True or False (write ‘true’ or ‘false’; 10 points total; 1 point each)

1. _______ The troposphere is closer to the earth than the stratosphere.

2. _______ Near Fort Huachuca, Arizona, areas with denser stands of Lehman Lovegrass have higher species richness.

3. _______ The Fringe-toed Lizard of southwestern Arizona is so-named because of an adaptive feature that improves its ability to climb trees while escaping predators.

4. _______ Plants meet most of their nitrogen needs by extracting N\textsubscript{2} from the air.

5. _______ About 95\% of the global increase in human population expected to occur in the next 30 years will take place in developing countries.

6. _______ Hawaii contains about 4\% of the species listed on the U.S. endangered species list.

7. _______ Most populations follow exponential growth curves as resources become limiting.

8. _______ All organic compounds contain carbon.

9. _______ Genetic mutation is the ultimate source of all biological variation.

10. _______ In the biosphere, matter is recycled but there is a one-way flow of energy.
Multiple Choice (questions have only one correct answer; 12 points total; 2 points each)

1. Current human population is closest to
   a) 3.2 billion,  b) 4.2 billion,  c) 5.2 billion,  d) 6.2 billion,  e) 7.2 billion.

2. Citizens of developed countries use what percentage of the world's natural resources?
   a) 8%,  b) 28%,  c) 48%,  d) 68%,  e) 88%

3. Which of these is considered a perpetual resource?
   a) solar energy,  b) forest trees,  c) freshwater,  d) natural gas  e) oil

4. On average, what percent of the useful energy in organisms at one trophic level is passed on to the next, higher trophic level?
   a) 4%,  b) 10%,  c) 16%,  d) 18%,  e) 22%

5. The reading by Aldo Leopold, 'Thinking Like a Mountain', best illustrates the importance of
   a) a keystone species  
   b) a bioindicator  
   c) economic development  
   d) biodiversity

6. If the initial population is 4 billion and growing at a rate of 1.2% annually \( (k = 0.012) \), the population resulting from exponential growth over 20 years is closest to: (show work for potential partial credit)
   a) 5 billion,  b) 6 billion,  c) 7 billion,  d) 8 billion,  e) 9 billion
Fill in the Blank (2 points per blank; 26 points total)

1. CO₂ + H₂O + _____________________ energy → C₆H₁₂O₆ + ________________
   in a process known as ________________________________.

2. Life first evolved on this planet about 3.5 ______________ years ago.

3. For a trait to evolve as the result of natural selection the trait must be ______________, it must be
   __________________, and it must differentially affect ________________________.

4. The ozone layer absorbs much of the harmful ______________________________ radiation that the
   sun sends toward the earth every day.

5. A ______________________ species (e.g., cockroach and coyote) has a broad niche while a
   ______________________ species (e.g., giant panda) has a narrow niche.

6. Net Primary Productivity is the rate at which ______________________ is converted to biomass, minus
   the rate at which biomass is consumed via the process of ____________________.

7. The boojum is a close relative (same Genus) of the native ________________________.
Really Short Answer (not more than a sentence; 32 points total; 4 points each)

1. From the video clip we watched with Alan Alda, what happens to the beaks of finches in the Galapagos as the weather changes from drought to above-average rainfall?

2. Do humans tend to make lakes more eutrophic or more oligotrophic? How?

3. Provide an example of a mutualistic species interaction discussed in class.

4. What are two major contributors to an individual's ecological footprint?

5. Define fitness in the sense used by evolutionary biologists.

6. What is the approximate doubling time for a population whose growth rate is 2%.

7. Define the 2nd Law of Thermodynamics.

8. List two ways that Kates (Population and consumption: what we know, what we need to know, 2000) proposes reducing the human population growth rate?
Short Answer (Choose 6 of the following 8 questions: a.k.a. you get to skip two; 45 points total; 7.5 points each; a few sentences may be required for an adequate answer)

1. Discuss the effects for local biodiversity of either a) over-pumping of groundwater in the Tucson basin, or b) urban sprawl in the Tucson basin.

2. How does our use of fossil fuels alter the natural carbon cycle?

3. Why does the Hawaiian Silversword Foundation pollinate individual silversword plants with pollen from as many other individuals as they feasibly can?

4. Thoreau wrote, "In wildness is the salvation of the world." How might this apply to the concept of biodiversity?
5. How could you argue that the price of gasoline is currently too low in this country?

6. Use the axes below to represent different relative levels of average precipitation and average temperature across the globe. Place in the graph space the letters representing the following biomes in their appropriate relative position: **Rainforest**, **Desert**, **Tundra**, **Grassland**, **Coniferous forest**.

7. Using the IPAT model, discuss differences between developed and developing countries.

8. Distinguish between the terms ecology and ecosystem.

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**A rare Extra Credit opportunity:**
Read the Dr. Seuss book *The Lorax*, referred to by Dr. Rob Robichaux in his lecture. If, by 9am Wednesday of next week, you turn in a typed, one page summary and interpretive essay you may receive up to 5 points toward your Exam I grade.