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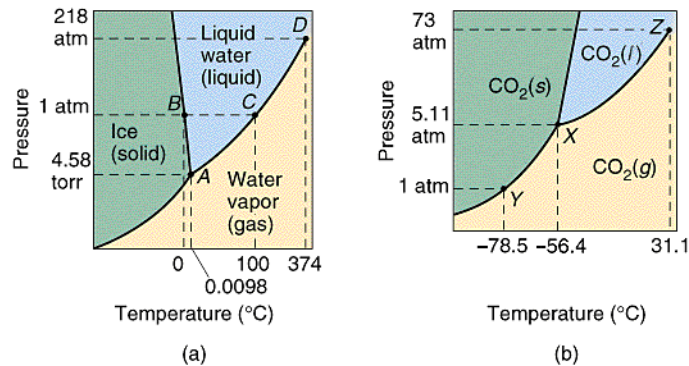
**HNRS 228 Spring 2005  
Examination #2**

1. You have 32 grams of a radioactive element with a half-life of two years. How many grams of the original element remain after six years?
  - A) 1 gram
  - B) 16 grams
  - C) 8 grams
  - \*D) 4 grams
  - E) 2 grams
  
2. Which of the following is NOT true about a light year?
  - A) It's a measure of distance.
  - B) It's the distance traveled by light in a year.
  - \*C) It's the distance traveled by sound in a year.
  - D) It's a standard measure of distance.
  - E) It's approximately 10 trillion kilometers.
  
3. Which of the following is not true about an Astronomical Unit?
  - A) It's approximately the mean distance from the Sun to the Earth.
  - B) It's equivalent to the semi-major axis of the Earth-Sun system.
  - C) It's a measure of distance.
  - D) It's a standard measure of distance.
  - \*E) It's equivalent to the semi-minor axis of the Earth-Sun system.
  
4. What is TRUE about the center of the universe?
  - A) The center of the universe is located near the constellation Sagittarius.
  - B) The center of the universe is located near the constellation Scorpius.
  - C) The center of the universe is located in the center of the Sun.
  - \*D) There is no center you can point to, within our 3 dimensions of space.
  - E) The center of the universe is located in the center of a balloon.
  
5. Which of the following is NOT true of the Miller-Urey experiment?
  - A) It demonstrated that you can make complex organic molecules from simple chemicals.
  - B) It utilized methane, ammonia, and carbon dioxide in its chamber.
  - C) It utilized a model of the primordial Earth that was later put into question.
  - D) It utilized lightening as an energy source.
  - \*E) It was able to create simple life forms.

6. Which is NOT true about the physical characteristics that change when a nebula collapses to form a star?

- A) As a nebula collapses to form a star it heats up.
- \*B) As a nebula collapses to form a star it radiates x-rays.
- C) As a nebula collapses to form a star it spins faster.
- D) As a nebula collapses to form a star it flattens out.
- E) As a nebula collapses to form a star its size gets smaller.

Use the proper phase diagram to answer the next 3 questions.



7. What phase is water at a pressure of 1 atmosphere and a temperature of 50 degrees Centigrade?

- A) Solid
- \*B) Liquid
- C) Gas
- D) It can exist as either a gas or a liquid.
- E) Its phase cannot be determined.

