

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

- 1) Scientific inquiry is based on 1) _____
 - A) information found in a gossip magazine.
 - B) stories that are passed down through generations.
 - C) natural causes.
 - D) cultural biases or traditions.

- 2) Which of the following is an example of a natural cause? 2) _____
 - A) Epilepsy is a disease caused by uncontrolled firing of nerve cells in the brain.
 - B) Mice arise from discarded garbage.
 - C) If you sneeze, you will die.
 - D) Maggots appear spontaneously on rotting meat.

- 3) Science cannot answer certain faith-based questions because 3) _____
 - A) there aren't enough variables.
 - B) faith-based beliefs are impossible to either prove or disprove.
 - C) faith requires deductive reasoning.
 - D) scientists are not able to study human behavior.

- 4) Which of the following is FALSE about scientific theories? 4) _____
 - A) They have been thoroughly tested.
 - B) They are developed by inductive reasoning.
 - C) They are used to support observations using deductive reasoning.
 - D) They are firmly established and cannot be refuted.
 - E) They can be either supported or modified by new observations.

- 5) Which of these would be an example of a NON-scientific study? 5) _____
 - A) Consumers are asked which tomato variety produces the best-tasting spaghetti sauce.
 - B) A study determines differences in the species composition in two parks.
 - C) A company uses different advertising methods for a product to determine which one produces the most sales.
 - D) People are immunized with different vaccines to determine their relative effectiveness against the flu virus.
 - E) NASA sends tadpoles up in the space shuttle to see how gravity affects their development.

- 6) The scientific method includes all of the following EXCEPT 6) _____
 - A) a testable theory.
 - B) an observation.
 - C) conclusions.
 - D) experimentation.
 - E) a hypothesis.

- 7) We use the scientific method every day. Imagine that your car doesn't start one morning before school. Which of these is a reasonable *hypothesis* regarding the problem? 7) _____
- A) I'm going to be late.
 - B) I should change the battery or the starter.
 - C) I should add a quart of oil.
 - D) If I put gas in my car, it will start.
 - E) I should check whether the lights were left on and drained the battery.
- 8) A scientific theory 8) _____
- A) is an educated guess.
 - B) will never be changed.
 - C) is a general explanation for natural phenomena.
 - D) is less reliable than a hypothesis.
- 9) A scientific explanation that is conditional and requires more investigation is called a(n) 9) _____
- A) control.
 - B) theory.
 - C) observation.
 - D) hypothesis.
 - E) fact.
- 10) A carefully formulated scientific explanation that is based on extensive observations and is in accord with scientific principles is called a 10) _____
- A) fact.
 - B) theory.
 - C) postulate.
 - D) hypothesis.
 - E) control.
- 11) All of the following are features of the scientific method EXCEPT 11) _____
- A) observation and experimentation.
 - B) repeatable by other scientists.
 - C) hypothesis formulation.
 - D) supernatural causes.
 - E) deductive reasoning.
- 12) Suppose you are testing a treatment for AIDS patients and find that 75% respond well, whereas 25% show no improvement or a decline in health. You should 12) _____
- A) review the results, modify the drug or the dosage, and repeat the experiment.
 - B) conclude that you have proven the effectiveness of the drug.
 - C) begin work on developing a new drug.
 - D) conclude that only 75% of AIDS patients should be treated.
 - E) discontinue experimentation with this treatment because 25% of patients did not improve.
- 13) Alexander Fleming observed a colony of mold that inhibited the growth of nearby bacteria. What was the hypothesis proposed by Fleming to explain this result? 13) _____
- A) The mold was dead.
 - B) The mold produced a substance that killed nearby bacteria.
 - C) The mold used all of the nutrients so that the bacteria couldn't grow.
 - D) The bacteria changed their DNA when growing near the mold.

- 14) Imagine that 1 milliliter of an experimental drug diluted in a saline solution is injected into 20 pregnant mice to determine possible side effects. Which of the following is a suitable control for this experiment? 14) _____
- A) 20 pregnant mice injected with 2 milliliters of the drug
 - B) 20 male mice injected with 1 milliliter of saline
 - C) 20 pregnant mice injected with 1 milliliter of saline
 - D) 20 non-pregnant mice injected with 1 milliliter of the drug
 - E) 20 male mice injected with 1 milliliter of the drug
- 15) Which of the following statements is a hypothesis rather than a theory? 15) _____
- A) Matter is composed of atoms.
 - B) Female birds prefer to mate with male birds that have longer tails.
 - C) Living things are made of cells.
 - D) Modern organisms descended from preexisting life-forms.
- 16) Which of the following is TRUE regarding faith-based beliefs and scientific theories? 16) _____
- A) Any and all scientific theories can be disproven, but faith-based beliefs cannot.
 - B) Any and all faith-based beliefs can be disproven, but scientific theories cannot.
 - C) Both faith-based beliefs and scientific theories can be proven.
 - D) Scientific theories are not modifiable, but faith-based beliefs are.
 - E) Faith-based beliefs can become scientific theories.
- 17) Which is the correct sequence of increasing organization? 17) _____
- A) Organelle, tissue, cell, organ
 - B) Organ, tissue, cell, molecule
 - C) Molecule, cell, organelle, organ
 - D) Atom, molecule, tissue, cell
 - E) Cell, tissue, organ, organ system
- 18) Which of the following levels of organization is the most inclusive (i.e., includes the most life-forms)? 18) _____
- A) Community
 - B) Ecosystem
 - C) Biosphere
 - D) Population
 - E) Species
- 19) The smallest units that still retain the characteristics of an element are called 19) _____
- A) molecules.
 - B) cells.
 - C) organic molecules.
 - D) atoms.
 - E) tissues.
- 20) Which of the following is an example of deductive reasoning? 20) _____
- A) Living objects are composed of cells.
 - B) If an object exhibits all the characteristics of life, it must be living.
 - C) All objects on Earth will fall down when dropped, and none will "fall up."
 - D) Atoms make up molecules, which make up cells, which make up tissues.

