Chapter 1--Understanding Earth: a Dynamic and Evolving Planet.

Student: _____

1. The earth is dynamic, constantly changing in response to interactions between its interior and surface processes.

   True False

2. The study of geology is not related to such contemporary issues as acid rain because it deals with timescales of millions and billions of years.

   True False

3. The study of geology includes many other disciplines in the natural sciences, including physics, chemistry, biology, and astronomy.

   True False

4. The role of the professional geologist and the need for expertise in the area of geology is increasing because of society's focus on environmental problems and issues.

   True False

5. Metamorphic rocks are formed by the melting and crystallization of magma far beneath the surface.

   True False

6. Rocks belonging to the sedimentary group always consist of rock and/or mineral particles from pre-existing rocks.

   True False

7. Sedimentary rocks may consist of particles of pre-existing sedimentary rocks.

   True False

8. Volcanic eruptions are the source of all igneous rocks.

   True False

9. Intrusive igneous rocks form at the surface.

   True False

10. The principle of uniformitarianism includes events which are sudden and catastrophic within the realm of human perception.

    True False

11. The principle of uniformitarianism includes only processes which occur gradually.

    True False

12. The principle of uniformitarianism does not include unusual or atypical geologic events such as an ice age or asteroid impact.

    True False

13. The principle of uniformitarianism includes phenomena of widely varying rates, scopes, frequencies, intensities and durations.

    True False

14. Movement along plate boundaries results in earthquake and volcanic activity.

    True False

15. Sedimentary rocks form from sediments subjected to extremely high temperatures and pressures.

    True False

16. Once rocks form they remain unchanged unless they are metamorphosed into metamorphic rocks.

    True False

17. Igneous rocks can form under many different conditions, but they are always the result of cooling and crystallization from magma.

    True False

18. Continental crust is thicker and less dense than oceanic crust.

    True False

19. If a theory stands the test of time, it becomes a fact.

    True False

20. Earth is a dynamic planet and as a result is always changing.

    True False

21. The Kyoto Protocol requires all countries to reduce their greenhouse-causing emissions proportionately.

    True False

22. Reductions of greenhouse-causing emissions by member countries according to the Kyoto Protocol is based in part on the amount of emissions being produced in 1990.

    True False

23. Solar nebula theory explains the low mean densities of the Jovian planets and high mean densities of terrestrial planets.

    True False

24. Solar nebula theory explains the large relative volume of rocky material and small relative volume of ice and gases in the terrestrial planets, and the converse in the Jovian planets.

    True False

25. All Jovian planets consist of a small rocky core surrounded by thick layers of frozen, liquid and gaseous materials.

    True False

26. Earth accreted as molten material and its layers differentiated as it cooled.

    True False

27. Which of the following is a renewable resource?

    A. natural gas
    B. gravel
    C. wood
    D. uranium
    E. coal

28. The Earth system is composed of

    A. the hydrosphere, lithosphere, mantle, core, biosphere, and atmosphere
    B. a series of inputs and outputs that do not vary over time
    C. igneous, sedimentary, and metamorphic rocks
    D. none of the above

29. Which of the following best summarizes Earth?

A. a simple system composed of 4 subsystems
B. a complex dynamic planet that has changed continuously since its origin
C. a complex planet composed of the lithosphere, hydrosphere, and biosphere
D. a dynamic system of inputs and outputs

30. Which of these environmental problems would a geologist be most likely to address?

A. the cause of acid rain
B. the effect of oil and gas production on atmospheric pollution
C. the impact of human activity on global warming
D. the toxicology of pesticides

31. Global warming is caused by

A. the heat generated by the burning of fossil fuels
B. the heat produced by sunlight and retained by carbon dioxide and other gases
C. increased heat produced through the hole in the ozone
D. increased solar radiation as the earth moves nearer the sun
E. none of the above

32. If global warming is occurring, it could potentially impact

A. just the atmosphere
B. the atmosphere and hydrosphere
C. the atmosphere, hydrosphere, and biosphere
D. the atmosphere, hydrosphere, biosphere, and the lithosphere

