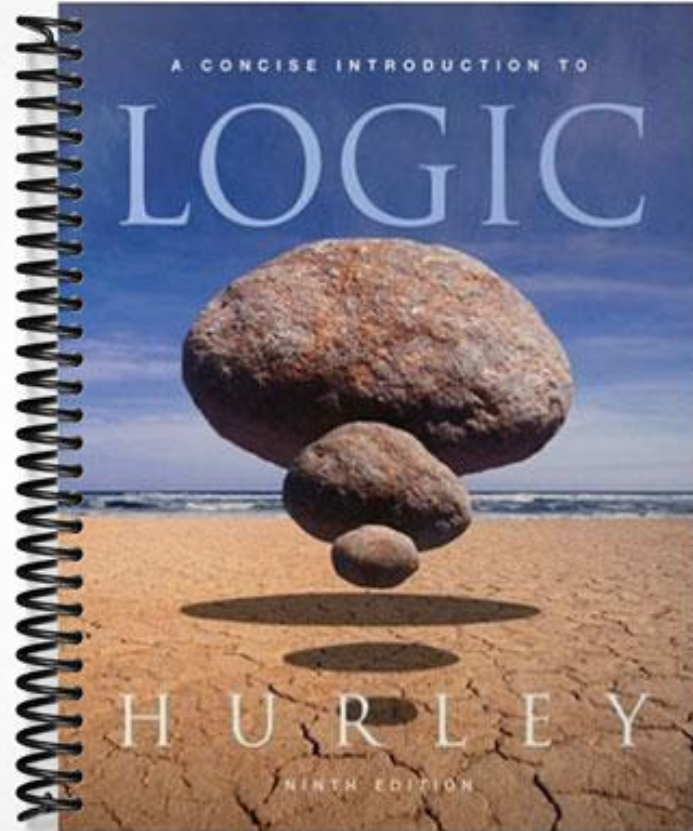


TEST BANK



CHAPTER 2--SCIENCE, MATTER, AND ENERGY

Student: _____

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 - A. was greater in volume by 30 to 40%
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 - C. had more soil nutrients dissolved in the water
 - D. was less in volume by 30 to 40% *and* had fewer soil nutrients dissolved in the water
 - E. was greater in volume by 30 to 40% *and* had more soil nutrients dissolved in the water

2. The Bormann-Likens study in the Hubbard Brooks Experimental Forest in New Hampshire can be described as
 - A. a comparison of a control site with an experimental site in nature
 - B. what can occur in a forest watershed without plants to absorb and retain water
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3. Science
 - A. is a study of the history of the natural world
 - B. attempts to discover order in nature to interpret the past
 - C. is best described as a random collection of facts
 - D. is supported by small amounts of evidence
 - E. is an endeavor to discover how nature works

4. When scientists are testing ideas to determine facts, they
 - A. follow a specific set of logical steps
 - B. report observations to the scientific community without data collection
 - C. use different steps that are unique to each scientist
 - D. use only mathematical modeling
 - E. all of these answers, *except* use only mathematical modeling

5. Scientific hypotheses differ from scientific theories in that they are
 - A. widely accepted descriptions of what we find happening over and over in nature
 - B. tentative explanations that need further evaluation
 - C. not subject to proper investigation and testing
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6. Which of the following statements does *not* describe scientific investigations?
- A. They can disprove things completely.
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 - E. They can utilize mathematical models.
7. Which of the following choices best describes the sequence scientists typically use in the beginning stages of their investigations about how nature works?
- A. analyze data -> search literature -> perform experiment -> identify a problem -> ask a question
 - B. ask a question -> search literature -> perform experiment -> analyze data -> identify a problem
 - C. search literature -> ask a question -> identify a problem -> analyze data -> perform experiment
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9. A tiny, tawny colored butterfly called the Carson Wandering Skipper was always known for its small and very localized populations. Typically, it was found along the western Nevada and eastern California high desert areas. It was always located close to hot springs and other wet areas that supported salt grass, the host plant it depended on.

