21. _____Carolus Linnaeus	(f) explained fossils as the remains of organisms
22. _____Marcello Malpighi	(g) discovered the way blood circulates in the body
23. _____Ulisse Aldrovandi	(h) founded the modern system of classification of living organisms

24. The book entitled *On The Origin of Species by Means of Natural Selection or the Preservation of Favored Races in the Struggle for Life* was written by_____ _____.

25. Write the **Life Principle**:
"_____
_____
_____."

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DARWIN AND THE THEORY OF EVOLUTION

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Charles Darwin's theory of _____ by ***natural selection*** holds that life evolved from a primordial soup at its earliest beginnings to the marvelous, complex diversity that exists today.

2. The catastrophist theory supports all of the following statements, **except:**_____ _____**.**
   (a) The Earth experienced a succession of creations of animal and plant life.
   (b) A sudden catastrophe destroyed the original creation.
   (c) All species share a common ancestor.
   (d) Created species changed very little over time.

3. Charles Darwin's work sparked debates between catastrophists and evolutionists. _____
   (a) True or (b) False

4. According to the text, Darwin's work:_____ _____.
   (a) sparked a rapid growth in biological research
   (b) was flawless
   (c) had little impact on biological research
   (d) caused a halt in scientific advancement

5. Darwin was born in _____ as the fifth child of a wealthy and sophisticated family.

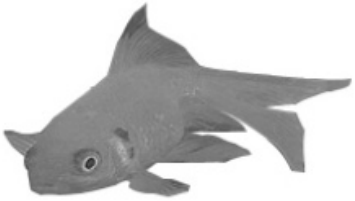
6. After graduating from the elite school at Shrewsbury in 1825 and dropping out of the University of Edinburg, Charles Darwin proceeded to:_____ _____.
   (a) Cambridge University to become a clergyman
   (b) his home to be a china and pottery entrepreneur
   (c) teach the biological sciences at the elite school at Shrewsbury
   (d) study medicine at Cambridge University

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7. In 1831, Darwin was taken aboard the *HMS Beagle* to study as a ***naturalist***. What is a naturalist? _____
   (a) a student of evolution
   (b) a student of religion
   (c) a student of nature
   (d) a journalist

8. Darwin's theory was first announced in a ***paper*** presented at the same time as one by _____, a young naturalist who also proposed the theory of natural selection.

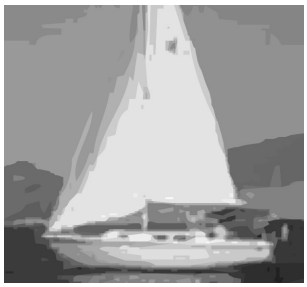
9. Which of the following would be most favored by ***natural selection*** in an aquatic environment?_____
   (a) fish (b) frog





   (c) human (d) boat





10. Darwin's book, *On The Origin of Species by Means of Natural Selection or the Preservation of Favored Races in the Struggle for Life*, is often referred to as "_____."

11. What infamous person put Darwin's teaching of "favored races" into practice? _____.

12. Darwin's theory consists of two major parts: the concept of evolutionary _____ and the concept of natural selection.

13. Darwin accepted the catastrophist theory. _____
   (a) True or (b) False

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14. According to Darwin:_____.
    (a) change is the rule
    (b) organisms have descended by gradual change from ancient ancestors
    (c) creatures do not exist now as they have since the beginning
    (d) all of the above

15. Darwin believed that:_____.
    (a) living things equally share food and space
    (b) predators and disease do not concern most living things
    (c) all living things are equally likely to survive in all environments
    (d) life is a competitive struggle to survive

16. According to Darwin, individuals with favorable characteristics for survival would pass these characteristics to their offspring; therefore, the population would soon contain only individuals with favorable traits for survival. _____
    (a) True or (b) False

17. A central component of the evolutionary theory is that all living organisms—from microscopic bacteria to plants, insects, birds and mammals—share a(n) _____.

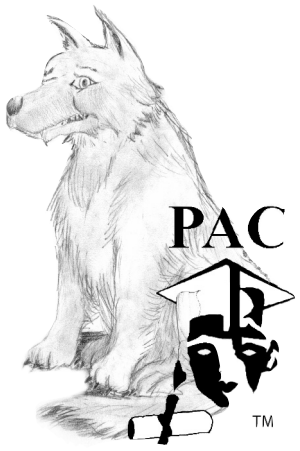
18. Essentially, Darwinism claims that humans evolved from a "primordial soup" of non-living materials. _____. (a) True or (b) False

19. Many biological and geological discoveries have been made since the announcement of Darwin's theory. Because of these discoveries:_____ _____.
    (a) Darwin's theory has been proven
    (b) Darwin's theory has been modified
    (c) debates between the evolutionists and catastrophists have ceased
    (d) none of the above

20. According to L. Harrison Matthews, evolution could be described as:_____.
    (a) an unproven theory
    (b) a faith
    (c) the backbone of biology
    (d) all of the above

21. Write the **Life Principle**: "_____ _____ _____."

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FEATURES OF LIFE



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. For each identified characteristic in living organisms, the same property can be found in some _____ system.

2. Living systems are generally highly ordered and complex on a ***molecular*** level. _____
   (a) True or (b) False

3. The chemicals that make up living organisms can be described as:_____.
   (a) unorganized
   (b) simple
   (c) orderly
   (d) all of the above

Matching:

4. _____ some cats	(a) sleep for 17 years
5. _____ octopuses	(b) eat their own arms and grow new ones
6. _____ archerfishes	(c) shoot water 15 feet in the air to hit a bug
7. _____ some insects	(d) run 70 miles per hour
8. _____ peregrine falcons	(e) swoop down on their prey at 150 miles per hour

9. All of the following are characteristics of the human eye, **except:**_____
   _____.
   (a) automatic aiming
   (b) automatic aperture adjustment
   (c) automatic focusing
   (d) automatic ultraviolet protection

10. While we sleep, our eyes perform their own maintenance procedures. _____
    (a) True or (b) False

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11. According to Charles Darwin, "To suppose that the eye could have been formed by natural selection seems to be:_____."
    (a) a logical conclusion
    (b) supported by evidence
    (c) absurd in the highest possible degree
    (d) an obvious supposition

12. Living things _____ things from their environment.

13. Most organisms:_____.
    (a) depend directly or indirectly on energy from the Sun
    (b) gain energy from food
    (c) grow and reproduce
    (d) all of the above

14. Put an "X" in front of all statements that describe the decoy-fish.
    _____ (a) It lives in waters near Oahu, Hawaii.
    _____ (b) It uses its ventral fin as a lure for other fish.
    _____ (c) Its dorsal fin appears as a separate, smaller fish.
    _____ (d) It is destroyed when another fish approaches the lure.

