

Chapters 1-6: Life develops on Earth

1. Extraterrestrial life elsewhere in the universe
  - A) will be unrecognizable
  - B) cannot exist
  - C) will be identical to life on Earth
  - D) will be completely different than life on Earth
  - E) could be similar to life on Earth or might be completely different
  
2. Astronomy has shown us that the Earth
  - A) occupies a special location in the universe so that life elsewhere is unlikely
  - B) is the only planet in the universe with any kind of life
  - C) is the only planet in the universe with advanced life
  - D) is just one planet orbiting an ordinary star in a vast universe
  - E) is the only planet in the universe with essential elements like carbon
  
3. Astronomy has shown us that the fundamental laws of physics are
  - A) the same in our solar system but different beyond the solar system
  - B) the same everywhere in the universe
  - C) completely random and unpredictable
  - D) different on other planets in our solar system
  - E) vary depending upon how old the world is being studied
  
4. A habitable world is defined to be one that
  - A) is identical to the Earth
  - B) is in orbit about a solar-type star
  - C) has an atmosphere
  - D) has conditions suitable for life
  - E) has carbon
  
5. The fact that the life on Earth seems to have appeared quite rapidly suggests that life
  - A) can arise on most habitable worlds
  - B) can only appear soon after a planet forms
  - C) on any kind of planet is inevitable
  - D) is only possible on Earth-like planets
  - E) was created by a supernatural force
  
6. Biologists have found that life on Earth can
  - A) only survive on the surface of the Earth
  - B) survive over only a very narrow range of environmental conditions
  - C) survive over a wide range of environmental conditions
  - D) survive only in the presence of sunlight
  - E) survive only in the absence of sunlight

7. Which planet lies between the planets Saturn and Neptune?
  - A) Pluto
  - B) Mars
  - C) Uranus
  - D) Jupiter
  - E) Earth
  
8. The study of life in the universe is best described by the term
  - A) astrochemistry
  - B) bioastronomy
  - C) extremobiology
  - D) astrobiology
  - E) blastobiologies
  
9. At its most fundamental level, the goal of astrobiology is to
  - A) contact extraterrestrials
  - B) find how life on Earth originated
  - C) find life beyond the Earth
  - D) understand the biological makeup of other life forms
  - E) discover the connection between life and the places it is found
  
10. For most of human history it was believed that Earth was at the center of the universe. This idea is referred to as
  - A) synodic
  - B) eccentric
  - C) heliocentric
  - D) mesocentric
  - E) geocentric
  
11. The astronomical object in our sky which plays the most fundamental role in our lives is the
  - A) Moon
  - B) nearest star
  - C) most massive planet in our solar system, Jupiter
  - D) Sun
  - E) Mars
  
12. In science, conceptual representations of observed phenomena are referred to as
  - A) facts
  - B) hypotheses
  - C) beliefs
  - D) models
  - E) guesses

13. Apparent retrograde motion occurs when a planet appears to
- A) be stationary with respect to background stars
  - B) move faster with respect to background stars
  - C) move backwards with respect to background stars
  - D) move forwards in pulses with respect to background stars
  - E) pass behind the Moon
14. The Ptolemaic model has planets moving in
- A) elliptical orbits about the Sun
  - B) a simple circle about the Earth
  - C) a simple circle about the Sun
  - D) small circles, the centers of which move in a larger circle about the Earth
  - E) perfect circles, but backwards
15. In the heliocentric (Sun-centered) model, apparent retrograde motion is due to
- A) the Earth reversing the direction of its orbit about the Sun
  - B) a planet moving in a small circle, the center of which moves in a larger circle about the Earth
  - C) relative motion between the Earth and another planet in its orbit
  - D) a planet reversing the direction of its orbit about the Sun
  - E) a planet reversing the direction of its orbit about the Earth
16. Kepler's Second Law of planetary motion states that
- A) the further a planet is from the Sun, the faster it moves in its orbit
  - B) an imaginary line joining the Sun and planet sweeps out equal areas in equal times
  - C) the further a planet is from the Sun, the slower it moves in its orbit
  - D) the orbits of planets are ellipses
  - E) the orbits of planets are perfect circles
17. The astronomical unit (AU) is defined to be equal to the
- A) diameter of the Earth
  - B) average distance between the Sun and the planet Pluto
  - C) distance between the Sun and the nearest star
  - D) average distance between the Earth and Sun
  - E) the distance light travels in a year
18. Galileo Galilei
- A) developed a theory of gravity to explain the motions of the planets
  - B) showed that the orbits of the planets were ellipses and not circles
  - C) made detailed measurements of the motions of the planets in the sky
  - D) invented the telescope
  - E) obtained the first observational evidence suggesting the Earth moved about the Sun

19. The observations of sunspots on the Sun and craters on the Moon by Galileo contradicted the commonly held belief that the universe was
- A) spherical
  - B) unchanging
  - C) perfect
  - D) infinite
  - E) 6000 years old
20. In the scientific method, what immediately follows a prediction?
- A) a hypothesis
  - B) a test
  - C) an observation
  - D) a question
  - E) a theory
21. A scientist intuitively believes, without experimental evidence, that a higher power must be present in the universe. This is an example of
- A) pseudoscience
  - B) hypothesis-driven science
  - C) discovery science
  - D) nonscience
  - E) a theory
22. Occam's Razor states that if we have two models that agree equally well with observations, we choose the one that
- A) is most complex
  - B) has been around the longest
  - C) is accepted by most scientists
  - D) is simplest
  - E) is the most mathematical
23. Scientific models supported by a large, compelling body of evidence are referred to as
- A) theories
  - B) facts
  - C) ideas
  - D) hypotheses
  - E) predictions
24. Two asteroids are found at the same distance from the Sun. However, one asteroid is twice as massive as the other. According to Newton's Universal Law of Gravitation the force of gravity exerted by the Sun on the more massive asteroid is
- A) twice as large as the force exerted on the less massive asteroid
  - B) four times as large as the force exerted on the less massive asteroid
  - C) half as large as the force exerted on the less massive asteroid
  - D) exactly the same as the force exerted on the less massive asteroid
  - E) zero