- 21) The experiments of Francesco Redi 21) _____
A) determined that fly larvae were present in raw meat, and when left on the counter they turned into flies.
B) disproved the idea of spontaneous generation.
C) disproved the scientific method.
D) used the scientific method to prove the idea of spontaneous generation.
E) disproved that maggots and flies were related.
- 22) Francesco Redi designed an experiment to test the notion of spontaneous generation. He left the first jar of meat open to the air and covered the second jar. The first jar would be called the _____ jar. 22) _____
A) conclusive B) experimental C) hypothetical D) control
- 23) To test the effect of vitamin D on growth, two groups of rats were raised under identical conditions and fed the same diet. One of the groups received daily injections of vitamin D. The other group received injections of saline, which did not contain vitamin D. All the rats were weighed weekly for 2 months. In this experiment, the control was the 23) _____
A) average weight gain of the rats. B) group receiving vitamin D.
C) 2-month period of time. D) group receiving saline.
- 24) Evolution is sometimes described as the change from preexisting life-forms to modern-day organisms. What actually changes, in every case of evolution, is the 24) _____
A) ability of organisms to respond to external stimuli.
B) rate of reproduction.
C) energy and nutritional demands of the organism.
D) species' physical appearance.
E) genetic makeup of the species, due to mutations.
- 25) All of the following are important to the theory of evolution EXCEPT 25) _____
A) mutations.
B) environmental change.
C) variation in traits within an entire population.
D) changes in individuals within their lifetimes.
E) inheritance of traits.
- 26) Which is NOT an example of evolution? 26) _____
A) Annual changes in the flu virus due to mutations
B) The 2- to 3-year effectiveness of most commercial pesticides in killing insects
C) The development of antibiotic-resistant bacteria
D) A dog learning how to open the cabinet where its food is kept
E) Flightless birds living on islands without predators
- 27) A mutation can be the cause for 27) _____
A) sperm and egg formation.
B) sexual reproduction.
C) growth and development.
D) environmental change.
E) natural selection.

- 28) A mutation is a 28) _____
A) physical deformity, such as the loss of a limb.
B) defective egg or sperm cell.
C) change in the DNA sequence.
D) dose of radiation.
- 29) In a word, "evolution" means 29) _____
A) improvement. B) nature. C) selection. D) change.
- 30) The concept of evolution is based on 30) _____
A) parents with variations that pass these variations on to their offspring.
B) any type of genetic variation within a population.
C) all genetic variation in a population being equally successful in the same environment.
D) survival and successful reproduction in organisms with favorable variations.
- 31) All of the following are examples of adaptations EXCEPT 31) _____
A) mice learning a maze to get food.
B) larger teeth in beavers for gnawing wood.
C) insects that resemble twigs.
D) different beak shapes for birds that eat seeds or insects.
E) flower coloration that attracts pollinators.
- 32) Suppose an organism has an enzyme that repairs changes in its DNA. The result is a decrease in mutations. This trait would definitely influence the organism's ability to 32) _____
A) move. B) maintain homeostasis.
C) evolve. D) obtain energy.
- 33) The variation among individuals, on which natural selection acts, describes 33) _____
A) genetic differences.
B) random occurrences in the lifetimes of individuals.
C) nutritional differences.
D) physical training and exercise.
- 34) Chromosomes are made of 34) _____
A) DNA and proteins.
B) cells.
C) carbohydrates.
D) proteins.
E) DNA.
- 35) A change in the genetic makeup of a species over time is called 35) _____
A) evolution. B) natural causality.
C) mutation. D) adaptation.
- 36) Adaptations include all of the following EXCEPT 36) _____
A) reduced heart rate and oxygen consumption in seals that dive deep for long periods of time.
B) teaching a pet parrot to talk.
C) inborn migratory behavior of young birds born in the Arctic.
D) larger body size in male gorillas, which fight over females.

- 37) Dinosaurs are not alive today because they 37) _____
A) did not possess the genetic material that beneficial mutations act on.
B) did not evolve fast enough to keep up with rapid environmental change.
C) evolved adaptations that were beneficial in their constant, unchanging environment.
D) evolved too quickly in response to a changing environment.
- 38) Which of the following is a characteristic of living organisms? 38) _____
A) Have membrane-bound organelles
B) Maintenance and regulation of internal conditions
C) Ability to produce energy
D) Eat other organisms
E) Have a nucleus
- 39) All of the following are true of all living organisms EXCEPT that they 39) _____
A) respond to stimuli.
B) are made of cells.
C) can reproduce themselves.
D) can grow.
E) possess either DNA or RNA.
- 40) After you drink a glass of acidic lemonade, your body's pH does not change. This is an example of 40) _____
how humans and other organisms
A) maintain cellular organization.
B) maintain precise internal conditions through homeostasis.
C) evolve in response to the environment.
D) are immune to weak acids.
- 41) Why do humans born without sweat glands usually not survive? 41) _____
A) Sweating is the only way the body eliminates excess water.
B) Sweating is an important mechanism for maintaining the correct body temperature.
C) Sweating is important for eliminating impurities from the body.
D) Sweat glands create openings in the skin where gas exchange occurs.
- 42) An organism's ability to detect stimuli from either the internal or external environment is called 42) _____
A) evolution.
B) DNA.
C) mutation.
D) natural selection.
E) responsiveness.
- 43) You observe a plant on your windowsill that is growing at an angle toward the outside. This is an 43) _____
example of a living thing
A) evolving. B) responding to stimuli.
C) maintaining precise internal conditions. D) reproducing.

- 44) Using its antennae, the male moth finds female moths by following a trail of airborne chemicals, called *pheromones*, upwind from the female producing them. This is an example of how living things _____
- A) grow.
 - B) maintain precise internal conditions.
 - C) detect and respond to stimuli.
 - D) acquire nutrients.
 - E) reproduce.
- 45) An organism in the domain Eukarya is characterized by all of the following EXCEPT _____
- A) ingestion of organic matter to acquire nutrients.
 - B) the ability to maintain precise internal conditions.
 - C) being composed of prokaryotic cells.
 - D) the potential to grow and reproduce.
- 46) Why do heterotrophs require "food" for survival? _____
- A) Food provides the organic chemicals needed by heterotrophs.
 - B) Heterotrophs cannot photosynthesize without the chemicals provided by food.
 - C) Food provides at least half of the water required by heterotrophs.
 - D) Food is an alternative source of energy for heterotrophs when sunlight is unavailable.
- 47) The main difference between an autotroph and a heterotroph is _____
- A) their ability to move.
 - B) how they reproduce.
 - C) how they respond to stimuli.
 - D) how they obtain energy.

