THE KNOX SCHOOL

AP Biology
2020 Summer Assignment

Directions: Below you will find assignments that will help you create a solid foundation of knowledge and skills that will be vital to your success throughout the school year.

Due Date: First day of your Biology class.

The first step of this summer assignment is going to help you build vocabulary. I provided a list of vocabulary words. I want you to create flashcards for the list of vocabulary words that I provided for each week. Practice these vocab words until you have them mastered.

The second step involves working on your ability to interpret data/information when given a table, chart or graph. This skill is of vital importance when it comes to the AP test and the ACT.

The third step of this summer assignment helps prepare you for the Science Section of the ACT exam.

Below I provided a link to an online textbook that will be useful as you look up definitions for the vocabulary.

Textbook link: http://www.ck12.org/book/CK-12-Biology-Advanced-Concepts/section/2.0/

Week 1

Vocabulary Section

Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Amino acids	2. Amino group	3. Carboxyl group
4. R-group	5. Side group (Amino acid)	6. Dipeptide
7. Peptide bond	8. Polypeptide	9. Protein

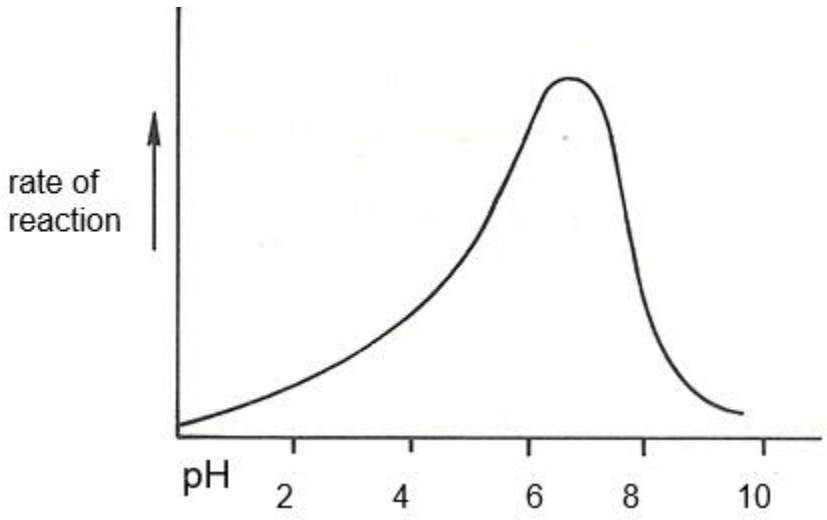
Data Inference Section:

Directions: Please answer the following question based on the information outlined by the figure provided.

The graph shows the rate of an enzyme reaction at different levels of acidity or alkalinity (pH). From the graph, what is the optimum pH for this enzyme?

(a) pH 2 (c) pH 10

(b) pH 7 (d) none of these.



What could you infer happens to the enzyme when the pH is not optimal?

Week 2

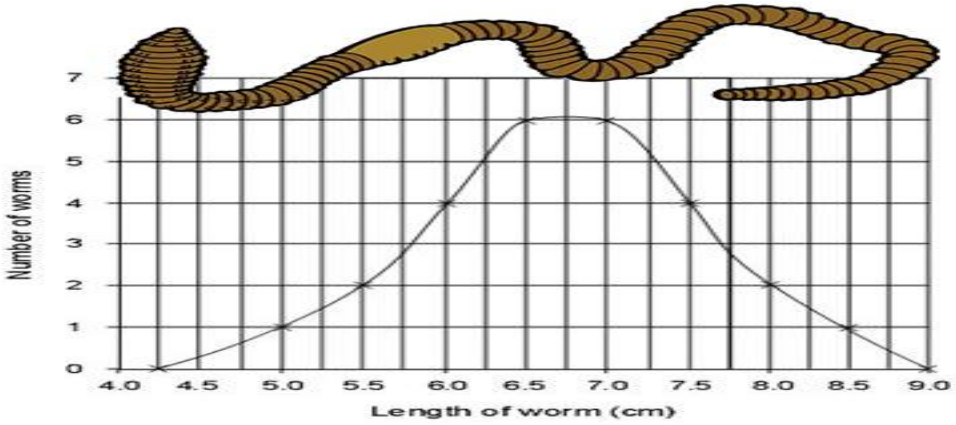
Vocabulary Section

Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Primary Structure	2. Secondary Structure	3. Tertiary Structure
4. Quaternary Structure	5. Chaperone proteins	6. Lipids
7. Triglycerides	8. Triglycerides	9. Steroids

Data Inference Section:

Directions: Please answer the following questions based on the information outlined by the figure provided. Questions can be found on the next page.