25. Which of the following lists the structures in increasing (smallest to largest) scale?
- A) Solar System, Local Group, Milky Way Galaxy, Local Supercluster
  - B) Local Supercluster, Local Group, Milky Way Galaxy, Solar System
  - C) Solar System, Milky Way Galaxy, Local Group, Local Supercluster
  - D) Solar System, Milky Way Galaxy, Local Supercluster, Local Group
  - E) Local Group, Local Supercluster, Milky Way Galaxy, Solar System
26. The light-year is defined to be the
- A) distance light travels in one year
  - B) time it takes light to travel from the Sun to the Earth
  - C) time it takes for light to travel from the nearest star to the Earth
  - D) average distance between the Earth and the nearest star
  - E) average distance between the Earth and the Sun
27. If we were to send a radio signal to an advanced civilization in 2014 which is located in the zeta reticuli star system approximately 39 light-years away and the signal was immediately replied to, when would the reply arrive back at Earth?
- A) 2014
  - B) 2020
  - C) 2044
  - D) 2053
  - E) 2092
28. According to current astronomical data, approximately how old is the universe?
- A) 65 million years
  - B) 6000 years
  - C) 4.6 billion years
  - D) 14 billion years
  - E) 25 billion years
29. The expansion of the Universe is due to the
- A) motion of galaxies through space
  - B) expansion of space between galaxies
  - C) expansion of space within galaxies
  - D) expansion of stars within galaxies
  - E) expansion of the size of atoms
30. In the process of nuclear fusion,
- A) two or more nuclei fuse or stick together to form a heavier nucleus that has exactly the same mass as the original nucleus
  - B) a heavy nucleus breaks apart into a number of smaller nuclei
  - C) two or more nuclei fuse or stick together to form a heavier nucleus whose combined mass is slightly greater than the original nucleus
  - D) the electrons orbiting the nucleus fuse
  - E) two or more nuclei fuse or stick together to form a heavier nucleus whose combined mass is slightly less than the original nucleus

31. A star more massive than the Sun will have
- A) an identical lifetime as the Sun because although its overall mass is higher, the mass of its nuclear burning core is the same
  - B) a longer lifetime because it has more fuel to burn
  - C) a shorter lifetime because its central core is hotter, denser, and uses fuel faster.
  - D) a longer lifetime because its overall mass is higher, and the mass of its nuclear burning core is smaller
  - E) a shorter lifetime because its fuel is the wrong type
32. Compared to the 4.6 BY history of the Earth, we have evidence that life on Earth first appeared
- A) within its first 0.1 billion years
  - B) as far back as about 3.5-3.8 billion years ago
  - C) 14 billion years ago
  - D) 545 million years ago
  - E) 6000 years ago
33. In our solar system, terrestrial planets are
- A) large, made mostly of gases and liquids with low densities, and found far from the Sun
  - B) small, made mostly of rock and iron with high densities, and found close to the Sun
  - C) large, made of pure gases with low densities, and found far from the Sun
  - D) small, made of pure rock with high densities, and found close to the Sun
  - E) large, made mostly of ice, and found very far from the Sun
34. In our solar system, Jovian planets are
- A) small, made of pure rock with high densities, and found close to the Sun
  - B) large, made mostly of gases and liquids with low densities, and found far from the Sun
  - C) large, made of pure gases with low densities, and found far from the Sun
  - D) small, made mostly of rock and iron with high densities, and found close to the Sun
  - E) large, made mostly of ice, and found very far from the Sun
35. Out immediately beyond the orbit of the planet Neptune we find
- A) the Kuiper belt
  - B) Orion's belt
  - C) the asteroid belt
  - D) the Oort cloud
  - E) the terrestrial planets

36. Far from the Sun in a spherical cloud surrounding the solar system we find
- A) Orion's belt
  - B) the Oort cloud
  - C) the asteroid belt
  - D) the Kuiper belt
  - E) the terrestrial planets
37. Apart from terrestrial planets, another promising place to find life in the solar system is
- A) inside comets
  - B) beneath the surfaces of icy Jovian moons
  - C) in the atmospheres of Jovian planets
  - D) inside asteroids
  - E) inside the Sun
38. According to the nebular theory for the formation of the solar system,
- A) planets can be rotating in any random direction compared to the direction they orbit the Sun
  - B) planets should be rotating in the opposite direction to the direction they orbit the Sun
  - C) planets should not be rotating at all!
  - D) planets should be rotating in the same direction as they orbit the Sun
  - E) no prediction is made as to the directions of rotations of the planets
39. The four key classes of compounds in solar system formation are
- A) amino acids, nucleic acids, organic molecules, lipids
  - B) carbohydrates, amino acids, organic molecules, ATP
  - C) metals, rocks, carbon, argon
  - D) metals, rocks, hydrogen rich compounds like H<sub>2</sub>O, hydrogen/helium gas
  - E) air, fire, water, rock
40. Which of the following do the atoms <sup>14</sup>N and <sup>15</sup>N have in common?
- A) total number of neutrons and electrons
  - B) total number of protons and neutrons
  - C) number of protons
  - D) number of neutrons
  - E) they both have the same mass
41. In astrobiology, which of the following is an organic molecule?
- A) N<sub>2</sub>H<sub>4</sub>
  - B) B<sub>2</sub>O<sub>2</sub>
  - C) C<sub>2</sub>H<sub>4</sub>
  - D) O<sub>2</sub>
  - E) CO<sub>2</sub>