Recently, the populations went into a steep decline, and a last hold-out area was threatened by imminent construction of a freeway bypass. Biologists became alarmed and began an intensive search for populations in locations other than the spot designated for the freeway bypass. They began their search by identifying all known locations of hot springs, in hopes of finding small populations of the Carson Wandering Skipper close by.

The biologists' observations that the Carson Wandering Skipper populations had declined is an example of

- A. data analysis
- B. identifying a problem
- C. performing an experiment
- D. proposing a hypothesis
- E. making testable predictions

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As they searched for previously unknown populations of the Carson Wandering Skipper, biologists wondered if hot springs were absolutely essential to its survival. This phase of the investigation is

- A. finding out what is known and asking a question
 - B. analyzing data and asking a question
 - C. Asking a question and testing predictions
 - D. accepting their hypothesis and analyzing data
 - E. accepting their hypothesis and asking a question
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The scientists, with enough data,

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12. Matter
- A. is anything that has mass and occupies space
 - B. has the capacity to do work
 - C. can exist as a solid, liquid, or gas
 - D. can produce change
 - E. is anything that has mass and occupies space *and* can exist as a solid, liquid, or gas

13. All of the following are elements *except*
- A. Water
 - B. oxygen
 - C. nitrogen
 - D. hydrogen
 - E. Carbon
14. The building blocks of matter are
- A. Atoms
 - B. Ions
 - C. molecules
 - D. all of these answers
 - E. Matter is only made up of atoms.
15. The atomic number is the number of
- A. atoms in a molecule
 - B. protons in an atom
 - C. Nuclei in a molecule
 - D. electrons in an atom
 - E. protons and neutrons in an atom
16. Protons, neutrons, and electrons are all
- A. forms of energy
 - B. equal in mass
 - C. subatomic particles
 - D. negative ions
 - E. charged particles
17. The atomic mass number is equal to the sum of the
- A. neutrons and isotopes
 - B. neutrons and electrons
 - C. neutrons and protons
 - D. protons, neutrons, and electrons
 - E. protons only
18. An element
- A. is identical to a compound
 - B. is made up of compounds
 - C. can combine with one or more other element to make a compound
 - D. exists only in a pure form as a single element, and never combines with other elements
 - E. more than one of these answers

19. Isotopes differ from each other by their number of
- Ions
 - protons
 - Atoms
 - neutrons
 - electrons
20. Ions are atoms or groups of atoms that have
- Gained or lost an electron
 - Gained or lost a proton
 - Gained or lost a neutron
 - Gained or lost either an electron or a proton
 - none of these answers
21. Which list of items contains only ions?
- CO_2 , H_2O , Na^+ , H^-
 - Na^{+2} , H^{+2} , Pb , Hg
 - Pb , Hg , CO , NaCl
 - Cl^- , Na^+ , Ca^{2+} , NO_3^-
 - NaCl , NO , CO , NaOH
22. An acidic solution would have
- more hydroxide ions than hydrogen ions
 - more hydrogen ions than hydroxide ions
 - a pH less than 7
 - a pH greater than 7
 - more hydrogen ions than hydroxide ions and a pH less than 7
23. All organic compounds are characterized by the presence of
- Carbon
 - hydrogen
 - oxygen
 - nitrogen
 - phosphorus
24. Which of the following sources of iron would be of the highest quality?
- iron deposits on the ocean floor
 - a field of spinach
 - a large scrap metal junkyard
 - a half-mile deep deposit of iron ore
 - none of these answers