1. What length of worm is most common? _____
2. What was the longest worm found?_____
3. How many worms were 7.25 cm long?_____
4. If the worms were given varying amounts of food, would you expect the longer worms to have more food or less food? Explain why.

Week 3

Vocabulary Section

Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Glycerol	2. Ester Linkage	3. Saturated Fat
4. Unsaturated Fat	5. Hydrophobic	6. Hydrophilic
7. Nucleic acids	8. Nucleotides	9. Deoxyribonucleic acid (DNA)

Data Inference Section:

Directions: Please answer the following questions based on the information outlined by the figure provided.

Background: The thickness of the annual rings indicates what type of environmental situation was occurring the time of the tree's development. A thin ring usually indicates a rough period of development such as lack of water, forest fires, or insect infestation. A thick ring means a prosperous period of development. Use the information from the data tables below to create a proper scientific graph and to answer the corresponding questions.

Age of Trees (years)	Average Thickness of Annual Rings in Forest A (millimeters)	Average Thickness of Annual Rings in Forest B (millimeters)
10	20	24
20	24	28
30	30	35
40	34	38
50	41	45

1. What is the dependent variable?
2. What is the independent variable?
3. Based on the data shown, what can be concluded about the comparative health of Forest A and B?
4. What type of relationship (constant, direct, or indirect) exists between the age of trees and the average thickness of the tree's rings? Explain.

Week 4

Vocabulary Section

Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Compound	2. Chemical reaction	3. Chemical bond
4. Ionic bond	5. Covalent bond	6. Hydrogen bond
7. Ions	8. Polar	9. Non polar

Data Inference Section:

Directions: Please answer the following questions based on the information outlined by the figure provided.

Background: Clams were placed into various temperatures of water. Use the information in the data table below in order to create a proper scientific graph and to answer the corresponding questions.

Water Temperature (Celsius)	Number of Developing Clams
10	72
20	92
30	140
40	72
50	36

1. What is the dependent variable?
2. What is the independent variable?
3. What is the optimum temperature for clam development?
4. Based on the trend in the data, estimate how many clams would develop in 0 degree celsius water.
5. Do you believe that claims grow better in lower, higher or more neutral temperatures? Provide evidence.

Week 5

Vocabulary Section

Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Cohesion	2. Adhesion	3. Surface tension
4. Heat capacity	5. Capillary action	6. Acidic
7. Basic	8. Neutral	9. pH scale

Data Inference Section:

Directions: Please answer the following questions based on the information outlined by the figure provided.

Background: Haley sets out to run 15 kilometers. Every 30 minutes she checks her pedometer to determine how far she had run. Use the data below to create a proper graph and to answer the following questions.

Time (minutes)	Total Distance (km)
0	0
30	6.8
60	10.1
90	12
120	13.3
150	15

1. What is the dependent variable?
2. What is the independent variable?
3. How many kilometers had Natalie run after 40 minutes?
4. What was Natalie's average speed (in kilometers per hour) over the course of her run? (Speed = Distance / Time)

