Multiple Choice Review - Origin of Life

1. Where did the heavier elements, present in our solar system, come from?
   a. collisions between the earth and stars
   b. the implosions of old stars
   c. the explosions of early stars
   d. they were produced on earth from precursor molecules

2. Which of the following were present in the early atmosphere of earth?
   I. Water vapor
   II. Carbon dioxide
   III. Nitrogen gas
   IV. Hydrogen gas
   V. Oxygen gas
   VI. Methane
   a. I, II, III
   b. I, II, III, VI
   c. I, II, III, IV
   d. I, II, IV, VI

3. Why is it considered ironic that life emerged on Earth during a time of intense UV radiation?
   a. UV radiation allows cells to reproduce quickly
   b. UV radiation increases the chances for lightning
   c. UV radiation damages cells
   d. UV radiation prevents photosynthesis

4. We know that the kinetic energy of an object can be calculated utilizing the formula KE = 1/2mv^2. Suppose the KE of helium atoms is equal to the KE of iron atoms. Which of these atoms would have the higher velocity?
   a. the iron atoms
   b. the helium atoms
   c. their velocity is the same because their KE is the same
   d. we need more information to answer this question

5. Which of the following statements are considered true statements about the elements listed on the periodic table?
   a. The atoms from all elements are light enough to escape from Earth’s atmosphere.
   b. All atoms found on Earth, were once found within stars
   c. There is an inverse relationship between the mass and velocity of the atoms of a gas.
   d. Both B & C
6. Stars perform fusion to fuel their existence. Which of the following is a balanced fusion reaction?
   a. \( H + e^- \rightarrow He \)
   b. \( He + Na^+ \rightarrow Al^{3+} \)
   c. \( 2He + H \rightarrow C \)
   d. \( He + He + He \rightarrow C \)

7. There are properties associated with water that support life on earth. Which of the following best describes two of these properties?
   a. It takes a great deal of energy to change the state of water; water can dissolve most compounds
   b. It takes the presence of a solute to cause water molecules to form hydrogen bonds; water is adhesive
   c. It takes little energy to change the state of water; water molecules can form ionic bonds with each other
   d. It takes the absence of water for most chemical reactions to occur; water can change temperature quickly allowing for changing conditions

8. Water is ______________. Liquid water occurs because it is able to form __________ bonds between the __________ on one water molecules and the __________ on another.
   a. adhesive; hydrogen, hydrogen, hydrogen
   b. cohesive; hydrogen; hydrogen, oxygen
   c. cohesive; hydrogen; hydrogen, hydrogen
   d. adhesive; nitrogen, hydrogen, nitrogen

9. Why are water molecules considered to be a critical component of the emergence of life on earth?
   a. All organic monomers consist of one water molecule connected to a unique carbon structure.
   b. Water provides the oxygen gas necessary for all life.
   c. All organic molecules are soluble in water.
   d. Chemical reactions between organic molecules require an aqueous environment.

10. Organic monomers can be found within very old meteorites. Currently, millions of kilograms of organic materials fall to Earth as cosmic dust each year. These two pieces of evidence support one theory about the origins of organic monomers on earth. Which of the following statements below, best states this theory?
    a. organic monomers were brought to earth by early alien plants and animals
    b. organic monomers originated from within stars that exploded long ago
    c. organic monomers were brought to earth by meteorites
    d. organic monomers were brought to earth by comets.
11. In the illustration to the right, a water chamber exists, directly over a heat source. What is this chamber representing and what is the process occurring within it?
   a. This chamber represents the atmosphere; inorganic molecules are heated which results in amino acids
   b. This chamber represents volcanic activity; this is where gases are cooled and liquid water is produced
   c. This chamber represents the primeval sea; water vapor is produced which contributes to the atmosphere
   d. This chamber represents the source of oxygen; released into the atmosphere where it catalyzes reactions

12. In Stanley Miller’s experiment, he was attempting to create conditions similar to those found ___________
   a. currently on Earth
   b. on early Earth
   c. inside of exploding stars
   d. inside of volcanoes on early Earth

13. Ultimately, others have developed experiments expanding upon Stanley Miller’s work. In these more recent experiments, which of the following molecules have been produced?
   a. Proteins
   b. Cells
   c. Sugars
   d. All of the above
14. There are considered to be four conditions required for chemical evolution. Which of the lists below best represents these conditions?
   a. oxygen absent - inorganic molecules present - high energy input - adequate time
   b. oxygen present - inorganic molecules - adequate time - hydrogen and helium in atmosphere
   c. oxygen absent - organic polymers present - low UV radiation - adequate time
   d. oxygen present - organic polymers present - ozone present - adequate time