33. Earth is considered dynamic because

A. surface landscapes are constantly changing due to erosion and deposition
B. the lithosphere and asthenosphere are constantly changing
C. rocks are susceptible to weathering
D. the impact of human activity is continuous

34. The crust, the outermost layer of Earth, consists of

A. continental and oceanic types
B. sediments and sedimentary rocks
C. igneous rocks originally produced by volcanism
D. mountains, plains, and valleys

35. Theories in geology are developed through a process known as

A. plate tectonics
B. uniformitarianism
C. scientific method
D. systems approach
E. none of the above

36. According to plate tectonic theory

A. crust is formed along divergent boundaries and consumed along convergent boundaries
B. continents have drifted from their original positions
C. magma in magma chambers helps break continents up and push them apart
D. volcanism and earthquakes reflect Earth's unrest

37. The rock cycle is an illustration of three different rock types and

A. their environments of formation
B. their potential change over time
C. their relation to internal and external earth processes
D. A, B, and C

38. A transform boundary is characterized by

A. lithospheric plates sliding past each other
B. the movement of one plate over another
C. the movement of plates away from each other
D. earthquakes, but no plate movement

39. Plate tectonic theory is considered a unifying theory because it

A. explains evidence for a dynamic Earth from a variety of subdisciplines in geology
B. a common belief of a broad spectrum of geologists from different disciplines
C. current explanation for the such earth processes as volcanism and earthquakes
D. is the only theory explaining earth dynamics that hasn't been disproven

40. The three main rock types are distinguished on the basis of which of the following characteristics?

A. composition
B. texture
C. size and shape of mineral or rock grains
D. A and B
E. A, B, and C

41. Which of the following best describes sedimentary rocks?

A. deposition of ash and larger particles produced by volcanism
B. weathering, transport, and deposition of sediment from pre-existing rocks
C. compaction and cementation of rock fragments, precipitates, and organic matter
D. alteration of sediment by heat, pressure, and the chemical activity of water

42. The evidence supporting the "Big Bang" theory includes

A. an expanding universe
B. a pervasive background radiation everywhere in the universe
C. the existence of the Doppler effect
D. A and B
E. all of the above

43. Mercury, Venus, Earth, and Mars are similar in that they have similar

A. tectonism
B. volcanism
C. composition
D. internal temperatures
E. all of the above

44. _____ are accreting masses of gases, liquids, and solids which eventually become true planets?

_____

45. Among earth's natural resources, _____ and _____ are used in your home or were used to construct your home.

_____

46. With regard to Earth's interior, the is _____ _____ solid, the _____ _____ is liquid

_____

47. The lithosphere is comprised of the _____ and the upper part of the _____.

_____

48. The three types of tectonic plate boundaries are _____, _____, and _____.

_____

49. Subduction is associated with _____ plate boundaries

_____

50. The discovery of _____, near the turn of the century, led to the development of techniques for determining absolute ages of rocks in years.

_____

51. The basic premise of the principle of _____ is that present-day processes have operated throughout geologic time.

_____

52. **Match the natural resource with its correct use in or around the home**.

1. energy	Coal ____
2. windows	Limestone/Calcite ____
3. concrete	Quartz ____
4. wall board	Gypsum ____
5. wiring	Copper ____

53. **Match the geologic specialty with the area of study.**

1. Geomorphology	Earth's interior ____
2. Paleontology	earthquakes ____
3. Structural Geology	fossils ____
4. Geophysics	landforms ____
5. Petrology	rock deformation ____
6. Seismology	Rocks ____

54. How is the rock cycle related to plate tectonics?

55. Select two of Earth's subsystems and describe how they interact with each other.

56. Using one of the theories presented in the chapter, describe the observations that geologists used to support the theory.

57. Is plate tectonics a fact or a theory? Explain.

58. Use an example to illustrate why the study of geology might involve more than one of Earth's subsystems.

59. What is meant by the term "system" as it is used in discussing Earth's complexity?

60. How is Earth unique among the planets of our solar system?

61. In addition to a hospitable atmosphere and climates, what are other favorable conditions for life's existence on Earth that we know?