25. When matter undergoes a physical change
- A. The arrangement of atoms does not change.
 - B. The physical or spatial pattern changes.
 - C. The arrangement of ions changes.
 - D. The physical or spatial pattern changes but the arrangement of atoms does not change.
 - E. All of these answers
26. The smallest functional and structural unit of life is the
- A. Ion
 - B. Atom
 - C. compound
 - D. molecule
 - E. Cell
27. The three major types of organic polymers are
- A. lipids, proteins, and nucleic acids
 - B. proteins, nucleotides, and simple carbohydrates
 - C. nucleic acids, amino acids, and fatty acids
 - D. complex carbohydrates, nucleic acids, and proteins
 - E. nucleic acids, fatty acids, and simple carbohydrates
28. Genetic information is contained in coded units on chromosomes called
- A. DNA molecules
 - B. Genes
 - C. macromolecules
 - D. nucleotides
 - E. proteins
29. The law of conservation of matter states that
- A. Atoms can be created.
 - B. Atoms can be destroyed.
 - C. Atoms cannot be created or destroyed.
 - D. Atoms can be destroyed if we compost them.
 - E. Atoms can be created through nuclear fission.
30. If a carbon atom combines with oxygen atoms to form CO_2 , this would be described as a
- A. Physical change.
 - B. Chemical change.
 - C. It is both a physical and chemical change.
 - D. First, it is a physical change, but then it becomes a chemical change.
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31. Energy can be formally defined as
- A. the velocity of any moving object
 - B. the heat generated by atoms losing electrons
 - C. the ability to do work or produce heat transfer
 - D. the displacement of heat from the Sun to the Earth
 - E. none of these answers
32. Most forms of energy can be classified as either
- A. chemical or physical
 - B. Kinetic or mechanical
 - C. potential or mechanical
 - D. chemical or kinetic
 - E. potential or kinetic
33. All of the following are examples of kinetic energy *except*
- A. a speeding bullet
 - B. a car battery
 - C. a flow of electric current
 - D. a falling rock
 - E. flowing water
34. An example of potential energy is
- A. electricity flowing through a wire
 - B. the chemical energy in a candy bar
 - C. a bullet fired at high velocity
 - D. a leaf falling from a tree
 - E. water flowing
35. Which of the following is the best description of the first law of thermodynamics?
- A. Atoms cannot be created or destroyed.
 - B. Energy input always equals energy output.
 - C. Heat is a form of kinetic energy.
 - D. Solar energy is converted into chemical energy in living systems.
 - E. All of these answers apply to the first law of thermodynamics.
36. Which of the following is an example of a lower quality energy form?
- A. the electricity that runs your household appliances
 - B. the heat dispersed in the ocean
 - C. the battery that operates your laptop computer
 - D. the propane that powers the furnace in your residence
 - E. the heat dispersed in the ocean *and* the battery that operates your laptop computer

37. When energy changes from one form to another
- A. It goes from a less useful to a more useful form.
 - B. It goes from a more useful to a less useful form.
 - C. It maintains the same degree of usefulness.
 - D. It could become more or less useful, depending on the original type of energy.
 - E. The usefulness of energy is not altered when it changes from one form to another.
38. The amount of useful work accomplished by a particular input of energy into a system is
- A. Energy quality
 - B. Energy potential
 - C. Energy capacity
 - D. Energy efficiency
 - E. Energy loss
39. Which of the following energy forms is high quality?
- A. Coal
 - B. the heat dispersed in the ocean
 - C. electricity
 - D. Food
 - E. all of these answers *except* the heat dispersed in the ocean
40. What percentage of useful energy in the United States is unnecessarily wasted?
- A. 16%
 - B. 43%
 - C. 35%
 - D. 10%
 - E. Energy in the United States is not wasted.
41. Scientists Bormann and Likens demonstrated in their experiment on a clear-cut forest that
- A. A cleared forest is more sustainable than an uncleared forest.
 - B. An uncleared forest is more sustainable than a cleared forest.
 - C. Cleared and uncleared forests have the same sustainability.
 - D. Clearing a forest violates the second law of thermodynamics.
 - E. At least two of these answers are correct.
42. A form of kinetic energy that travels in the form of waves as a result of changes in electrical and magnetic fields is
- A. wind
 - B. electromagnetic radiation
 - C. waterfalls
 - D. electricity
 - E. solar radiation

