TEST BANK


environment
THE SCIENCE
BEHIND THE STORIES
CANADIAN EDITION
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MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

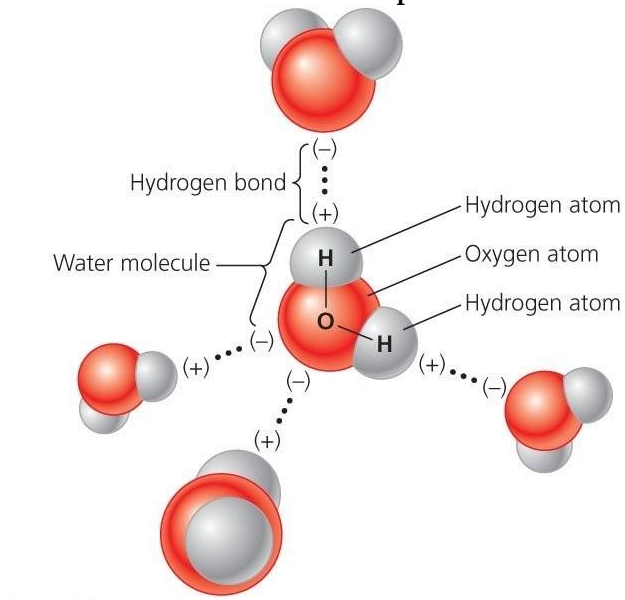

Figure 2.1

Use Figure 2.1 to answer the following questions.

1) Refer to Figure 2.1. Within the water molecule, _____ bonds connect two hydrogens to every oxygen. 1) _____
   A) ionic
   B) doric
   C) nonpolar covalent
   D) hydrogen
   E) polar covalent

2) Refer to Figure 2.1. Why is one end of each water molecule negative and one end positive? 2) _____
   A) Oxygen is larger, so it has a greater pull on the protons.
   B) Hydrogen bonds create a charge difference.
   C) The two hydrogens present have a greater pull on the protons.
   D) The two hydrogens present have a greater pull on the electrons.
   E) Oxygen is larger, so it has a greater pull on the electrons.

3) Refer to Figure 2.1. What property of water is due to hydrogen bonds? 3) _____
   A) ability to dissolve lipids
   B) low pH
   C) ability to change temperature quickly
   D) high pH
   E) ability to form droplets

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

4) The smallest components of elements that still maintain the chemical properties of the element	A) neutrons	4) _____
	B) electrons	
5)		

Negatively charged particles	C) ions	5) _____
6) Elements with the same atomic number but with different atomic masses	D) molecules	6) _____
	E) isotopes	
7) Elements or molecules with a charge	F) atoms	7) _____
8) Charged particles located in the nucleus	G) protons	8) _____
9) Combinations of elements held together with bonds		9) _____

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

10) What was the role of fertilization in bioremediation of the *Exxon Valdez* oil spill? 10) _____

11) Briefly explain the overall processes of photosynthesis and cellular respiration. Include a brief explanation of autotrophs and heterotrophs in your answer. 11) _____

12) Briefly explain how isotopes are used in environmental science and provide an example from your text. 12) _____

13) Name Earth's natural power sources. 13) _____

14) Why does ice float? 14) _____

15) Describe what distinguishes prokaryotic and eukaryotic organisms. 15) _____

16) What is the first law of thermodynamics, and why is it important? 16) _____

17) _____ is that which can change the position, physical composition, or temperature of matter. 17) _____

18) Write the balanced chemical equation for photosynthesis. 18) _____

19) Write the balanced chemical equation for aerobic cellular respiration. 19) _____

20) The degree of disorder in a substance, system, or process is called _____. 20) _____

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

21) _____ is defined as the number of protons plus the number of neutrons. 21) _____

A) Nuclear number
B) Ionic number
C) Isotopic number
D) Atomic number
E) Atomic mass

