

Module I

1.1 Question: Classify the following organisms as herbivores, carnivores, or omnivores:

a. tigers

1.2 Question: Classify the following organisms as producers, consumers, or decomposers:

a. rose bushes

1.3 Question: A biologist studies an organism and then two of its offspring. They are all identical in every possible way. Do these organisms reproduce sexually or asexually?

1.4 Question: When trying to convince you of something, people will often insert “Science has proven...” at the beginning of a statement. Can science actually prove something? Why or why not?

1.5 Question: A scientist makes a few observations and develops an explanation for the observations that she has made. At this point, is the explanation a hypothesis, theory, or scientific fact?

1.6 Question: Suppose you chose two organisms at random out of a list of the members of kingdom Plantae, then you chose two organisms at random out of a list of the members of family Pinaceae. In which case would you expect the two organisms to be the most similar?

1.7 Question: You compare several organisms from different orders within a given class. You then compare organisms from different classes. In which case would you expect the differences to be greatest?

1.8 Question: An organism is made up of one eukaryotic cell. To what kingdom does it belong?

1.9 Question: An organism is multicellular and an autotroph. To what kingdom does it belong?

1.10 Question: An organism is multicellular with eukaryotic cells. It is also a decomposer. To what kingdom does it belong?

1.11 Question: Two different species of bacteria attempt to infect an organism. One bacterium succeeds, while the other is destroyed by the organism's infection-fighting mechanisms.

Module 2

2.1 Question: Two different species of bacteria attempt to infect an organism. One bacterium succeeds, while the other is destroyed by the organism's infection-fighting mechanisms. What is most likely the major difference between these two bacteria?

2.2 Question: A bacterium is poisoned by a substance that is allowed into the interior of the cell. What bacterial component did not do its job?

2.3 Question: If a bacterium cannot move, what structure is it missing?

2.4 Question: Can saprophytic bacteria be autotrophic?

2.5 Question: Can an aerobic bacterium be chemosynthetic?

2.6 Question: A population of bacteria grown from a single “starter” bacterium is rather fragile. When conditions are changed, the population dies quickly. Based on what you have just learned, develop a hypothesis for why this is the case.

2.7 Question: A population of bacteria reaches a steady state and then, after several days, the population actually increases dramatically. What could cause such an event?

2.8 Question: A population of bacteria is living in a lake. Due to volcanic activity nearby, the lake's temperature begins to increase. In the population, there are some bacteria that are resistant to low temperatures (call them type A) and another type that are resistant to high temperature (call them type B). Which type will be the donor and which the recipient as the population begins to conjugate?

2.9 Question: A bacterial colony is called staphylobacillus. What shape do the bacteria in the colony possess: spherical, rod-shaped, or helical?

2.10 Question: A bacterium has no cell wall. To what phylum does it belong?

2.11 Question: A bacterium is classified as Gram-positive. To what phylum does it belong?.

2.12 Question: A bacterium appears red after a Gram stain. To what phylum does it belong?

2.13 Question: A bacterium has a cell wall that is different from both Gram-positive and Gram-negative bacteria. To what phylum does it belong?

2.14 Question: Construct a biological key that separates bacteria into their different classes. You can assume that the only organisms the key will be used to analyze are bacteria. (HINT: The first question should determine whether or not the bacterium has a cell wall.)

Module 3

3.1 Question: Construct a biological key for separation of organisms in kingdom Protista into phyla. You can assume that any organism for which you use the key is already known to be in kingdom Protista. You can also assume that if an organism is completely autotrophic it belongs in subkingdom Algae, but if it is at all heterotrophic it belongs in subkingdom Protozoa. With those assumptions, you should be able to use the characteristics in Figure 3.1 to construct the questions for the key.

3.2 Question: Suppose you were observing an amoeba under the microscope and it suddenly exploded. What organelle was probably not working properly in the amoeba?

3.3 Question: A biologist is studying an amoeba and sees a vacuole with several small solid objects in it. Most likely, what kind of vacuole is it?

3.4 Question: A euglena is in dim light. There is a bright spot of light not too far away, but the euglena does not move towards it. Instead, it seems to wander aimlessly. What organelle is not functioning properly in the euglena?

3.5 Question: According to most biologists, an organism must always perform photosynthesis or chemosynthesis to be considered autotrophic. Why do these biologists say that the euglena is not autotrophic?

3.6 Question: In a later section of this module, you will learn about members of genus *Plasmodium*, which can live in people. These microorganisms get food and shelter from the people they inhabit, but they cause malaria, which can be deadly. Is this an example of symbiosis? If so, what kind?

3.7 Question: A paramecium cannot conjugate. What organelle is not functioning properly?

3.8 Question: A biologist studies a group of bacteria (all one species) and a group of paramecia (all one species). She notices that while the bacteria all seem to be almost exact duplicates of each other, there is a great deal of variation among the paramecia. Why?

3.9 Question: What is the difference between cysts (such as those formed by amoebae and ciliates) and spores?

3.10 Question: One way that people fight the spread of malaria is to significantly reduce the population of mosquitoes in their vicinity. Why does this work?

3.11 Question: If an organism is in phylum Chlorophyta, it must have a chloroplast. Why?

3.12 Question: Of the three genera of green algae discussed above, which would you consider the most complex?

3.13 Question: You might say that diatoms are the most important form of algae in creation. Why?

3.14 Question: Suppose you could analyze a water sample for the presence of any chemical. If you were given two samples, one that contained members of phylum *Chlorophyta* and another that contained members of phylum *Chrysophyta*, how could you determine which was which?

3.15 Question: In the book of Exodus (chapter 7), God caused several plagues to befall Egypt. In the first plague, all of the rivers turned to blood, the fish died, and the Egyptians could not drink from the rivers. Some have said that algae offer a natural explanation for this miracle. What algae are they referring to and why do they think this? Why is this not a good explanation? to look for naturalistic explanations for clearly supernatural events!

3.16 Question: A biologist has a sample of what looks to be a marine plant. He thinks, however, that it might be an unknown species of brown algae. To test this, he takes part of the “plant,” dries it, crushes it into a powder, and mixes it with a solution. The solution thickens. Is this evidence that the organism is a plant or an alga? Why?

Module 4

4.1 Question: An organism eats food and then digests it. Does this organism belong to kingdom Fungi? Why or why not?

4.2 Question: A farmer tries to remove a patch of mushrooms from his field by pulling all of the stalks and caps in the patch out of the ground. Why has the farmer really not gotten rid of the fungus?