62. What are the two broad areas into which the field of geology is divided?

63. Give two examples of geology-related environmental concerns and briefly explain why geology holds the focal position of environmental science?

64. What is one way in which geologic knowledge is used to help humans?

65. How have geologic natural resources been important in history?

66. How has geology been important to the arts and literature?

67. Give one specific example of how geology has an effect on your daily life in terms of materials and energy needs.

68. Give one example of how you might use geology as you prepare to purchase property on which to build your home.

69. How does knowledge of geology benefit other professions? Provide one example.

70. What was the origin of the material which now forms the solar system, according to a current theory?

71. By how long ago had the early Earth formed?

72. On what bases are the concentric layers of Earth primarily distinguished?

73. Why is Earth considered to be a dynamic (as opposed to static) planet?

74. What are the two types of crust?

75. Which of Earth's major concentric divisions forms the largest volume?

76. The lithosphere is comprised of which layer or layers?

77. What are the three zones into which the mantle can be divided, based on physical characteristics?

78. Given that the asthenosphere behaves like a plastic, deforming under high pressures and temperatures, explain why oceanic crust always occurs at lower elevations/greater depths than continental crust.

79. Give a definition for the term "theory" as it is used in science.

80. Briefly explain the differences between hypothesis and theory.

81. What fact about scientific theories best distinguishes science from other forms of human inquiry?

82. Briefly explain how human conflicts over mineral resources and territory could ultimately be considered the result of the products and processes of plate tectonics.

83. What are the three types of tectonic plate boundaries?

84. With which type(s) of plate boundaries is subduction associated?

85. With which type(s) of plate boundaries is volcanic activity generally associated?

86. With which type(s) of plate boundaries are earthquakes associated?

87. Briefly describe the meaning of the term "plate" in "plate tectonic theory."

88. Briefly describe the role of plate tectonics in geological processes:

89. Briefly describe how the discovery of sea floor spreading transformed the continental drift hypothesis into the theory of plate tectonics.

90. Who proposed the hypothesis of continental drift, and when?

91. After Wegener's hypothesis of continental drift was rejected, what laterhypothesis was proposed to explain new data obtained from studies of the ocean floors?

92. Briefly explain, using plate tectonics as an example and clearly stating each step, how the scientific method may be used to formulate a hypothesis and then transform it into theory.

93. What is the difference between a rock and a mineral?

94. What are the three major groups of rocks?

95. What is the sequence of steps in the formation of sedimentary rocks?

96. How do igneous rocks form?

97. How do metamorphic rocks form?

98. Why are igneous rocks classified as either intrusive or extrusive if both originate from melted material many kilometers beneath the surface?

99. Name the three transporting agents or media which produce sediment deposits and, ultimately, sedimentary rocks.

100.Along which plate boundary types are metamorphic rocks formed?

101.Along which tectonic plate boundary type(s) are igneous rocks formed?

102.Which plate boundary type is not strongly associated with the formation of any rock family?

103. Why can the rock cycle, including its surface processes, be considered part of plate tectonics? Use examples from each group of rocks in your explanation.

104. Plate tectonics is a global process which has components of both surficial and internal change. Name each. Which one of the two drives the other, and which one is, in part, the product of the other?

105. What discovery, near the turn of the century, led to the development of techniques for determining absolute ages of rocks in years?

106.What is the basic premise of the principle of uniformitarianism?

107.Explain why the concept of geologic time is important to geologists.

108.How is the age of the universe estimated?

109. What are the two fundamental phenomena that are taken as evidence for the Big Bang origin of the universe?

110. What are the four basic forces responsible for all interactions of matter?

111. Briefly describe the current theory of the origin of the early universe.

112.Name the terrestrial planets.

113.Name the Jovian planets.

114.How do the Jovian planets differ from the terrestrial plants?

115.Briefly narrate the solar nebula theory of the solar systems' origin.

116.What is the value of forensic geology?

