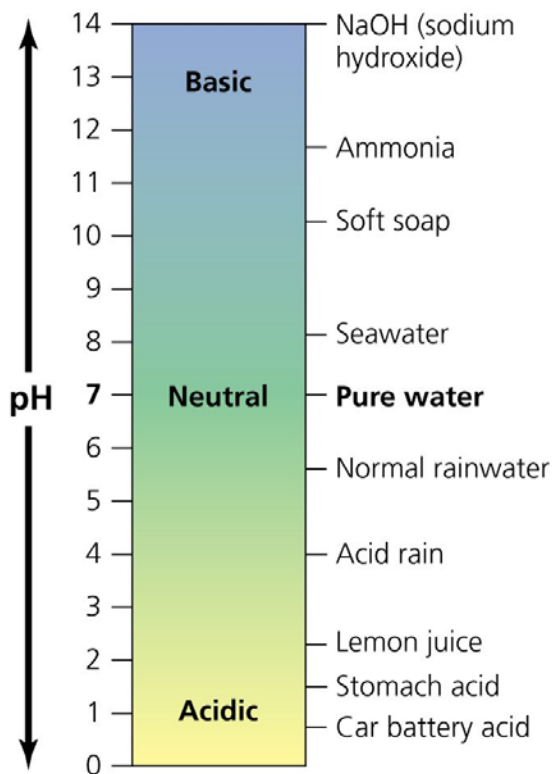


Exam

Name _____

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



Use the figure above to answer the following question(s).

- 1) A decrease of one unit in the pH scale above represents a tenfold increase in the hydrogen ion concentration of a solution. For example, a solution having a pH of 4 is 10 times more acidic than a solution with a pH of 5. If acid precipitation rain changes the pH of a pond from 7.5 to 6.5, the level of hydrogen ion has changed by a factor of _____. 1) _____
- A) 10 B) 100 C) 13.0 D) 0.01 E) 2.0

Answer: A

- 2) If the pond above is chemically treated to raise the pH to 7.0 _____. 2) _____
- A) the concentration of hydrogen ion is now lower than at pH 7.5
 B) the water of the pond is now slightly alkaline
 C) the pond is now pH neutral and it has more hydrogen ions than at pH 7.5
 D) the water of the pond is now slightly acid
 E) there will be no measurable levels of hydrogen ion in the pond

Answer: C

- 3) The figure suggests that the biological pH values displayed in the graph (are) _____. 3) _____
- A) indicate an absence of hydrogen ions
 - B) in the extremely acid range
 - C) range from 1.5 to 8
 - D) indicate an absence of hydroxide ions
 - E) in the extremely alkaline range

Answer: C

- 4) The pH of stomach acid suggests that it _____. 4) _____
- A) would be harmful to living organisms ingested with food
 - B) is inside the biological range of pH values
 - C) must be very close to the pH of other body fluids
 - D) is an excellent environment for bacteria and fungi to multiply
 - E) has a very high concentration of hydroxide ions

Answer: B

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

Match the following:

- 5) The smallest components of elements that still maintain the chemical properties of the element 5) _____
- A) atoms
 - B) electrons

Answer: A

- 6) Negatively charged particles 6) _____
- C) isotopes
 - D) ions

Answer: B

- 7) Elements with the same atomic number but with different atomic masses 7) _____
- E) molecules
 - F) protons

Answer: C

- 8) Elements or molecules with a charge 8) _____
- G) neutrons

Answer: D

- 9) Charged particles located in the nucleus 9) _____
- F) protons

Answer: F

- 10) Combinations of elements held together with bonds 10) _____

Answer: E

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

- 11) _____ is defined as the number of protons plus the number of neutrons. 11) _____
- A) Atomic number
 - B) Mass number
 - C) Nuclear number
 - D) Ionic number
 - E) Isotopic number

Answer: B

- 12) _____ are composed of amino acids. 12) _____
- A) Proteins
 - B) Lipids
 - C) Bases
 - D) Nucleic acids
 - E) Carbohydrates

Answer: A

- 13) _____ are the primary water-insoluble components of cell membranes. 13) _____
- A) Proteins
 - B) Nucleic acids
 - C) Carbohydrates
 - D) Lipids
 - E) Acids