22) _____ are composed of amino acids. 22) _____

A) Proteins

B) Carbohydrates
C) Lipids
D) Nucleic acids
E) Bases

23) _____ are the primary water-insoluble components of cell membranes. 23) _____
A) Lipids
B) Carbohydrates
C) Proteins
D) Nucleic acids
E) Acids

24) Finger nails, hair, and enzymes are classified as _____. 24) _____
A) proteins
B) carbohydrates
C) organelles
D) nucleic acids
E) lipids

25) Macromolecule → _____ → cell 25) _____
A) organism B) molecule C) tissue D) atom E) organelle

26) Organisms with a nucleus are called _____ organisms. 26) _____
A) aerobic
B) anaerobic
C) prokaryotic
D) eukaryotic
E) prekaryotic

27) Which of the following represents an example of aerobic cellular respiration? 27) _____
A) water + carbon dioxide + energy → glucose + oxygen + water
B) glucose + oxygen → water + carbon dioxide + energy
C) water + carbon dioxide → glucose + oxygen + water + energy
D) nitrogen + oxygen + glucose → methane + carbon dioxide
E) nitrogen + carbon dioxide + energy → methane + oxygen

28) Which of the following represents chemosynthesis? 28) _____
A) nitrogen + carbon dioxide + energy → methane + oxygen
B) carbon dioxide + water + hydrogen sulfide → sugar + sulfuric acid
C) water + carbon dioxide + energy → glucose + oxygen + water
D) glucose + water → methane + carbon dioxide
E) glucose + oxygen → water + carbon dioxide + energy

29) The force causing water molecules to adhere to one another in interactions called _____. 29) _____
A) nonpolar covalent bonds
B) Van der Waals attractions
C) hydrogen bonds
D) polar covalent bonds
E) acid–base attractions

30) Which of the following describes a property of water? 30) _____
A) changes temperature rapidly

B) dissolves many chemicals necessary for life
C) more dense as a solid
D) noncohesive
E) high pH

31) Precipitation _____. 31) _____
A) that is acidic would have a pH higher than 7
B) that is acidic would have a pH lower than pure water
C) that is acidic has a low concentration of hydrogen ions
D) has become increasing more basic in the last 100 years, due to industrial air pollution
E) that measures pH = 4 is twice as acidic as precipitation that measures pH = 5

32) Bacteria use _____ to break down hydrocarbons during bioremediation, just as we use them to digest food. 32) _____
A) alcohol molecules
B) polycyclic aromatic hydrocarbons
C) isotopes
D) nucleic acids
E) enzymes

33) Which of the following is *not* a macromolecule? 33) _____
A) starch B) DNA C) glucose D) cellulose E) chitin

34) Which of the following describes lipids? 34) _____
A) include hormones vital to sexual maturation
B) dissolve in water
C) include DNA
D) include components of the body's immune system
E) are absent from most animal cells

35) River water held behind a dam is best described as a form of _____. 35) _____
A) potential energy
B) chemical energy
C) entropy
D) thermodynamics
E) kinetic energy

36) During photosynthesis within plants, _____. 36) _____
A) the high-quality energy of the sun is converted to a lower quality
B) there is net consumption of water and carbon dioxide
C) entropy increases
D) oxygen is consumed
E) entropy stays the same

37) Cellular respiration _____. 37) _____
A) represents a decrease in entropy
B) requires the green pigment chlorophyll
C) involves a net consumption of water
D) results in a net consumption of energy
E) liberates carbon dioxide and water

38) Early Earth (4.5 billion years ago) _____. 38) _____

A) was stagnant and lifeless
B) had very high levels of oxygen
C) had a very similar atmosphere to today's Earth but lacked water
D) had more abundant and complex life forms compared to today's earth
E) was virtually void of oxygen

39) The _____ hypothesis, proposed in the 1930s, says that carbon dioxide, oxygen, and nitrogen dissolved in Earth's water formed simple amino acids and eventually complex organic compounds that self-replicated. 39) _____
A) homotrophic
B) ultraterrestrial
C) extraterrestrial
D) heterotrophic
E) chemoautotrophic