15. Which of the following statements describes the migratory instincts of the white-throated warbler?_____
    (a) The parent bird escorts young birds on their first flight to Africa.
    (b) These birds spend summers in Africa and winters in Germany.
    (c) Within the brains of these birds is the inherited knowledge of how to identify latitude, longitude, and direction by the stars.
    (d) The parent birds give the young birds calendars, clocks, and navigational data for oceanic flights.

16. Living things are designed to function in their own environment. _____
    (a) True or (b) False

17. Place an "X" in front of all statements that accurately describe the ***symbiotic relationship*** between the Bull's Horn Acacia tree and a species of ants.
    _____ (a) The Bull's Horn Acacia tree is inhabited by a species of ferocious stinging ants.
    _____ (b) Small bumps on the Bull's Horn Acacia tree provide shelter for ants.
    _____ (c) Ants living in the Bull's Horn Acacia tree are harmful to the health of the tree.
    _____ (d) Ants living in the Bull's Horn Acacia tree help to provide the tree with plenty of sunlight and space.
    _____ (e) Without ants inhabiting the Bull's Horn Acacia tree, the tree would live for only two to fifteen months.

18. Living things produce offspring that are of like kind. _____
    (a) True or (b) False

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19. Living things contain genetic material in an information store known as _____.

20. The transmission of hereditary information through genetic material is known as _____.

21. All of the following statements are true concerning ***DNA***, **except**:_____ _____.

(a) DNA is the basis of inheritance.
(b) DNA is located in the cell cytoplasm.
(c) DNA "programs" all human characteristics.
(d) DNA storage capacity exceeds that of modern technology.

Review Question. Identify the six main features of living organisms.

22. Living systems are _____.

23. Living things _____.

24. Living things respond _____.

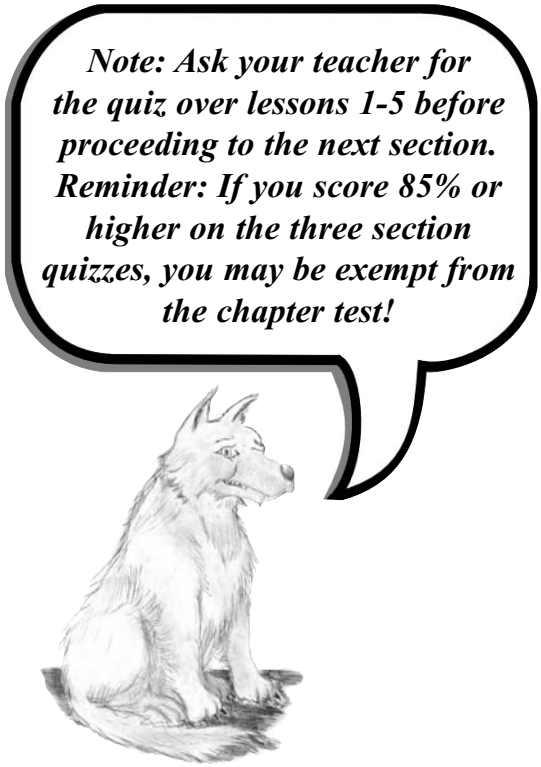
25. Living things are _____.

26. Living things reproduce _____.

27. The information that each organism needs to survive, develop, and reproduce is _____ _____.

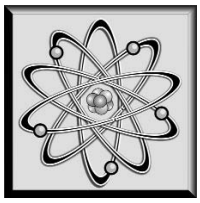
28. Write the **Life Principle**:
"_____ _____ _____."

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ELEMENTS AND ATOMS—THE FOUNDATION OF LIFE

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1. A chemical ***element***:_____
_____.
(a) does not participate in ordinary chemical reactions
(b) does not split into other kinds of substances during ordinary chemical reactions
(c) is split into separate substances during an ordinary chemical reaction
(d) none of the above

Matching:

2. _____ hydrogen	(a) C
3. _____ oxygen	(b) H
4. _____ carbon	(c) Mg
5. _____ chlorine	(d) O
6. _____ magnesium	(e) Na
7. _____ potassium	(f) Cl
8. _____ sodium	(g) K

9. Chemists have discovered more than 100 chemical elements, but living organisms contain only about _____ elements.

10. The elements found in living organisms are the most common elements. _____
(a) True (b) False

11. The most common element in Earth's crust is _____.

12. Which of the following statements is **incorrect** concerning carbon?_____
_____.
(a) It is a critical component of every living thing.
(b) It is suitable for biological structures.
(c) It is the most abundant element.
(d) It has many unique properties.

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13. Organisms reject chemicals that are not necessary for life processes. _____
(a) True or (b) False

14. Benefits of the symbiotic relationship between the Egyptian plover and the Nile crocodile include which of the following?_____
_____



(a) The Egyptian plover gets nutrients from parasites in the crocodile's mouth.
(b) The crocodile's mouth is cleaned up.
(c) The Egyptian plover is protected.
(d) all of the above

Matching:

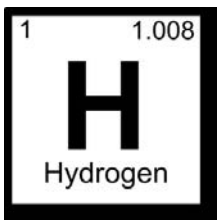
15. _____ ***atom*** (a) particle that carries a negative charge and has very little mass
16. _____ ***nucleus*** (b) particle that carries no charge and has a mass of 1 amu
17. _____ ***proto***n (c) smallest unit of an element that retains the properties of the element
18. _____ ***neutron*** (d) the amount of matter an object contains
19. _____ ***mass*** (e) dense core at the center of the atom that contains protons and neutrons
20. _____ ***electron*** (f) particle that carries a positive charge and has a mass of 1 amu
21. _____ ***electron orbital*** (g) the region around the nucleus where electrons are found

22. Because opposite charges _____, the protons help to hold the electrons in each orbital.

23. The number of protons in an atom determines the atom's:_____.
(a) atomic number
(b) atomic mass
(c) valence number
(d) electron orbital

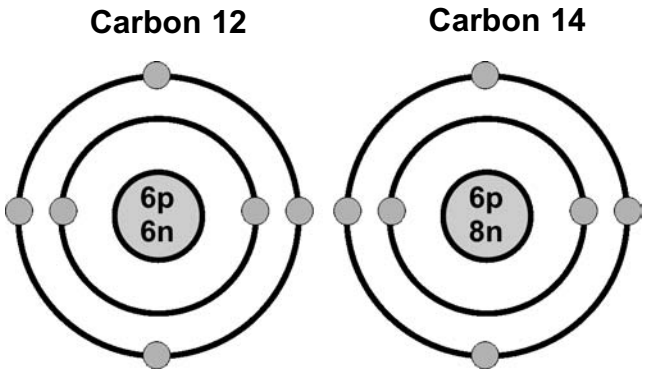
24. An Atom's _____ is determined by adding together the number of protons and neutrons.