MATCHING. Choose the item in column 2 that best matches each item in column 1.

For the following question(s), choose the characteristic of a living organism that best corresponds to each statement. Selections may be used once, more than once, or not at all.

- | | | |
|---|-------------------------------------|-----------|
| 48) A sunflower follows the sun as it moves across the sky during the period of a single day. | A) Response to stimuli
B) Growth | 48) _____ |
| 49) A puppy is born weighing 5 pounds and eventually becomes a 75-pound golden retriever. | | 49) _____ |
| 50) At the beginning of the week, a plant is 3 inches tall and at the end of the week, it is 4 inches tall. | | 50) _____ |

- 51) A paramecium moves from direct light toward the dark. A) Reproduction 51) _____
- B) Response to stimuli 52) _____
- 52) A bacterium divides into two bacteria that are identical to, but smaller than, the original bacterium. C) Evolution
- 53) Over time, the average neck length of giraffes has increased. Only those giraffes with longer necks survived by eating the leaves high up on the trees, and they were able to reproduce and pass those long-neck genes on to the next generation. 53) _____

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

- 54) Of the following levels of organization, Archaea have 54) _____
 A) molecules only.
 B) organs only.
 C) atoms only.
 D) atoms and molecules.
 E) atoms, molecules, and organs.
- 55) In evolutionary terms, which of the following cells is considered to be the most primitive? 55) _____
 A) Eukaryote B) Prokaryote C) Heterotroph D) Autotroph
- 56) In which kingdom does a multicellular, eukaryotic, photosynthetic organism belong? 56) _____
 A) Animalia B) Protists C) Plantae D) Fungi
- 57) A basic difference between a prokaryotic cell and a eukaryotic cell is that the prokaryotic cell 57) _____
 A) lacks a nucleus.
 B) is structurally more complex.
 C) possesses membrane-bound organelles.
 D) is considerably larger.
 E) lacks DNA.
- 58) Which of the following statements about the Bacteria and Eukarya domains is TRUE? 58) _____
 A) All members of Bacteria acquire nutrients via ingestion and all members of Eukarya acquire nutrients by photosynthesis.
 B) All members of Bacteria are prokaryotic cells and all members of Eukarya are eukaryotic cells.
 C) All members of Bacteria are single-celled and all members of Eukarya are multicellular.
 D) Only members of Eukarya have the ability to grow and reproduce.
- 59) Which group has prokaryotic individuals? 59) _____
 A) Domain Archaea
 B) Kingdom Plantae
 C) Kingdom Animalia
 D) Protist kingdoms
 E) Kingdom Fungi

- 60) Which kingdom possesses unicellular animal-like species and unicellular plantlike species? 60) _____
 A) Fungi B) Plantae C) Animalia D) Protista
- 61) A cell that lacks organelles is a(n) 61) _____
 A) prokaryotic cell. B) animal cell.
 C) member of the Kingdom Plantae. D) eukaryotic cell.

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

- 62) Scientific theories are the same in any part of the world (meaning they do not vary by location). 62) _____
- 63) Scientific experimentation generally leads to more questions. 63) _____
- 64) A good experiment should include as many variables as possible at the same time. 64) _____
- 65) A hypothesis is typically stated as an "If . . . then" statement. 65) _____
- 66) Variation among organisms is due to mutations. 66) _____
- 67) Adaptations aid in the survival and reproduction of an organism in a particular environment. 67) _____
- 68) The energy that sustains life ultimately comes from sunlight. 68) _____
- 69) Photosynthetic bacteria are examples of autotrophs. 69) _____
- 70) Prokaryotic cells have a true nucleus and eukaryotic cells do not. 70) _____
- 71) Biodiversity is the total number of organisms in an ecosystem. 71) _____




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

- 72) All scientific study begins with _____ and the formation of testable hypotheses. 72) _____
- 73) A group of individuals who are able to interbreed, regardless of their geographical location, is defined as a(n) _____. 73) _____
- 74) A group of similar, interbreeding individuals that live in the same area is a(n) _____. 74) _____
- 75) The basic unit of life is the _____. 75) _____
- 76) Errors or changes in the DNA of an organism are called _____. 76) _____
- 77) The three natural processes that underlie evolution are genetic variation, inheritance, and _____. 77) _____
- 78) Single-celled organisms that lack a nucleus belong to the domains Bacteria and _____. 78) _____

- 79) Cells that contain a nucleus are eukaryotic, and cells without a nucleus are _____. 79) _____
- 80) Photosynthetic plants are considered "self-feeders," or _____. 80) _____
- 81) Consider the observation that people taking Drug X for headaches also seem to have low blood pressure. Design a simple experiment based on this observation, and include a hypothesis statement and your actual experimental design for the study. 81) _____
- 82) The instructions for producing and maintaining life are contained in what molecule? 82) _____
- 83) Evolution is based on adaptations that aid in the survival and reproduction of a species. List three different adaptations. 83) _____
- 84) Imagine that in 2020 you are the top biologist at a research station studying biodiversity in Costa Rica. A young scientist brings you a sample from a previously unexplored site. She asks you to look at the sample and determine whether it indeed contains microscopic, living organisms. As you begin your investigations, you must first decide what characteristics distinguish life from nonlife. How would you differentiate a living organism from nonliving matter (including viruses and prions)? 84) _____
- 85) Define *biodiversity*. 85) _____
- 86) List four characteristics of living things, and give an example to illustrate each. 86) _____
- 87) Describe at least two cellular-level differences between a photosynthetic prokaryote and a plant. 87) _____