Chapter 1--Understanding Earth: a Dynamic and Evolving Planet. Key

1. TRUE
2. FALSE
3. TRUE
4. TRUE
5. FALSE
6. FALSE
7. TRUE
8. FALSE
9. FALSE
10. TRUE
11. FALSE
12. FALSE
13. TRUE
14. TRUE
15. FALSE
16. FALSE
17. TRUE
18. TRUE
19. FALSE
20. TRUE
21. FALSE
22. TRUE
23. TRUE
24. TRUE
25. TRUE
26. FALSE
27. C
28. A
29. B

30. C

31. B

32. D

33. B

34. A

35. C

36. A

37. D

38. A

39. A

40. E

41. C

42. D

43. C

44. planetesimals

45. Gypsum in wallboard, calcite/limestone in concrete, quartz in glass windows, electrical wiring, and the water and energy provided to your home.

46. inner core, outer core

47. crust, mantle

48. divergent, convergent, and transform

49. convergent

50. radioactivity

51. uniformitarianism.

52. energy :: Coal *and* concrete :: Limestone/Calcite *and* windows :: Quartz *and* wall board :: Gypsum *and* wiring :: Copper

53. Geophysics :: Earth's interior *and* Seismology :: earthquakes *and* Paleontology :: fossils *and* Geomorphology :: landforms *and* Structural Geology :: rock deformation *and* Petrology :: Rocks

54. Plate tectonics creates the conditions or environment in which the different rock types are formed. An appropriate answer would include examples for each rock type relative to a plate boundary or process along a boundary.

55. The answers here will probably reflect discussions in the book or from class, but encourage students to focus on real interactions, where change in one subsystem leads to or dependent on change in another. For example, lithospheric processes such as mountain building impact weather patterns and the amount of rainfall. This in turn affects soils and stream systems.

56. Plate tectonic theory will probably be chosen by many. The observations that support it may vary from spatial distribution of earthquakes and volcanoes to the subdivisions of the earth.

57. An appropriate answer here might begin with definitions of fact and theory. Given that a theory is a coherent explanation for one or several related natural phenomena that is supported by a large body of objective evidence, the answer may illustrate this using several phenomena supporting plate tectonic theory.

58. Because of the interactions between the different subsystems, geologists can rarely isolate a single subsystem. Look for illustrations that get to specific impacts or dependencies of one subsystem on another.

59. It is a combination of related parts that interact in an organized fashion.

60. Earth supports life, has oceans of water, has a hospitable atmosphere, has a variety of climates.

61. the presence of water, low levels of carbon dioxide

62. historical geology and physical geology

63. water quality and distribution, soil formation and erosion. Geology concerns all aspects of the physical Earth and their interactions with the biosphere.

64. finding mineral or energy resources/helping solve environmental problems/predicting natural hazards

65. States, nations, empires have risen and fallen because of, and fought for control of, natural resources.

66. It has inspired artists, especially landscape artists, musicians, and writers for centuries.

67. Coal is used in producing steel and other materials, and supplies an increasing percentage of our energy needs.

68. Two of the most common natural hazards that affect homeowners are landslides and floods.

69. Property rights to natural resources and environmental assessments are becoming important for lawyers. Politicians are increasingly faced with legislation and issues related to the physical environment.

70. Interstellar material in a spiral arm of the Milky Way Galaxy, which condensed and collapsed.

71. 4.6 billion years ago

72. variations in pressure, temperature and composition

73. Earth has been continuously changed through its 4.6 billion year existence.

74. oceanic, continental

75. the mantle

76. the crust and the underlying upper mantle

77. solid inner mantle, plastic asthenosphere, solid upper mantle

78. Oceanic crust is denser than continental crust and both "float" at equilibrium levels on the deformable asthenosphere.

79. a coherent explanation for one or several related natural phenomena that is supported by a large body of objective evidence

80. A theory is a systematic, broad-scope explanation consisting of one or more hypotheses that have been or can be tested and that provide predictions that permit verification or rejection. A hypothesis is an untested explanation of incomplete scope, from which there may or may not emerge verifiable predictions.