43. Which of the following is the best short summary of the law of conservation of matter?
- A. There is no away.
 - B. You cannot get something for nothing.
 - C. You cannot break even.
 - D. You can break even, but not get something for nothing.
 - E. You can get something for nothing, but cannot break even.
44. Some forms of electromagnetic radiation with short wavelengths are:
- A. Visible light and IR radiation
 - B. Visible light and x-rays
 - C. x-rays and IR
 - D. gamma rays and UV radiation
 - E. Visible light and gamma rays
45. Since scientific theories are tentative explanations, they should not be taken seriously.
- True False
46. Scientists analyze data before they take any other steps to investigate natural processes, since that is the only logical place to start.
- True False
47. The two chemical forms of matter are elements and compounds.
- True False
48. Frontier science always ends up being unreliable science.
- True False
49. The steps in the scientific investigative process are always followed in the same sequence by every scientist, without fail.
- True False
50. When matter undergoes physical changes, the chemical composition also changes.
- True False
51. Hydrocarbons are organic compounds.
- True False
52. Matter can be destroyed, but it can never be created.
- True False

53. When electrical energy lights an incandescent light bulb, 50 percent of the energy produces light.

True False

54. When energy changes from one form to another, it always goes from a more useful to a less useful form.

True False

55. The idea that all elements are made up of molecules is called the atomic theory.

True False

56. A chemical element cannot be broken down into simpler substances by chemical means.

True False

57. Atoms as a whole have no net electrical charge.

True False

58. The atomic number of an atom designates the number of protons and neutrons found in its nucleus.

True False

59. Carbon-12, carbon-13, and carbon-14 all have different numbers of protons. Thus, they can be described as isotopes.

True False

60. The first step in the process of scientific study is to _____.

61. If an overwhelming body of observations and measurements supports a scientific hypothesis, it becomes known as a(n) _____.

62. A tentative explanation that needs further investigation is called a(n) _____.

63. Matter that is near the Earth's surface, that is highly concentrated, and that has great potential for use as a resource is referred to as _____.

64. _____ consists of elements and compounds.

65. A chemical that is a combination of two or more different elements is called a(n)
_____.
66. An atom or group of atoms with one or more net positive or negative charges is called a(n)
_____.
67. The pH of a solution is a measure of the _____ ions and _____ ions.

68. Na is the chemical symbol for _____.
69. The nucleus of an atom contains the _____ and _____.
70. An ion that is an essential nutrient for plant growth, and which was studied by Bormann and Likens, is the _____ ion.

71. A simple carbohydrate that plants and animals use to obtain energy is _____.
72. Organic compounds always contain _____ atoms.