8. What phase is carbon dioxide at a pressure of 7 millibars and a temperature of minus 60 degrees Centigrade?

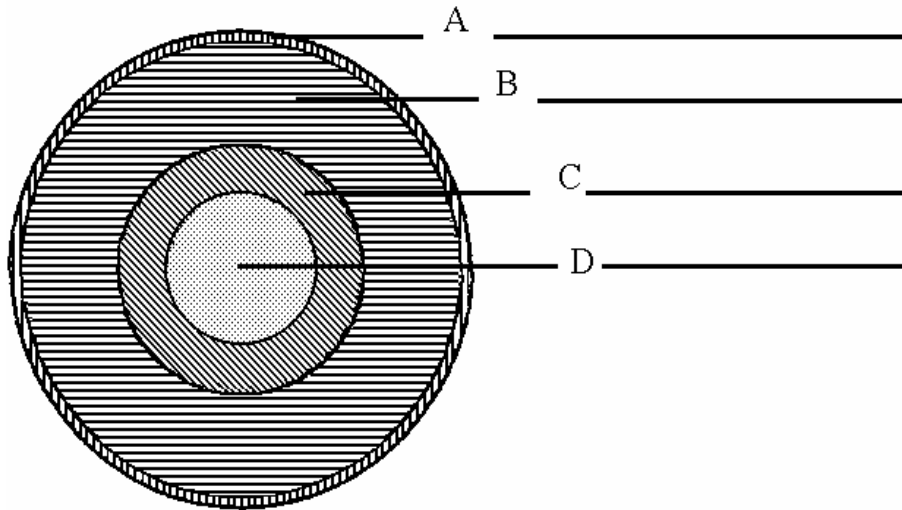
- A) Solid
- B) Liquid
- \*C) Gas
- D) It can exist as either a gas or a liquid.
- E) Its phase cannot be determined.

9. What phase is water at a pressure of 1 atmosphere and a temperature of 100 degrees Centigrade?

- A) Solid
- B) Liquid
- C) Gas
- \*D) It can exist as either a gas or a liquid.
- E) It can exist as either a gas, liquid or solid.

10. Which of the following DOES NOT help explain why Earth possesses few visible craters and the Moon possesses many?
- A) The Earth has been subjected to water erosion unlike the Moon.
  - B) The Earth has been subjected to wind erosion unlike the Moon.
  - \*C) The Earth has been subjected to cratering unlike the Moon.
  - D) The Earth has a thick atmosphere unlike the Moon.
  - E) The Earth has plate tectonics unlike the Moon.
11. Which of the following is NOT a major step in the scientific method?
- A) Forming a hypothesis.
  - B) Testing a hypothesis.
  - C) Making observations.
  - D) Modifying the hypothesis based upon experiments.
  - \*E) All of the above are part of the scientific method.
12. Which is NOT a common feature to ALL major extinction events in geological history?
- A) Geological time periods measured in a period of time less than a million years.
  - \*B) An impact of a an asteroid or comet.
  - C) A large number of taxa or species lost.
  - D) A period of time followed by recovery of species.
  - E) All of the above are features of all major extinctions.
13. Which are NOT constituents of an atom's nucleus?
- A) Protons
  - B) Neutrons
  - C) Quarks
  - \*D) Electrons
  - E) All of the above are part of an atom's nucleus.

Use the following diagram for the next 3 questions.



Earth's Interior

14. Which represents the outer core?  
 A)  
 B)  
 \*C)  
 D)  
 E) None of the above.
15. Which represents the mantle?  
 A)  
 \*B)  
 C)  
 D)  
 E) None of the above.
16. Which represents the magnetosphere?  
 A)  
 B)  
 C)  
 D)  
 \*E) None of the above.
17. Which of the following is NOT a characteristic of ALL living things?  
 A) Reproduction.  
 \*B) Respiration.  
 C) Evolution through natural selection.  
 D) Energy usage.  
 E) None of the above.

18. Anaerobic organisms require all of the following EXCEPT for
- A) Energy useage.
  - B) Evolution through natural selection.
  - \*C) Presence of oxygen.
  - D) Reproduction.
  - E) None of the above are required of anaerobes.
19. What is meant by “valence electrons”?
- \*A) Electrons in the outermost shell of an atom, involved in chemical bonding.
  - B) All electrons in the atom’s nucleus.
  - C) All of the electrons in the atom.
  - D) All of the electrons in fusion.
  - E) None of the above.
20. Which is the best definition of the term “igneous rock”?
- A) Rocks formed from sediments.
  - B) Rocks that are a changing combination of the other two kinds of rocks and are changed due to pressures, physical and chemical.
  - C) Rocks made of natural forming minerals.
  - \*D) Rocks that are formed from the cooled magma or lava from a volcano are called igneous rocks.
  - E) None of the above.
21. What is meant by the term “extremophile”?
- A) Microbes which are extremely prolific.
  - \*B) Microbes that inhabit unusually “hostile” environments due to either chemical or physical features.
  - C) Microbes which hate extreme environments.
  - D) Microbes which exist on Mars.
  - E) None of the above.
22. What is meant by the term “metamorphic rock”?
- A) Rocks formed from sediments.
  - \*B) Rocks that are a changing combination of the other two kinds of rocks and are changed due to pressures, physical and chemical.
  - C) Rocks made of natural forming minerals.
  - D) Rocks that are formed from the cooled magma or lava from a volcano are called igneous rocks.
  - E) None of the above.