Answer: D

- 14) Geographic Information Systems (GIS) is _____. 14) _____
- A) useful in tracking the movements of individual organisms
 - B) used to measure the economic value of ecosystem services
 - C) helping conservation biologists study habitats and study biodiversity
 - D) useful in determining the number of heterotrophs in an ecosystem
 - E) used to predict rainfall and temperature changes in ecosystems

Answer: C

- 15) An example of a positive feedback loop _____. 15) _____
- A) is melting arctic snow exposing dark surfaces that heat up and cause further melting
 - B) is a thermostat turning on the furnace as the temperature drops
 - C) are birds migrating south in response to colder temperatures
 - D) are predators eating most of their prey and then declining in numbers
 - E) is a pond becoming more acidic as a result of pollution

Answer: A

- 16) Which of the following represents an example of aerobic cellular respiration? 16) _____
- A) water + carbon dioxide + energy → glucose + oxygen + water
 - B) glucose + oxygen → water + carbon dioxide + energy
 - C) nitrogen + oxygen + glucose → methane + carbon dioxide
 - D) water + carbon dioxide → glucose + oxygen + water + energy
 - E) nitrogen + carbon dioxide + energy → methane + oxygen

Answer: B

- 17) The greatest source of both nitrogen and phosphorus entering Chesapeake Bay is _____. 17) _____
- A) agriculture
 - B) municipal and industrial wastewater
 - C) urban fertilizer runoff
 - D) septic systems
 - E) natural sources

Answer: A

- 18) Ecological modeling is most useful for studying _____. 18) _____
- A) small isolated microhabitats, where the inputs and outputs are well-studied
 - B) large complex ecosystems that have many interactions
 - C) how individual species interact with one another
 - D) artificial data generated by computers
 - E) the biodiversity in ecosystems

Answer: B

- 19) In all ecosystems energy is eventually lost to the environment via _____. 19) _____
- A) heat resulting from respiration
 - B) radiation and reflection of light
 - C) matter
 - D) photosynthesis
 - E) trophic levels

Answer: A

- 20) Compared to energy-flow in ecosystems, the flow of matter _____. 20) _____
- A) is one-way
 - B) moves from consumers to producers
 - C) does not involve either detritivores or detritus
 - D) is always dissipated as heat
 - E) reflects conservation and recycling

Answer: E

- 21) In the flow of matter in ecosystems, the greatest flow of nutrients is between _____. 21) _____
- A) middle consumers and producers
 - B) the sun and producers
 - C) detritus and producers
 - D) decomposers and top consumers
 - E) producers and top consumers

Answer: C

- 22) Of the following, _____ is not a macromolecule. 22) _____
- A) DNA B) starch C) proteins D) glucose E) cellulose

Answer: D

- 23) The greatest source of water in the hydrological cycle is _____. 23) _____
- A) groundwater
 - B) soil water
 - C) oceans
 - D) precipitation
 - E) the atmosphere

Answer: C

- 24) River water held behind a dam is best described as a form of _____. 24) _____
- A) chemical energy
 - B) entropy
 - C) kinetic energy
 - D) potential energy
 - E) thermodynamics

Answer: D

- 25) During photosynthesis within plants, _____. 25) _____
- A) entropy increases
 - B) oxygen is consumed
 - C) there is net consumption of water and carbon dioxide
 - D) entropy stays the same
 - E) the high-quality energy of the sun is converted to a lower quality

Answer: C

- 26) Cellular respiration _____. 26) _____
- A) involves a net consumption of water
 - B) liberates carbon dioxide and water
 - C) results in a net consumption of energy
 - D) requires the green pigment chlorophyll
 - E) represents a decrease in entropy

Answer: B

- 27) During the light reactions of photosynthesis, the solar energy absorbed by chlorophyll is used to _____. 27) _____
- A) split water molecules and release oxygen in the form of O₂
 - B) break down macromolecules such as starch
 - C) produce small, high-energy molecules that are used in the Calvin cycle to manufacture sugars
 - D) defend against predators
 - E) Both A and C

Answer: E

- 28) The trophic level of "producers" includes _____. 28) _____
- A) the sum of both living and dead biomass in an ecosystem
 - B) any organism producing biomass directly from photosynthesis
 - C) any organism using oxygen for respiration
 - D) heterotrophs only
 - E) heterotrophs and autotrophs

Answer: B

- 29) Net primary productivity is _____. 29) _____
- A) the energy used by plants to make biomass after respiration
 - B) the total biomass of an entire ecosystem
 - C) the amount of detritus produced by an ecosystem
 - D) the biomass of producers minus that of consumers
 - E) the amount of energy consumers derive from producers

