Part I.
In the following numbered questions, select from possible answers given by the letters. Fill in the blanks in the questions below with the letter representing the correct response. Not all answers are necessarily used, AND some answers might be used more than once. (2 points for each each blank, for a total of 40 points)

a Alfred Russell Wallace  
b allopatric  
c amino acids  
d Archaea  
e autapomorphy  
f Bacteria  
g carbohydrates and proteins  
h Carl Woese  
i Charles Darwin  
j convergent  
k D- and L-amino acids  
l parapatric  
m deoxyribo  
a Alfred Russell Wallace  
b allopatric  
c amino acids  
d Archaea  
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1. ___a__, a school teacher and collector, was obscured by ___i________, a wealthy landowner of independent means, after their back to back presentations of the mechanism of evolution by natural selection.

2. In the 1800s ___a____ studied evolution on islands and emphasized the role of geographic isolation in the process of speciation.

3. Indirect evidence for the fact of evolution on Earth is recorded in ___p_________ deposits and in ___z__________ organs of animals.

4. Evidence of evolution by natural selection, or change over time in the mean of a variable phenotypic trait within a population has been documented by direct observation of living populations. An excellent example of this over the last 30 years is the work on the Galapagos finches by _______ s_______

5. ___t______ indicate the pattern of the history of life, and with the appropriate data they can provide evidence of life’s genealogy.

6. Both morphology and DNA reflect past events and historical relationship through the study of ___q___ characters.
7. When a parent population becomes subdivided into two populations due to separation by a geographic barrier, this can lead to speciation known as ________b__________ speciation.

8. A new species may form by ______r__________ speciation when a colonist or small founder group leaves the parent population and remains separated for long enough to become reproductively isolated.

9. As a graduate student, Stanley Miller discovered that he could create ___c________in the laboratory.

10. If ribozymes were the first self-replicating molecules, then _____w_______ nucleic acid preceded ___m_______ nucleic acid as the important molecule in the earliest stages of the origin of life.

11. One of the big questions in evolutionary biology is: Is there life beyond our own Earth? The presence of equal ratios of ___k_________ in meteorites found in Australia and elsewhere is presented as evidence in support of the argument that life exists beyond Earth.

12. Using 18S (small-subunit) rRNA, ______h_____________ and several close colleagues hypothesized the revolutionary view that the Archaea are most closely related to the _____o______

13. If you consider no flight to be the ancestral (plesiomorphic) state for the whole group below, the character state flight would then be a ______x____________ for the whole group

14. If you restrict the group to include only penguins, pigeons and robins, the character state flight becomes a _____u________ for that group of three. (3 points).

15. Similarities between A and B or between C and D are considered to be ______q__________.

16. Similarity between A and C would be _____j____________ similarity.
Part II. Use bubble form to record your answers (a-e) for each question in this part of the exam. Each question is worth 2 points for a total of 35 points in this section. Some questions have 2 blanks, and are worth 4 points. Question 6 (with 3 blanks is worth 5 points).

1. The earth is estimated to have formed about 4.5 billion years ago. Approximately how many years after this before the first living organisms began to appear?
   a) 3.9 billion yrs
   b) 1 billion yrs
   c) 10 million yrs
   d) 500,000 yrs
   e) 10,000 yrs

2. The oldest fossil organisms are thought to be photosynthesizing ______________.
   a) purple bacteria
   b) mitochondria
   c) trilobites
   d) cyanobacteria
   e) ribozymes

3. In cladogram A below, the circled group is a ______________ group.
   a) polyphyletic
   b) paraphyletic
   c) parapatric
   d) polytomy
   e) monophyletic

   [Diagram A]

4. In cladogram B above, the circled group is a ______________ group.
   a) polyphyletic
   b) paraphyletic
   c) parapatric
   d) polytomy
   e) monophyletic

   [Diagram B]

5. In cladogram C above, the circled group is a ______________ group.
   a) polyphyletic
   b) paraphyletic
   c) parapatric
   d) polytomy
   e) polynomial

   [Diagram C]
6. Based on your experience in analyzing phylogenetic data, for the tree below you would most likely conclude that the data contained strong phylogenetic signal and gave good support for groups ____c__________ and ______e__________. Poor support is evident for group _____d________.
   a) F(D+C)
   b) (C+D)
   c) (A+B)
   d) D((C)(A+B))
   e) C(A+B)

7. Your text points to the fact that some of the best studies of speciation in the wild have made use of ____________________ as their laboratories.
   a) hot springs
   b) islands
   c) bogs
   d) ocean currents
   e) black lights

8. Life had an origin on Earth. For life to have taken hold, _________________ molecules would have been the first crucial step.
   a) lipid
   b) photosynthesizing
   c) heat shock
   d) self replicating
   e) glycerol

9. To determine whether a trait is an adaptation requires experimental testing. An excellent set of experiments was designed to test whether the wing-waving behavior and wing markings of the tephritid fruit fly (Zonosemata) are adaptations to avoid predation. After several experimental treatments (each designed to test one hypothesis) the conclusion was that these traits were
   a) adaptations for courtship
   b) adaptations to scare off other flies
   c) adaptations to scare off (by mimicry) their major predators, the jumping spider
   d) evolved by sexual selection
   e) were irrelevant to the survival and reproduction of the fly

10. The paradox in the earliest stages of the origin of life is that ______e__________ molecules are poor replicators and that _____c__________ molecules are poor at being enzymes.
    a) small
    b) 3-dimensional
    c) DNA
    d) RNA
    e) protein
11. In the theory of the RNA World, ribozymes are thought to have been both self-_________________.
   a) compatible and inert
   b) protective and aggressive
   c) catalytic and replicating
   d) predacious and defeating
   e) resistant and immune

12. Based on the criterion of maximum parsimony, what character state of the recruitment dance (zig-zag or waggle) likely existed in the common ancestor of these different groups of bees at the root of tree A? [Note: the roundish squiggly pattern represents “zig-zag dance”; the egg-shaped pattern represents “waggle dance”].
   a) zig-zag dance  
   b) waggle dance  
   c) both equally likely

13. What ancestral character state of the dance likely existed at the root of tree B?
   a) zig-zag dance  
   b) waggle dance  
   c) both equally likely

14. Females are known to have preferences for some males over others? The question is how do such preferences evolve? An elegant study of stalk-eyed flies leads to the conclusions that
   a) runaway selection is responsible for female preference of flies with longer eyestalks.
   b) choosy females receive direct benefits from flies with longer eyestalks.
   c) choosy females get better genes from flies with longer eyestalks.
   d) a female can increase her chances of producing many sons if she chooses a long eyestalk male
   e) a, c and d

15. A trait that is used by chance in a new or novel way and is then elaborated by natural selection to become a different structure with a completely new function (e.g., the Panda’s thumb) is called an
   a) artificial selection
   b) adaptation
   c) preadaptation
   d) evolutionary constraint
   e) plesiomorphy