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

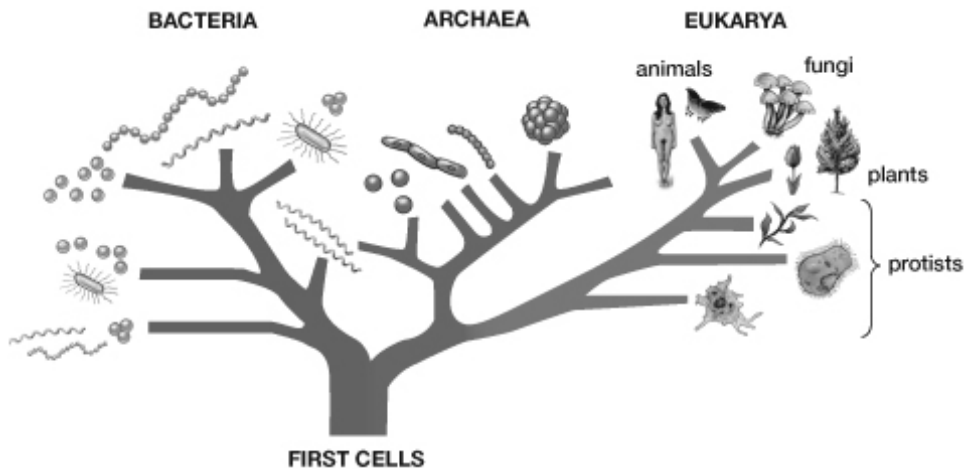
- 88) Which of the following is NOT a part of the community shown in this figure? 88) _____

Ecosystem	A community together with its nonliving surroundings	 snake, antelope, hawk, bushes, grass, rocks, stream
Community	Populations of different species that live in the same area and interact with one another	 snake, antelope, hawk, bushes, grass
Species	All organisms that are similar enough to interbreed	 herd of pronghorn antelope
Population	All the members of a species living in the same area	

- A) Stream
- B) Hawk
- C) Grass
- D) Pronghorn antelope
- E) Snake

89) The "first cells" shown at the bottom of this illustration were most likely

89) _____



- A) prokaryotes.
- B) protists.
- C) animals.
- D) fungi.
- E) plants.

90) A 57-year-old woman was admitted to a hospital with an infected toe, and the infection was spreading rapidly. The damage was being caused by an unknown microorganism that could not be cultured in the lab. Doctors observed that antibiotics, which kill only prokaryotes, were ineffective. They suspected that the microbe was a fungus, so they tried the drug Amphotericin, which targets the ergosterols in fungal cells. Because animal cells contain cholesterol, not ergosterols, they are unaffected by the drug. Shortly after receiving Amphotericin, the patient improved, her infection ceased, and she was released from the hospital.

90) _____

In this scenario, what was the hypothesis?

- A) A microbe that has cholesterol is causing the infection.
- B) Why didn't the antibiotics kill the microbe that caused the infection?
- C) The infection will spread rapidly.
- D) If the infection is caused by an animal, then Amphotericin will cure the patient.
- E) Antibiotics will not kill the microbe because it is a fungal species.

91) Suppose that a meteorite crashes into Earth and a sample of it is taken to a local research lab for analysis. Embedded several inches within the rocky structure, a microscopic cluster of dormant, spore-like structures is found. The scientists culture some of this material in a standard microbiological nutrient broth, and they are surprised to find many single-celled "organisms" moving around, growing, and reproducing in the broth. The "organisms" behave the same in both daylight and dark conditions, do not require oxygen, and thrive under a wide range of temperatures and pH levels. They stop moving, growing, and reproducing, however, when fewer nutrients are available in the medium.

91) _____

In this scenario, the "organisms" most closely resemble a(n)

- A) nonliving virus.
- B) heterotrophic species of Eukarya.
- C) autotrophic species of Eukarya.
- D) photosynthetic species of Bacteria.
- E) heterotrophic species of Archaea.

- 92) A substance with specific properties that cannot be broken down or converted into another substance is called a(n) 92) _____
- A) element.
 - B) compound.
 - C) mixture.
 - D) ion.
 - E) molecule.
- 93) If you examined the human body on a chemical composition basis, which of the following combinations of elements would be most common? 93) _____
- A) O, C, N, Na
 - B) O, C, P, S
 - C) C, N, Ca, S
 - D) O, C, H, N
 - E) C, H, Ca, Cl
- 94) The atomic number of an atom is defined as the 94) _____
- A) number of neutrons in the atomic nucleus.
 - B) number of electrons in the outermost energy level.
 - C) total number of electrons and neutrons.
 - D) total number of energy shells.
 - E) number of protons in the atomic nucleus.
- 95) Phosphorus has an atomic number of 15, so what is the distribution of its electrons? 95) _____
- A) The first energy level has 2 and the second has 13.
 - B) The first energy level has 8 and the second has 7.
 - C) The first, second, and third energy levels have 5 electrons each.
 - D) The electron arrangement cannot be determined from the atomic number alone.
 - E) The first energy level has 2, the second has 8, and the third has 5.
- 96) Which four elements make up approximately 96% of living matter? 96) _____
- A) Carbon, phosphorus, hydrogen, sulfur
 - B) Oxygen, hydrogen, calcium, sodium
 - C) Carbon, hydrogen, nitrogen, oxygen
 - D) Carbon, oxygen, calcium, sulfur
 - E) Carbon, sodium, chlorine, magnesium
- 97) Imagine that you have been hired as a chemist and your first task is to examine a newly discovered atom. The paperwork you are given states that its atomic number is 110. What does this mean? 97) _____
- A) The atom contains 55 protons and 55 neutrons.
 - B) The atom is an isotope.
 - C) The atom contains 110 protons.
 - D) The atom contains 55 electrons.
- 98) Iron is an important element in human body cells. If iron has an atomic number of 26, what does this tell you about this element? 98) _____
- A) An iron atom has 13 protons and 13 neutrons.
 - B) An iron atom is unable to become an isotope.
 - C) An iron atom has 13 electrons and 13 protons.
 - D) An iron atom has 26 protons.