4.3 Question: A fungus produces haustoria (plural of haustorium). Is it saprophytic or parasitic?

4.4 Question: What job does the fruiting body of a fungus perform?

4.5 Question: Spores of a fungus give rise to offspring that are identical in every way to the parent. Were the spores formed asexually or sexually?

4.6 Question: Construct a biological key that separates organisms into the phyla of kingdom Fungi. For this key, you can assume you already know that any organism you have is a part of kingdom Fungi. Thus, you just need to use the characteristics in Table 4.1 to construct the questions that will separate the organisms into the proper phyla.

4.7 Question: A mushroom is in its button stage. Has it released its spores yet?

4.8 Question: One major characteristic that separates the members of phylum Basidiomycota into different subgroups is the structure in which the fungi form their basidia. Where are the basidia formed in mushrooms? What about in puffballs? Where are they formed in shelf fungi?

4.9 Question: A single-celled organism asexually reproduces by duplicating its nucleus, causing a bulge to form in its plasma membrane, transferring the copied nucleus and some cytoplasm to the bulge, and then separating the bulge into a small cell. The small cell grows to the size of the parent in a day or so. How does this compare to the budding that takes place in yeasts?

4.10 Question: Bread rises because of the fermentation process. Since this process produces both alcohol and carbon dioxide, why don't you get drunk when you eat bread?

4.11 Question: A bread mold forms a stolon for reproduction. Is it reproducing sexually or asexually?

4.12 Question: A fungus forms a fruiting body. Is it likely to be a bread mold?

4.13 Question: A biology teacher once said, "The only thing imperfect about the imperfect fungi is our knowledge of them." What does the biology teacher mean?

4.14 Question: In medical journals these days, there is a lot of concern about the overuse of antibiotics. Doctors think that since antibiotics are so effective, they are prescribed far too often for patients. Why are doctors worried about overuse of antibiotics?

4.15 Question: A biologist observes a slime mold only during its feeding stage. In what kingdom will the biologist most likely classify it?

4.16 Question: Suppose a biologist were to separate the fungus spores from the alga spores in a soredium. Could the fungal spores develop into a free-living fungus? Could the spores from the alga develop into a free-living alga?

4.17 Question: There are some scientists who have studied the effect of air pollution on fungi. They conclude that air pollution destroys fungi at a much higher rate than it destroys other organisms. These same scientists say that if air pollution kills too many fungi, trees and other plants will begin to die as well. Why?

Module 5

5.1 Question: The Bohr model of the atom is sometimes called the “planetary model” of the atom. Why?

5.2 Question: What determines all of an atom's properties? What determines the vast majority of an atom's properties?

5.3 Question: An atom has 13 electrons. How many protons does it have?

5.4 Question: Two atoms have slightly different properties, but they belong to the same element. What is different about them: their numbers of protons, neutrons, or electrons?

5.5 Question: The element carbon is composed of all atoms that have 6 protons. One of the atoms in the element carbon is carbon-13. How many protons, neutrons, and electrons are in a carbon-13 atom?

5.6 Question: Identify the following as either an atom, element, or molecule: a. NH_3

5.7 Question: Identify the following as either an atom, element, or molecule: b. P

5.8 Question: Identify the following as either an atom, element, or molecule: c. carbon-14

5.9 Question: Identify the following as either an atom, element, or molecule: d. S

5.10 Question: Identify the following as either an atom, element, or molecule: e. P_4

5.11 Question: A student is told to study the chemicals nitrogen monoxide (NO) and nitrogen dioxide (NO_2) and determine their differences. The student reports back that there are no differences between the molecules because they are made up of the same elements. Is the student right or wrong? Why?

5.12 Question: Name each element and the number of atoms of that element in one molecule of acetic acid ($\text{C}_2\text{H}_4\text{O}_2$), which is the active ingredient of vinegar.

5.13 Question: Identify the following changes as chemical or physical: a. putting milk on cereal

5.14 Question: Identify the following changes as chemical or physical: b. baking bread

5.15 Question: Identify the following changes as chemical or physical: c. boiling saltwater

5.16 Question: A semi permeable membrane is placed in a beaker. Equal amounts of salt water solution are placed on each side of the membrane, but the solution on one side is twice as concentrated with salt as is the solution on the other side. After one hour, the water level of the solution on the right increases, and the water level of the solution on the left decreases. Which solution (the one on the left or the one on the right) started out with the higher salt concentration?

5.17 Question: One of the main chemical reactions used to run an automobile engine is the combustion of octane (C_8H_{18}): $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

a. Write the chemical formulas of the reactants in this equation.

5.18 Question: One of the main chemical reactions used to run an automobile engine is the combustion of octane (C_8H_{18}): $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

b. Write the chemical formulas of the products in this equation.

5.19 Question: One of the main chemical reactions used to run an automobile engine is the combustion of octane (C_8H_{18}): $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

c. How many molecules of C_8H_{18} are used in the reaction?

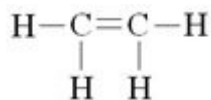
5.20 Question: One of the main chemical reactions used to run an automobile engine is the combustion of octane (C_8H_{18}): $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

d. How many molecules of H_2O are made in the reaction?

5.21 Question: A plant loses all of its chlorophyll. Will it be able to produce any glucose at all?

5.22 Question: A chemist is trying to speed up a chemical reaction. If the chemist does not have a catalyst, what other means can be used?

5.23 Question: What is the chemical formula of the molecule with the following structural formula?



5.24 Question: A chemist takes a polysaccharide and turns it into many disaccharides. Has the chemist used dehydration or hydrolysis?

5.25 Question: A chemist measures the pH of several solutions. The results are: Solution A: 8.1, Solution B: 1.1, Solution C: 5.5, Solution D: 13.2. Which solution is the most alkaline?

5.26 Question: A chemist measures the pH of several solutions. The results are: Solution A: 8.1, Solution B: 1.1, Solution C: 5.5, Solution D: 13.2. Which solution is the most acidic?

5.27 Question: If plenty of glycerol is available, how many fat molecules can be made from 15 fatty acid molecules?

5.28 Question: Since dehydration reactions link amino acids in order to form proteins, you can probably guess that hydrolysis reactions break them down. Why don't proteins quickly break down into their amino acids when they are mixed with water?