23. What is meant by the “Copernican revolution” and what was its significance?
- A) This refers to the Polish revolution of 1885, led by Copernicus.
  - B) This refers to the Revolutionary War period of the U.S.
  - \*C) This refers to the time period when the Copernican heliocentric model of our solar system, became the dominant model.
  - D) This refers to the burning at the stake of Nicholas Copernicus.
  - E) None of the above.
24. What is meant by “absolute dating” and what is the physical basis of it?
- A) A process of time-dependent elemental fusion.
  - B) A process that determines the relative age of an object compared to another.
  - C) A process that refers to the relative location of objects in the rock layers.
  - \*D) A process that determines the age of an object in years.
  - E) None of the above.
25. What is meant by “relative dating” and what is an example of it?
- A) A process based upon radioactive decay.
  - B) A process of time-dependent elemental fusion.
  - \*C) A process that determines the relative age of an object compared to another.
  - D) A process that determines the age of an object in years.
  - E) None of the above.
26. What is meant by eukaryotes?
- \*A) The group of organisms that have cellular structure characterized by nuclei and multiple organelles.
  - B) A special group of extremophiles.
  - C) The group of organisms discovered on other planets in the solar system.
  - D) Multicellular organisms without any DNA.
  - E) None of the above.
27. What scale is used to describe the concentration of H<sup>+</sup> and OH<sup>-</sup> in solution?
- A) The metric scale.
  - B) The Kelvin scale.
  - C) The phase scale.
  - \*D) The pH scale.
  - E) None of the above.

28. At standard pressure on the surface of the Earth, water is a liquid in what range of temperatures?
- A) 32 – 212 °C
  - B) 0 – 100 °C
  - C) 273 – 373 °K
  - D) 273 – 373 °C
  - \*E) Both B and C above.
29. What hypothesis states that life came to earth by a process of interplanetary transport via meteors?
- A) The Big Bang
  - B) The Nebular Condensation Theory
  - \*C) Panspermia
  - D) The First Law of Thermodynamics
  - E) None of the above.
30. Which scientific theory seeks to explain the origin of the universe?
- \*A) Big Bang
  - B) Nebular Condensation
  - C) Panspermia
  - D) Creationism
  - E) None of the above.
31. Which scientific theory seeks to explain the formation of the Sun and planets?
- A) Big Bang
  - \*B) Nebular Condensation
  - C) Panspermia
  - D) Creationism
  - E) None of the above.
32. Which describes a way that scientists can search for life on planets in our solar system.
- A) In situ measurements by astronauts.
  - B) Remote sensing with flyby spacecraft.
  - C) Remote sensing with orbiting spacecraft.
  - D) In situ measurements by automated robots.
  - \*E) All of the above.
33. Which is a characteristic of enzymes?
- A) Enzymes are catalysts.
  - B) Enzymes are proteins.
  - C) Enzymes increase the number of reactions in a given time.
  - D) Enzymes reduce the time it takes for a reaction.
  - \*E) All of the above.