42. The process by which molecules escape from a liquid into the gas phase is called
- A) melting
  - B) gasification
  - C) sublimation
  - D) condensation
  - E) evaporation
43. What kind of energy does a speeding bullet possess in abundance?
- A) radiative
  - B) mechanical
  - C) kinetic
  - D) chemical potential
  - E) electrical
44. Which of the following sequences of electromagnetic radiations is in order of increasing wavelength?
- A) radio, infrared, UV, gamma ray
  - B) X-ray, visible, infrared, radio
  - C) gamma ray, UV, radio, microwave
  - D) UV, infrared, visible, microwave
  - E) radio, visible, gamma ray, microwave
45. Human beings mostly emit which kind of electromagnetic radiation?
- A) ultraviolet
  - B) visible
  - C) infrared
  - D) microwave
  - E) radio
46. The Earth owes its habitability to
- A) the chemical composition of its surface—nothing else matters!
  - B) the fact that it has a large moon
  - C) its size—nothing else matters!
  - D) its distance from the Sun—nothing else matters!
  - E) a combination of its size and its distance from the Sun
47. Which of the following processes is believed to have been an important source of the Earth's atmosphere?
- A) gas trapped from the solar nebula
  - B) outgassing by volcanoes on the Earth's surface
  - C) matter blasted from the surface of the Moon
  - D) charged particles trapped from the Sun
  - E) gas brought to the Earth by Saturn



48. Which component of Earth's geology is believed to have been largely responsible for the long-term climate stability that has allowed life to evolve?
- A) global magnetism
  - B) seismic activity
  - C) plate tectonics
  - D) erosion and weathering
  - E) asteroidal impacts
49. Which component of Earth's geology has helped to shield the Earth's atmosphere from energetic particles of solar wind from the Sun which would have gradually stripped it away into space?
- A) volcanism
  - B) seismic activity
  - C) plate tectonics
  - D) earthquakes
  - E) global magnetism
50. How are the "geological record" and the "fossil record" related?
- A) the fossil record is part of the geological record
  - B) the geological and fossil records are completely unrelated
  - C) the geological record is part of the fossil record
  - D) the geological record and the fossil record are just different names for the same thing
  - E) the fossil record tells us "how," the geological record tells us "why"
51. Rocks are found on the surface of another planet which appear to have been formed from the solidification of molten lava. Given this, they are most likely to be classified as
- A) meteoritic
  - B) metamorphic
  - C) igneous
  - D) sedimentary
  - E) asteroidal
52. Rocks are found on the surface of another planet which appear to have been formed at the bottom of an ancient ocean. Given this, they are most likely to be classified as
- A) metamorphic
  - B) sedimentary
  - C) igneous
  - D) meteoritic
  - E) asteroidal

53. Granite is a common type of
- A) meteoritic rock
  - B) igneous rock
  - C) metamorphic rock
  - D) sedimentary rock
  - E) asteroidal rock
54. A fossil is found in a layer of strata above another layer dated at 10 million years and below another layer dated at 5 million years. From this we can deduce the age of the fossil to be
- A) 6000 years
  - B) younger than 5 million years
  - C) between 5 and 10 million years old
  - D) older than 10 million years
  - E) we can tell nothing about the fossil's age from this data
55. The Earth's geological time scale is divided into four main
- A) epochs
  - B) periods
  - C) eras
  - D) eons
  - E) ages
56. In which eon of Earth's history did the early heavy bombardment occur?
- A) Modern
  - B) Archean
  - C) Phanerozoic
  - D) Hadean
  - E) Proterozoic
57. At the start of which eon of Earth's history do we find the earliest evidence of life?
- A) Phanerozoic
  - B) Proterozoic
  - C) Archean
  - D) Hadean
  - E) Modern
58. Tiny grains of zirconium silicate (zircons) found embedded in sedimentary rocks have been radiometrically dated to what age?
- A) 6000 years
  - B) 3.5 billion years ago
  - C) 3.85 billion years ago
  - D) 4.0 billion years ago
  - E) 4.4 billion years ago

59. Isotopic analysis of meteorites suggests the Earth and the rest of the solar system formed
- A) 6000 years ago
  - B) 3.85 billion years ago
  - C) 4.0 billion years ago
  - D) 4.4 billion years ago
  - E) 4.57 billion years ago
60. Given the Earth's larger size and strong gravity, the Earth's surface should have more impact craters than the Moon. However, it has very few. Why is this?
- A) the Moon acted like a shield, protecting the Earth from most impacts
  - B) the Earth's surface was almost completely molten during the Hadean Eon so no impact craters were formed
  - C) almost all impacts occurred in the oceans so no impact craters were formed
  - D) geological processes like plate tectonics, volcanism, and erosion have erased them
  - E) the Earth is more resilient than the Moon, and just doesn't dent as easily.
61. Given that all bodies in the solar system should have suffered equally from collisions during the period of early heavy bombardment, if we find a body with relatively few craters on its surface we deduce that
- A) the surface of the body is made of material that produces fewer impact craters
  - B) geological activity or other processes must have removed older craters resulting in a younger, smoother surface
  - C) the body must have been located in a region of the solar system that for some reason suffered fewer collisions
  - D) the body must have formed after the period of early heavy bombardment
  - E) it wandered into the solar system recently
62. A sterilizing impact is one during which
- A) all life on the surface of a planet is destroyed but life in the oceans or beneath the surface survives
  - B) a planet is fragmented into pieces
  - C) all life on a planet is destroyed
  - D) life on a planet is rendered incapable of reproduction
  - E) the Earth is struck by a very hot asteroid, which sterilizes the point of impact by its hot surface
63. During the Hadean Eon, life
- A) may have existed but probably could not have survived for long periods due to sterilizing impacts
  - B) could have existed and survived regardless of impacts
  - C) probably survived and existed until the late heavy bombardment during which it was destroyed
  - D) could not have existed at all
  - E) was in the form of dinosaurs and tiny, tiny mammals