Answer: A

30) Biological nitrogen fixation (nitrogen fixation that is performed by living organisms) is carried out by _____. 30) _____
A) pine trees
B) mammals
C) fungi
D) various species of specialized bacteria
E) slime molds

Answer: D

31) The greatest planetary pool of nitrogen is _____. 31) _____
A) the lithosphere
B) the hydrosphere
C) in fossil fuel deposits
D) the atmosphere
E) the biosphere

Answer: D

32) Aquifers are _____. 32) _____
A) large bodies of surface water such as lakes and oceans
B) a source of water largely untapped by agriculture and urban systems
C) moist areas of soils that permit infiltration of nitrogen and phosphorus
D) areas where the water table is above ground most of the year
E) porous rock formations located underground that store groundwater

Answer: E

33) Consider the following processes: respiration, combustion, polymerization, nitrification, industrial fixation, and photosynthesis. How many of these result in the release of oxygen into the atmosphere? 33) _____
A) 1 B) none C) all D) 2 E) 4

Answer: A

34) When you burn a log in your fireplace you are converting _____. 34) _____
A) electromagnetic to chemical
B) chemical to nuclear energy
C) proteins to amino acids
D) thermal to electromagnetic energy
E) chemical to thermal (heat) energy

Answer: E

35) The greatest human impact on the carbon cycle has been through _____. 35) _____
A) depletion of aquifers
B) combustion of fossil fuels
C) increased respiration of the exponentially growing human population
D) mining of limestone (calcium carbonate)
E) use of synthetic fertilizers

Answer: B

- 36) That all the energy of the universe remains constant, is conserved, neither created nor destroyed, but may change form is a statement of the _____. 36) _____
- A) First Law of Thermodynamics
 - B) Law of Cosmic Inertia
 - C) Law of Feedback
 - D) Law of Systemic Connection
 - E) Law of Entropy

Answer: A

- 37) Skin, hair, muscles, and enzymes are all made up of _____. 37) _____
- A) proteins
 - B) organelles
 - C) lipids
 - D) carbohydrates
 - E) nucleic acids

Answer: A

- 38) Precipitation _____. 38) _____
- A) that is acidic would have a pH lower than pure water
 - B) has become increasingly more basic in the last 100 years, due to industrial air pollution
 - C) that is acidic would have a pH higher than 7
 - D) that measures pH = 4 is twice as acidic as precipitation that measures pH = 5
 - E) that is acidic has a low concentration of hydrogen ions

Answer: A

- 39) Forming the cell walls of stems, leaves, and roots, what compound is the primary structural constituent of plant tissues? 39) _____
- A) Enzymes
 - B) Cellulose
 - C) Chlorophyll
 - D) Starch
 - E) Protein

Answer: B

- 40) Electrically charged atoms or combinations of atoms are called _____. 40) _____
- A) isotopes
 - B) compounds
 - C) elements
 - D) molecules
 - E) ions

Answer: E

- 41) How do organic compounds differ from inorganic compounds? 41) _____
- A) Inorganic compounds never contain carbon, whereas organic compounds always contain carbon.
 - B) Inorganic compounds always only consist of two atoms.
 - C) Organic compounds are always acidic, while inorganic compounds are always basic.
 - D) Organic compounds consist of carbon atoms joined by covalent bonds and may contain other elements, such as nitrogen, oxygen, sulfur, and phosphorus. Inorganic compounds lack carbon-carbon bonds.
 - E) A and C are correct.

Answer: D

- 42) Some organisms, such as plants, algae, and cyanobacteria, produced their own food by absorbing the sun's radiation. These organisms are referred to as _____. 42) _____
- A) autotrophs or producers
 - B) mutualists or consumers
 - C) parasites or heterotrophs
 - D) heterotrophs or consumers
 - E) heterotrophs or producers

Answer: A

- 43) All of the following are approaches to reducing eutrophication except _____. 43) _____
- A) planting and maintaining vegetation buffers around ditches and streams that trap nutrient and sediment runoff
 - B) using artificial wetlands to filter stormwater and farm runoff
 - C) upgrading stormwater systems to capture runoff from roads and parking lots
 - D) applying fertilizers to farmland just before heavy rains are predicted
 - E) reducing fertilizer use on farms and lawns

Answer: D

- 44) The total amount of chemical energy produced by autotrophs, such as plants and phytoplankton, is called gross primary production. The energy that remains after plants use some of the gross primary production to fuel their own metabolism is known as _____. 44) _____
- A) secondary production
 - B) negative primary production
 - C) net primary production
 - D) negative secondary production
 - E) positive primary production

Answer: C

- 45) Plants release water vapor through their leaves; this process is called _____. 45) _____
- A) magnification
 - B) evaporation
 - C) transpiration
 - D) condensation
 - E) percolation

Answer: C

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

46) Briefly describe what ecologists mean by an ecosystem.