5.29 Question: Suppose you have just one strand of a portion of DNA. This strand has the following order of nucleotide bases: adenine, cytosine, thymine, guanine
If you could find the other strand of DNA that connects to this one to form the double helix, what would the order of nucleotide bases be?

Module 6

6.1 Question: A cell makes proteins in an organelle that is near the center of the cell. It then transports the proteins to the edge of the cell and sends them into the surroundings to be used by other cells. What three of the basic life functions are employed to accomplish this series of tasks?

6.2 Question: A cell takes in a polysaccharide and sends it to an organelle to be digested. The digestion products are then used to produce energy. The soluble waste products are eliminated. What five of the basic life functions are performed in this procedure?

6.3 Question: In the first section of this module, we discussed the 11 main functions of life that a cell has to perform (absorption, digestion, respiration, biosynthesis, excretion, egestion, secretion, movement, irritability, homeostasis, and reproduction). Take the items listed in Figure 6.1 (with the exception of the nucleolus and the chromatin) and indicate which of the 11 functions the organelle helps the cell to perform. For example, you would list respiration for the mitochondrion, because it breaks down molecules with a release of energy. Some organelles might participate in more than one of the 11 basic life functions, so be sure to list multiple functions when appropriate. Please note that you will need to spend some serious time reviewing what you have read in order to answer this question. That's the purpose of the question. Please take it seriously and work hard, as you will need this kind of review to be able to assimilate all of the information you were given so far.

6.4 Question: As we mentioned in Module #5, lactose-intolerant people cannot digest the disaccharide lactose due to the lack of an enzyme. Which organelle in the cells of a lactose-intolerant person does not have what it needs to get its job done?

6.5 Question: List the organelles that are commonly found in plant cells but not in animal cells. List those organelles commonly found in animal cells that are not found in plant cells.

6.6 Question: Even though ribosomes are considered organelles, they exist in both prokaryotic and eukaryotic cells. A student claims that this contradicts the definition of a prokaryotic cell, because he says that a prokaryotic cell cannot have organelles. Why is the student wrong?

6.7 Question: If the plasma membrane were made out of regular lipids (not phospholipids) it could never self-reassemble. Why?

6.8 Question: A scientist observes a cell and watches as it explodes. Was the cell in an isotonic, hypertonic, or hypotonic solution?.

6.9 Question: A cell's mitochondria cease to function, and the cell has no more energy. Will all transport across the plasma membrane stop? Why or why not?

6.10 Question: Make a table that describes what you have learned so far. The table should have one row for each stage of aerobic cellular respiration, and it should have four columns. In the first column, indicate the name of the stage. In the second column, indicate what is used during that stage. In the third column, indicate what is produced. In the fourth column, indicate where the stage happens. Finally, make a list at the bottom that details what is used and made after all four stages are complete.

6.11 Question: What stages in the process of aerobic respiration make it an aerobic process?

6.12 Question: Despite the fact that a cell has all of the enzymes necessary for cellular respiration, plenty of glucose, functioning mitochondria, and a plentiful supply of oxygen, it cannot produce energy that is useable by the cell. What is it missing?

6.13 Question: How many glucose molecules would have to undergo respiration in anaerobic conditions in order to produce the same amount of energy that 1 glucose molecule produces in aerobic conditions?

6.14 Question: After a hard workout, your muscles often ache. One reason for this is the buildup of lactic acid in your muscles. Where does that lactic acid come from, and why does the process that produces lactic acid occur in your muscle cells during a hard workout?

Module 7

7.1 Question: Two identical twins have exactly the same set of genes. They are separated at birth and grow up in different households. If a scientist were to study the twins as adults, would he find them to be identical in every way, since they have the same genes? Why or why not?

7.2 Question: An RNA strand has the following sequence of nucleotides: uracil, adenine, adenine, guanine, cytosine, cytosine. What was the nucleotide sequence in the DNA that it transcribed?

7.3 Question: A DNA strand has the following sequence of nucleotides: thymine, thymine, thymine, adenine, guanine, cytosine. What will the RNA sequence be when this DNA section is transcribed?

7.4 Question: A scientist is studying a nucleic acid, but her notes are sketchy. You do not know whether she is studying DNA or RNA. You can make out the following nucleotide sequence, however: guanine, cytosine, cytosine, uracil, guanine, adenine. Is the scientist studying DNA or RNA?

7.5 Question: A protein has alanine as its first amino acid. One codon that calls for alanine has the following sequence of nucleotide bases: guanine, cytosine, adenine. a. If a portion of DNA instructs a cell to make this protein, what will be the first three nucleotide bases of that DNA portion?

7.5 Question: A protein has alanine as its first amino acid. One codon that calls for alanine has the following sequence of nucleotide bases: guanine, cytosine, adenine. b. What will be the sequence of nucleotide bases on the tRNA that responds to the mRNA codon given above?

7.6 Question: The phases of a cell's life are listed below. Which one is not a part of mitosis? Take the remaining phases and order them according to when they occur in the mitosis process. anaphase, prophase, interphase, telophase, metaphase

7.7 Question: A cell uses vesicles to build the plasma membrane during the telophase of mitosis. Is it a plant cell or an animal cell?

7.8 Question: In which phase of mitosis are the chromosomes separated from their duplicates?

7.9 Question: A pea plant has seven pairs of homologous chromosomes. What is its haploid number? What is its diploid number?

7.10 Question: In a scientist's notebook, you find notes regarding a new species that is being studied. The notes say that the species is diploid, with a chromosome number of 17. Is this the haploid or diploid number? If this is the haploid number, give the diploid number. If this is the diploid number, give the corresponding haploid number.

7.11 Question: Which phases of meiosis are essentially the same as the corresponding phases of mitosis? Which are different?

7.12 Question: A cellular reproduction process results in four diploid cells. Is this mitosis or meiosis? How many cells underwent this process?

7.13 Question: A cellular reproduction process results in four haploid cells. Is this mitosis or meiosis? How many cells underwent this process?

7.14 Question: A sperm cell finds a polar body and attempts to fuse with it. Will a viable zygote develop?

7.15 Question: What is the principal difference between viruses and pathogenic bacteria?

7.16 Question: The human body can produce the antibodies that destroy smallpox. If this is the case, why did so many people die from it? Why didn't their bodies just kill the virus?