64. The very center of the Earth is made of
- A) liquid iron and nickel
  - B) solid iron and nickel
  - C) liquid rock
  - D) solid rock
  - E) oxygen and carbon
65. Differentiation is a process by which
- A) denser materials like iron sank to the center of the Earth while less dense materials like rock rose to the surface
  - B) the Earth's surface separated into continents and oceans
  - C) convection mixed up the materials in the interior of the Earth
  - D) less dense materials like rock sank to the center of the Earth while denser materials like iron rose to the surface
  - E) oxygen accumulated in the crust, oceans, and atmosphere
66. The Earth's lithosphere has broken up into plates because of
- A) earthquakes
  - B) tidal forces due to the Moon
  - C) forces arising from mantle convection
  - D) tidal forces due to the Sun
  - E) the oxygen in the atmosphere
67. Compared to oceanic crust, continental crust is
- A) thinner and denser
  - B) thicker and denser
  - C) thinner and less dense
  - D) made out of basalt
  - E) thicker and less dense
68. Seafloor spreading on the Earth is the process by which
- A) volcanic material flows from the deep interior to produce volcanic islands
  - B) dense material sank while lighter material rose to the surface during the early geological history
  - C) molten lava oozes out between two tectonic plates that are slowly moving apart
  - D) oceanic crust sinks below continental crust at a tectonic plate boundary
  - E) oceanic crust rises above continental crust at a tectonic plate boundary
69. Subduction on the Earth is the process by which
- A) dense material sank while lighter material rose to the surface during the early geological history
  - B) molten lava oozes out between two tectonic plates that are slowly moving apart
  - C) volcanic material flows from the deep interior to produce volcanic islands
  - D) rock is eroded into sedimentary material
  - E) oceanic crust sinks below continental crust at a tectonic plate boundary

70. The Himalayas were formed by
- A) two pieces of continental crust colliding
  - B) two pieces of oceanic crust colliding
  - C) two pieces of continental crust separating
  - D) pieces of oceanic and continental crust colliding
  - E) North America and South America colliding
71. The Andes were formed by
- A) two pieces of continental crust separating
  - B) two pieces of continental crust colliding
  - C) two pieces of oceanic crust colliding
  - D) North America and South America colliding
  - E) pieces of oceanic and continental crust colliding
72. The Hawaiian Islands were formed when
- A) volcanic material flowed out from the interior at a hot spot beneath the Pacific Ocean
  - B) oceanic crust sank below continental crust at a tectonic plate boundary
  - C) molten lava oozed out between two tectonic plates that were slowly moving apart
  - D) dense material sank while lighter material rose to the surface during the early geological history
  - E) North America and South America collided
73. The Moon, Mercury, and Mars do not have plate tectonics because
- A) they cooled so rapidly that they do not have enough internal convection to break up their thick crusts
  - B) they have no oceans for subduction and seafloor spreading to occur in
  - C) impacts have filled in the plate boundaries essentially turning the process off
  - D) their crusts have dried up and thickened so the crust cannot be broken up into plates
  - E) their crusts are stabilized by their magnetic fields
74. The sweeping of atmospheric gas particles into space by the Sun is referred to as
- A) a solar flare
  - B) evaporation
  - C) thermal escape
  - D) solar wind stripping
  - E) the coriolis effect
75. In order to have a global magnetic field, a planet must have
- A) magnetic rocks in its interior
  - B) magnetic rocks on its surface
  - C) a large core of solid magnetized iron
  - D) an electrically conducting fluid in its interior which is undergoing convection and a reasonably rapid rotation
  - E) a thick atmosphere

76. The greenhouse effect is the
- A) generation of heat in the outer layer of the Earth's atmosphere due to absorption of short wavelength radiation
  - B) generation of heat in the ozone layer due to the absorption of ultraviolet radiation
  - C) trapping of infrared radiation from the Earth's surface by greenhouse gases like carbon dioxide, methane, and water
  - D) release of heat by volcanism along tectonic plate boundaries
  - E) trapping of heat in the planet's core
77. Most of the Earth's carbon dioxide
- A) is present in the atmosphere
  - B) has dissolved in the oceans and is locked up in sedimentary carbonate rocks like limestone
  - C) has escaped into space
  - D) has been destroyed in the atmosphere by solar radiation
  - E) is locked in the Earth's inner core
78. What is the most important role that the carbon dioxide cycle plays in the regulation of the Earth's climate?
- A) it removes carbon dioxide from the atmosphere produced by respiration
  - B) it provides carbonate minerals in the oceans for aquatic life forms
  - C) it provides carbon dioxide in the atmosphere for photosynthesis
  - D) it offsets the reactive effects of corrosive oxygen.
  - E) it regulates the surface temperature by varying the amount of carbon dioxide in the atmosphere
79. If the temperature of the Earth warms up how does the carbon dioxide cycle respond?
- A) it slows the formation of carbonate minerals in the oceans, thus pulling less carbon dioxide out of the atmosphere
  - B) it increases the rate of volcanic eruptions, thus increasing the rate of carbon dioxide production
  - C) it increases the global precipitation rates, thus pulling more carbon dioxide out of the atmosphere
  - D) it reduces the rate of volcanic eruptions, thus reducing the rate of carbon dioxide production
  - E) it offsets the reactive effects of corrosive oxygen.
80. Why can't the carbon dioxide cycle easily correct for the increasing amounts of carbon dioxide introduced into our atmosphere by industrialization?
- A) pollution has stopped the carbon dioxide cycle from operating
  - B) it operates far too slowly to correct for any short-term changes
  - C) the carbon dioxide cycle only influences carbon dioxide produced by natural sources
  - D) it operates far too quickly to correct for any short-term changes
  - E) the carbon dioxide cycle was proven incorrect in the 1960s

81. Mild, short-term cooling periods during the Earth's history are known as
- A) ice storms
  - B) nuclear winters
  - C) snowball Earth
  - D) ice ages
  - E) freezelings
82. Severe, long-term cooling periods during the Earth's history are known as
- A) ice storms
  - B) nuclear winters
  - C) snowball Earth
  - D) ice ages
  - E) freezelings
83. The Earth is able to recover from a snowball phase by
- A) the gradual melting of snow and ice by solar radiation
  - B) the gradual build up of heat beneath the snow and ice layer
  - C) the breaking up of the snow and ice layer by plate tectonics
  - D) energy released from asteroidal impacts
  - E) carbon dioxide from volcanism gradually building up in the atmosphere
84. The currently accepted theory for the formation of the Moon is the
- A) co-formation model in which the Moon formed from a rotating disk of gas and dust around the Earth
  - B) fission model in which the Moon was spun out from a rapidly rotating Earth
  - C) giant impact model in which material was blasted from the Earth after an impact with a body the size of the planet Mars
  - D) capture model in which the Moon formed elsewhere and was later captured into orbit by the Earth's gravity
  - E) big-bounce, in which the fully-formed Moon struck the Earth, and the two recoiled into the current configuration
85. Strong evidence that supports the giant impact model for the formation of the Moon is that the
- A) Moon has no global magnetic field
  - B) Moon is larger compared to the Earth than other moons
  - C) overall composition of Moon rocks returned from the Apollo program is similar to the composition of Earth's mantle material, except for the lack of volatile elements
  - D) overall composition of Moon rocks returned from the Apollo program is similar in composition to rocks found on the surface of the Earth
  - E) Moon has craters