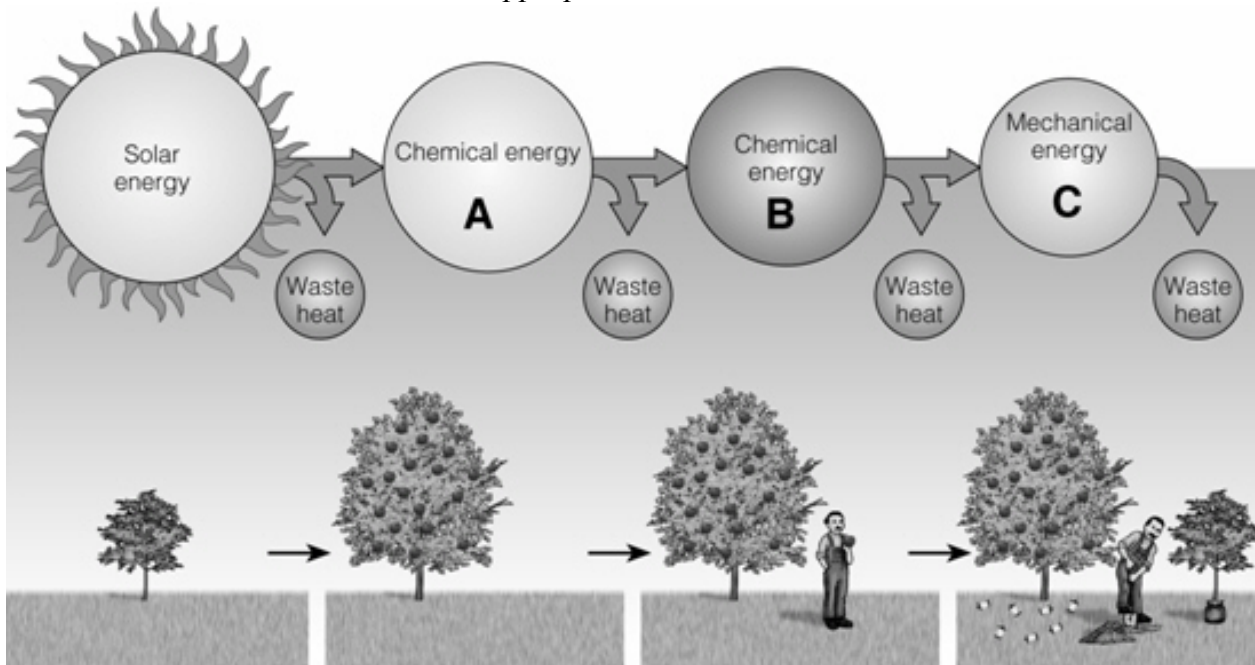
73. Genes are segments of _____.
74. Macromolecules formed from a number of monomers are called _____.

75. Match items with their appropriate chemical description.

1. The small, dense center of an atom
2. Chemical symbol for the hydrogen ion
3. The total number of protons and neutrons in an atom's nucleus
4. A subatomic particle with no net electrical charge
5. The chemical symbol for sulfur
6. The chemical symbol for sodium
7. A compound
8. The nitrate ion
9. Subatomic particle with a positive charge
10. Subatomic particle with a negative charge
11. Atoms with variable numbers of neutrons

- Na _____
- neutron _____
- NO³⁻ _____
- Nucleus _____
- mass _____
- number _____
- Proton _____
- S _____
- CO₂ _____
- Isotopes _____
- Electron _____
- H⁺ _____

76. Match the items listed below with the appropriate choice



1. Which letter represents primary, secondary, and tertiary consumers?
2. Which letter represents the least amount of energy?
3. Which letter represents autotrophs using photosynthesis to convert solar energy into sugar?

- choice _____
- B _____
- choice _____
- A _____
- choice _____
- C _____

77. Name at least three things you did during the last hour that degraded high-quality energy to low-quality energy.
78. Curiosity and skepticism are important features of the scientific process. Explain how these two attributes in a scientist come into play during a late phase of scientific investigation called *accept or reject the hypothesis*.
79. Employing the concepts of high-quality matter and low-quality matter, explain to a friend why recycling aluminum drink containers is a good idea.

80. Just prior to the year when the striped bass population reached 100 percent of the established goal, what was occurring in the blue crab population? What was the implication for the striped bass population?
81. Explain why the Bormann-Likens scientific investigation of clear-cutting forest watersheds is considered reliable science.
82. List an example of each of the following terms: element, compound, ion, organic molecule, simple carbohydrate.

83. Explain how the differences between humans and other living organisms, such as plants or animals, are controlled and encoded at the cellular level.
84. What are some of the ways scientists examine scientific inquiries and studies to determine if the work is reliable or unreliable?
85. Briefly explain how the second law of thermodynamics affects energy changes.

CHAPTER 2--SCIENCE, MATTER, AND ENERGY **Key**

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 - C. Pb , Hg , CO , NaCl
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 - B.** Energy input always equals energy output.
 - C. Heat is a form of kinetic energy.
 - D. Solar energy is converted into chemical energy in living systems.
 - E. All of these answers apply to the first law of thermodynamics.