Module 8

8.1 Question: The factor for producing smooth peas (we will call it “S”) is dominant over the factor for producing wrinkled peas (which we will call “s”). Three plants (a, b, and c) have the following factors. Determine whether they will make smooth peas or wrinkled peas. a. ss

8.2 Question: The factor for producing smooth peas (we will call it “S”) is dominant over the factor for producing wrinkled peas (which we will call “s”). Three plants (a, b, and c) have the following factors. Determine whether they will make smooth peas or wrinkled peas. b. Ss

8.3 Question: The factor for producing smooth peas (we will call it “S”) is dominant over the factor for producing wrinkled peas (which we will call “s”). Three plants (a, b, and c) have the following factors. Determine whether they will make smooth peas or wrinkled peas. c. SS

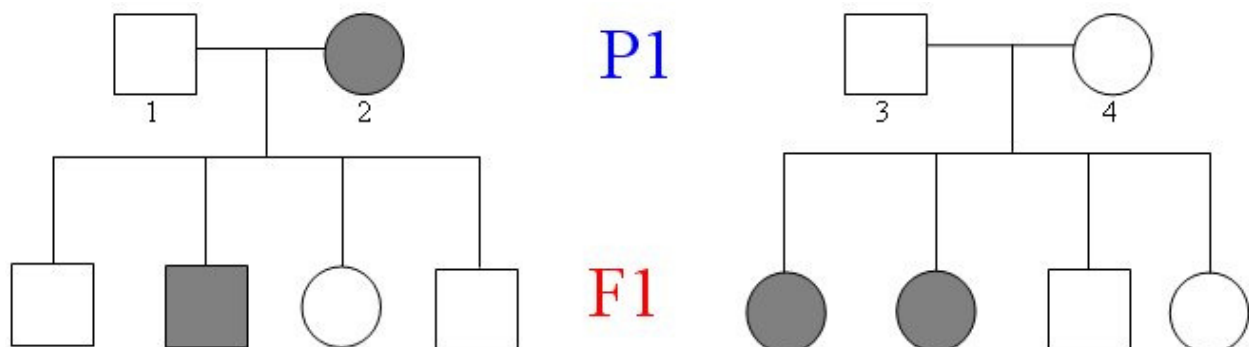
8.4 Question: The factor for producing yellow peas (“Y”) is dominant over the factor for producing green peas (“y”). Suppose a pea plant produces yellow peas. What possible combination(s) of factors can it have?

8.5 Question: Given the information in the previous question, what possible combination(s) of factors can a pea plant that produces green peas have?

8.6 Question: A student repeats one of Mendel's experiments. He self-pollinates an “Ss” pea plant, where “S” is the dominant allele for smooth peas and “s” is the recessive allele for wrinkled peas. The result is one “SS” offspring, two “Ss” offspring, and one “ss” offspring. For each of these three sets of offspring, list the genotype, whether it is homozygous or heterozygous, and the phenotype.

8.7 Question: Using a Punnett square, predict the possible genotypes and phenotypes, along with the percentage chance for each, when a heterozygous, purple-flowered pea plant is crossed with a white-flowered pea plant.

8.8 Question: In the following pedigrees, a biologist studies the presence of a tail on a certain species of animal. Some individuals have a tail (represented by the gray circles and squares) and others do not (represented by the white circles and squares). Which allele is dominant, the one for having a tail or the one for not having a tail? What are the genotypes of individuals #1-4?



8.9 Question: Suppose we are going to set up a Punnett square that concentrates on the smooth/wrinkled nature of the peas produced in a pea plant (“S” for smooth, “s” for wrinkled) and the color of the pea produced (“Y” for yellow and “y” for green). What are all possible allele combinations for the gametes produced by a plant that is heterozygous in both traits?

8.10 Question: In domestic chicken, a change in one particular allele can affect the development of the feathers, wings, lungs, kidney, and liver. What is this an example of?

8.11 Question: A woman who has type A blood but carries the type O allele marries a man with type B blood who also carries the type O allele. List the possible blood types of the children, including the percentage chance for each.

8.12 Question: Suppose the woman in the previous question was heterozygous and Rh-positive. If the father is Rh-negative, what are the possible Rh-factors for the children and the percentage chance of each?

Module 9

9.1 Question: What two concepts promoted by other scientists influenced Darwin in developing his ideas?

9.2 Question: The cheetah is the fastest land-dwelling animal on the planet. It has been observed to reach peak speeds in excess of 70 miles per hour! It uses this speed to catch animals that are often too fast to be killed by most other predators. Use Darwin's reasoning to explain how natural selection could produce such a creature from a slower animal.

9.3 Question: Why is Darwin's hypothesis sometimes called “the survival of the fittest”?

9.4 Question: House sparrows are small, seed-eating birds that are native to parts of Europe, Northern Africa, and the Middle East. In the fall of 1851 and the spring of 1852, one hundred of these birds were brought to Brooklyn, New York. Since then, they have spread throughout the United States. Even though the original 100 birds were all very similar, their descendants are not. In fact, if you study the size of house sparrows in the United States, you will find that they are bigger in the northern parts of the United States and smaller in the southern parts of the United States. Is this an example of microevolution or macroevolution? Can you think of what might have caused this difference in size?

9.5 Question: Some biologists believe that the whale once had a cowlike ancestor that lived on land. This ancestor was very heavy, so it started spending a great deal of time in the water. The water helped buoy it up, making it easier for the animal to walk. As time went on, the animal began adapting to the water, slowly changing its legs into fins and its skin into a substance more ideal for swimming in the water. Eventually, the cowlike creature gave rise to the whale. Is this an example of microevolution or macroevolution?

9.6 Question: What is the big assumption that must be made in order to interpret the geological column as evidence for macroevolution?

9.7 Question: Why is the geological column not conclusive evidence for or against macroevolution?

9.8 Question: If macroevolution really occurred, would you expect to find more fossils of individual species or of intermediate links?

9.9 Question: What features on *Archaeopteryx* make macro evolutionists think that it is an intermediate link? What features make creation scientists think that it is not?

9.10 Question: Why do macro evolutionists consider *Australopithecus afarensis* an intermediate link between man and ape? Why do creation scientists think that it is not?

9.11 Question: What major scientific breakthrough led to structural homology changing from evidence for macroevolution to evidence against it?