25. What is hydrogen's atomic number?_____
(a) 1
(b) 2
(c) 1.008
(d) H1



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26. ***Isotopes*** have a different number of _____ but the same number of _____.
(a) neutrons, protons
(b) protons, neutrons
(c) electrons, protons
(d) electrons, neutrons



27. The above picture illustrates:_____.
(a) ions of carbon
(b) isotopes of carbon
(c) electronegativity of carbon
(d) atomic mass of carbon

28. Niels Bohr:_____.
(a) introduced the proton theory
(b) discovered isotopes
(c) introduced the atomic structure model
(d) developed a microscope to view atoms

Match the electron shell with the number of electrons each can hold.

29. _____ innermost shell of atoms (a) 2 electrons each

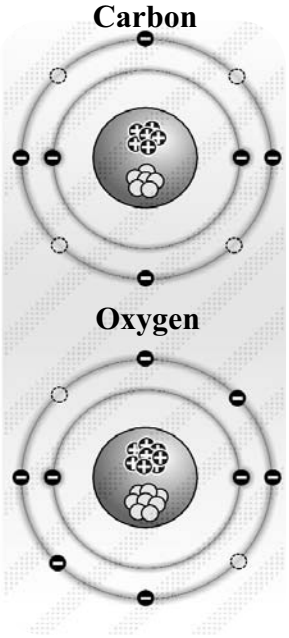
30. _____ outer shells of atoms (b) 8 electrons each

31. Electrons are particles in constant,_____.

32. Atoms tend to _____ their outer shells during chemical reactions in which they gain, lose or share electrons.

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Using the figure to the right, answer questions 33-34.



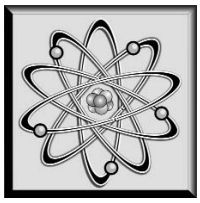
33. The Bohr model for carbon shows that carbon has 6 total electrons, two in its inner shell and four in its outer shell. However, the outer shell has room for 8 total electrons. If carbon's ***valence*** is the number of electrons that it must share, lose or gain to complete its outer shell, what is its valence? _____
    (a) 2 (b) 4
    (c) 6 (d) 8

34. Determine the valence of oxygen. _____
    (a) 2 (b) 4
    (c) 6 (d) 8

35. The valence of an atom determines how many connections it can form when it combines with other atoms. _____
    (a) True or (b) False

36. Write the **Life Principle**:
    "_____
    _____
    _____."

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ATOMIC BONDING--KNITTING LIFE TOGETHER

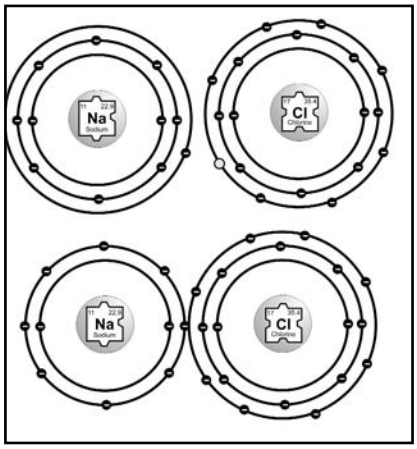
You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. In order to attain stable outer electron shells, atoms join, or _____, with one or more other atoms.

2. An ***ionic bond*** is formed when:_____.
   (a) two atoms share a pair of electrons
   (b) one atom gives up one or more of its outermost electrons to another atom
   (c) a hydrogen atom is covalently bound to an electronegative atom
   (d) none of the above

3. An ***ion*** is formed when:_____.
   (a) an atom gains or loses protons
   (b) an atom is covalently bound to another atom
   (c) an atom gains or loses electrons & acquires an electric charge
   (d) a particle loses its electric charge

4. The figure to the right illustrates which of the following?_____
   (a) sodium (Na) donating its outer electron to chlorine (Cl)
   (b) sodium (Na) attaining a negative charge of –1
   (c) chlorine (Cl) attaining a negative charge of –2
   (d) sodium (Na) donating a proton to chlorine (Cl)



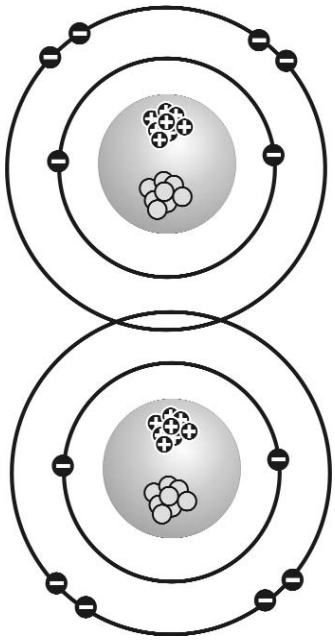
5. If an atom has 20 protons and 17 electrons, what is its net charge? _____
   (a) +2
   (b) +3
   (c) –2
   (d) –3

6. A sodium ion and a chlorine ion tend to attract each other, forming the compound we know as *table salt*, or sodium chloride, whose symbol is_____.

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7. When two atoms share a pair of electrons so that each has a stable, complete, outer energy shell, it is known as a(n):_____.
   (a) ionic bond
   (b) electrostatic interaction
   (c) covalent bond
   (d) hydrogen bond

8. Fill in the missing electrons in the ***covalent bond*** between the two oxygen atoms below.



9. Covalent bonds are the _____ of the chemical bonds.
   (a) strongest
   (b) longest
   (c) weakest
   (d) least common

Match the type of covalent bond with the number of electrons it contains.