Week 6

Vocabulary Section

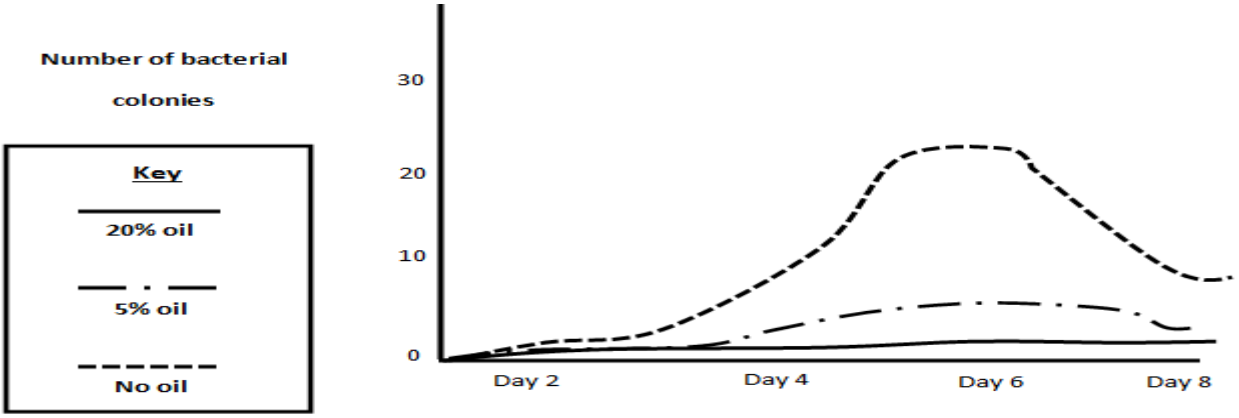
Directions: Please use the following list of vocabulary words relating to Biochemistry and create flashcards. How I want you to format these flashcards is as follows: One side has the word itself, and on the other side write out the definition and provide an image that represents the word. You can either draw the image or print the picture.

1. Organic compounds	2. Inorganic compounds	3. Polymer
4. Monomer	5. Carbohydrates	6. Monosaccharides
7. Disaccharides	8. Polysaccharides	9. Hydrolysis

ACT Practice

Passage

A group of scientists were studying the growth of bacteria. It is their hope that they will be able to induce the bacteria to grow and metabolize oil as a food source. They have taken three samples of Escherichia coli and are growing them on nutrient agar plates. The scientists used three conditions to test the E. coli bacteria. The first group was grown at 37˚C on plain nutrient agar plates. The second group was grown at 37˚C on plain nutrient agar plates with a 5% oil solution. The third group was grown at 37˚C on plain nutrient agar plates with a 20% oil solution. The results of the experiment are listed in the graph below.



1. What is the independent variable in the experiment above?
2. What is the dependent variable in the experiment above?
3. Which bacterial culture had the greatest rate of growth throughout the 8 day period?
4. Why do you believe that the nutrient agar plate with 20% oil reached a population plateau and then dropped as they approached day 8?

Week 7

Going forward with the summer assignment we are going to focus strictly on ACT Prep in regards to the Biology that you may see on the exam. Below you will be given a passage and questions that pertain to the passage. Use your knowledge of biology and the passage to help you answer the questions.

Passage

Eutrophication is a phenomenon where excessive amounts of nutrients are added to a marine ecosystem. These nutrients cause plant life like algae to multiply rapidly, leading to very high population densities. In freshwater ecosystems, the algae can become so dense that it can turn ponds, lakes or even smaller rivers green. The algae grows to an unreasonable level at a very fast rate. The algae are known as phytoplankton and are microscopic, single-celled organisms.

A body of water that is experiencing eutrophication and a resulting bloom can be quickly devastated. Eutrophication affects all living organisms in the area including fish, birds and mammals. The top layer of phytoplankton causes such a build-up on the surface that they accumulate sediment. When this occurs the sunlight is blocked and it will choke off the plant life below the surface. The phytoplankton will also cause less surface area for the water to interface with air. As a result, there will be less oxygen available in the water. As oxygen continues to deplete, the depletion can have a negative effect on life as there will be less oxygen to support the organisms below the surface that depend on the oxygen from plants that diffuses into the water.

Scientist 1

The root cause of eutrophication is not known. However, the frequency and increasing incidents of eutrophication point to human farming activity as the potential cause. The growth of the phytoplankton is caused by runoff that contains multiple sources of nitrates that are also found in fertilizer. The nitrates allow for the phytoplankton to grow rapidly. The solution to the problem is to either move the drainage so the runoff from the human farming activity cannot reach the water source or move the farms.

Scientist 2

Sometimes eutrophication can happen naturally without any real cause. Sometimes when there are periods of heavy rain, the increase in rain water leads to an imbalance in the pH of the water. This in turn creates favorable conditions for the phytoplankton to grow and proliferate. This is a natural cycle that also ensures that too many fish and other animals do not build up in a freshwater source. This type of bloom is nature's way of eliminating overpopulation with an abiotic factor. Although many organisms will die as a result, it will help to thin the numbers of organisms and ensure a healthier freshwater source.