36. Which of the following is an example of a lower quality energy form?
- A. the electricity that runs your household appliances
 - B. the heat dispersed in the ocean
 - C. the battery that operates your laptop computer
 - D. the propane that powers the furnace in your residence
 - E.** the heat dispersed in the ocean *and* the battery that operates your laptop computer
37. When energy changes from one form to another
- A. It goes from a less useful to a more useful form.
 - B.** It goes from a more useful to a less useful form.
 - C. It maintains the same degree of usefulness.
 - D. It could become more or less useful, depending on the original type of energy.
 - E. The usefulness of energy is not altered when it changes from one form to another.
38. The amount of useful work accomplished by a particular input of energy into a system is
- A. Energy quality
 - B. Energy potential
 - C. Energy capacity
 - D.** Energy efficiency
 - E. Energy loss
39. Which of the following energy forms is high quality?
- A. Coal
 - B. the heat dispersed in the ocean
 - C. electricity
 - D. Food
 - E.** all of these answers *except* the heat dispersed in the ocean
40. What percentage of useful energy in the United States is unnecessarily wasted?
- A. 16%
 - B.** 43%
 - C. 35%
 - D. 10%
 - E. Energy in the United States is not wasted.
41. Scientists Bormann and Likens demonstrated in their experiment on a clear-cut forest that
- A. A cleared forest is more sustainable than an uncleared forest.
 - B.** An uncleared forest is more sustainable than a cleared forest.
 - C. Cleared and uncleared forests have the same sustainability.
 - D. Clearing a forest violates the second law of thermodynamics.
 - E. At least two of these answers are correct.

42. A form of kinetic energy that travels in the form of waves as a result of changes in electrical and magnetic fields is
- A. wind
 - B. electromagnetic radiation**
 - C. waterfalls
 - D. electricity
 - E. solar radiation
43. Which of the following is the best short summary of the law of conservation of matter?
- A. There is no away.**
 - B. You cannot get something for nothing.
 - C. You cannot break even.
 - D. You can break even, but not get something for nothing.
 - E. You can get something for nothing, but cannot break even.
44. Some forms of electromagnetic radiation with short wavelengths are:
- A. Visible light and IR radiation
 - B. Visible light and x-rays
 - C. x-rays and IR
 - D. gamma rays and UV radiation**
 - E. Visible light and gamma rays
45. Since scientific theories are tentative explanations, they should not be taken seriously.
- FALSE**
46. Scientists analyze data before they take any other steps to investigate natural processes, since that is the only logical place to start.
- FALSE**
47. The two chemical forms of matter are elements and compounds.
- TRUE**
48. Frontier science always ends up being unreliable science.
- FALSE**
49. The steps in the scientific investigative process are always followed in the same sequence by every scientist, without fail.
- FALSE**

50. When matter undergoes physical changes, the chemical composition also changes.

FALSE

51. Hydrocarbons are organic compounds.

TRUE

52. Matter can be destroyed, but it can never be created.

FALSE

53. When electrical energy lights an incandescent light bulb, 50 percent of the energy produces light.

FALSE

54. When energy changes from one form to another, it always goes from a more useful to a less useful form.

TRUE

55. The idea that all elements are made up of molecules is called the atomic theory.

FALSE

56. A chemical element cannot be broken down into simpler substances by chemical means.

TRUE

57. Atoms as a whole have no net electrical charge.

TRUE

58. The atomic number of an atom designates the number of protons and neutrons found in its nucleus.

FALSE

59. Carbon-12, carbon-13, and carbon-14 all have different numbers of protons. Thus, they can be described as isotopes.

FALSE

60. The first step in the process of scientific study is to _____.

identify a problem

61. If an overwhelming body of observations and measurements supports a scientific hypothesis, it becomes known as a(n) _____.

scientific theory

62. A tentative explanation that needs further investigation is called a(n) _____.

hypothesis

63. Matter that is near the Earth's surface, that is highly concentrated, and that has great potential for use as a resource is referred to as _____.

high quality

64. _____ consists of elements and compounds.