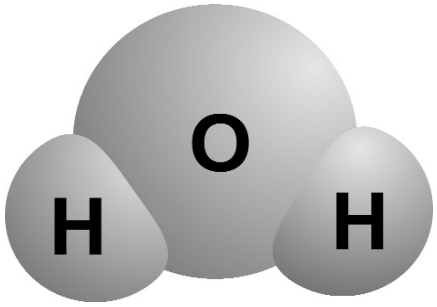
10. _____ double bond (a) 2

11. _____ single bond (b) 6

12. _____ triple bond (c) 4

13. The tendency of an atom to pull electrons toward itself is called ***electronegativity***. _____
    (a) True or (b) False

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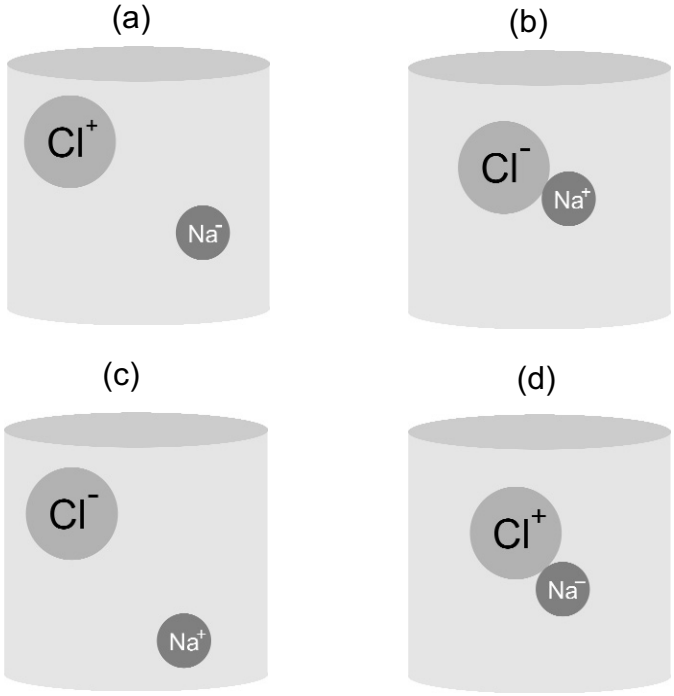


14. Which of the above atoms is the most electronegative?_____

15. Place an "X" in front of all statements that correctly describe hydrogen bonding.
    _____ (a) A positive hydrogen atom is covalently bonded to a strongly electronegative atom.
    _____ (b) A negative atom is covalently bonded to a strongly positive atom.
    _____ (c) The charges of two atoms from polar covalent bonds repel each other.
    _____ (d) Hydrogen bonds are weak but very important chemical bonds.

16. When ionic bonds of compounds dissociate into separate ions, they are_____.

17. Which of the following illustrates what happens when NaCl (salt) is placed in H_2O (water)?_____



18. Ions are _____ particles that behave differently from neutral atoms or molecules in living systems.

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19. Place an "X" in front of all true statements concerning ***acids*** and ***bases***.
_____ (a) Both are ionic compounds.
_____ (b) Acids release H^+ in water.
_____ (c) Hydrogen chloride (HCl) will produce OH^- and Cl^- in water.
_____ (d) Bases release OH^- in water.
_____ (e) Sodium hydroxide (NaOH) will produce Na^+ and OH^- in water.

20. The ***pH scale*** measures all of the following, **except**:_____.
(a) hydrogen ion concentration
(b) hydroxyl ion concentration
(c) acidity
(d) alkalinity

21. Number the pH scale values below from 1 to 6 starting with the most basic (alkaline).
_____ (a) pH 2
_____ (b) pH 7
_____ (c) pH 8
_____ (d) pH 3
_____ (e) pH 10
_____ (f) pH 4

Fill in the chart below according to the pH scale in your text.

Strongly Acidic	**Somewhat Acidic**	**Strongly Alkaline**
22._____	23._____	24._____
_____	_____	_____
_____	_____	
	_____	

Somewhat Alkaline	**Neutral**
25._____	26._____
_____	
_____	
_____	

27. Most chemical reactions of life occur at a pH near: _____.
(a) 2
(b) 14
(c) 4
(d) 7

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28. _____ are substances that are used by organisms to minimize pH changes and to help stabilize the amount of acid or base in the system.

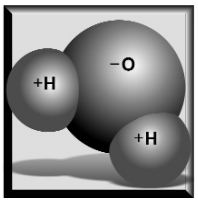
29. Write the **Life Principle**:
"_____
_____
_____."

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COMPOUNDS AND MOLECULES



You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. A _____ consists of two or more atoms of different elements, chemically combined in specific proportions, with a specific pattern of bonds.

2. The smallest part of a ***compound*** that retains all of the properties of that compound is a(n):_____.
   (a) particle
   (b) atom
   (c) molecule
   (d) element

3. A molecular notation, or shorthand, representing the kinds and quantities of different atoms in a molecule is known as the:_____.
   (a) molecular weight
   (b) structural formula
   (c) molarity
   (d) molecular formula

4. The ***structural formula*** for water is:_____.
   (a) H-O-H
   (b) H=O=H
   (c) H-H-O
   (d) H=O-H

5. Although dimethyl ether and ethyl alcohol have the same ***molecular formula***, their structural formulas are different. _____
   (a) True or (b) False

6. To obtain the ***molecular weight*** of a molecule, you should:_____
   _____.
   (a) sum the atomic masses of all its atoms
   (b) multiply the atomic masses of all its atoms
   (c) weigh it with a special balance
   (d) none of the above

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CHEMICAL ELEMENTS FOUND IN ANIMALS, THEIR APPROXIMATE ABUNDANCE BY WEIGHT AND THEIR ATOMIC MASSES

ELEMENT	SYMBOL	WEIGHT, PERCENT	ATOMIC MASS UNITS
Oxygen	O	62	16.0
Carbon	C	20	12.0
Hydrogen	H	10	1.0

7. Using the atomic masses from the table above, calculate the molecular weight of carbon dioxide (CO_2):_____.

(a) 28 atomic mass units (c) 44 atomic mass units

(b) 40 atomic mass units (d) 48 atomic mass units

8. The _____ of a substance is the molecular weight of the substance in grams.

9. Place an "X" in front of all of the following that correctly describe ***Avogadro's number***.

_____ (a) the number of molecules contained in one mole of any substance

_____ (b) 6.023×10^{23} molecules

_____ (c) the number of moles contained in 6.023×10^{23} grams of any substance

_____ (d) formulated by Amendeo Avogadro

Match each word with its proper definition.

10. _____ ***solution*** (a) a substance that is dissolved in solution

11. _____ ***solvent*** (b) a homogeneous, liquid mixture of two or more substances

12. _____ ***solute*** (c) the number of moles of solute in one liter of solution

13. _____ ***molarity*** (d) the dissolving agent in a solution

14. Which of the following is the most versatile solvent?_____

(a) 

(b) 

(c) 

(d) 

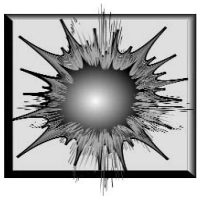
15. Write the **Life Principle**:

"_____

_____

_____."

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CHEMICAL REACTIONS—LIFE'S CRITICAL PROCESSES

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. During a(n) _____, molecules or ions interact with one another to form new substances.