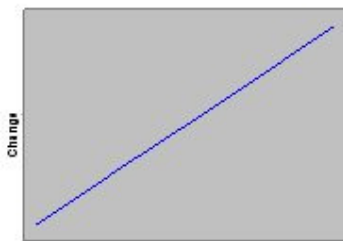
9.12 Question: A molecular biologist details the amino acid sequences in a common protein for the following creatures: a human, a rat, an amoeba, a fish, and a frog. Assuming macroevolution did occur; list these creatures in terms of increasing similarity between their protein and the human protein.

9.13 Question: Why is the comparison of amino acid sequences in common proteins such a useful tool in determining whether or not macroevolution occurred?

9.14 Question: What is the main difference between Darwin's hypothesis of macroevolution and the neo-Darwinist hypothesis?

9.15 Question: What does punctuated equilibrium explain that neo-Darwinism and Darwin's original hypothesis cannot?

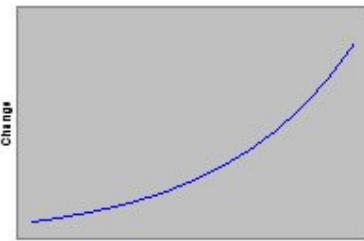
9.16 Question: The three graphs below are hypothetical graphs that plot macro evolutionary change (on the y-axis) versus time (on the x-axis). Which graph represents Darwin's original hypothesis, which represents neo-Darwinism, and which represents punctuated equilibrium?



Graph A



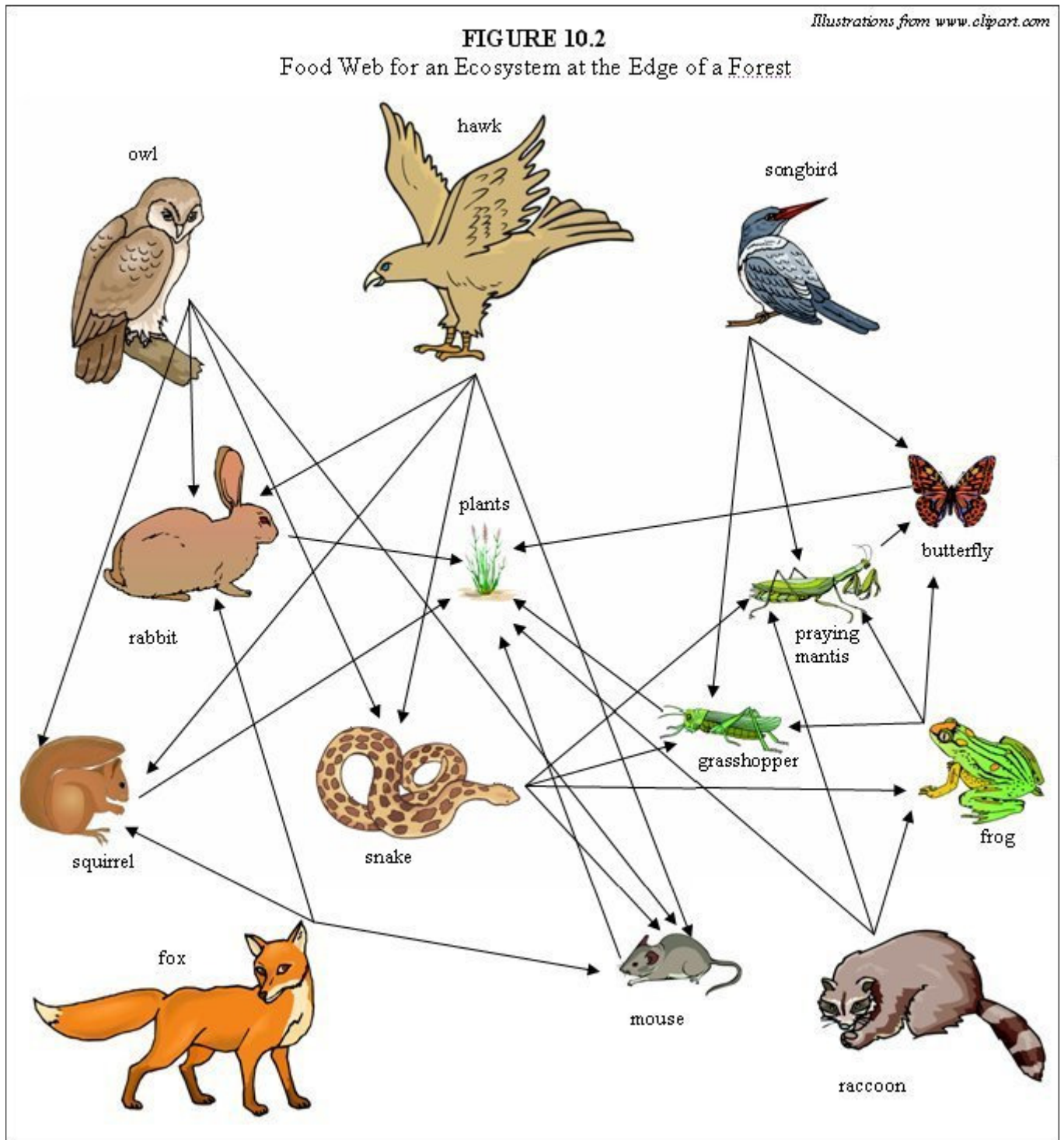
Graph B



Graph C

Module 10

10.1 Question: Looking at the figure below, identify all possible trophic levels of each organism in the figure.



10.2 Question: Based on Figure 10.2 and the idea of an ecological pyramid, would you expect more owls or more mice in the ecosystem that is illustrated there?

10.3 Question: Based on the ecological pyramid in Figure 10.3, between which two trophic levels is the greatest amount of energy lost?

10.4 Question: Although macroevolution can never hope to explain most of the examples of mutualism in creation, it can explain some. Which of the three examples of mutualism that you read about in this section would be easiest to explain in terms of macroevolution? How would macroevolution attempt to explain the relationship?

10.5 Question: A biologist is studying two different ecosystems. One is defined as a 30-yard stretch of ocean shoreline. The other is a forest that runs one mile across and half of a mile wide. Which ecosystem will be the easiest to study? Which will most likely reveal more information?

10.6 Question: The following is a list of things found near a pond. Which are part of the ecosystem's physical environment?