34. Which is NOT a goal of astrobiology?
- A) Studying the origin of life on Earth.
  - B) Studying the development of life on Earth.
  - C) Studying the distribution of life in the solar system.
  - D) Searching for life in the universe.
  - \*E) All of the above are goals of astrobiology.
35. Among the following, where in our solar system are you least likely to find microbial life?
- A) Mars
  - B) Europa
  - C) Titan
  - \*D) Io
  - E) Earth
36. Which is not a property of water?
- A) It has a wide range of temperatures within which it remains a liquid.
  - \*B) Its solid phase is more dense than its liquid phase.
  - C) It is an excellent medium for transporting organic materials in the cell.
  - D) It is a universal solvent.
  - E) Its pure form has a pH of 7.
37. Which is not true of evolution?
- A) Gradual change that takes place in populations of organisms over time.
  - B) Understanding the origin and development of life on Earth.
  - C) Describing the changes in populations.
  - \*D) Describing the changes in individuals.
  - E) All of the above are true of evolution.
38. Which of the following statements is true of DNA and its significance?
- A) It is the basis of heredity.
  - B) It stands for Deoxyribo-Nucleic Acid
  - C) It transfers information from one generation of cells to the next.
  - D) It is a biomolecule.
  - \*E) All of the above are true statements about DNA.
39. A future news release reports that a new planet has been found around a star very similar to the Sun. This newly discovered planet is claimed to have a mass 40 times that of Earth and is located nearly 25 AU from the star it orbits. Which of the following is a reasonable prediction about the physical nature of the planet based upon this information?
- A) It has no moons orbiting it.
  - B) It has a heavy metal core.
  - \*C) It's a gas giant type of planet.
  - D) It's a terrestrial type of planet.
  - E) None of the above.

40. Which of the following is not an aspect of the greenhouse effect?
- \*A) Visible light is blocked.
  - B) Infrared radiation is blocked.
  - C) Heat transfer is blocked.
  - D) The material is opaque to infrared radiation.
  - E) Visible light passes through easily.
41. Which of the following is not a limitation making it difficult to travel to the stars?
- A) The limiting velocity of light.
  - B) The amount of energy required to travel to the stars.
  - \*C) The time required to travel to the stars would be longer than a lifetime.
  - D) The amount of money required to build a spaceship to travel to the stars.
  - E) The amount of energy available from chemical combustion.
42. Which of the following is not part of the Drake equation?
- A) The number of habitable planets in the galaxy.
  - B) The fraction of habitable planets that actually have life.
  - C) The fraction of the life-bearing planets upon which a civilization has at some time arisen.
  - \*D) The fraction of the velocity of travel to the speed of light.
  - E) The fraction of the civilization bearing planets that happen to have a civilization now.
43. What causes the seasons on Mars?
- A) The distance from the sun varies in the different seasons.
  - \*B) The tilt of the axis of rotation.
  - C) The difference it takes light to travel to the planet from the Sun.
  - D) The change in solar insolation.
  - E) The different sunspot cycles.
44. Which of the following was not part of the Viking Lander?
- A) Labeled Release Experiment
  - B) Gas Exchange Experiment
  - C) Gas Chromatograph Mass Spectrometer
  - D) Thermometer
  - \*E) All of the above were on the Viking Landers.

45. Two scientists, Abbott and Costello, are trying to search for life around other stars. Costello is studying a star that is a blue main sequence star. Abbott is studying a star that is a yellow main sequence star. Who is more likely to be able to detect a radio signal from his cluster, Abbott or Costello?
- \*A) Abbott is more likely to detect a radio signal.
  - B) Costello is more likely to detect a radio signal.
  - C) Abbott and Costello are equally likely to detect a radio signal.
  - D) Abbott and Costello are equally unlikely to detect a radio signal.
  - E) None of the above are true.
46. What is the estimated age of the oldest fossilized microbial remnants that have been found on Earth?
- A) 1 billion years old
  - B) 1 million years old
  - C) 3.8 million years old
  - \*D) 3.8 billion years old
  - E) 4.6 billion years old
47. Evidence of organic molecules has not been discovered where?
- A) In interstellar molecular clouds.
  - \*B) In the soil of Mars.
  - C) On the surface of Titan.
  - D) In asteroids.
  - E) In comets.
48. What is the name given to the dilemma that we have yet to discover any extraterrestrial life?
- A) Incompleteness Theorem
  - B) Sagan Dilemma
  - C) Drake Paradox
  - D) Big Bang
  - \*E) Fermi Paradox
49. The K-T boundary and the Alvarez theory are important examples of what?
- A) A major extinction event caused by volcanoes.
  - B) A geologic timescale for evolution.
  - C) Erosion of sedimentary rock.
  - \*D) A major extinction event caused by a meteor.
  - E) A time when anaerobes dominated Earth.