40) Stanley Miller and Harold Urey did experiments in the early 1950s to prove the _____ hypothesis. 40) _____
A) homotrophic
B) heterotrophic
C) extraterrestrial
D) ultraterrestrial
E) chemoautotrophic

41) The _____ hypothesis, proposed by Svante Arrhenius in the early 1900s, suggests that meteorites delivered life and organic material to Earth. 41) _____
A) ultraterrestrial
B) heterotrophic
C) extraterrestrial
D) chemoautotrophic
E) homotrophic

42) The _____ hypothesis, proposed in the 1970s and 1980s by Jack Corliss and others, suggests that life on Earth originated in the deep sea where sulfur was abundant. 42) _____
A) extraterrestrial
B) heterotrophic
C) homotrophic
D) ultraterrestrial
E) chemoautotrophic

43) Which of the following is true? 43) _____
A) The number of species existing at one time has decreased throughout history.
B) Most organisms present early in Earth's prehistory were more complex than modern organisms.
C) Species on Earth today are but a fraction of all species that ever lived.
D) Bacteria represent a newer form of life, not present during the early prehistory of Earth.
E) Extinctions of past species has happened gradually and on a small scale.

44) Coal, oil, and natural gas are _____. 44) _____
A) part of a sustainable energy future
B) inorganic
C) fossil fuels
D) renewable

E) synthetic

45) Consider the following processes: respiration, chemosynthesis, combustion, fermentation, polymerization and photosynthesis. How many of these result in the release of oxygen into the atmosphere? 45) _____

A) 4 B) none C) all D) 1 E) 2

46) When you burn a log in your fireplace you are converting _____. 46) _____

A) thermal to electromagnetic energy
B) proteins to amino acids
C) chemical to nuclear energy
D) electromagnetic to chemical
E) chemical to thermal (heat) energy

47) The fossil record clearly shows that _____. 47) _____

A) large complex organisms evolved long before simple organisms
B) nearly all species that have existed in the past still exist today
C) several different species can hybridize to produce a single new species
D) all species evolve from pre-existing species
E) new species appear suddenly and fully differentiated, without an ancestral species

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

48) Most scientists today favour the heterotrophic hypothesis for the origin of life on Earth. 48) _____

49) The chemoautotrophic hypothesis is also known as the panspermia hypothesis. 49) _____

50) A major problem with the *Exxon Valdez* oil spill was that the oil coated the feathers of birds causing them to overheat and die. 50) _____

51) In phytoremediation, Dr. Pravena Saxena has found that the germanium is a more powerful accumulator of toxic metals than any plant that has yet been tested. 51) _____

52) Bacteria in deep sea vents use the chemical bond energy in water to transform inorganic compounds into organic compounds in a process called chemosynthesis. 52) _____

53) The Murchison meteorite, which fell in Australia in 1969, was found to contain bacteria. 53) _____

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

54) What is bioremediation? How can it help with environmental problems? Give examples and list some advantages and disadvantages to its use.

55) List the four types of macromolecules essential to life. Describe the structures of each and describe their major role(s) in organisms.

56) Describe the first and second laws of thermodynamics.

57) Why does chemistry play a central role in examining environmental issues? Provide an example from the text that illustrates how chemistry helps solve environmental problems.

58) Summarize the heterotrophic hypothesis, the extraterrestrial hypothesis, and the chemoautotrophic hypothesis for the development of life on Earth.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.
Read the following scenario and answer the questions below.

Global climatic change has been a controversial topic. However, almost all environmental scientists agree that gases contribute to global climate change. Carbon dioxide, methane, nitrous oxide, ozone, hydrochlorofluorocarbons, and water vapour are the main culprits. These "greenhouse gases" have increased dramatically in our atmosphere in the last 300 years, due to rapid industrialization. Human activities, chief among them the tapping and burning of fossil fuels for energy, significantly increase greenhouse gases in our atmosphere. With rising standards of living in developing countries, emissions of carbon dioxide and other greenhouse gases are expected to continue to rise. If unchecked, it is predicted that carbon dioxide levels will reach twice preindustrial levels by mid-century and double again by the end of the century. Computer models have shown that this rise alone could raise Earth's temperatures by 1 to 3 degrees Celsius by 2100.