- a. water
- b. rocks
- c. fish
- d. algae
- e. grass
- f. mud

10.7 Question: There are at least three different means by which water can potentially leave an ecosystem. Which of these means exists in a watershed but not an ocean shore environment?

10.8 Question: Suppose you studied a watershed ecosystem in depth and measured the amount of water that evaporates, the amount of water that goes through transpiration, and the amount of water that the watershed gains through precipitation. If you were to add the total amount of water that leaves the watershed by both evaporation and transpiration, would you expect that to be larger or smaller than the amount of water that the watershed gains through precipitation?

10.9 Question: Suppose producers made only the food that they needed and never made any extra. What would happen to the oxygen level in the atmosphere? What would happen to the consumers of creation?

10.10 Question: As you learned previously, Biosphere II was an attempt at making an artificial, enclosed ecosystem that was self-sustaining. It did not work. Suppose you were working on Biosphere III and were having problems keeping the right amount of oxygen in the air: the oxygen level continually rose, resulting in too much oxygen. What could you do in an attempt to fix the problem?

10.11 Question: If a tree dies and slowly rots away, does this add carbon dioxide to or remove it from the air?

10.12 Question: If you were able to see carbon dioxide as it interacted with the surface of the ocean, you would see the ocean absorb an enormous amount of carbon dioxide. Only a portion of that carbon dioxide actually dissolves in the ocean, however. A large amount of the carbon dioxide goes into the ocean but is not dissolved. If it isn't dissolved, what is it used for?

10.13 Question: Suppose you are once again designing Biosphere III. In your initial tests, you find that the amount of nitrogen gas in the air of your biosphere is decreasing as time goes on, but the amount of nitrates, nitrites, and ammonia are fairly constant and cannot be decreased much without affecting the organisms that need them. What should you look at in order to try to fix this problem so that nitrogen does not have to be pumped into your biosphere?

Module 11

11.1 Question: Identify the symmetry (if any) possessed by these animals:

Illustration from www.clipart.com



a.

Manta Ray

11.2 Question: Identify the symmetry (if any) possessed by these animals:

Illustration from www.clipart.com



b.

Sponge

11.3 Question: Identify the symmetry (if any) possessed by these animals:

Illustration from www.clipart.com



c.

Jellyfish

11.4 Question: Identify the symmetry (if any) possessed by these animals:

Illustration by Megan Whitaker



d.

Coccolithophore

11.5 Question: One biology book calls sponges “tireless, natural pumps.” Why is this a good description of sponges?

11.6 Question: If a sponge has plenty of food but cannot distribute it to all of its cells, what is the sponge missing?

11.7 Question: A sponge feels hard and prickly. Does it contain spicules or spongin?

11.8 Question: An organism has a mouth, tentacles, and a gut. It also has bilateral symmetry. Can it be placed in phylum Cnidaria?

11.9 Question: If a clownfish were to brush up against a hydra, would the hydra release its nematocysts into the clownfish?

11.10 Question: A lot of animals need some sort of respiratory and excretion systems. Why don't cnidarians need these?

11.11 Question: If a jellyfish reproduces asexually, is it in polyp form or medusa form?

11.12 Question: If an earthworm's mouth is fully functional but it cannot ingest soil, what organ is malfunctioning?

11.13 Question: What process will stop if the earthworm's cuticle dries up?

11.14 Question: In a dissected earthworm, you see a nerve chord with ganglia at each segment right next to a long blood vessel. Is blood flowing towards the anterior or the posterior in this blood vessel?

11.15 Question: An earthworm's seminal vesicle is empty but its oviducts are full. Has the earthworm mated yet?

11.16 Question: Compare the digestion of a planarian with a fungus. What are the similarities?

11.17 Question: A flatworm has very complex digestive and nervous systems. Is this flatworm likely to be parasitic? Why or why not?

11.18 Question: If you were to observe a sidewalk that a snail had just traveled across, what would you expect to find?

11.19 Question: Clams often burrow into the sand. What organ do you think they use when they do this?

Module 12

12.1 Question: Suppose an arthropod lives in an ecosystem which contains no predators. The arthropod would never, ever be threatened. Would it need an exoskeleton in this situation?

12.2 Question: If you count the cephalothorax as one body segment, how many major segments does an arthropod with a cephalothorax have?

12.3 Question: An organism moves its joints with muscles that lie on top of the joint. Is the organism an arthropod?

12.4 Question: If an arthropod cannot taste something, but the rest of the nervous system is operational, what sensory organ is malfunctioning?

12.5 Question: Why do we say that arthropods are constantly bleeding internally?

12.6 Question: Although the gills of a certain crayfish seem to be working fine, the crayfish suffocates because it cannot get fresh water into the gill chambers. What organs are not working properly?

12.7 Question: Trace the flow of blood from the pericardial sinus and back again. Mention the following organs in your discussion: pericardial sinus, sternal sinus, green glands, heart, and gills.

12.8 Question: A crayfish loses its claw in a fight. What happens?

12.9 Question: If a crayfish cannot stay upright in the water, what organ is most likely not working?

12.10 Question: Most spiders have poison glands and produce poison that they inject into their prey. Does that mean that we must fear most spiders because they are poisonous?

12.11 Question: Where are the abdomen and cephalothorax in Figure 12.7?

12.12 Question: An insect's outer wings are incredibly tough. Most likely, what kind of wings are they?

12.13 Question: You can suffocate an insect by wrapping up its body, except for the head, in plastic wrap. Why, if the mouth is exposed to air, does the insect still suffocate?

12.14 Question: An insect cannot digest food in its stomach due to a lack of digestive enzymes. Which organ is most likely not working?

12.15 Question: An insect goes through a nymph stage in its development. Does it undergo complete or incomplete metamorphosis?

Module 13

13.1 Question: If the sea squirt feeds like a sponge and stays fixed to a surface like a sponge, why isn't it classified in phylum Porifera?

13.2 Question: What structure in the adult sea squirt performs the function that the notochord performs in the larva?

13.3 Question: A dead lancelet is found to have large particles of sand lodged in the slits of its pharynx. What, most likely, was not functioning properly prior to the lancelet's death?

13.4 Question: One way that we fight cancer today is through bone marrow transplants. In this procedure, the bone marrow of the sick person is replaced with bone marrow from a healthy person. What cells in the body are most affected by this procedure?

