
Multiple guess. Circle the letter of the best answer. [4 points each, 40 pts total]

1. The two hosts most responsible for the spread of West Nile virus to most of the states in the U.S. were _______ and _______. [TB Concept 1.1, p. 8]
   a. mosquitoes; frogs
   b. mosquitoes; rats
   c. birds; rats
   d. mosquitoes; birds
   e. rats; frogs

2. Labord’s chameleons (shown) complete their life cycle in one year. Cole’s paradox suggests
   a. natural selection should lead to iteroparous mutants replacing these chameleons.
   b. natural selection should lead to semelparous mutants replacing these chameleons.
   c. that these chameleons are to be expected by natural selection.
   d. that these chameleons are not inconsistent with natural selection.
   e. none of the above!

3. Seasonality on a planet like Earth (that already sustains life) depends on which of the following (circle all that are necessary)
   a. Tilt of the rotational axis.
   b. A moon.
   c. Rotation ≠ one prograde rotation per year.
   d. all of the above.
   e. none of the above.

4. The process of plate tectonics is driven primarily by
   a. the rotation of the Earth
   b. the revolution of the Earth
   c. the effect of the moon on Earth, including tides and ocean currents
   d. convection of heat from the Earth’s core
   e. none of the above.

5. During the summer, temperatures and plankton activity in lakes are highest at the _______. This is also the period of _______ lake stratification. [TB: Concept 2.5, p. 39]
   a. epilimnion; highest
   b. epilimnion; lowest
   c. thermocline; highest
   d. thermocline; lowest
   e. hypolimnion; highest

6. Whittaker and Niering (1975) studied the dramatic changes in plant communities as they went from low to high elevations near Tucson AZ. Note that these patterns occur on most mountain ranges. They attributed the vegetational changes to the following environmental variables (as they went up this elevational gradient):
   a. water availability increased and temperature increased
   b. water availability increased and temperature decreased
   c. water availability decreased and temperature increased
   d. water availability decreased and temperature decreased
   e. none of the above.
7. Which of the following organisms regulates its body temperature? [TB: Concept 4.2, p. 92]
   a. Lizard
   b. Mouse
   c. Tuna
   d. All of the above
   e. Only b and c

8. Which of the following is not a heterotroph? [TB: Concept 5.1, p. 108]
   a. Fungi feeding on soil detritus
   b. Bacteria consuming dissolved organic compounds
   c. Parasitic protozoa living in the gut of a pig
   d. Chemosynthetic archaea synthesizing carbohydrates
   e. Deer grazing on grass

9. In which of the following pathways are carbon dioxide uptake and the Calvin cycle separated in time, allowing stomates to be open at night? [TB: Concept 5.3, p. 117]
   a. C₃ photosynthetic pathway
   b. C₄ photosynthetic pathway
   c. CAM pathway
   d. Both a and b
   e. None of the above

10. The triangle to the right suggests that plants [TB: fig. 7.12]
    a. prefer either competitive, disturbed, or stressful environments.
    b. are adapted evolutionarily to competitive, disturbed, or stressful environments.
    c. evolve strategies that allow each species to compete well in all environments.
    d. all of the above.
    e. none of the above.
Short answers. **Answer SIX** questions only. Circle the numbers of those you want me to assess. Please constrain the length of your answer to the space provided (5 pts ea., 30 pts total)

1. In the space provided draw the difference between isometric growth and allometric growth for humans. Indicate what happens with the human head in your diagram. Label the axes!

2. Carefully define “ecology”:

3. A theory is a “comprehensive explanation of natural phenomena supported by extensive evidence gathered through observations and/or experiments.” Provide two examples, preferably from lecture, of “current theories” supported by evidences and two examples of “past theories” that are no longer supported by evidence. Be sure to provide enough info for me to understand.

   Current theory #1:

   Current theory #2:

   Past theory #1:

   Past theory #2:

4. Using the example of wheat (from your reading Science, Evolution, and Creationism) explain the difference between natural and artificial selection.
5. Use the circular diagram to the right of an idealized Earth for the following two requests. [TB: fig 2.9]
   
a. Inside the circle draw the directions of the winds on the surface of the Earth.

   b. On the outside of the circle draw in the directions of rising and falling air masses around the Earth.

6. Draw the relationship between metabolic rate and body temperature for endothermic organisms. Label the regions of the graph. [TB: fig 4.16]

7. Draw the marginal value theorem for an animal foraging in many patches. Discuss (and show on your graph) when an animal should switch patches. [TB: fig 5.22]
8. The graph shows data that are consistent with two characteristics that are imperative for evolution to occur by means of natural selection. Label the axes carefully and provide these two characteristics by indicating how they are apparent in the data.

9. Provide three attributes each for r- and K-selected species. Provide two examples of each. [TB: p 162]

<table>
<thead>
<tr>
<th>Attributes</th>
<th>r-selected</th>
<th>K-selected</th>
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<tbody>
<tr>
<td>1.</td>
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<td>2.</td>
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<td>3.</td>
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</table>

Example #1

Example #2

10. Provide a graph of seagull data portraying the percent of chicks fledged as function of the number of eggs laid (on the left). We discussed why this is a bad representation of these data that are so important to fitness and, ultimately, evolution. What’s the problem with this graph from your text (why it’s a bad graph!)? Provide a better graph on the right. Label your axes clearly. [TB: fig 7.14]
Mandatory Questions. Answer All. (10 pts ea., 30 pts)

1. Describe the four easily observed characteristics of natural selection? (2.5 pts per char.)
   a. 
   b. 
   c. 
   d. 

2. Draw the relationship between population growth rate and an environmental factor. Label axes and the different “zones” on the graph (6 pts). In a second graph draw this relationship for a real example from the Arboretum with properly labeled axes. (4 pts)
3. Biomes are strongly dependent on precipitation and average temperature. Provide the biomes in the figure. Identify where you are right now and where you’d find a gorilla and a polar bear. [TB: fig 3.4]

Extra Credit (1 pt each)

1. What percent of children 1.5 – 3 yrs old get some kind of vaccination in US?

2. What’s the exact term for when unvaccinated individuals benefit when most the other individuals in a population are vaccinated?

3. Hurricanes are unpredictable because they are chaotic. What’s the defining characteristic of systems that are technically “chaotic”? Hint: We say such systems exhibit ___________________ ____________________________.

4. Besides general attractiveness, what’s the difference between hairy and hairless dogs?

5. Each Hartvigsen lecture begins with what question? ______________________________

6. According to lecture, biology is a subdiscipline of what field? ______________________