81. Scientific theories are always subject to further testing, which may result in their being supported or rejected.

82. Geology, including the distribution of resources, is determined by plate tectonic motions. In turn, geology determines physical geography and the distribution of natural resources. Physical geography and resources shape the political and cultural presence of peoples, as well as their histories, and futures.

83. divergent, convergent, and transform

84. convergent boundaries

85. divergent and convergent

86. divergent, convergent, transform (all three)

87. rigid independent sections of lithosphere which move about on the surface of the asthenosphere and interact along their boundaries.

88. Convergence, divergence, and transform movement of plates cause faulting, folding, earthquakes, mountain building, and volcanism. Subduction results in partial recycling of crust to mantle.

89. Sea-floor spreading demonstrated that new crust was continually being formed and that continental and oceanic crust moved together as a unit or plate in response to the forces that cause sea-floor spreading.

90. Alfred Wegener, 1912

91. sea-floor spreading

92. The hypothesis of continental drift was rejected and then resurrected in modified form (motion of plates) as the combined explanatory-predictive theory emerging from the hypotheses of sea floor spreading, paleomagnetic reversal, and subduction.

93. A rock is an aggregate of minerals. Minerals are naturally occurring, inorganic, crystalline solids that have definite physical and chemical properties.

94. igneous, sedimentary, metamorphic

95. weathering, erosion, transportation, deposition and consolidation/lithification

96. crystallization of magma

97. by alteration of other rocks, usually underground, as a result of heat, pressure, and chemical activity

98. because the property of crystalline texture differs between rock crystallized at or near the surface and rock crystallized far below the surface

99. water, wind, glaciers

100. largely along convergent boundaries.

101. divergent and convergent

102. transform boundary

103. Igneous rocks form by intrusive and extrusive processes at convergent plate boundaries, become part of the continents, and thus, further differentiate continental crust from oceanic crust. These rocks weather to form sediments and sedimentary rock, some of which is returned to the mantle and remelted, only to rise again during sea-floor spreading. Sedimentary and igneous rocks at convergent margins are metamorphosed and eventually turned into sedimentary rocks.

104. convection and partial melting (internal), the rock cycle (surficial). The internal process drives the external one. The rock cycle is a product of the internal process (especially so when it is considered that water and the atmosphere originated from volcanic outgassing).

105. radioactivity

106. Present-day processes have operated throughout geologic time.

107. It allows geologists to show how small, almost imperceptible changes over vast lengths of time have resulted in significant changes.

108. by the rate at which galaxies are moving away from one another

109. The galaxies are all moving away from one another, and there is a universal background radiation slightly above absolute zero.

110. gravity, electromagnetic force, strong nuclear force, weak nuclear force

111. Scientists believe that the universe originated with the Big Bang between 13 and 20 billion years ago. In the first second following the Big Bang the four basic forces separated and the universe experienced enormous expansion. Matter and antimatter collided leaving a slight surplus of matter. Three minutes after the Big Bang, matter became cool enough for protons and neutrons to fuse to form the nuclei of helium and hydrogen atoms. Roughly 100,000 years later electrons joined these nuclei to make complete atoms while photons separated from matter to make light. Stars and galaxies formed as the universe continued to expand and cool and the chemical makeup of the universe underwent change from having been 100% hydrogen and helium to its current composition of 98% hydrogen and helium.

112. Mercury, Venus, Earth, Mars

113. Jupiter, Saturn, Uranus, Neptune

114. The Jovian planets are large and have low mean densities, and are composed largely of gases and heavy elements.

115. Interstellar matter in an arm of the Milky Way Galaxy condensed and collapsed. The gravity that influenced the collapse also caused a cloud to flatten and begin to rotate. As 90% of the mass was concentrated in the central part of the cloud an embryonic sun formed, surrounded by a turbulent rotating cloud called a solar nebula. Localized eddies within the nebula formed in which gas and solid particles condensed and began to accrete into planetesimals that eventually became planets. The material that had concentrated at the center of the nebula condensed and collapsed under gravity to form a new star, the Sun.

116. Geologic materials can be diagnostic of specific places. A forensic geologist examines earth materials involved in crime scenes to determine where a crime was committed or where a criminal had been.