- 99) Carbon-14 is often used for carbon dating, where scientists measure the rate of carbon-14 decay to determine the age of items. Carbon-14 contains six protons and eight neutrons. During the process of carbon-14 decay, one of its eight neutrons becomes a proton and an electron is emitted. Which of the following is the best explanation of what has occurred? 99) _____
- A) The resulting atom is still carbon-14.
 - B) The resulting atom has a more stable nucleus.
 - C) The resulting atom is now a different element because the number of protons has changed.
 - D) An ionic bond has formed.
- 100) Radioactive isotopes are biological tools that are often used to 100) _____
- A) measure the size of fossils.
 - B) detect brain tumors and other important medical technologies.
 - C) increase the pH of blood.
 - D) build up a store of calcium in a cell.
- 101) For an atom to achieve maximum stability and become chemically inert, what must occur? 101) _____
- A) The number of electrons must equal the number of protons.
 - B) Ionization occurs.
 - C) Electron pairs are shared.
 - D) Its outermost energy shell must be completely filled with electrons.
- 102) An atom's nucleus is composed of 102) _____
- A) protons and electrons.
 - B) neutrons and electrons.
 - C) neutrons only.
 - D) protons and neutrons.
 - E) protons only.
- 103) The formation of ions involves the 103) _____
- A) gain or loss of protons.
 - B) gain or loss of electrons.
 - C) sharing of electrons.
 - D) gain or loss of neutrons.
 - E) sharing of protons.
- 104) If a certain atom has a tendency to lose two electrons, that atom can then become a(n) 104) _____
- A) isotope.
 - B) polar molecule.
 - C) water molecule.
 - D) ion.
- 105) The formation of sodium chloride (NaCl) is the result of 105) _____
- A) covalent bonding.
 - B) attraction between opposite charges.
 - C) repelling between the same charges.
 - D) chemical unreactivity.
- 106) Atoms or molecules that have gained or lost electrons are called 106) _____
- A) ions.
 - B) acids.
 - C) covalent.
 - D) buffers.
 - E) bases.

- 107) Most biological molecules are joined by _____
A) peptide bonds.
B) ionic bonds.
C) covalent bonds.
D) hydrogen bonds.
E) disulfide bonds.
- 108) Sulfur is an essential element in the human body, and studying its characteristics is important in understanding human physiology. Sulfur atoms have six electrons in their outer shell. Based on this information, which of the following is TRUE? _____
A) Sulfur can form important molecules using covalent bonds.
B) Sulfur is an important isotope of hydrogen.
C) Sulfur is inert.
D) Sulfur has eight electrons in its outer shell.
- 109) Free radicals contain unpaired electrons in their outermost energy shell, so they react readily with other atoms or molecules to reach a more stable state. Which of the following could potentially be a free radical? _____
A) Magnesium (atomic number 12) B) Neon (atomic number 10)
C) Helium (atomic number 2) D) Fluorine (atomic number 9)
- 110) Free radicals are considered dangerous because they _____
A) steal electrons from other atoms, causing those atoms to become unstable.
B) damage oxygen and cause it to become an antioxidant.
C) attack the atomic nucleus.
D) emit dangerous radiation.
- 111) Scientists recommend a diet rich in antioxidants to stay healthy. What occurs at the atomic level to explain this recommendation? _____
A) Antioxidants prevent free radicals from attacking other atoms or molecules.
B) Antioxidants steal electrons, which gives cells extra energy.
C) Antioxidants cause an increase in pH, which is necessary for neutrality in cells.
D) Antioxidants are inert and do not interact with free radicals.
- 112) Which of the following best explains why a particular atom may not form compounds easily? _____
A) The atom has an uneven number of protons.
B) The atom's outer energy shells are completely full.
C) The atom has no electrons.
D) The atom has seven electrons in its outer shell.
- 113) The element carbon has atomic number 6. Carbon most likely _____
A) shares two electrons with another atom. B) donates two electrons to another atom.
C) forms four covalent bonds. D) forms ionic bonds with other atoms.
- 114) Sodium (Na), atomic number 11, has a tendency to lose an electron in the presence of chlorine. After losing the electron, Na has _____ protons in its nucleus. _____
A) 10 B) 12 C) 21 D) 22 E) 11

- 115) Carbon has atomic number 6. Carbon most likely _____
A) shares neutrons.
B) loses protons.
C) loses electrons.
D) shares protons.
E) shares electrons.
- 116) What does H-O-H represent? _____
A) Atom of water
B) Ionic bonding of water
C) Molecule of water
D) Mixture including water
- 117) The atomic number of hydrogen is 1. Based on this fact, all of the following must be true of hydrogen gas (H₂) EXCEPT that it _____
A) is a polar molecule.
B) uses covalent bonds to form the molecule.
C) shares one pair of electrons between the two hydrogen atoms.
D) is a stable molecule.
- 118) Polar covalent bonds form when _____
A) atoms from two molecules are repelling each other.
B) electrons are shared unequally between atoms.
C) more than one pair of electrons is shared.
D) an acid and a base are combined.
E) ions are formed.
- 119) Which of the following represents a molecule characterized by polar covalent bonding? _____
A) H₂O B) NaCl C) O₂ D) CH₄ E) H₂
- 120) What type of bond is easily disrupted in aqueous solutions (one in which the solvent is water)? _____
A) Covalent B) Ionic C) Polar covalent
- 121) If sulfur has an atomic number of 16, how many covalent bonds can it form with other atoms? _____
A) Two B) Eight C) Zero D) Four E) Six
- 122) The part of the atom that has the greatest biological interest and interactions with other atoms is the _____
A) innermost electron shell.
B) proton.
C) neutron.
D) electron.
- 123) Which of the following pairs has the most similar chemical properties to each other? _____
A) ¹²C and ²⁸Si
B) ¹⁶O and ³²S
C) ¹H and ²He
D) ¹²C and ¹⁴C
E) ¹H and ²²Na
- 124) A single covalent chemical bond represents the sharing of how many electrons? _____
A) Four B) Six C) Two D) Three E) One