50. One of the requirements for living systems is the availability of elements such as C, O, Fe, and N. The origin and abundance of these elements in the Universe is explained by what?
- A) Einstein's Theory
  - B) Mendeleev Theory
  - C) Avogadro's Number
  - D) The Big Bang
  - \*E) The Life Cycle of the Stars
51. Of the following, what is similar between the Earth and Venus?
- A) Mass
  - B) Size
  - C) Surface temperature
  - \*D) Both A and B
  - E) Both B and C
52. Of the following, what is different between the Earth and Venus?
- A) Mass
  - B) Size
  - \*C) Surface temperature
  - D) Both A and B
  - E) Both B and C
53. What is the key physical characteristic of the habitable zone?
- A) The temperature at which water boils.
  - \*B) The temperature that allows water to be in the liquid phase.
  - C) The temperature at which water freezes.
  - D) The temperature that allows oxygen to exist in the gas phase.
  - E) The temperature that allows nitrogen to exist in the gas phase.
54. Which type of star is the best candidate for habitable planets?
- A) F
  - B) G
  - C) K
  - D) M
  - \*E) A, B and C above
55. Which is not a technique used to detect extrasolar planets.
- A) Astrometric Technique
  - B) Doppler Technique
  - C) Gravitational Lensing
  - D) Transit Technique
  - \*E) All of the above are techniques used to detect extrasolar planets.

56. Approximately what percentage of stars in our galaxy are part of a multiple star system?
- A) 90%
  - B) 10%
  - C) 20%
  - \*D) 67%
  - E) 50%
57. Which of the following is the most likely way we will first encounter an alien civilization?
- A) Spacecraft debris.
  - B) Close encounter of the second kind.
  - C) Close encounter of the third kind.
  - \*D) Radio communications.
  - E) Face to face communications.

In the following questions you will be asked to judge if the statement given is feasible (reasonable, believable, true) or not feasible (not reasonable, not believable, false).

58. There is scientific evidence for aliens having already visited the Earth.
- A) True
  - \*B) False
59. If you able to travel at a velocity close to the speed of light, you would still be older than Dr. Geller by time you arrived at the nearest star.
- A) True
  - \*B) False
60. If you able to travel at a velocity close to the speed of light to the star Alpha Centauri (~4.3 light years away) and return, at least 8.6 years would pass on Earth.
- \*A) True
  - B) False
61. In the year 2750 we receive a signal from a civilization around a nearby star telling us that the Voyager 2 spacecraft recently crash-landed on its planet.
- A) Feasible
  - \*B) Not Feasible
62. Sea creatures, no matter how clever they are, could never master the technology required to communicate with other worlds.
- \*A) True
  - B) False

63. In 2010, astronomers discover an Earth-like world orbiting a Type B star.  
A) Feasible  
\*B) Not Feasible
64. In 2010 a new extrasolar planet is detected and it has an orbit and size just like Jupiter.  
\*A) Feasible  
B) Not Feasible
65. If Venus were just a little bit smaller, its climate would be more Earth-like.  
A) True  
\*B) False
66. If the Sun were twice as bright as it is now, life on Earth would not be likely.  
\*A) True  
B) False
67. If the Sun were several times brighter than it actually is, then the habitable zone could include Jupiter's orbit.  
\*A) True  
B) False
68. We discover a crater on Io that formed as the result of an impact during the heavy bombardment in the early history of the solar system.  
A) Feasible  
\*B) Not Feasible
69. Titan has few impact craters in certain regions.  
\*A) True  
B) False
70. We find life in the European ocean, but it consists only of microbes that live in conditions like those on Earth near deep se vents.  
A) Feasible  
\*B) Not Feasible
71. We discover life on Triton that uses liquid ammonia, rather than liquid water, as its transport medium.  
A) Feasible  
\*B) Not Feasible
72. We discover a previously unknown moon of Uranus that is like Europa and has a subsurface ocean of liquid water.  
A) Feasible  
\*B) Not Feasible