2. The ***chemical reaction*** of substances A and B to form two new substances, C and D, can be written:_____.
   (a) C + D → A + B
   (b) A + C → B + D
   (c) A + B → C + D
   (d) A + B + C → D

Label each of the following as a *reactant* or *product*

A + C → B + D

3._____ 4._____ 5._____ 6._____

7. Place an "X" in front of all of the following propositions that would increase the rate of a chemical reaction.
   _____ (a) decreasing the concentration of reactants
   _____ (b) raising the pressure on the reactants
   _____ (c) cooling the reactants
   _____ (d) increasing the concentration of reactants
   _____ (e) heating the reactants

8. ***Thermal agitation*** _____ the motion of the molecules in a reation.
   (a) slows down
   (b) stops
   (c) speeds up
   (d) reverses

9. A + B → C + D + energy is an example of a(n) _____ reaction.
   (a) exergonic
   (b) slow
   (c) endergonic
   (d) fast

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10. A + B + energy → C + D is an example of a(n) _____ reaction.
    (a) exergonic
    (b) slow
    (c) endergonic
    (d) fast

11. _____ reactions release energy, and _____ reactions require energy.
    (a) exergonic; exergonic
    (b) endergonic; exergonic
    (c) exergonic; endergonic
    (d) endergonic; endergonic

12. In living things, energy released from one reaction is often used to drive another reaction.
    _____ (a) True or (b) False

13. ***Reversible reactions***:_____.
    (a) keep reactants and products from dwindling
    (b) proceed in only one direction
    (c) proceed until all of the reactants are used up
    (d) none of the above

14. Which symbol, when written between reactants and products, indicates a reversible reaction?_____
    (a) →
    (b) ⇌
    (c) ←
    (d) =

15. The ***equilibrium point*** is reached when:_____
    _____.
    (a) the forward reaction is occurring at a faster rate than the reverse reaction
    (b) the concentrations of reactants and products are oscillating
    (c) the rates of forward and backward reactions are equal
    (d) energy is released

16. If concentrations of reactants and products change, a reaction will proceed in the direction that will restore _____.

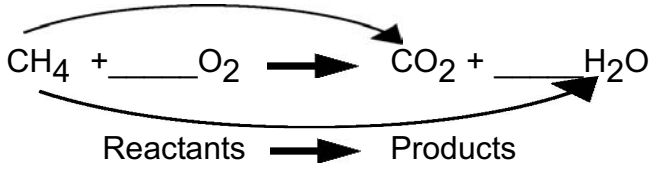
17. A reaction that can only go in the forward direction is a(n)_____
    _____.

18. ***Activation energy*** is the "push" that gets non-spontaneous reactions going. _____
    (a) True or (b) False

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19. The burning of paper is an example of a(n):_____.
    (a) endergonic, reversible energy reaction
    (b) irreversible, activation energy reaction
    (c) reversible, exergonic reaction
    (d) none of the above

20. **Carefully examine the reactants and products of the following chemical reaction. All reactants and amounts appear in different forms as products. Fill in the missing numbers.**



21. Write the **Life Principle**: "_____
_____
_____."

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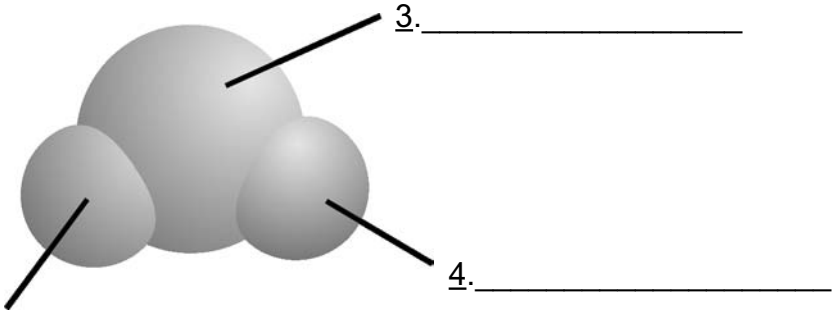
WATER—THE SEA OF LIFE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

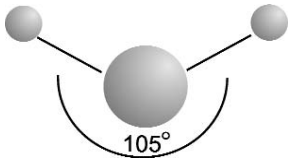
1. Water comprises _____ percent of all living material.
   (a) 10-20
   (b) 50-60
   (c) 80-90
   (d) 100

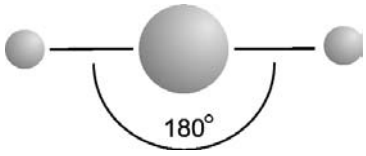
2. A healthy human can go almost eighty days without water. _____
   (a) True or (b) False

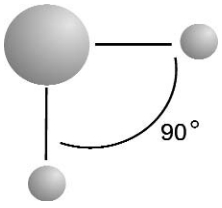
Label the atoms in this water molecule as oxygen or hydrogen.

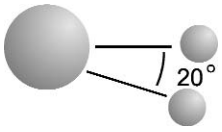


6. Which of the following best illustrates the shape of a water molecule?_____

(a)


(b)


(c)


(d)


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7. In a molecule of water, why does oxygen have a partial negative charge and each hydrogen atom have a partial positive charge?_____
_____
(a) Hydrogen pulls electrons to itself.
(b) Oxygen pulls electrons to itself.
(c) Oxygen weighs more than hydrogen.
(d) There are more hydrogens.

8. A geometric solid having four triangular sides is known as a(n)_____.

9. Why is water a ***polar*** molecule?_____
(a) It has a net charge.
(b) The protons are shared unequally.
(c) It has an unequal charge distribution.
(d) none of the above.

10. Because water molecules are polar, they form hydrogen bonds with one another, forming: _____.
(a) strands of molecules
(b) a well-ordered lattice
(c) a disorganized bundle
(d) a double-helix

11. Hydrogen bonds are strong and long-lasting. _____
(a) True or (b) False

12. In ice, _____ percent of the hydrogen bonds are formed, whereas in liquid water, only eighty percent of the hydrogen bonds are formed.

13. More substances are soluble in water than any other known liquid, because:_____ _____.
(a) it is plentiful
(b) it is polar
(c) it has strong bonds
(d) none of the above

14. ***Nonpolar*** substances readily dissolve in water. _____
(a) True or (b) False

15. _____ are formed at the interfaces of polar and nonpolar substances, such as oil and water.

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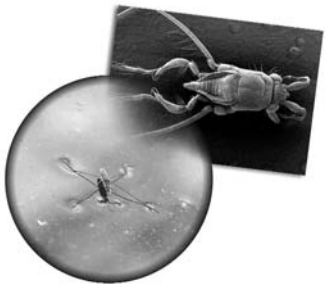
Match the following terms with the appropriate definitions.