13.5 Question: A shark's skeleton is much more flexible than a human's skeleton. What is a shark's skeleton made of?

13.6 Question: If you see a sealed tube full of bright red blood, did it most likely come from a vein or an artery?

13.7 Question: Blood is traveling back to the heart. Is it in a vein or an artery?

13.8 Question: Although an animal's eyes seem to function properly, it still cannot see. What part of the brain is most likely not working?

13.9 Question: If a person's spinal cord is cut, he loses the ability to move the limbs below the place in which the cut occurred. Why?

13.10 Question: A viviparous mother eats plenty of food but the developing offspring is not nourished properly. What structure is not performing its job?

13.11 Question: Fish typically reproduce when the female lays her eggs and then the male fertilizes them. What kind of fertilization is this? What kind of development is it?

13.12 Question: Are there any lampreys that reproduce in marine environments?

13.13 Question: A student says, "lampreys are parasites." How should the student's incorrect statement be modified to make it correct?

13.14 Question: If a vertebrate relies on its sense of smell for survival, what brain lobes will most likely be larger as compared to those of other vertebrates?

13.15 Question: If you cut the anterior and posterior dorsal fins off a shark, what will happen when it tries to swim?

13.16 Question: When a creature dies, under the right conditions, its remains can be preserved as fossils. Typically, the harder the remains, the more likely they are to fossilize. Thus, if a clam dies, the inside body parts are rarely fossilized, but the shells often are. What parts of the shark would be most likely to fossilize?

13.17 Question: Underwater photographers have batteries in their cameras. When the batteries go dead, photographers sometimes throw them into the water, which is not a good thing to do, because those batteries pollute the water with their chemicals. Some shark photographers have noticed that the sharks sometimes go after those batteries, as if they are prey. Why?

13.18 Question: You see something flat on the ocean floor. It has large pectoral fins that look like wings and a very thin tail. Is it most likely a ray or a skate?

13.19 Question: A student sees a portion of a rib from a fish and notices that it is made of cartilage. Based on this, the student says that the fish cannot be a member of class Osteichthyes. Is the student correct? Why or why not?

13.20 Question: A fish expels a lot of digestible fat from its anus. What organ is probably not functioning properly?

13.21 Question: Most arteries carry oxygen-rich blood, as the blood is traveling away from the heart in order to supply oxygen to the tissues. Name an artery in the fish that carries oxygen-poor blood.

13.22 Question: An amphibian is breathing with gills. Is it in its larval or adult stage?

13.23 Question: A frog that has overexerted itself leaves its mouth wide open. Why?

13.24 Question: You find a creature from order Anura. If you find it far from any body of water, what (most likely) is it?

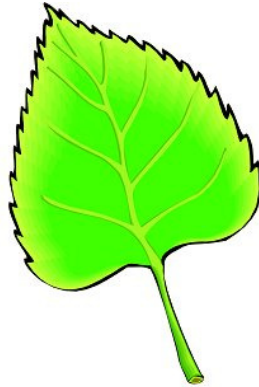
Module 14

14.1 Question: A gardener plants a group of flowers that grow beautifully over the course of a year. In order to have the same flowers each year, however, he must replant. Are these most likely woody plants or herbaceous plants?

14.2 Question: A carrot is the root of a carrot plant. What kind of organ is it?

14.3 Question: A section of plant no longer has any mitosis going on. What kind of tissue should be absent in that section?

14.4 Question: Determine the shape, margin, and venation of the following leaf.



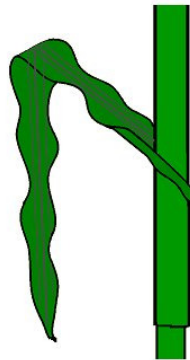
14.5 Question: Determine the shape, margin, and venation of the following leaf.



14.6 Question: Determine the shape, margin, and venation of the following leaf.



14.7 Question: Determine the shape, margin, and venation of the following leaf.



14.8 Question: A leaf cannot get the carbon dioxide that it needs for photosynthesis. What, most likely, is wrong?

14.9 Question: Why can't the parenchyma be made of two layers of palisade mesophyll?:

14.10 Question: In the first section of this module, you learned about the four basic tissues in a plant: dermal, ground, meristematic, and vascular. In this section, you learned about the epidermis, the parenchyma, and the collenchyma. Classify each of these tissues within one of the four basic tissue types.

14.11 Question: There are a few leaves, such as the floating leaves of a water lily plant, in which the stomata and the spongy mesophyll are on the top side of the leaf while the palisade mesophyll is on the bottom. In these leaves, which side will have the darker green color?

14.12 Question: If a leaf isn't green, does that mean there is no chlorophyll in it?

14.13 Question: If a green leaf has no abscission layer, what color will the leaf be in the winter?

14.14 Question: A 12-foot high plant has a root system that travels to a soil depth of only three feet. Does this plant have a taproot system or a fibrous root system?

14.15 Question: Classify each tissue labeled in Figure 14.11 as ground tissue, dermal tissue, meristematic tissue, or vascular tissue.

14.16 Question: If a root contains little cortex tissue compared to similar roots, what function can you conclude the root does **not** perform?

14.17 Question: If a stem has no cork, is it woody or herbaceous?

14.18 Question: If a stem has no limits to its growth, is it woody or herbaceous?

14.19 Question: A stem has xylem and phloem packed together in fibrovascular bundles scattered throughout the stem. Is it woody or herbaceous?

14.20 Question: You see a plant that is two feet tall. Can it be a bryophyte?

14.21 Question: You study a moss that reproduces by making spores. Is it composed of diploid or haploid cells? Does it make the spores using mitosis or meiosis? If you study the offspring of this reproduction, will its cells be haploid or diploid? What kind of cells will it make in order to reproduce? Will it use mitosis or meiosis to make these cells?

14.22 Question: A biologist studies a fern leaf with sorri. Is the fern leaf made of diploid or haploid cells?

14.23 Question: A student sees a fern growing on the branch of another tree. The student says that the fern is obviously a parasite. Is the student correct? Why or why not?

14.24 Question: Suppose a conifer self-fertilizes. From a genetic point of view, is this the same as asexual reproduction? Why or why not?

14.25 Question: Construct a biological key for the classification of plants. Assume that the specimen you are examining is definitely a part of kingdom Plantae and is in one of the phyla we have discussed. For phyla other than Anthophyta, simply stop at the phylum level. If the plant is a part of phylum Anthophyta, classify it down to the class level, using the fundamental distinction between monocots and dicots.