Answer: An ecosystem is a network of dynamic relationships among components that interact with one another and influence one another by exchanging inputs of energy, materials, organisms and information. Some of the outputs are communities that may take the forms of forests, grasslands or marshes, while others we may view as ecosystem services such as pollination, water purification and renewal of soil fertility which have great value to human enterprises.

47) In what ways are macromolecules essential to life? Describe the structures of three and describe their major role(s) in organisms.

Answer: Macromolecules provide critical components of organismal structure, energy storage and mobilization and genetic coding to name just a few of their many roles. Carbohydrates are made of carbon, hydrogen, and oxygen and have the general formula CH_2O . Carbon and water exist in a 1:1 ratio. They are the primary components of plant cell walls and are the preferred energy source for many organisms. Proteins are chains of amino acids (amine group + carboxyl or acid group + central carbon). They are primarily structural molecules. They are blood transporters, aid in the function of the immune system, and promote metabolic reactions. Most enzymes are proteins. Nucleic acids are made of chains of nucleotides (phosphate + sugar + nitrogenous bases). They carry genetic information (genes) that coordinates all organismal functions and passes traits from generation to generation.

48) What is the first law of thermodynamics, and why is it important?

Answer: This law says that the total energy and mass in the universe are constant and conserved. This law is important because it says that there is a finite amount of energy on Earth. Humans cannot make new energy. This Law has also saluted the balancing of all chemical reactions, where we acknowledge that mass is conserved, even though we may change its form. In terms of our management of resources, especially those that are non-renewable, it implies that efficient and sustainable use of energy and materials is extremely important since their abundance is limited.

49) Compare the first and second laws of thermodynamics.

Answer: The first law states that energy can change from one form to another; it cannot be created or lost. The total energy in the universe remains constant. However, the second law states that the universe will change from a more ordered state to a less ordered state. Entropy in the universe is increasing, as energy is converted from high to low quality. Organisms must consume energy to maintain structure and keep entropy at bay. Low quality energy from organisms is usually released into the environment as heat. For example, if you had a bowl of oatmeal for breakfast, your digestive systems digests the starch to glucose and your cells then burn the glucose to produce energy to run your body, but most of it is lost as heat. The low-quality exhaust products of this process are carbon dioxide and water neither of which has any potential energy for you to use. Therefore, you have to keep taking in more chemical energy in food to keep your system running.

50) Briefly explain the overall processes of photosynthesis and cellular respiration. Include a brief explanation of autotrophs and heterotrophs in your answer.

Answer: Photosynthesis is performed by autotrophs. In photosynthesis, light energy is converted into chemical energy (stored within the bonds of glucose). Water and carbon dioxide are consumed, and oxygen is released. In most autotrophs, photosynthesis occurs in the chloroplasts. Cellular respiration represents the reverse chemical process. It is performed by both autotrophs and heterotrophs to meet their energy needs. In cellular respiration, oxygen is consumed, and the bonds of glucose are broken to release energy (which is then used for work within the cell). Along with the energy, carbon dioxide and water are end products. In most organisms, cellular respiration takes place in the mitochondria.

51) Briefly discuss how human activities have affected the balance of global hydrological and carbon cycles.

Answer: Human activities have impacted nearly every aspect of the hydrological cycle. Groundwater and aquifer resources have been depleted by urban and agricultural growth. Rivers have been dammed and diverted such that they have slowed and diminished their flow toward the seas. The removal of vegetation from watersheds has increased surface runoff and decreased infiltration and transpiration. Certainly the greatest disruption of the carbon cycle has been the enormous input to the atmosphere of the greenhouse gas carbon dioxide by the burning of fossil fuels. This has been the most important driver of global climate change. In addition, extensive deforestation, particularly in tropical regions, has diminished the ability of these regions to remove carbon dioxide from the atmosphere. Today, the atmospheric carbon dioxide reservoir is greater than it has been in more than 800,000 years.