73. We discover an extrasolar planet like Jupiter, and it has moons that experience significant tidal heating.  
\*A) Feasible  
B) Not Feasible
74. We discover a string of active volcanoes in the southern highlands of Mars.  
A) Feasible  
\*B) Not Feasible
75. We discover subterranean pools of water on the slopes of one of the Tharsis volcanoes of Mars.  
\*A) Feasible  
B) Not Feasible
76. Scientists announce that Mars was subjected to global, heavy rainfall about 100 million years ago.  
A) Feasible  
\*B) Not Feasible
77. A future Mars orbiting spacecraft discovers newly formed gullies alongside some of the ones already seen by the Mars Global Surveyor.  
A) Feasible  
\*B) Not Feasible
78. A future sample return mission to Mars discovers fossil evidence of martian plants including tall trees.  
A) Feasible  
\*B) Not Feasible
79. We discover life on Mars that is apparently descended from life on Earth.  
A) Feasible  
\*B) Not Feasible
80. Future astronauts are able to ice fish in a lake of ethane on a distant moon of Saturn.  
A) Feasible  
\*B) Not Feasible
81. In a future colony on Mars, we obtain water from a deep well.  
\*A) Feasible  
B) Not Feasible
82. On a future mission to Venus, astronauts discover fossils.  
A) Feasible  
\*B) Not Feasible

83. A future Pluto lander mission discovers that the surface material of Pluto is nearly identical to that of comets.  
\*A) Feasible  
B) Not Feasible
84. A robotic airplane is sent to study the atmosphere of Jupiter, but we could not keep it at a steady altitude and it was quickly ripped apart.  
\*A) Feasible  
B) Not Feasible
85. On a moon of Neptune, we discover plant life that has a metabolic rate many times as fast as that of any photosynthetic organism on Earth.  
A) Feasible  
\*B) Not Feasible
86. We discover an intact fossil of a eukaryotic cell that is 3 billion years old.  
A) Feasible  
\*B) Not Feasible
87. We discover a new species of bacteria with a genome that is 95% identical to the human genome.  
A) Feasible  
\*B) Not Feasible
88. Researchers carry out an experiment in which they mix amino acids and other building blocks of life in a flask. By using a novel energy source, they cause the molecules to react in such a way that within minutes they combine to make a living cell.  
A) Feasible  
\*B) Not Feasible
89. We discover an asteroid about 3 kilometers across that is on a collision course with Earth.  
\*A) Feasible  
B) Not Feasible
90. We find fossil remains of an early primate that lived about 50 million years ago and was, from all appearances, identical to a modern gorilla.  
A) Feasible  
\*B) Not Feasible

91. Nearly all the rocks found in a lava field of Hawaii are igneous rocks.  
\*A) Feasible  
B) Not Feasible
92. Rocks found in the strata of the Grand Canyon are sedimentary rocks.  
\*A) Feasible  
B) Not Feasible
93. Although the Earth contains its densest material in its core, it's quite likely that terrestrial planets in other star systems would contain their lowest density rock in their cores and their highest density rock in their crusts.  
A) Feasible  
\*B) Not Feasible
94. If you had a time machine that dropped you off on the Earth during the Hadean eon, the first thing that would kill you would probably be getting bonked on the head by a meteor impact.  
A) Feasible  
\*B) Not Feasible
95. We discover a prokaryote that builds proteins using 45 different amino acids.  
A) Feasible  
\*B) Not Feasible
96. We discover a single-celled organism that lives deep in peat bogs, where no oxygen is available.  
\*A) Feasible  
B) Not Feasible
97. If life did exist on one out of every million planets in the galaxy, the galaxy would be teeming with life.  
\*A) Feasible  
B) Not Feasible
98. If the universe didn't contain stars more massive than our Sun, life on Earth would not exist.  
\*A) True  
B) False
99. What did you think about the Bennett textbook  
A) Liked it a lot B) Liked it a little C) Never read it D) Disliked it E) Hated it
100. Would you like GMU to build a planetarium or observatory or both.  
A) A planetarium B) An observatory C) Both