59) Why is water vapour a greenhouse gas? 59) _____
A) Water has a high heat capacity.
B) The ionic bonds holding water vapour together help it trap heat.
C) Hydrogen-containing compounds trap the most heat.
D) Water is a good conductor of electricity.
E) Water molecules dissolve many other chemicals.

60) Nitrous oxide contributes indirectly to acid precipitation and directly to global warming. This can be explained by _____. 60) _____
A) the hydrogen bonds connecting the nitrogen and oxygen atoms in the molecule
B) its ability to form compounds that lower pH
C) the ability of acids to raise the temperature of the substances which dissolve them
D) the airborne nature of all compounds containing nitrogen
E) its ability to form compounds that raise pH

61) Overpopulation contributes to global warming when _____. 61) _____
A) solar energy is used as the primary source of energy
B) we compromise our living standards
C) most people use public transportation
D) there is also greater consumption of natural resources
E) most of the population is vegetarian

62) The primary source of increased levels of greenhouse gases on Earth is _____. 62) _____
A) modern human lifestyles
B) asteroids falling to Earth
C) loss of heterotrophs
D) increased photosynthetic activity
E) aerosol spray cans

63) Climatic change is a major concern for environmentalists because it can directly lead to _____. 63) _____
A) a decrease in the amount of energy on Earth
B) extinctions
C) an increase in the diameter of the ozone hole
D) more heterotrophs on Earth
E) an increase in the amount of energy on Earth

64) Why does burning fossil fuels increase global warming? 64) _____
A) Fossils, if left untouched, cool Earth.
B) Carbon present in coal, oil, and natural gas becomes carbon dioxide when these fuels burn.

C) Burning fossil fuels destroys the ozone layer.
D) Burning fossil fuels removes water vapour from the atmosphere.
E) New energy is created on Earth when fossil fuels are burned.

65) _____ represents a positive feedback loop in regards to global warming. 65) _____
A) Reforestation
B) Controlling development
C) Sequestering carbon dioxide underground
D) Limiting use of fossil fuels as a source of energy
E) Warming of Earth, causing the evaporation of surface water,

1) E
2) E
3) E
4) F
5) B
6) E
7) C
8) G
9) D
10) The bacteria used to clean up the hydrocarbons (in the oil) needed essential nutrients such as nitrogen and phosphorous to metabolize the oil and use it as an energy source. As a result of the fertilization (addition of nitrogen and phosphorous), the bacterial population grew, and oil residues visibly decreased.
11) 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.
12) Isotopes are powerful instruments for environmental scientists. The radioactivity of some isotopes allows them to be quantified and traced. They emit energy that can be traced inside organisms (to follow metabolic pathways, such as photosynthesis). Ecological pathways (such as nutrient and pollutant pathways) can also be traced using isotopes. Because radioactive isotopes emit a measurable quantity of radiation and decay over time (according to their half-life), they can be used to date organic materials such as human remains, grain, shells, tissues of ancient animals, and fossils. We can learn about ancient cultures and Earth's history from them. The text gives an example of the conversion of the isotope 14C to 14N in nature. Scientists date fossils, human remains, foodstuffs, and other carbon-containing items by measuring the percent of 14C.
13) The sun is Earth's primary power source. The gravitational pull of the moon and sun, which cause ocean tides, is a second power source. A third source is geothermal energy. Geothermal energy results from heat generated deep within the planet due to radiation. Geothermal energy can warm groundwater and be harnessed for commercial power.
14) Because of the unique nature of the hydrogen bonds that hold water molecules together and the crystalline structure of ice, as water freezes, its density decreases. Because ice is less dense than water, it floats.
15) A major distinguishing feature of prokaryotic organisms is their lack of a true nucleus. Their genetic material is not encased by a nuclear membrane. Eukaryotic organisms have a true nucleus. Their DNA is encased by a nuclear membrane. Eukaryotic organisms also are distinguished by the presence of many membrane-bound subcellular components, called organelles, in their cytoplasm. Examples of organelles present in eukaryotic organisms are chloroplasts and mitochondria.
16) This law says that the total energy in the universe is 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. We only can change its form.
17) Energy
18) Light energy + $6CO_2$ (carbon dioxide) + $12^{H_2}O$ (water) → $^{C_6H_{12}O_6}$ (sugar) + $6O_2$ (oxygen) + $6^{H_2}O$ (water)
19) $^{C_6H_{12}O_6}$ (sugar) + 6^{O_2} (oxygen) → $6CO_2$ (carbon dioxide) + $6^{H_2}O$ (water) + energy (to perform cellular work)
20) entropy
21) E
22) A
23) A
24) A
25) E
26) D