Module 15

15.1 Question: If water is in short supply, a plant wilts but does not die unless the water stays in short supply for a long time. Based on this, which one of the four water-based processes that we discussed can be temporarily neglected?

15.2 Question: Some people think that putting plant roots underwater will allow the plant to absorb all of the water it needs. If you do this to most plants, however, it will kill them. Why?

15.3 Question: A botanist has two samples of liquid. Sample A is composed primarily of organic materials, while sample B is composed mostly of water and minerals. Which liquid was extracted from the xylem of a plant and which came from the phloem?

15.4 Question: Typically, a plant opens its stomata during the day and closes them at night. When would you expect transportation of water to occur, in the day or during the night?

15.5 Question: Regardless of how you plant a seed, the seedling always sprouts up through the soil. What growth hormone is responsible for this amazing ability?

15.6 Question: You see a bean plant that has grown abnormally long and is more yellow than green. What is the most likely reason for this bean plant's appearance?

15.7 Question: In order to be healthy, a Venus flytrap needs insects, water, and what else?

15.5 Question: A gardener is experimenting with one of her African violet plants. This plant produces large, deeply colored flowers. She shows you two offspring from the plant. The first produces small, lightly colored flowers, while the second produces large, deeply-colored flowers. Which offspring was produced with vegetative reproduction? Which one was produced with sexual reproduction?

15.9 Question: A gardener wants to graft a limb from a McIntosh apple tree onto another tree so that he can have more McIntosh apples. Should the gardener graft this limb to his Red Delicious apple tree or to his wild cherry tree?

15.10 Question: Is there any way a plant that produces imperfect flowers can sexually reproduce with itself? Why or why not?

15.11 Question: Suppose a flower has a carpel with a very short style. Which would you consider to be the best means of transferring pollen grains to the carpel: the wind or an animal?

15.12 Question: If a pollen sac contains 1,000 diploid cells before the formation of pollen grains, how many pollen grains could there be in the pollen sac once pollen formation is complete?

15.13 Question: After the original cell of an ovule undergoes meiosis and forms one viable megaspore, how many times does mitosis occur in order to get a total of eight nuclei in the megaspore?

15.14 Question: Suppose you were blindfolded and asked to smell several flowers. If you encountered a flower with little or no smell, what would be a good guess as to its predominant color?

15.15 Question: Suppose you were on an island with plenty of plant life but essentially no insects or birds. Would you expect to see many flowering plants? Why or why not?

15.16 Question: In Module #7, we used the letter “n” to represent haploid cells, and “2n” to represent diploid cells. Using this notation, how would you represent the zygote formed during double fertilization? How would you represent the endosperm?

15.17 Question: The process of a seedling sprouting from a seed is often called “germination.” One of the steps in the fertilization process described above is often called germination as well. What part of the fertilization process discussed above could be called germination?

15.18 Question: The mature bean seed shown in Figure 15.10 has no endosperm. Did it ever have one? If so, what happened to it?

15.19 Question: If you plant a seed too deep, the seedling will break through the seed and begin to grow. It will die before it reaches the surface, however. Why does the plant die?

Module 16

16.1 Question: You are blindfolded and asked to feel the skin of two creatures. One is a fish and the other is a snake. If the first creature feels dry and leathery and the second feels slimy and rough, which is the fish and which is the snake?

16.2 Question: If an amniotic egg develops without an allantois, will the embryo live? Why or why not?

16.3 Question: Using X-ray technology, you observe the inside of an egg as the embryo develops. At first, the yolk sac and allantois are the same size, so you cannot tell them apart. After a few days, the one on the left is smaller than it was, and the one on the right is the same size as before. Which one is the allantois?

16.4 Question: You have a tadpole and a baby water snake. Can either of them drown? If so, which one?

16.5 Question: We assume that the tuatara uses its parietal eye to limit the time that it basks in the sun. Why must it limit its time in the sun?

16.6 Question: A reptile has no eyelids and is deaf. Is it a lizard or a snake?

16.7 Question: Why do biologists say that human beings are responsible for the tuatara's dwindling population, even though humans do not hunt or kill tuataras?

16.8 Question: If a snake generally hunts at night, what is it most likely using to detect its prey?

16.9 Question: Why do some biologists say that snakes smell with their tongues?

16.10 Question: You see a member of order Testudines that has flippers. Is it a turtle or a tortoise?

16.11 Question: You see a member of order Crocodylia with its mouth closed. You cannot see any teeth. Is this an alligator or crocodile?

16.12 Question: Fresh samples of blood are taken from a bird and a reptile. If the samples were taken during a cool night, which creature's blood will be the warmest?

16.13 Question: A biologist shows you a sample of blood taken from a creature's ventricle. If this blood is a mixture of oxygen-rich and oxygen-poor blood, did it come from an amphibian or a bird?

16.14 Question: You find an egg that has a very hard shell. Is it a bird egg or a reptile egg?

16.15 Question: A bird's feathers begin to lose their flexibility. What should the bird do in order to fix this problem?

16.16 Question: You see a picture of a bird in a book. The alula on each wing is pushed against the wing so that there is no gap in between the alula and the wing. Is this bird most likely in the middle of its flight or in the process of landing?

16.17 Question: Two bones look identical. The person showing you the bones says that one comes from a reptile and the other from a bird. How could you tell which came from the bird without damaging the bones in any way?

16.18 Question: The roseate spoonbill feeds by standing in water and sweeping its open bill back and forth, catching small fish, shrimp, snails, and insects. In which order does it belong?

16.19 Question: The red jungle fowl has tender white breast meat when cooked. It flies in short bursts, spending the rest of its time on the ground. In which order does it belong?

16.20 Question: Which mammal would have thicker underhair, a polar bear (which lives in a very cold climate) or a prairie dog (which lives in a warmer climate)?

16.21 Question: A cat with its whiskers cut off tends to run into objects a lot more frequently than the same breed of cat whose whiskers are not cut off. Why?

16.22 Question: Two different species of mammals have different gestation periods. The first has a long gestation period and the second has a short gestation period. Which mammal will have offspring that are more developed at birth?

16.23 Question: A mammal has a long snout, eats ants and termites, and has teeth. To which order does it belong?

16.24 Question: A mammal lays eggs. To which order does it belong?.

16.25 Question: A mammal has a hoof with three toes. To which order does it belong?