16. _____ ***cohesion*** (a) the ability of water to move up porous material or creep through the fine pores in the soil or in a leaf

17. _____ ***adhesion*** (b) the holding together of like substances

18. _____ ***surface tension*** (c) the measure of how difficult it is to stretch or break the surface of a liquid

19. _____ ***capillary action*** (d) the holding of one substance to a different kind of substance



20. The Water Strider illustration above depicts which of the following?_____
    (a) cohesion (c) surface tension
    (b) adhesion (d) capillary action

21. Water has a high ***specific heat***. What does this mean?_____
    _____
    (a) Much heat must be lost to raise the temperature of water.
    (b) Much heat must be gained to lower the temperature of water.
    (c) Much heat must be gained to raise the temperature of water.
    (d) Water will always be hot in a hot environment.

22. Although organisms produce large amounts of heat, water _____ the heat so the organism's body temperature remains normal.

23. Due to ***thermal conductivity***, when one part of a body of water is heated, a long time is required for the heat to be conducted throughout the rest of the water. _____
    (a) True or (b) False

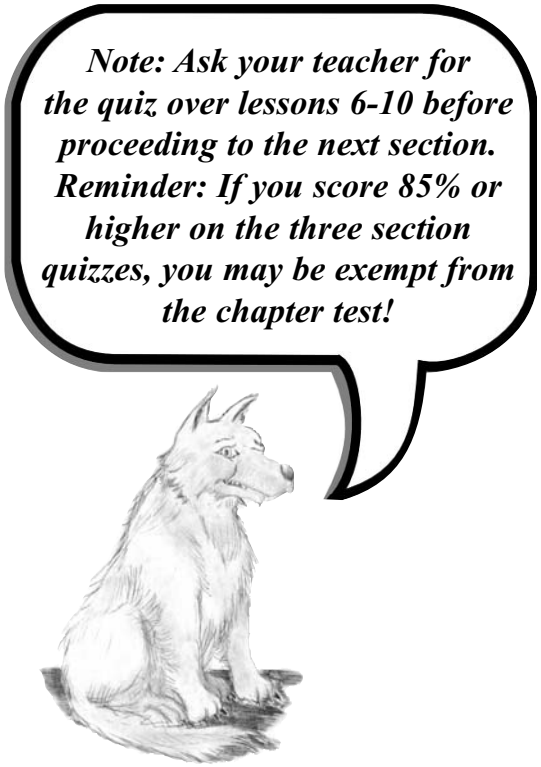
24. To change water from a liquid to a gas: _____.
    (a) very little heat is needed
    (b) a great deal of heat is needed
    (c) attractions between water molecules must increase
    (d) water must first be frozen

25. Water is a good evaporative _____.

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26. Water molecules are not packed as tightly in ice as in liquid water, causing:_____
_____.
(a) ice to sink in water
(b) water to shrink when it freezes
(c) ice to have a greater density than water
(d) ice to float in water

27. Write the **Life Principle**:
"_____
_____
_____."



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BIOLOGICAL CHEMISTRY— THE CHEMISTRY OF LIFE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The four most abundant elements in living organisms are_____ _____.

2. The four most abundant elements in the Earth's crust are_____ _____.

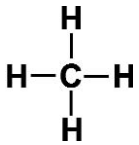
3. ***Organic compounds*** always contain:_____.
   (a) hydrogen
   (b) oxygen
   (c) carbon
   (d) silicon

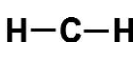
4. Non-carbon containing compounds, carbon dioxide, and carbonate compounds are considered:_____.
   (a) elements
   (b) inorganic
   (c) pollutants
   (d) organic

5. More _____ compounds exist than any other compounds of all other elements.

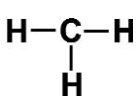
6. A beautiful diamond and dirty coal are both different forms of carbon. _____
   (a) True or (b) False

7. Which of the following shows carbon with the appropriate number of covalent bonds?_____

   (a)
   

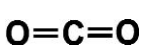
   (b)
   

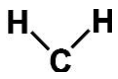
   (c)
   

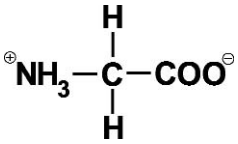
   (d)
   

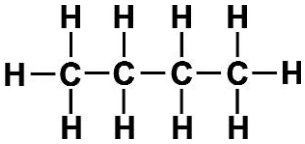
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8. Which of the following is a ***hydrocarbon***?_____

(a) 

(b) 

(c) 

(d) 

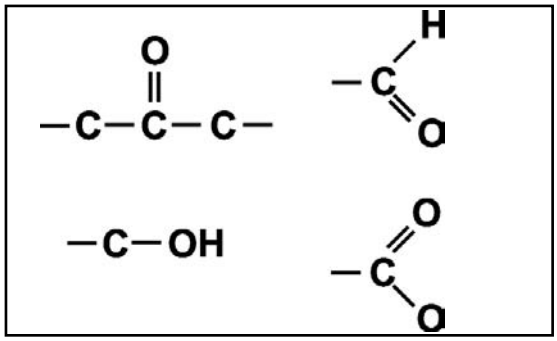
9. When carbon forms covalent bonds, the atoms bonded to carbon are:_____
_____.

(a) as close together as possible
(b) in a straight line
(c) perpendicular
(d) as far apart as possible

10. ***Monomers*** link together to form _____, also called ***macromolecules***, which may be long, straight, or branched chains.

11. Specific configurations of atoms that are commonly attached to the carbon skeletons of organic molecules are known as:_____.

(a) organic acids
(b) hydrocarbons
(c) functional groups
(d) polar bodies



12. All of the groups above can be labeled as:_____.

(a) organic acids
(b) hydrocarbons
(c) functional groups
(d) amino acids

13. The types of ***functional groups*** present in a molecule will help to determine in which reaction the molecule will participate. _____ (a) True or (b) False

14. Acetic acid and amino acids contain _____ groups and are called ***organic acids***.

15. Write the **Life Principle**: "_____
_____
_____."

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ACTIVITIES
Lesson 12:

CARBOHYDRATES, LIPIDS AND PROTEINS

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

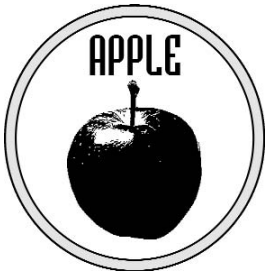
1. Place an "X" in front of all of the following statements that correctly describe ***carbohydrates***.
   _____ (a) They are composed of carbon, hydrogen, and oxygen.
   _____ (b) They include sugars, starches, and related molecules.
   _____ (c) They include cellulose.
   _____ (d) They have a ratio of 2 oxygen atoms for each hydrogen atom.