- 125) Polar molecules 125) _____
A) are always ions.
B) have an overall positive electric charge.
C) have an overall negative electric charge.
D) have an unequal distribution of electric charge.
E) have an equal distribution of electric charge.
- 126) The hydrogen bond between two water molecules forms because water is 126) _____
A) hydrophobic.
B) a large molecule.
C) a small molecule.
D) polar.
E) nonpolar.
- 127) Hydrogen bonding can take place between a hydrogen atom and what other atom? 127) _____
A) Oxygen
B) Nitrogen
C) Nitrogen, oxygen, and fluorine
D) Fluorine
E) Hydrogen
- 128) Which statement is an accurate description of water molecules? 128) _____
A) They are charged and nonpolar. B) They are ionically bonded.
C) They are slightly charged and polar. D) They are uncharged and nonpolar.
- 129) Which of the following is an example of hydrogen bonding? 129) _____
A) The bond between O and H in a single molecule of water
B) The bond between H of one water molecule and H of a separate water molecule
C) The bond between O of one water molecule and O of a separate water molecule
D) The bond between O of one water molecule and H of a separate water molecule
E) The bond between the H of a water molecule and H of a hydrogen molecule
- 130) Which of the following results from a transfer of electron(s) between atoms (e.g., NaCl)? 130) _____
A) Nonpolar covalent bond
B) Polar covalent bond
C) Ionic bond
D) Hydrogen bond
E) Electron-proton interaction
- 131) Which of the following results from an unequal sharing of electrons between atoms? 131) _____
A) Nonpolar covalent bond
B) Polar covalent bond
C) Ionic bond
D) Hydrogen bond
E) Electron-proton interaction

- 132) Which of the following best explains the attraction of water molecules to each other? 132) _____
A) Nonpolar covalent bond
B) Polar covalent bond
C) Ionic bond
D) Hydrogen bond
E) Electron-proton interaction
- 133) Which of the following is LEAST affected by the presence of water? 133) _____
A) Nonpolar covalent bond
B) Polar covalent bond
C) Ionic bond
D) Hydrogen bond
E) Electron-proton interaction
- 134) What happens when hydrochloric acid (HCl) dissociates in pure water? 134) _____
A) The concentration of OH⁻ ions increases.
B) The water has a decrease of H⁺ ions.
C) The HCl molecules float on top of the water.
D) The HCl molecules separate into H⁺ and Cl⁻ ions.
E) The pH of the solution increases.
- 135) An atom of nitrogen attracts electrons more strongly than an atom of hydrogen. In an ammonia molecule (NH₃), which of the following best describes the electrical charge of the individual atoms? 135) _____
A) The nitrogen is slightly positive.
B) The nitrogen becomes neutral.
C) The hydrogens are strongly negative.
D) The nitrogen is slightly more negative.
E) Charges balance out and none of the atoms has any charge.
- 136) If a substance measures 7 on the pH scale, that substance 136) _____
A) is basic.
B) may be lemon juice.
C) has equal concentrations of H⁺ and OH⁻ ions.
D) has a higher concentration of OH⁻ than H⁺ ions.
E) probably lacks OH⁻ ions.
- 137) A neutral solution 137) _____
A) has equal amounts of H⁺ and OH⁻.
B) has a pH of 0.
C) has no H⁺.
D) has no OH⁻.
E) is hydrophobic.
- 138) How do buffers work? 138) _____
A) They monitor the blood pH.
B) They soak up extra acid and base.
C) They convert H⁺ and OH⁻ to water.
D) They accept and release H⁺.
E) They accept and release OH⁻.

- 139) The human body must maintain a constant pH. In the blood, bicarbonate serves as a(n) _____ to help maintain the necessary pH. 139) _____
A) buffer B) solvent C) base D) acid
- 140) Milk of magnesia is often used to treat stomach upset. It has a pH of 10. Based on this information, milk of magnesia 140) _____
A) is a base. B) has the same pH as stomach acid.
C) is an acid. D) is hydrophobic.
- 141) What is meant by the statement that water has a high specific heat? 141) _____
A) Water can heat up to only a certain temperature.
B) Water freezes easily.
C) It can absorb a lot of energy without changing temperature.
D) The boiling point of water is low.
E) It grows hot quickly.
- 142) Which of the following properties of water enable(s) it to function as a regulator of temperature for living organisms? (Hint: Think about what happens when you are sunbathing.) 142) _____
A) Low specific heat
B) High specific heat and high heat of vaporization
C) High heat of vaporization
D) High specific heat
E) High specific heat and low heat of vaporization
- 143) The fact that salt dissolves in water is best explained by the 143) _____
A) hydrophobic nature of the water.
B) hydrophobic nature of salt.
C) ionic nature of water molecules.
D) slightly charged nature of water molecules.
E) polar nature of water molecules.
- 144) Hydrophilic molecules 144) _____
A) form hydrogen bonds among themselves.
B) do not readily dissolve in water.
C) are repelled by water.
D) are neutral and nonpolar.
E) readily dissolve in water.
- 145) Water moves through a plant because of the property of 145) _____
A) high heat of vaporization. B) high specific heat.
C) cohesion. D) high heat of fusion.
- 146) Water molecules are cohesive because they 146) _____
A) stick to other polar molecules.
B) form hydrogen bonds.
C) are repelled by nonpolar molecules.
D) contain protons.
E) make up 60% to 90% of an organism's body weight.

- 147) When the acidic level of human blood increases, how is the proper balance of hydrogen ions (H^+) restored? 147) _____
- A) Bicarbonate (HCO_3^-) accepts H^+ ions and forms carbonic acid.
 - B) Carbonic acid eats up the extra OH^- ions.
 - C) H^+ ion-donor levels increase.
 - D) Bicarbonate (HCO_3^-) releases H^+ ions that combine with excess OH^- ions to form H_2O .
- 148) For ice to melt, it has to 148) _____
- A) increase its property of cohesion.
 - B) increase its heat of vaporization.
 - C) absorb heat from its surroundings.
 - D) become less dense.
- 149) What determines the cohesiveness of water molecules? 149) _____
- A) Ionic bonds
 - B) Covalent bonds
 - C) Hydrophobic interactions
 - D) Hydrogen bonds
- 150) If you place a paper towel in a dish of water, the water will 150) _____
- A) move up the towel because water molecules move quickly as it vaporizes.
 - B) dissolve the towel because water is a good solvent.
 - C) move away from the towel because water molecules have hydrophobic interactions.
 - D) separate into H^+ and OH^- ions, which will react with the paper towel molecules.
 - E) move up the towel as the water adheres to the paper towel while the cohesive water molecules stay bound to each other.
- 151) Sweating is a useful cooling mechanism for humans because water 151) _____
- A) takes up a great deal of heat in changing from its solid state to its liquid state.
 - B) is an outstanding solvent.
 - C) ionizes readily.
 - D) takes up a great deal of heat in changing from its liquid state to its gaseous state.
 - E) can exist in two states at temperatures common on Earth.
- 152) In general, a substance that carries an electric charge can dissolve in water. Given this fact, which of the following would most likely NOT dissolve in water? 152) _____
- A) Nonpolar molecules
 - B) Polar covalent molecules
 - C) Ionic compounds
 - D) NaCl
- 153) If you place a feather on the surface of a bowl of water, the feather remains suspended on the surface due to the 153) _____
- A) density of the water.
 - B) fact that water is a good solvent.
 - C) polarity of the water.
 - D) surface tension of the water.
- 154) The specific heat of water is 10 times greater than that of iron. You place a metal pot full of water on the stove to heat it up. You touch the metal handle of the pot when the water is still only lukewarm. Which of the following best describes what happens? 154) _____
- A) You find that the handle is cooler than the water in the pot.
 - B) You find that both the water and the handle are the same temperature.
 - C) You burn your finger and pull your hand away from the hot metal handle.
 - D) You determine that metal pots full of water produce acids and bases.