Questions:

According to Scientist 1, which of the following is the cause of the eutrophication?

a. A change in the pH of the water.
b. The increasing changes in phytoplankton.
c. Agricultural run-off from human activity.
d. The build-up of phosphates in the body of water.

What is the main point of disagreement between Scientist 1 and Scientist 2?

a. The source of nitrogen.

b. The root cause of the eutrophication.
c. The effects of the lack of oxygen.
d. The effect of the plant life in the aquatic ecosystem.

Both scientists would likely agree that eutrophication is

a. Algae that will occasionally grow in aquatic ecosystems due to human activities.
b. A bloom of phytoplankton that grows in response to high levels of phosphates.
c. A large build-up of algae that grows at a rapid rate in a body of water.
d. An explosion of algae due to natural factors and the need to reduce overpopulation.

According to Scientist 2, eutrophication is necessary for

a. The control of overpopulation in an aquatic ecosystem.
b. The natural control of the pH of water in an aquatic ecosystem.
c. The normal process that takes place in a pond in response to farmland runoff.
d. The rejuvenation of aquatic life, which thrives during such an event.

Scientist 1 probably mentions farming and agriculture in order to:

a. Point to a human activity that would cause eutrophication.
b. Show that humans changing natural land is bad for the environment.
c. Bolster his case for humans causing a change in the pH of the water that leads to eutrophication.
d. Bolster his case that human activity such as farming increases nitrates leading to eutrophication.

The end result of a severe eutrophication event will always be:

a. A regrowth of new life because of the nitrates in the water.
b. The death of the phytoplankton when it over-accumulates.
c. A massive die off of both plant and animal life in the aquatic environment.
d. The growth of more plant life in the water as they grow well with plankton.