86. What can be said about the presence of order as a criterion for something being considered “alive”?
- A) it does not occur in living organisms
  - B) it is a sufficient condition, but not a necessary condition for life
  - C) it is both a necessary condition and a sufficient condition for life
  - D) it is neither a necessary condition nor a sufficient condition for life
  - E) it is a necessary condition, but not a sufficient condition for life
87. Bacteria reproduce by the process of cell division. This kind of reproduction is referred to as
- A) sexual
  - B) asexual
  - C) unsexual
  - D) binary
  - E) trinary
88. Scientists generally feel that viruses are not living because the viruses
- A) are much smaller than other simple living organisms
  - B) can reproduce but do not require any utilization of energy to do so
  - C) can reproduce under certain conditions, but they do not contain any RNA or DNA
  - D) can only reproduce within a host cell and not independently
  - E) are clearly from outer space
89. What is the main factor that drives Darwinian evolution?
- A) the competition for finite resources
  - B) the need to have sex
  - C) the ability of an organism to harness the energy of the Sun
  - D) the size of an organism
  - E) the age of the organism
90. The increasing resistance of bacteria to certain antibiotics is a current example of
- A) natural variety
  - B) artificial selection
  - C) un-natural selection
  - D) natural selection
  - E) scientific falsehood
91. Evolutionary adaptations are related to changes that occur through time in
- A) lipids
  - B) carbohydrates
  - C) DNA
  - D) proteins
  - E) enzymes



92. The basic biological structures of life on Earth are called
- A) viruses
  - B) bacteria
  - C) molecules
  - D) atoms
  - E) cells
93. The fact that all cells used in life on Earth are based on the same biochemistry suggests that
- A) life originated from a variety of sources
  - B) life on Earth was created by some omnipotent being
  - C) the biochemistry of life on Earth is universal
  - D) all life on Earth shares a common ancestor
  - E) life came to the Earth from outer space
94. Which is the MOST important property of the element carbon that makes it ideal as a fundamental building block of biological molecules?
- A) it readily forms chemical bonds with itself and other elements, allowing a wide variety of complex molecules to form
  - B) it is a very stable element
  - C) it is the only element capable of bonding to itself
  - D) it is a common element
  - E) it is fairly low mass
95. Chemists refer to molecules containing carbon atoms bonded to hydrogen atoms as
- A) carbonic
  - B) carbonaceous
  - C) organic
  - D) inorganic
  - E) alkaloids
96. Why might we think that silicon would be an obvious alternative to carbon as a building block for biological molecules?
- A) it forms the basis of some life forms on Earth
  - B) it has a similar electronic structure to carbon, forming a maximum of four bonds and, hence, should have a similar chemistry
  - C) it has a similar abundance on Earth to carbon
  - D) it forms complex molecules like carbon
  - E) it is common in the universe

97. What is the MOST important role that carbohydrates play in living organisms on Earth?
- A) long-term energy storage and membrane structure
  - B) short-term energy storage
  - C) information storage
  - D) basic building blocks in cellular structures
  - E) it protects them from ultraviolet radiation
98. What is the MOST important role that nucleic acids play in living organisms on Earth?
- A) the storage and transfer of information
  - B) long-term energy storage and membrane structure
  - C) basic building blocks in cellular structures
  - D) short-term energy storage
  - E) it protects them from ultraviolet radiation
99. What is the MOST important role that lipids play in living organisms on Earth?
- A) long-term energy storage and membrane structure
  - B) basic building blocks in cellular structures
  - C) short-term energy storage
  - D) information storage
  - E) it protects them from ultraviolet radiation
100. What is the MOST important role that proteins play in living organisms on Earth?
- A) basic building blocks in cellular structures
  - B) short-term energy storage
  - C) information storage
  - D) long-term energy storage and membrane structure
  - E) it protects them from ultraviolet radiation
101. The basic molecular building blocks of proteins are
- A) amino acids
  - B) nucleotides
  - C) fatty acids
  - D) monosaccharides
  - E) oxygen atoms
102. How many different amino acids make up proteins found in life on Earth?
- A) 4
  - B) 5
  - C) 20
  - D) 23
  - E) 117

103. Amino acids found in protein in life on Earth are
- A) all left-handed molecules
  - B) all right-handed molecules
  - C) a unequal mixture of left-handed and right-handed molecules, left-handed being most abundant
  - D) an equal mixture of left-handed and right-handed molecules
  - E) not classifiable as left-handed and right-handed molecules
104. What do plant cells have that animal cells do not?
- A) a nucleus
  - B) nucleic acids
  - C) cell walls
  - D) organelles
  - E) DNA
105. Organisms whose cells lack a nucleus are called
- A) eukaryotes
  - B) non-nucleotes
  - C) prokaryotes
  - D) karyotes
  - E) bikaryotes
106. An amoeba is an example of a
- A) multicellular prokaryote
  - B) multicellular eukaryote
  - C) unicellular prokaryote
  - D) unicellular eukaryote
  - E) unicellular bacterium
107. Human beings are examples of
- A) unicellular bacteria
  - B) unicellular prokaryotes
  - C) unicellular eukaryotes
  - D) multicellular prokaryotes
  - E) multicellular eukaryotes
108. Based on cellular biochemistry, how many different domains is life currently classified into?
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 23