155) You drop a handful of common table salt into a glass of water. Which of the following best describes what is happening inside the glass at the molecular level? 155) _____
A) Sodium and chloride ions form a covalent bond.
B) The positively charged hydrogen ends of the water molecules are attracted to chloride ions.
C) The positively charged hydrogen ends of the water molecules are attracted to sodium ions.
D) Water and sodium form a covalent bond.

156) Your friend does a belly flop into a swimming pool. The stinging pain he feels is most likely due to the 156) _____
A) hydrophobic nature of your friend's skin.
B) surface tension of water (caused by the large number of hydrogen bonds that form between water molecules).
C) pH of the water.
D) fact that water is a good solvent.

157) Which of the following is the densest? 157) _____
A) Liquid water B) Ice C) Steam

158) Unlike a rock, a reptile can sit in the hot sunshine without its body temperature soaring quickly. This is because the water in its body 158) _____
A) is a poor solvent. B) is a good solvent.
C) has a low specific heat. D) has a high specific heat.

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

159) Isotopes are atoms of the same element that have different numbers of protons. 159) _____

160) Every atom of the same element has an equal number of electrons and protons. 160) _____

161) Acids have pH values below 7, whereas bases have pH values above 7. 161) _____

162) The attractive force that holds two or more water molecules together is an example of an ionic bond. 162) _____

163) When water freezes, stable hydrogen bonds form between the water molecules that create an open, six-sided (hexagonal) arrangement. 163) _____

164) Water surface tension is a result of the cohesive nature of water molecules. 164) _____

165) To maintain a constant pH, buffers act to either accept or release H⁺. 165) _____

166) Most liquids become less dense upon solidification, but water is different in that it becomes denser when it solidifies. 166) _____

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

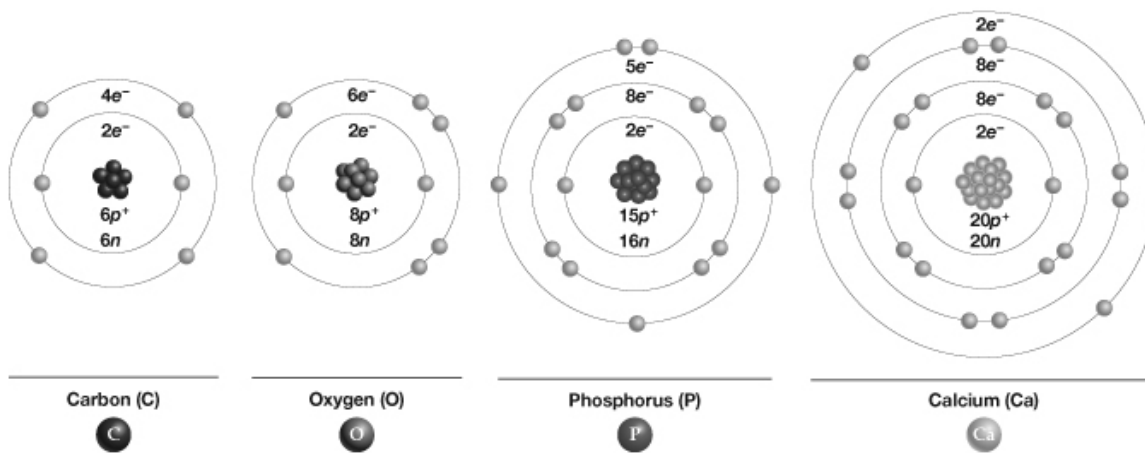
167) The chemical properties of an element are determined by the number of _____ in its outermost energy shell. 167) _____

168) Isotopes are atoms of the same element that have different numbers of _____. 168) _____

- 169) The second electron shell is considered to be full when it contains _____ electrons. 169) _____
- 170) A basilisk lizard can run across the surface of a pond due to a property of water called _____. 170) _____
- 171) Ions and polar molecules that are electrically attracted to water molecules are _____. 171) _____
- 172) What is the difference between covalent and ionic bonds? 172) _____
- 173) more stable than a hydrogen atom (atomic number 1)? 173) _____
- 174) What type of bonding exists between the slight positive charge of a hydrogen atom and the slight negative charge of a nearby oxygen atom? 174) _____
- 175) What property of water, in which water molecules stick to each other, is responsible for the ability of plants to get water from their roots up to their leaves? 175) _____
- 176) How does a base differ from an acid? 176) _____
- 177) Imagine that you are trying to make a homemade salad dressing and place several drops of olive oil into a container of water. You stir the solution, but the oil doesn't readily mix. Instead, you observe a glistening clump of oil floating on the surface. Explain what is happening at the molecular level. (Your answer should include the term *hydrophobic*.) 177) _____

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

- 178) Which of these atoms would become inert if it accepted three electrons? 178) _____