2. The simple sugar, fructose, is found in which of the following?_____

(a)



(b)



(c)



(d)



3. The breakdown of sugars in a cell provides the cell with _____.

4. Sugars like galactose and fructose are:_____
   _____.
   (a) converted into glucose
   (b) synthesized from glucose
   (c) simple sugars
   (d) all of the above

5. When you exercise, glucose is released into your _____.

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6. The simplest carbohydrates, or _____, can be used individually or assembled into polymers.

7. Sucrose is an example of a(n):_____.
   (a) monosaccharide
   (b) disaccharide
   (c) polysaccharide
   (d) lipid

8. Plants store excess sugar in the form of a ***polysaccharide*** known as_____, and animals store excess sugar in the form of a polysaccharide known as _____.
   (a) starch, glycogen
   (b) glycogen, starch
   (c) glucose, cellulose
   (d) cellulose, glucose

9. Place an "X" in front of all of the statements that correctly describe ***lipids***.
   _____ (a) They are made from carbon, oxygen, and nitrogen.
   _____ (b) They are waxy, fatty or oily compounds.
   _____ (c) They store and release energy.
   _____ (d) They are formed from fatty acids and glycerol.

Matching:

10. _____ ***fatty acids***	(a) long chains of carbon and hydrogen acids that have an acidic carboxyl group attached to the end
11. _____ ***steroids***	(b) three-carbon alcohol that contains three hydroxyl groups
12. _____ glycerol	(c) large lipids consisting of four carbon rings joined to one another

13. The most complex and abundant organic components of the cell are lipids. _____
    (a) True or (b) False

14. Place an "X" in front of all of the statements that correctly describe ***amino acids***.
   _____ (a) They make up proteins.
   _____ (b) They have a carboxyl group and an amino group attached to the same carbon atom.
   _____ (c) Their side chains determine differences between the twenty amino acids.
   _____ (d) All proteins contain 50 amino acids.
   _____ (e) Amino acids always bond in the same sequence.

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15. Which of the following statements best describes a peptide bond?_____
    (a) The amino group of one amino acid is joined to the carboxyl group of another amino acid.
    (b) The amino group of one amino acid is joined to the amino group of another amino acid.
    (c) The carboxyl group of one amino acid is joined to the carboxyl group of another amino acid.
    (d) all of the above

16. _____ is a ***protein*** that carries oxygen in the blood.

17. Proteins are components of biological membranes and they play an important role in regulating the passage of substances through membranes. _____
    (a) True or (b) False

18. Insulin is an example of a(n) _____ that acts as a chemical messenger between different parts of the body.

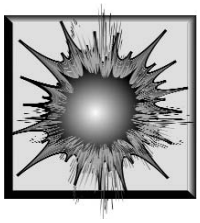
19. The most important proteins in living things are:_____.
    (a) hormones
    (b) enzymes
    (c) membrane proteins
    (d) structural proteins

20. Write the **Life Principle**:
    "_____
    _____
    _____."

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ACTIVITIES
Lesson 13:

ENZYMES—THE CATALYSTS OF LIFE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Reactions require a certain activation energy in order to begin. In the laboratory, the activation energy is usually reached by using _____; but in living organisms, these reactions can occur at low temperatures.

2. What is the function of a ***catalyst***?_____
   (a) to provide energy to a reaction
   (b) to lower the activation energy
   (c) to slow down a chemical reaction
   (d) to change the direction of a reaction

3. Catalysts in living systems are known as _____.

4. An ***enzyme*** is not permanently changed by a reaction, nor are the amounts of ***reactants*** used or products formed. _____ (a) True or (b) False

5. Place an "X" in front of all of the following statements that correctly describe the enzyme *urease*.
   _____ (a) It catalyzes the conversion of urea to carbon dioxide and ammonia.
   _____ (b) It is the fastest working enzyme.
   _____ (c) It is produced by bacteria in the air.
   _____ (d) It speeds up the hydrolysis of urea by hundreds of thousands of times.

6. A single enzyme can catalyze many different types of reactions. _____
   (a) True or (b) False

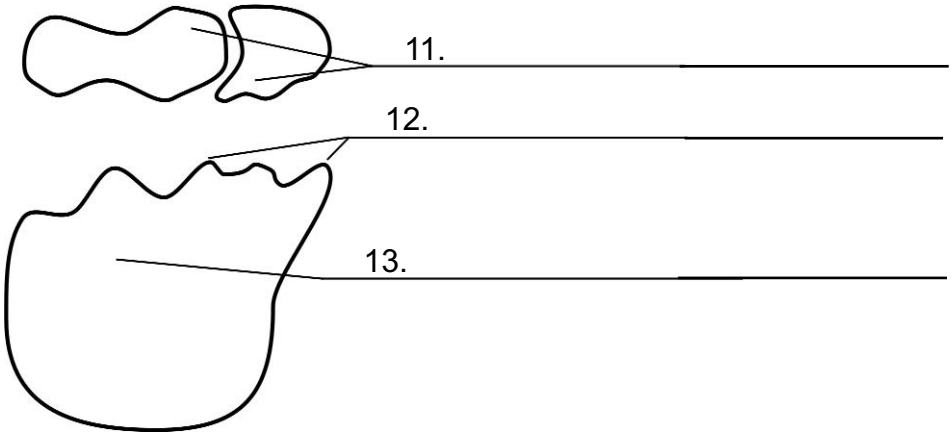
7. Why are enzymes and their ***substrates*** often compared to a lock and key?_____
   _____
   (a) Enzymes are often lost in biological systems just as keys.
   (b) Substrates can be changed just as a lock.
   (c) Enzymes only catalyze reactions in which the substrates fit the surfaces of the enzymes.
   (d) only a and b

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Matching:

8. _____ substrate — (a) the change in shape of the active site of an enzyme so it binds more snugly to the substrate
9. _____ ***active site*** — (b) the substance on which an enzyme works
10. _____ ***induced fit*** — (c) portion of an enzyme that attaches to the substrate

Label the illustration below with the appropriate terms.



14. Most proteins work best at a(n) _____ pH.

15. Digestive enzymes of the stomach work best at a pH of: _____.
    (a) 7-9 (c) 4-6
    (b) 12-14 (d) 1.5-2.0

16. High temperatures above 60 degrees Celsius: _____.
    (a) increase enzyme activity
    (b) cause enzymes and substrates to collide less frequently
    (c) disrupt enzyme structures so they cannot function
    (d) stabilize substrates to their enzymes

17. Some enzymes are designed to work at temperatures close to freezing. _____
    (a) True or (b) False

18. Place an "X" in front of each of the following statements that are functions of enzymes.
    _____ (a) They transfer information.
    _____ (b) They help to store and release energy.
    _____ (c) They help to synthesize and break down compounds.
    _____ (d) They regulate chemical pathways.