52) Discuss how natural ecosystems provide valuable ecosystem services to humankind.

Answer: Because we are part of natural ecosystems we share in the benefits they provide in supporting all species that inhabit them. For example, the food chains and webs by which energy and materials flow through ecosystems provide pest control (e.g. predators) and pollination, which is a byproduct of the feeding by certain animals, mainly insects, on plant flowers. Forests purify water moving through watersheds, control erosion, provide complex habitats for species of great economic value to us, provide timber and remove pollutants such as carbon dioxide from air. Soils provide essential mechanisms for the movement of nutrients in biogeochemical cycles and their fertility is indispensable for plant growth. Finally, all aspects of ecosystems provide intangible services of aesthetic, recreational and cultural value which contribute greatly to our psychological and spiritual well being.

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

Read the following scenario and answer the question(s) below.

Glass Lake, located in a valley in low forested mountains, for many decades of the 19th and early 20th centuries was a favorite picnic, recreation, and fishing site for people in surrounding towns and farms. However, in the middle of the 20th century, a trend began in which the privately-owned farms in the Lake's watershed were purchased by large agribusinesses. The decision was made to grow a profitable crop. The demand for quality farmland resulted in the sale of most of the family-owned establishments and a large increase in the area of land under cultivation. Most of the forests were cut to acquire the land needed for crops. The use of chemical fertilizers and pesticides increased several fold by the end of the century. In addition, the combined population of the lakeside villages quadrupled during the same time. The lake experienced a slow degradation of water quality and biodiversity. Sport fishing declined and the lake became murky while the sediments in the lake increased in depth.

- 53) The symptoms of the lake suggest _____. 53) _____
- A) overfishing
 - B) eutrophication
 - C) that all the problems have been created by deforestation
 - D) pesticide poisoning
 - E) the effects of global climate change

Answer: B

- 54) A water quality expert checked the level of dissolved oxygen in lake water and found it _____. 54) _____
- A) was within normal limits for an unpolluted lake
 - B) very low at the surface and normal near the bottom sediments
 - C) was low-normal on the surface but extremely low near the bottom sediments
 - D) absent entirely
 - E) was much higher than normal

Answer: C

- 55) The same expert found that dissolved phosphorus and nitrogen levels were more than ten times what they were seventy years ago. The primary sources of these are very likely from _____. 55) _____
- A) natural atmospheric phosphorus and nitrogen fixation
 - B) the increased algal biomass in the lake
 - C) agricultural and urban fertilizer runoff as well as increased urban wastewater discharges
 - D) soil particles eroded from the deforested watershed
 - E) the changes in dissolved oxygen levels

Answer: C

- 56) The murkiness (turbidity) of the water was analyzed and found to have several major sources, including _____. 56) _____
- A) algae, increased microscopic animal life, and pesticides
 - B) fertilizer particles, wind-borne atmospheric particles and wastewater discharge
 - C) pesticides, atmospheric deposition and wastewater discharges
 - D) erosion from the deforested hillsides, sediments produced from poorly treated wastewater discharge, and sediments produced from the increased plant biomass of the lake
 - E) erosion from the hillsides, solid nitrogen and phosphorus from agricultural fertilizers and numerous microscopic animals living in bottom sediments

Answer: D

- 57) A biodiversity survey of the lake revealed a striking decline in nearly all animal species and in rooted plant life, especially where streams discharged into the lake. The immediate cause(s) of the decline most likely were _____. 57) _____
- A) pesticide poisoning
 - B) natural declines in aging wildlife populations
 - C) very low oxygen levels and lack of plants to support animal consumers
 - D) toxicity of nitrogen and phosphorus to wildlife
 - E) the fact that the past two winters were colder than usual

Answer: C

- 58) A task force composed of water quality chemists, environmental landscape experts, townspeople and corn growers meet and share information. They decide that they must focus on _____ in the initial efforts to restore the lake. 58) _____
- A) banning agriculture from the entire region
 - B) reducing fertilizer inputs into the lake by exploring alternative farming techniques, increasing the efficiency of the wastewater plant and using aerators to increase oxygen levels in the areas where streams flow into the lake
 - C) closing the wastewater treatment plant and reducing agriculture by 75%
 - D) restoring biodiversity to the deforested areas and closing the wastewater plant
 - E) reducing the population of the town by 50% and agriculture by 50%

Answer: B