109. Metabolism is a term that describes the
- A) breaking down of complex organic molecules by bacteria
  - B) chemical processes that occur inside cells
  - C) rate at which molecules travel across cell membranes
  - D) rate of cell division of bacteria
  - E) way that alcohol affects normal cells
110. All living cells use the molecule adenosine triphosphate (ATP)
- A) to carry oxygen into cells
  - B) to store and release energy for biochemical processes
  - C) to catalyze biochemical reactions
  - D) as a building block for nucleic acids
  - E) to store genetic information
111. A chemoheterotroph gets its energy from
- A) chemical reactions and its carbon from its environment
  - B) the Sun and its carbon from its environment
  - C) the Sun and its carbon from other organisms
  - D) chemical reactions and its carbon from sunlight
  - E) chemical reactions and its carbon from other organisms
112. A photoheterotroph gets its energy from
- A) the Sun and its carbon from other organisms
  - B) chemical reactions and its carbon from other organisms
  - C) the Sun and its carbon from its environment
  - D) chemical reactions and its carbon from its environment
  - E) the Sun and its carbon from sunlight
113. A photoautotroph gets its energy from
- A) the Sun and its carbon from its environment
  - B) the Sun and its carbon from other organisms
  - C) chemical reactions and its carbon from other organisms
  - D) chemical reactions and its carbon from its environment
  - E) the Sun and its carbon from sunlight
114. A chemoautotroph gets its energy from
- A) chemical reactions and its carbon from its environment
  - B) the Sun and its carbon from other organisms
  - C) chemical reactions and its carbon from other organisms
  - D) the Sun and its carbon from its environment
  - E) the Sun and its carbon from sunlight

115. Life on Earth can use a variety of different carbon and energy sources. However, the one thing that no organism on Earth can survive without is
- A) water in any form (solid, liquid, or gas)
  - B) oxygen
  - C) silicon
  - D) water, but it must be in liquid form
  - E) chlorophyll
116. How many different nucleotide bases are used in nucleic acids in life on Earth (consider both DNA and RNA)?
- A) 2
  - B) 4
  - C) 5
  - D) 20
  - E) 25
117. What is the complementary sequence corresponding to the DNA fragment GATACA?
- A) CTATGT
  - B) AGCGTG
  - C) TGCCAC
  - D) ACATAG
  - E) GATACA
118. A section of DNA that corresponds to a particular protein is known as a
- A) codon
  - B) chromosome
  - C) genome
  - D) gene
  - E) junk DNA
119. A section of DNA that does not correspond to a known protein is referred to as
- A) redundant
  - B) noncoding or junk
  - C) recombinant
  - D) unencoding
  - E) chromosome
120. The complete set of genetic information that makes up an organism is known as a
- A) codon
  - B) genome
  - C) chromosome
  - D) gene
  - E) junk DNA

121. The “words” that make up the genetic code contain how many letters?
- A) 3
  - B) 4
  - C) 5
  - D) 20
  - E) 25
122. Using the following fragment of the genetic code: Leu = ATG, Gly = CAC, Ala = GTC, which of the following simple proteins does the gene GTCATGCACCACATG correspond to?
- A) Ala-Gly-Leu-Ala-Gly
  - B) Gly-Gly-Ala-Gly-Leu
  - C) Leu-Ala-Leu-Gly-Gly
  - D) Ala-Leu-Gly-Gly-Leu
  - E) Leu- Gly -Leu-Gly-Gly
123. Instead of thymine, RNA uses the nucleotide base
- A) guanine
  - B) adenine
  - C) uracil
  - D) cytosine
  - E) glycine
124. How is RNA different from DNA?
- A) its monomers do not contain nucleotide bases
  - B) it consists of a triple helix rather than a double helix
  - C) it is single stranded rather than consisting of a double helix
  - D) its strands are much longer than DNA
  - E) it is based on silicon instead of carbon
125. Which kinds of mutation tend to have the most dramatic effects on protein structure?
- A) all mutations are equally dramatic
  - B) those which change a single base that do not result in a change in the amino acid
  - C) those that add or delete a base within a gene
  - D) those which change a single base that result in a single amino acid being changed
  - E) those that change the coding in junk DNA
126. Chemically based extraterrestrial life
- A) will not need to store information
  - B) may not use DNA to store information but will very likely use a molecule with a similar function
  - C) will certainly use DNA to store information, but with different nucleotides
  - D) will certainly use DNA to store information
  - E) has been proven to be impossible

127. Endospores are
- A) fossilized organisms found inside meteorites
  - B) dormant or resting cells formed by certain organisms that are able to survive extreme conditions
  - C) organisms that embed themselves inside other cells
  - D) organisms which that live beneath Earth's crust
  - E) parasites that live in your eyelashes
128. The discovery of extremophiles on Earth suggests that
- A) life elsewhere will only be found under conditions that are similar to those of Earth
  - B) life elsewhere may be possible over a much wider range of conditions than initially thought
  - C) life elsewhere will only be possible over a much narrower range of conditions than initially thought
  - D) extraterrestrial life will exist only under extreme conditions
  - E) life probably arrived on Earth from outer space
129. Stromatolites date back to approximately
- A) 1.2 billion years ago
  - B) 3.5 billion years ago
  - C) 3.85 billion years ago
  - D) 4.0 billion years ago
  - E) 4.6 billion years ago
130. Why is the claim of the discovery of microfossils controversial?
- A) they are found in rocks from the Hadean Eon
  - B) the rocks they are found in are probably contaminated by terrestrial bacteria
  - C) they are too small to be of biological origin
  - D) it is not clear whether they are of biological or mineral origin
  - E) they were found to be manufactured, false evidence
131. Microfossil evidence suggests that life
- A) originated about 6000 years ago
  - B) originated about 3.0 billion years ago
  - C) existed 3.0-3.5 billion years ago, and perhaps even longer
  - D) originated when the Earth formed 4.6 billion years ago
  - E) originated when the Universe formed 13.7 billion years ago
132. Why can studies of carbon isotopes be used to detect the presence of past biological activity in rocks?
- A) living organisms absorb only the most common carbon isotope
  - B) living organisms absorb certain carbon isotopes more easily than others
  - C) living organisms remove all carbon from rocks
  - D) carbon isotopes are found only in living organisms
  - E) carbon is extremely unstable