15. Identify the process shown in the illustration below:
   a. combustion
   b. dehydration synthesis
   c. decomposition
   d. hydrolysis

16. What are the reactants in a dehydration synthesis reaction?
   a. Two monomers
   b. Two polymers
   c. A monomer and a water molecule
   d. A polymer and a water molecule

17. One end of a phospholipid molecule forms hydrogen bonds with water. We can describe this end of the molecule as the _____________.
   a. polar hydrophilic end
   b. polar hydrophobic end
   c. non-polar hydrophilic end
   d. non-polar hydrophobic end

18. Synthesis is
   a. the process of splitting apart something larger into smaller pieces
   b. the process of generating new cells
   c. the process of combining negatively charged particles together
   d. the process of combining smaller parts to make a larger product

19. Development refers to:
a. an organism’s increase in size
b. an organism’s ability to adapt quickly
c. an organism’s change from asexual to sexual reproduction
d. an organism’s change through a life cycle

20. Which characteristic refers to the creation of offspring?
   a. Regulation
   b. Order
   c. Development
   d. Reproduction

21. Which characteristic refers to homeostasis?
   a. Adaptation
   b. Response to the environment
   c. Regulation
   d. Reproduction

22. Which characteristic of life does fire lack?
   a. Energy processing
   b. Response to the environment
   c. Order
   d. Reproduction

23. Approximately how long did Earth exist before life formed?
   a. 4.6 billion years
   b. 3.6 billion years
   c. 1 billion years
   d. 2 million years

24. Deep time is a phrase that we use to illustrate the concept that
   a. it has required only a short period of time for life on Earth to develop into the
      diversity we see today
   b. humans have been on Earth for an extremely long time relative to Earth’s
      history
   c. development of life has occurred over an extremely long period of time and is
      accelerating
   d. development of life has occurred over an extremely long period of time and is
      decelerating

25. The wooly mammoth became extinct approximately 10,000 years ago. If a
    human lifetime is approximately 72 years, how many lifetimes ago did the
    mammoth become extinct?
   a. 13.9 human lifetimes
   b. 139 human lifetimes
   c. 720,000 human lifetimes
   d. 72,000 human lifetimes
26. The sequence of events that represent how life may have emerged is shown in which of the following lists?
   a. polymers formed - monomers formed - development of RNA - membrane-bound “sacs” emerged - metabolism and self-replication
   b. polymers formed - monomers formed - membrane-bound “sacs” emerged - metabolism and self-replication - RNA produced
   c. monomers formed - polymers formed - membrane-bound “sacs” emerged - metabolism and self-replication - RNA produced
   d. membrane-bound “sacs” emerged - monomers formed - polymers formed - metabolism and self-replication developed - RNA produced

27. What does the term hydrolysis refer to and how does it relate to the production of organic polymers?
   a. combining molecules with a loss of water; this is how larger molecules such as DNA are created.
   b. splitting molecules apart with the input of water; the most important molecules of life, such as DNA, can be formed from larger molecules.
   c. splitting molecules apart with the input of water; synthesizing molecules relies upon the creation or recycling of molecules or atoms
   d. combining molecules with a loss of water; this is how smaller molecules are created from larger molecules.

Use the table provided below to answer questions 28-30:

<table>
<thead>
<tr>
<th>Event</th>
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<tbody>
<tr>
<td>Formation of Earth</td>
<td>4.6 BYA</td>
<td>Mammals</td>
<td>200 MYA</td>
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<tr>
<td></td>
<td>A.</td>
<td>Birds</td>
<td>150 MYA</td>
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<td>First Prokaryotic Cell</td>
<td>3.5 BYA</td>
<td></td>
<td>D.</td>
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<td>Photosynthesis (in Cyanobacteria)</td>
<td>3.0 BYA</td>
<td>Dinosaurs Extinction</td>
<td>65 MYA</td>
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<td>First Eukaryotic Cell (single celled)</td>
<td>2.0 BYA</td>
<td>First Hominids (Genus Homo)</td>
<td>2.5 MYA</td>
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<td>First Eukaryote (multi-cellular)</td>
<td>1.0 BYA</td>
<td>First <em>Homo habilis</em> (species of hominid that made the first stone tools)</td>
<td>2.4 MYA</td>
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<td>B.</td>
<td>First <em>Homo neanderthalensis</em></td>
<td>350,000 YA</td>
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<td>Simple Animals in Oceans</td>
<td>600 MYA</td>
<td>First Early Humans (<em>Homo sapiens</em>)</td>
<td>100,000 YA</td>
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<tr>
<td>Fish</td>
<td>500 MYA</td>
<td>Extinction of <em>Homo neanderthalensis</em></td>
<td>30,000 YA</td>
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</table>
First Vertebrate appears (fish) | 480 MYA | Extinction of Wooly Mammoth | 10,000 YA
--- | --- | --- | ---
C. | 360 MYA | Extinction of America Mastodon | 6,000 YA
Reptiles | 320 MYA | The Fall of the Roman Empire | 1,500 YA

28. LUCA existed during the time period marked
   A.    B.    C.    D.

29. The first multicellular eukaryotic cells occurred approximately ________ years after the earth was formed.
   a. 3.6 billion
   b. 1.0 billion
   c. 2.6 billion
   d. 2.6 million

30. Approximately how long after the first vertebrates evolved, did *Homo sapiens* develop?
   a. 479.9 my
   b. 479 my
   c. 470 my
   d. 380 my

31. Which of the following best describes membranes?
   a. membranes are always a bilayer; they do not allow any materials into or out of the internal environment
   b. membranes may be a bilayer or a single layer; they regulate which materials move into or out of the internal environment
   c. membranes are always a single layer; they do not play any role in regulating what enters or leaves the internal environment
   d. membranes are composed of nucleic acids; they play a major role in asexual reproduction

32. Which of the following correctly identifies a role played by RNA in early life, and the molecule that currently functions in that role?
   a. replication; ATP now functions primarily in this role
   b. metabolization; proteins now function primarily in this role
   c. metabolization; ATP now functions primarily in this role
   d. catalyzation; RNA continues to function primarily in this role

33. Molecular biology, the study of the molecules of life, is a major topic of the study of life. Why is molecular biology such a critical portion of our studies?
   a. Similarities in molecular biology provide evidence to support a single common ancestor.
   b. Molecular biology is the chemical basis unique to each life form on Earth.
c. Molecular biology is a newer study of biology and therefore is more interesting to scientists.
d. Molecular biology is focused on how life emerged on Earth.

34. Why do we utilize specific properties of life to help us determine if something should be considered living?
   a. the organism could be dead; the list of properties help us decide if that individual organism is alive or not
   b. we don’t need to utilize these properties, we can tell my look and by feel if something is living or not
   c. specific properties help us to identify whether or not something is representative of a living organism whether or not the individual organism is currently alive
   d. specific properties of life change depending on whether we are investigating plants or animals, as they do not share these properties of life.

35. Protobionts became more and more complex eventually producing molecules of RNA, DNA and associated enzymes. As a result, protobionts led directly to ________.
   a. Liposomes
   b. Micelles
   c. LUCA
   d. plant cells

36. Cells are part of the characteristic of "order". They are considered the ________.
   a. building blocks of life
   b. building blocks of animal life
   c. smallest unit of molecules
   d. requirement for reproduction

37. Which example below best reflects the characteristic of homeostasis?
   a. a plant growing to fill a container
   b. a single cell regulating what enters through the membrane
   c. a person sleeping to ensure a healthy day when they awaken
   d. a person moving their hand quickly away from a fire source

38. Which of the choices below correctly shows the sequence of development leading to mammals?
   a. fish - eukaryotic cells - dinosaurs – mammals
   b. reptiles - amphibians - fish – LUCA
   c. dinosaurs - primates - mammals – humans
   d. fish - amphibians - reptiles - mammals

39. Water molecules form ___________ bonds with other water molecules. This type of bonding occurs between the ________atoms and ___ atoms of water molecules.
a. hydrogen; hydrogen; hydrogen  
b. helium; helium; hydrogen  
c. oxygen; oxygen; hydrogen  
d. hydrogen; hydrogen; oxygen

40. We study the origin of life on Earth as a way to better understand  
a. the molecular biology of life both prior and present  
b. how life currently on Earth may change as evolution continues  
c. how we can distinguish living organisms from non-living objects  
d. all of the above
## Answers

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