Matter

65. A chemical that is a combination of two or more different elements is called a(n) _____.

compound

66. An atom or group of atoms with one or more net positive or negative charges is called a(n) _____.

ion

67. The pH of a solution is a measure of the _____ ions and _____ ions.

hydrogen, hydroxide *or*
hydroxide, hydrogen

68. Na is the chemical symbol for _____.

sodium

69. The nucleus of an atom contains the _____ and _____.

protons, neutrons *or*
neutrons, protons

70. An ion that is an essential nutrient for plant growth, and which was studied by Bormann and Likens, is the _____ ion.

nitrate

71. A simple carbohydrate that plants and animals use to obtain energy is _____.

glucose

72. Organic compounds always contain _____ atoms.

carbon

73. Genes are segments of _____.

DNA

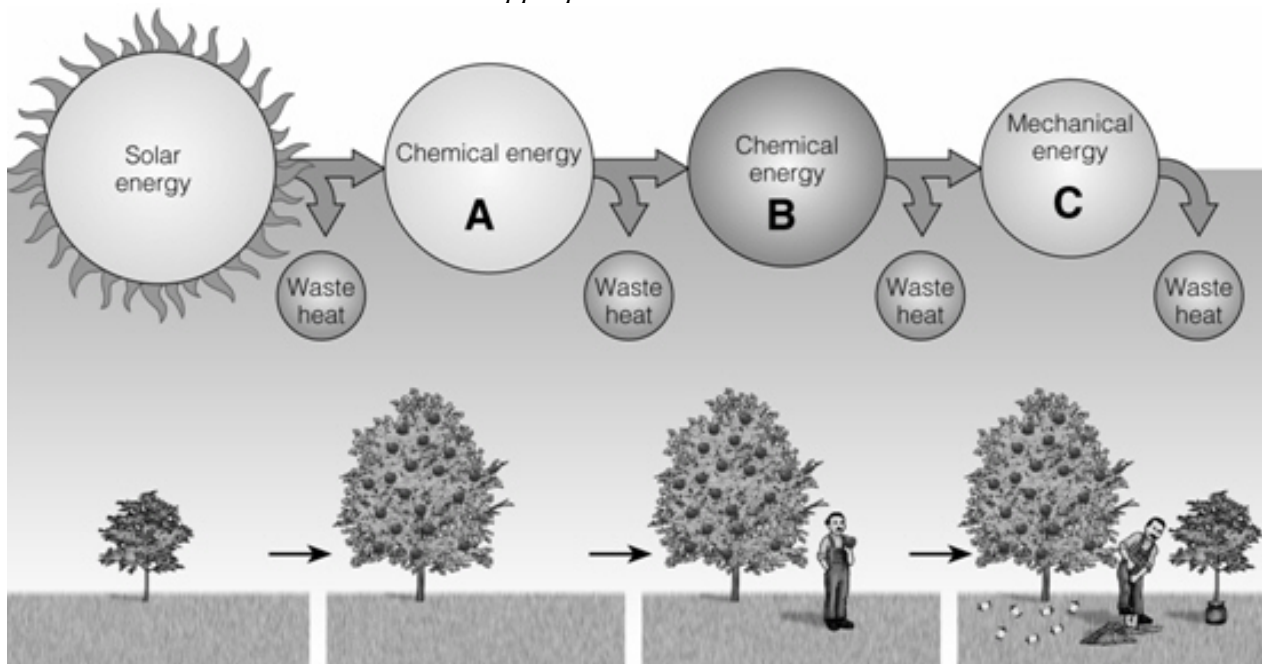
74. Macromolecules formed from a number of monomers are called _____.