133. Current geological evidence suggests that life
- A) appeared very soon after the late heavy bombardment in a short time period of perhaps only 200 million years
  - B) took billions of years to appear
  - C) appeared as soon as the Earth formed
  - D) appeared during the late heavy bombardment period
  - E) appeared first in our atmosphere, suggesting life is from outer space
134. Life probably did not originate on the land surface because
- A) impacts would have destroyed any life that appeared
  - B) water was not plentiful on land
  - C) there was no ozone layer to shield out harmful UV rays
  - D) organic materials were not present on the land
  - E) it was first found in the atmosphere
135. Creationists feel the Miller–Urey experiment proves life could not develop naturally because
- A) the experiment was a hoax that was never really performed
  - B) it is hard to understand
  - C) life was not created in the apparatus
  - D) it produced amino acids
  - E) the experiment was designed to insult creationists
136. In modern Miller–Urey experiments it is assumed that carbon and nitrogen in the early atmosphere were present as
- A) carbon dioxide ( $\text{CO}_2$ ) and nitrogen ( $\text{N}_2$ )
  - B) methane ( $\text{CH}_4$ ) and ammonia ( $\text{NH}_3$ )
  - C) carbonates ( $\text{CO}_3^-$ ) and nitrates ( $\text{NO}_3^-$ )
  - D) carbon and nitrogen atoms
  - E) pure carbon grains
137. Under what conditions will prebiotic molecules NOT be manufactured in Miller–Urey experiments?
- A) if oxygen ( $\text{O}_2$ ) is present in the flask
  - B) if ammonia ( $\text{NH}_3$ ) is present in the flask
  - C) if methane ( $\text{CH}_4$ ) is present in the flask
  - D) if carbon dioxide ( $\text{CO}_2$ ) is present in the flask
  - E) if the experiment includes an energy source



138. What is the “chicken-and-egg” type problem we face when trying to decide which came first—proteins or nucleic acids?
- A) proteins and nucleic acids probably looked very different before the origin of life
  - B) early proteins and nucleic acids were very similar to each other
  - C) nucleic acids cannot replicate without proteins, and proteins cannot be made without nucleic acids
  - D) proteins and nucleic acids are always present together at the same time
  - E) guanine will only bond with thymine
139. Why do we think that DNA was probably NOT the first self-replicating molecule?
- A) it is able to replicate using carbohydrates rather than proteins
  - B) it is able to replicate at high temperatures found near deep ocean vents
  - C) laboratory have shown that it is able to catalyze its own replication
  - D) it is far too complex to have been the first self-replicating molecule
  - E) DNA is not a molecule!
140. The first molecules of RNA probably formed
- A) long after DNA formed
  - B) deep within the earth
  - C) in the atmosphere
  - D) in space and then transported to the Earth in meteorites
  - E) on the surfaces of clays or other minerals
141. Why are clay surfaces good at promoting the formation of biological polymers?
- A) they bring monomers close together, allowing them to react with each other
  - B) they are the only types of material monomers will stick to
  - C) they are very common on the Earth
  - D) clays are made of biological polymers
  - E) clays are very slippery
142. What is one reason that cells would have been advantageous to early life or protolife?
- A) cell walls prevent heat from escaping
  - B) only cells can replicate
  - C) cells concentrate molecules together so they react more easily
  - D) biological reactions can occur only within cells
  - E) cells protect the organism from ATP
143. What was one reason that RNA was eventually replaced by DNA as the molecule of choice for storing genetic information?
- A) the bases that make up DNA became much more common
  - B) RNA is far more stable than DNA
  - C) the double helix of DNA is better able to correct errors in replication
  - D) DNA can catalyze its own replication
  - E) DNA is far more unstable

144. One theory for the origin of life suggests that the earth and life were created by some supernatural being. This is referred to as
- A) panspermia
  - B) naturism
  - C) intelligent design
  - D) chemical evolution
  - E) the Miller-Urey hypothesis
145. One theory for the origin of life suggests that life was transported to Earth in meteorites. This is referred to as
- A) panspermia
  - B) naturism
  - C) intelligent design
  - D) chemical evolution
  - E) the Miller-Urey hypothesis
146. One theory for the origin of life suggests that life formed spontaneously from increasingly complex chemical reactions on the Earth. This is referred to as
- A) intelligent design
  - B) naturism
  - C) panspermia
  - D) chemical evolution
  - E) the Miller-Urey hypothesis
147. Based on current scientific evidence, what is the likelihood that life on Earth was created by a God (or Gods)?
- A) science does not address untestable hypotheses involving supernatural forces
  - B) impossible
  - C) certain
  - D) very likely
  - E) somewhat likely
148. Based on current scientific evidence, what is the likelihood that life on Earth was transported to Earth in meteorites?
- A) impossible
  - B) almost certainly impossible
  - C) possible, but we can't really say more without more information
  - D) very likely
  - E) absolutely certain

149. Based on current scientific evidence, what is the likelihood that life on Earth formed spontaneously from increasingly complex chemical reactions?
- A) impossible
  - B) almost certainly impossible
  - C) possible, but we can't really say more without more information
  - D) very likely
  - E) absolutely certain
150. To date, meteorites have been identified originating from which planets and moons?
- A) The Moon and Mars
  - B) Mars only
  - C) The Moon only
  - D) All terrestrial planets
  - E) All the planets and their moons
151. The possibility of life being transferred from another planet like Mars largely depends on whether that life can survive
- A) being lasted from the parent planet
  - B) inside the meteorite with very little water present
  - C) long enough in space to make the journey to Earth
  - D) the impact onto the Earth's surface
  - E) saltwater
152. The first living organisms probably resembled
- A) single-celled prokaryotes
  - B) single-celled eukaryotes
  - C) multicellular eukaryotes
  - D) multicellular prokaryotes
  - E) RNA
153. The very first living organisms on the Earth were probably
- A) chemoautotrophs
  - B) chemoheterotrophs
  - C) photoautotrophs
  - D) photoheterotrophs
  - E) eukaryotes
154. The first living organisms interacted with the atmosphere
- A) sexually
  - B) symbiotically
  - C) aerobically
  - D) via photosynthesis
  - E) anaerobically