A) Phosphorus

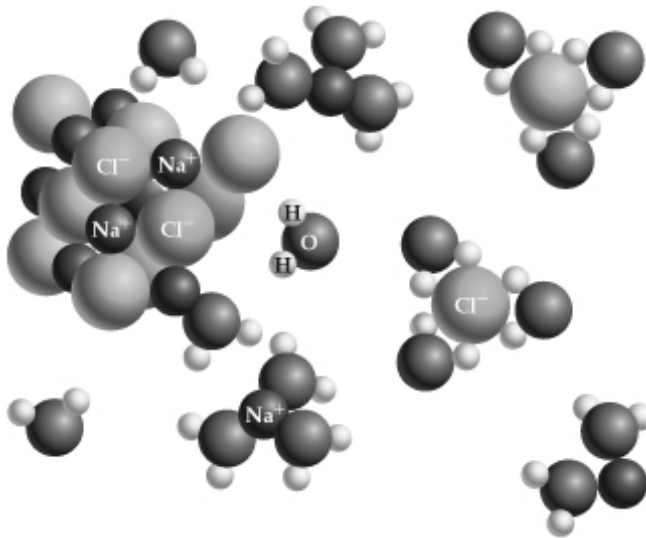
B) Carbon

C) Oxygen

D) Calcium

179) Which of the following is attracted to the hydrogen "end" of a water molecule, as depicted in this figure?

179) _____



A) NaCl

B) H

C) Na+

D) Cl-

180) Different types of living matter often have different forms of the same elements in their bodies. For example, the nitrogen in an animal often has a slightly different atomic structure than the nitrogen in a plant. Recently, nutritionists have discovered how to deduce the diets of various animal species by examining the type of nitrogen (and other elements) inside their bodies.

180) _____

What is the chemical basis behind this scenario?

- A) Hydrophobic interactions keep water molecules from forming bonds with fats and oils.
- B) Antioxidants buffer the potential damage that free radicals do to cells.
- C) Radioactive elements can be used to trace the paths of molecules through the body.
- D) Covalent bonds result when two atoms share electrons.
- E) Isotopes of the same element have the same atomic number but different atomic masses.

181) All animals need oxygen gas (O_2) for their primary cellular-level functioning. Inside the cell, O_2 is split apart into oxygen atoms. Eventually, electrons that are flowing through the cell will be "received" by this oxygen. But first, the electrons combine with protons present in the cell to form a basic element that has a single proton and a single electron. Then this element combines with the oxygen to form a certain chemical compound.

181) _____

In this scenario, what chemical compound is produced when this element combines with oxygen?

- A) Water (H_2O)
- B) Bicarbonate (HCO_3)
- C) Ozone (O_3)
- D) Carbon dioxide (CO_2)

Answer Key

Testname: UNTITLED1

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

Answer Key

Testname: UNTITLED1

- 51) B
- 52) A
- 53) C
- 54) D
- 55) B
- 56) C
- 57) A
- 58) B
- 59) A
- 60) D
- 61) A
- 62) FALSE
- 63) TRUE
- 64) FALSE
- 65) FALSE
- 66) TRUE
- 67) TRUE
- 68) TRUE
- 69) TRUE
- 70) FALSE
- 71) FALSE
- 72) observations
- 73) species
- 74) population
- 75) cell
- 76) mutations
- 77) natural selection
- 78) Archaea
- 79) prokaryotic
- 80) autotrophs
- 81) Answers should include a controlled variable, repetition, and a hypothesis statement.
- 82) DNA
- 83) There are many correct answers. Some acceptable answers are roots of plants that help land plants gain water, fleshy fish fins that allow for movement across a surface, and wings of eagles that aid in hunting.
- 84) Answers should describe several characteristics of a living organism.
- 85) Biodiversity is the number of species in a given geographic region.
- 86) There are many correct answers. Some acceptable answers are: Living things are both complex and organized (cells have organelles with specific organization); living things respond to stimuli (plants grow toward light); living things maintain homeostasis (the human body maintains its body temperature); living things acquire and use energy (plants use photosynthesis); living things grow (animals grow during their lifetime); living things reproduce (organisms produce offspring); living things have the capacity to evolve (bacteria have evolved antibiotic resistance).
- 87) The prokaryote does not have any membrane-bound organelles (including a nucleus), but the plant (being a eukaryote) does. The prokaryote is unicellular, whereas the plant is multicellular.
- 88) A
- 89) A
- 90) E
- 91) E
- 92) A
- 93) D
- 94) E

Answer Key

Testname: UNTITLED1

- 95) E
- 96) C
- 97) C
- 98) D
- 99) C
- 100) B
- 101) D
- 102) D
- 103) B
- 104) D
- 105) B
- 106) A
- 107) C
- 108) A
- 109) D
- 110) A
- 111) A
- 112) B
- 113) C
- 114) E
- 115) E
- 116) C
- 117) A
- 118) B
- 119) A
- 120) B
- 121) A
- 122) D
- 123) D
- 124) C
- 125) D
- 126) D
- 127) A
- 128) C
- 129) D
- 130) C
- 131) B
- 132) D
- 133) A
- 134) D
- 135) D
- 136) C
- 137) A
- 138) D
- 139) A
- 140) A
- 141) C
- 142) E
- 143) E
- 144) E

Answer Key

Testname: UNTITLED1

- 145) C
- 146) B
- 147) A
- 148) C
- 149) D
- 150) E
- 151) D
- 152) A
- 153) D
- 154) C
- 155) B
- 156) B
- 157) A
- 158) D
- 159) FALSE
- 160) TRUE
- 161) TRUE
- 162) FALSE
- 163) TRUE
- 164) TRUE
- 165) TRUE
- 166) FALSE
- 167) electrons
- 168) neutrons
- 169) eight
- 170) surface tension
- 171) hydrophilic
- 172) Covalent bonds are the sharing of electrons between atoms, whereas ionic bonds are the electric charge attraction between two ions (typically a metal and a non-metal).
- 173) Two electrons completely fill the outermost electron shell of helium, but hydrogen must accept an electron before its outermost shell is filled.
- 174) hydrogen bonding
- 175) cohesion
- 176) A base is a solution with a concentration of OH^- that is higher than the concentration of H^+ (pH greater than 7). An acid has a H^+ concentration that exceeds its OH^- concentration (pH less than 7).
- 177) When oil molecules are together in water, their nonpolar surfaces are hydrophobic and nestle together. They are surrounded by water molecules that form hydrogen bonds with one another but not with the oil.
- 178) A
- 179) D
- 180) E
- 181) A