polymers

75. *Match items with their appropriate chemical description.*

- | | | |
|--|------------------|-----------|
| 1. The small, dense center of an atom | Na | <u>6</u> |
| 2. Chemical symbol for the hydrogen ion | neutron | <u>4</u> |
| 3. The total number of protons and neutrons in an atom's nucleus | NO ³⁻ | <u>8</u> |
| 4. A subatomic particle with no net electrical charge | Nucleus | <u>1</u> |
| 5. The chemical symbol for sulfur | mass number | <u>3</u> |
| 6. The chemical symbol for sodium | Proton | <u>9</u> |
| 7. A compound | S | <u>5</u> |
| 8. The nitrate ion | CO ₂ | <u>7</u> |
| 9. Subatomic particle with a positive charge | Isotopes | <u>11</u> |
| 10. Subatomic particle with a negative charge | Electron | <u>10</u> |
| 11. Atoms with variable numbers of neutrons | H ⁺ | <u>2</u> |

76. Match the items listed below with the appropriate choice



- | | |
|--|-----------------|
| 1. Which letter represents primary, secondary, and tertiary consumers? | choice <u>1</u> |
| | B |
| 2. Which letter represents the least amount of energy? | choice <u>3</u> |
| | A |
| 3. Which letter represents autotrophs using photosynthesis to convert solar energy into sugar? | choice <u>2</u> |
| | C |

77. Name at least three things you did during the last hour that degraded high-quality energy to low-quality energy.

Sample answers:

- Drove a gasoline-powered car
- Used a computer powered by electricity
- Used hot water for a shower, dish washing, or laundry
- Used a furnace or air conditioner to adjust room temperature

78. Curiosity and skepticism are important features of the scientific process. Explain how these two attributes in a scientist come into play during a late phase of scientific investigation called *accept or reject the hypothesis*.

A skeptical and curious scientist will want to know the real reason for why nature works in a certain way. He/she would not be satisfied until reaching the appropriate conclusion about the investigation being conducted.

79. Employing the concepts of high-quality matter and low-quality matter, explain to a friend why recycling aluminum drink containers is a good idea.

The aluminum needed to produce more aluminum products is more easily obtained from the concentrated metal in a recycled container than by mining aluminum ore from the soil. Aluminum ore is more widely dispersed, difficult to extract, and ends up being more costly in terms of environmental degradation.

80. Just prior to the year when the striped bass population reached 100 percent of the established goal, what was occurring in the blue crab population? What was the implication for the striped bass population?

The striped bass population reached 100 percent of the established goal in 1995. Just prior to that, the blue crab population was very high, at over 100 percent of its established goal. The implication is that the predator species population (striped bass) increased because of the high food availability.

81. Explain why the Bormann-Likens scientific investigation of clear-cutting forest watersheds is considered reliable science.

It has been subjected to peer review, and other scientists have repeated the study and produced similar results.

82. List an example of each of the following terms: element, compound, ion, organic molecule, simple carbohydrate.

Possible answers:

Element — carbon

Compound — carbon dioxide

Ion — nitrate ion

Organic molecule — hydrocarbons

Simple carbohydrate — glucose

83. Explain how the differences between humans and other living organisms, such as plants or animals, are controlled and encoded at the cellular level.

Within the nucleus of each cell is a set of chromosomes, found in pairs. Each chromosome consists of a long DNA molecule that contains the coding in sequences called genes. The genes are distinct pieces of genetic information to make specific proteins that result in specific traits or characteristics.

84. What are some of the ways scientists examine scientific inquiries and studies to determine if the work is reliable or unreliable?

The work is subjected to the following critical thinking questions:

Was the experiment well-designed?

Have the results been reproduced by other scientists?

Does the proposed hypothesis explain the data?

Are there any more reasonable explanations for the data?

Are the investigators unbiased in their interpretation of the results?

Have the data and conclusions been subjected to peer review?

Are the conclusions of the research widely accepted by other experts in the field?

85. Briefly explain how the second law of thermodynamics affects energy changes.

When energy changes from one form to another, it always goes from a more useful to a less useful form. In other words, it goes from a high-quality energy form to a low-quality energy form. The lower-quality energy is usually given off as heat.