155. The first living organisms to develop photosynthesis were probably
- A) purple and green sulfur bacteria
  - B) trilobites
  - C) cyanobacteria
  - D) stromatolites
  - E) ferns
156. Organisms first started building up oxygen in the Earth's atmosphere around
- A) 2.4 billion years ago
  - B) 3.5 billion years ago
  - C) 4.0 billion years ago
  - D) 4.6 billion years ago
  - E) 13.7 billion years ago
157. What do we mean by "The Oxygen Crisis" in relation to the evolution of life on Earth?
- A) the time period before the development of the ozone layer
  - B) a period when evolution accelerated so rapidly that there was insufficient oxygen available
  - C) the destruction of oxygen in the early atmosphere
  - D) the extinction of older anaerobic life as oxygen builds up in the atmosphere
  - E) the time the dinosaurs died out
158. What is one piece of evidence that some organelles like mitochondria and chloroplasts within eukaryotes used to be independent prokaryotes that were incorporated into eukaryotic cells?
- A) the DNA inside organelles is not made of the same four bases as the DNA in the host cells
  - B) organelles float around independently inside eukaryotic cells
  - C) prokaryotes are seen incorporating into cells today
  - D) organelles are very similar to present-day bacteria, suggesting a common ancestor
  - E) organelles are much larger than modern cells
159. All multicellular organisms are
- A) Bacteria
  - B) Prokaryotes
  - C) Eukarya
  - D) Archaea
  - E) microscopic
160. Prior to the Cambrian Period, life consisted of
- A) protocells
  - B) prokaryotes only
  - C) multicellular organisms
  - D) RNA-based life
  - E) single-celled organisms

161. The Cambrian Explosion began approximately
- A) 6000 years ago
  - B) 65 million years ago
  - C) 360 million years ago
  - D) 545 million years ago
  - E) 2.1 billion years ago
162. The colonization of life onto land was closely tied to the
- A) appearance of multicellular organisms
  - B) development of photosynthesis
  - C) oceans being overcrowded
  - D) development of the ozone layer
  - E) the formation of the Earth's magnetic field
163. The colonization of land by plants appears to have begun about
- A) 65 million years ago
  - B) 360 million years ago
  - C) 545 million years ago
  - D) 475 million years ago
  - E) 2.1 billion years ago
164. Most likely, oxygen was first released into the atmosphere by
- A) the decomposition of dead organisms
  - B) plants
  - C) cyanobacteria
  - D) oxidation reactions
  - E) decaying dinosaurs
165. What is the K-T boundary?
- A) a layer of dark sediment in the geological record formed at the same time humans learned to use fire
  - B) a boundary between rocks containing the oldest life and older rocks that contained no life
  - C) a boundary between the Earth's crust and the molten rock beneath it
  - D) a layer of dark sediment in the geological record separating the Cretaceous and Tertiary periods of Earth's history
  - E) the boundary between Mars and Jupiter, filled with asteroids
166. Approximately how long ago did the dinosaurs suddenly become extinct?
- A) 6000 years ago
  - B) 10,000 years ago
  - C) 6 million years ago
  - D) 65 million years ago
  - E) 245 million years ago

167. What is the most compelling piece of evidence that suggests that the dinosaurs were made extinct by the impact of an asteroid 65 million years ago?
- A) a layer of sediment laid down at that time which is rich in the element iridium, an element common in asteroids but less common on the Earth
  - B) a layer of sediment laid down at that time which is littered with dinosaur fossils
  - C) dinosaur fossils are found in rock layers older than 65 million years but not younger than 65 million years
  - D) the crater from this impact can still be seen in the deserts of Arizona
  - E) it is mentioned in ancient Greek texts
168. Impacts of large asteroids on the Earth's surface usually result in
- A) the destruction of most but not all life on Earth
  - B) localized destruction close to the impact area
  - C) the formation of Moons
  - D) total remelting of the entire Earth
  - E) the development of new oceans
169. Where did the asteroid that is believed responsible for the extinction of the dinosaurs hit the surface of the Earth?
- A) in the Yucatan peninsula in Mexico
  - B) in Siberia in Russia
  - C) in the desert in Arizona
  - D) in the middle of the Pacific Ocean
  - E) the north pole, wiping out Santa and his elves in the bargain
170. Modern mammals are descendents of
- A) birds that were able to survive the impact that wiped out the dinosaurs 65 million years ago
  - B) sea animals that colonized the land after the impact that wiped out the dinosaurs 65 million years ago
  - C) early mammals that killed off the dinosaurs
  - D) early mammals that lived under the ground that were able to survive the impact that helped to wipe out the dinosaurs 65 million years ago
  - E) dinosaurs
171. How many mass extinctions have occurred over the last 500 million years?
- A) 1
  - B) 2
  - C) 3
  - D) 4
  - E) 5

172. Which of the following are possible causes for mass extinctions on Earth?
- A) episodes of widespread volcanism
  - B) impacts of asteroids
  - C) snowball Earth episodes
  - D) all of these can be responsible for mass extinctions
  - E) none of these could cause mass extinctions
173. The probability of Earth being hit by a large asteroid in the next few hundred years is
- A) zero
  - B) small but not zero
  - C) almost certain
  - D) absolutely certain
  - E) impossible to predict
174. The probability of Earth being hit by a large asteroid in the next few hundred million years is
- A) zero
  - B) small but not zero
  - C) almost certain
  - D) absolutely certain
  - E) impossible to predict
175. The oldest hominid so far discovered dates back to
- A) a few thousand years ago
  - B) 6 to 8 million years ago
  - C) 65 million years ago
  - D) 540 million years ago
  - E) 4.6 billion years ago
176. The earliest *Homo sapiens* appeared about
- A) 100,000 years ago
  - B) 6 to 8 million years ago
  - C) 25 million years ago
  - D) 545 million years ago
  - E) 4.6 billion years ago
177. How similar are humans and chimpanzees genetically?
- A) they have no DNA sequences in common
  - B) fairly similar indeed, having approximately 60% of DNA sequences in common
  - C) very different, having only approximately 25% of DNA sequences in common
  - D) very similar indeed, having approximately 98% of DNA sequences in common
  - E) completely the same, having 100% of DNA sequences in common