27) B
28) B
29) C
30) B
31) B
32) E
33) C
34) A
35) A
36) B
37) E
38) E
39) D
40) B
41) C
42) E
43) C
44) C
45) D
46) E
47) D
48) FALSE
49) FALSE
50) FALSE
51) TRUE
52) FALSE
53) FALSE
54) Bioremediation is a process in which organisms are used to metabolize toxins to remove them from the environment. In this process, the natural processes of biodegradation are accelerated. It may be used as a low-cost alternative to expensive, large-scale cleanup operations. After the oil spill from the *Exxon Valdez* in 1989, microbes were used in bioremediation to break down the oil hydrocarbons that spilled into the ocean. In other examples, arsenic and lead have been extracted by plants at residential sites and military and energy facilities. Zinc and cadmium have been removed by plants from toxic sites. Tungsten has been removed from abandoned mines. Radioactive uranium and strontium have been removed from Canadian military sites and the Chernobyl nuclear reactor site. Although, in theory, bioremediation is a great way to detoxify our environment, it usually takes months to years for plants and trees to decontaminate an area. Another problem is that toxic metals need to be in a water-soluble form for plants to take them up. Furthermore, cleanup is limited to the depth of soil that plants' roots reach. Finally, plants that accumulate toxins can potentially harm insects that eat the plants and animals that eat the insects and plants.
55) Carbohydrates are made of carbon, hydrogen, and oxygen and have the general formula $C^{H_2}O$. Carbon and water exist in a 1:1 ratio. They are the primary components of 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.All enzymes are proteins.

    Nucleic acids are made of chains of nucleotides (phosphate + sugar + nitrogenous bases). They carry genetic information that passes traits from generation to generation.

    Lipids are long chains or rings of hydrogen and carbon. They can store high amounts of energy and are the primary components of cell membranes. Lipids also include the steroid hormones, which regulate sexual function in animals.
56) 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. 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.

57) Chemistry is the study of the structure of matter and so is crucial to an understanding how gases such as carbon dioxide and methane contribute to global climate change, how pollutants such as sulfur dioxide and nitric oxides cause acid rain, and how pesticides and other artificial compounds we release into the environment affect the health of wildlife and people. Chemistry is central in understanding water pollution and sewage treatment, atmospheric ozone depletion, hazardous waste and its disposal, and energy issues. An understanding of chemistry is also crucial to developing solutions to environmental problems. Bioremediation is one clear example.

58) The heterotrophic or "primordial soup" hypothesis advances the idea that life evolved from simple inorganic chemicals—carbon dioxide, oxygen, and nitrogen—dissolved in the surface waters of the oceans or tidal shallows around oceanic margins. Simple amino acids may have formed under these conditions, and more complex organic compounds may have followed, including nucleic acids that could replicate and give rise to basic forms of life. It is called the heterotrophic hypothesis because it advances that heterotrophs evolved first. The extraterrestrial hypothesis is similar but suggests that early chemical reactions on Earth may have received help from outer space. Bacteria from space may have been deposited on meteorites that crashed to Earth, seeding our planet. The chemoautotrophic hypothesis suggests that early life was formed at hot deep-sea vents where sulfur was abundant.

59) A

60) B

61) D

62) A

63) B

64) B

65) E