19. Write the **Life Principle**:
    "_____
    _____
    _____."

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NUCLEIC ACIDS— THE BLUEPRINT OF LIFE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

Matching:

1. _____ ***nucleic acids*** (a) carries out the instruction of the DNA code
2. _____ ***genetics*** (b) the study of heredity
3. _____ ***DeoxyriboNucleic Acid*** (c) information-carrying molecules of the cell, two types
4. _____ ***RiboNucleic Acid*** (d) transmits genetic information from one generation to the next and codes for the production of proteins
5. _____ nucleotides (e) nucleic acid monomers

6. The three units that make up a nucleotide are a_____, a _____ and a _____.

7. What is deoxyribose? _____
   (a) the 5-carbon sugar found in nucleotides of DNA
   (b) the 5-carbon sugar found in nucleotides of RNA
   (c) the nitrogenous base of DNA nucleotides
   (d) the phosphate group of RNA nucleotides

8. The nucleotide ATP is an immediate source of _____ for the cell.

9. An important intermediary in the function of some hormones is:_____.
   (a) ATP
   (b) DNA
   (c) AMP
   (d) RNA

10. DNA is a highly unstable molecule. _____ (a) True or (b) False

11. The order of the DNA units tells the machinery of a cell how to_____ _____.

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12. In protein synthesis, DNA could be described as a(n) _____, and RNA could be described as a(n) _____.
    (a) blueprint, carrier
    (b) carrier, encoder
    (c) blueprint, copy
    (d) carrier, blueprint

13. Cell division results in:_____.
    (a) one copy of the parent cell DNA
    (b) two copies of the parent cell DNA
    (c) three copies of the parent cell DNA
    (d) four copies of the parent cell DNA

14. DNA programs _____ of the characteristics in the human body.
    (a) most (b) some (c) all (d) none

15. DNA has the capacity to store a lot of information, but not as much as a modern computer. _____ (a) True or (b) False

16. The laws of probability favor the instantaneous appearance of DNA more than its prolonged development over millions of years. _____
    (a) True or (b) False

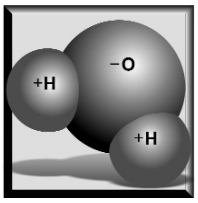
17. The hemoglobin molecule is responsible for:_____
    _____.
    (a) oxygen uptake as we breathe
    (b) DNA synthesis
    (c) translation of proteins
    (d) none of the above

18. Diseases such as ***hemoglobin opathy*** occur if the DNA directs even one_____
    _____ to be out of place or repeated when making hemoglobin.

19. With the vast possibilities for amino acid sequence in the hemoglobin molecule, it appears highly improbable that hemoglobin occurred by chance. _____
    (a) True or (b) False

20. Write the **Life Principle**:
    "_____
    _____
    _____."

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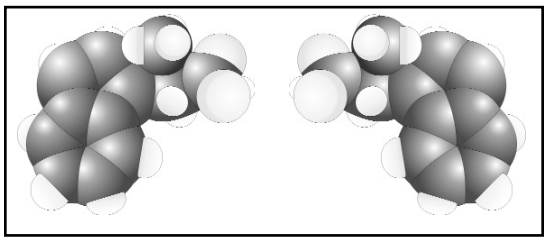


OPTICAL ISOMERS— THE MIRROR IMAGES OF LIFE

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. A protein's _____ is very important to its function.

2. Molecules that have the same structural formula, the same bonds, but are mirror images of each other are known as _____.



3. The most distinguishing feature of the ***optical isomers*** of ***tryptophan*** (above) is that: _____.
   (a) they are identical
   (b) they contain different atoms
   (c) they are mirror-images of each other
   (d) they are different amino acids

4. The *L* in L-tryptophan stands for _____, the latin word for *left-handed.*

5. The *D* in D-tryptophan stands for _____, the latin word for *right-handed.*

6. *L* and *D* isomers have properties that are almost identical. _____
   (a) True or (b) False

7. A ***racemic*** mixture contains:_____.
   (a) equal amounts of both *L* and *D* isomers
   (b) more *L* isomer than *D* isomer
   (c) more *D* isomer than *L* isomer
   (d) all *L* isomers

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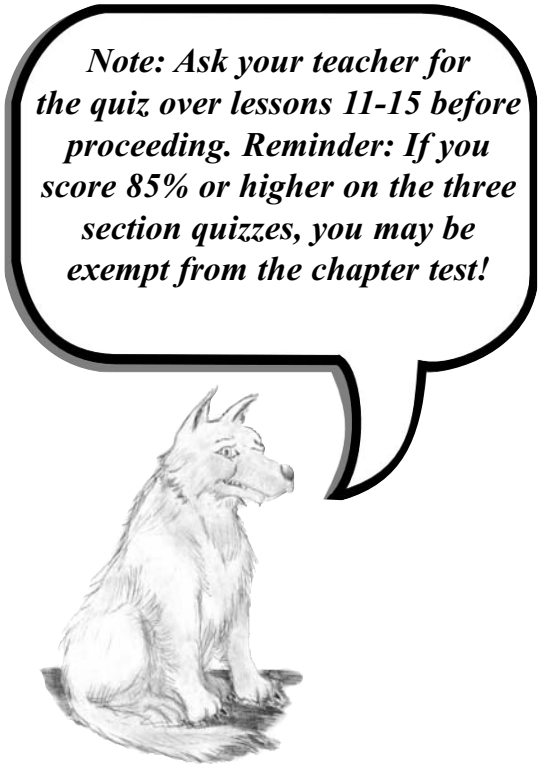
8. In the pain reliever *ibuprofe*n, the *L* isomer is _____ and the *D* isomer is _____.
   (a) active, active
   (b) inactive, active
   (c) active, inactive
   (d) inactive, inactive

9. Both isomers of the glucose molecule have a sweet taste and are metabolized by the body.
   _____ (a) True or (b) False

10. Which of the following statements is true concerning *D-glucose*?_____
    _____.
    (a) It has no taste.
    (b) It is a primary energy source for the body.
    (c) It is not metabolized by the body.
    (d) It is the only optical isomer of glucose.

11. Amino acids found in living organisms are of which type of isomer? _____

12. Write the **Life Principle**:
    "_____
    _____
    _____."



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