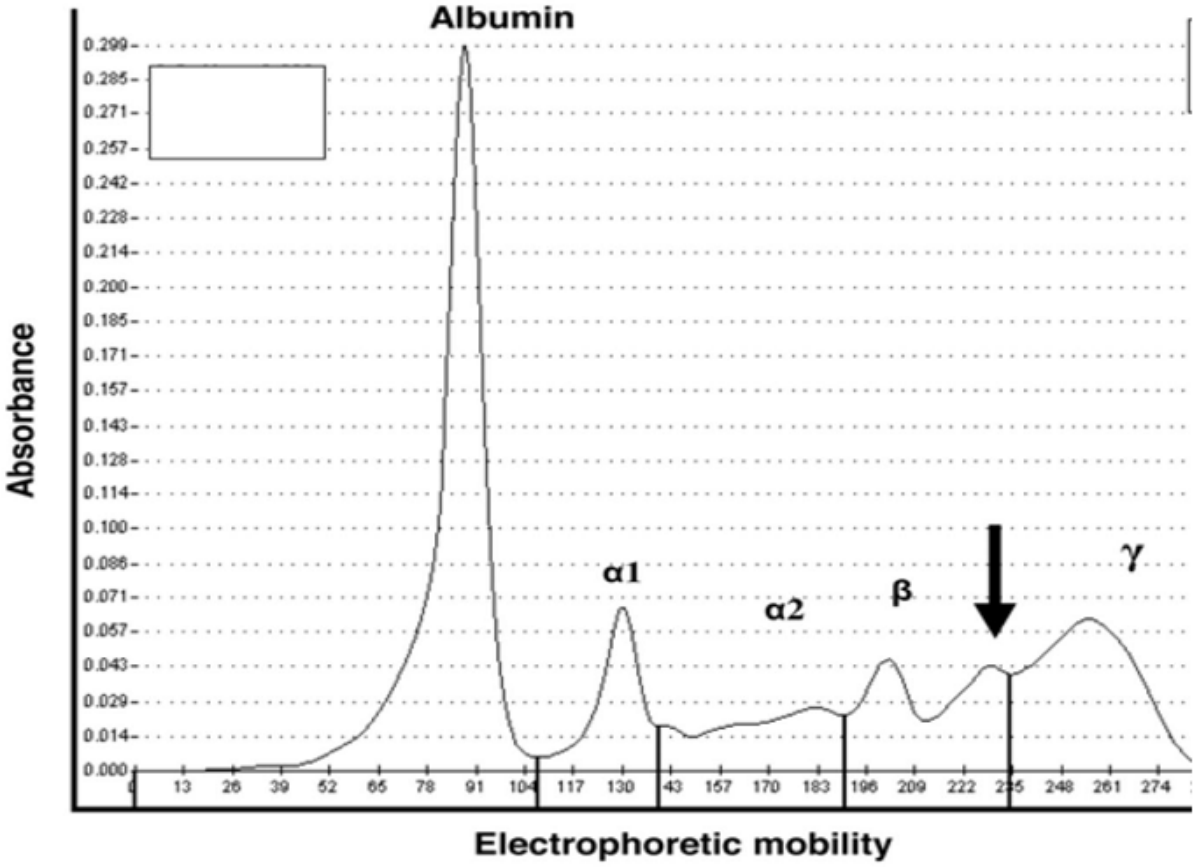
Week 7

ACT Passage

Blood consists of a liquid called plasma, in which many different types of blood cells are suspended. The plasma also contains many dissolved proteins. These proteins may be studied by subjecting the plasma to electrophoresis, in which it is subjected to an electric field, which pulls the proteins through a porous gel. Proteins typically have a negative charge on their surface, so they move toward the anode (positive electrode) in an electric field. The gel acts as a molecular sieve: it interferes with the movement, or migration, of the larger proteins more than the small ones, allowing the proteins to be separated on the basis of size. The further the proteins move during the experiment, the smaller they must be.

The experiment results in an electropherogram, such as the one shown in the figure below. This is a plot, or graph, of protein concentration versus migration, and corresponds to a graph of concentration versus size. Concentration is measured by passing light of a certain wavelength through the gel: proteins absorb the light, and the resulting absorbance measurement is proportional to protein concentration. Many major blood component proteins, such as albumin and several identified by Greek letters, have been discovered in this way. When disease is present, some component proteins may break down into smaller fragments. Others may aggregate, or clump together, to form larger fragments. This results in a change in the electropherogram: new species, corresponding to the aggregates or breakdown products, may be present, and the sizes of the normal peaks may be changed as the concentration of normal products is altered.

The Figure shows an electropherogram from a sick patient with an abnormal component in her blood (arrow). Peaks corresponding to some normal plasma proteins have been labeled. Please examine the electropherogram and answer the following questions.



Questions

Which blood component protein is present in the greatest amounts in the plasma?

a. β
b. a2
c. Albumin
d. A1

Which of the following is the fastest-moving component in the electropherogram?

a. Albumin
b. a1
c. a2
d. Y

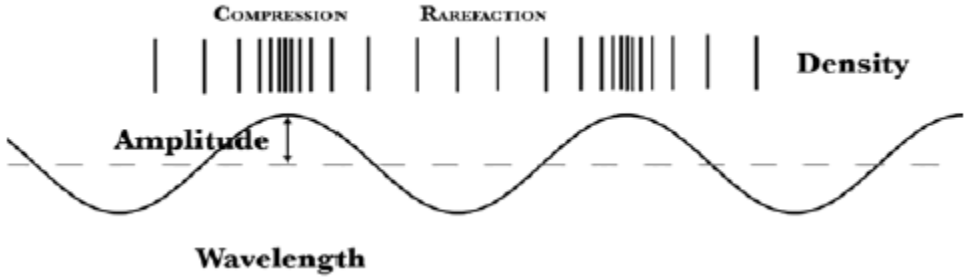
Which of the following statements is true about component α1?

a. Molecules move through the gel faster than those of α2, but slower than Albumin.
b. The molecules are larger than albumin, but smaller than all the other components.
c. It is not a protein.
d. The molecules are smaller than albumin, but larger than all the other components.

Week 8

ACT Passage

A vibrating source will produce sound by alternately forcing the air molecules in front of it closer together as it moves towards them, and then further apart as it draws away from them. In this way, alternating regions of high and low pressure, called compressions and refractions, are produced. The figure shows a typical sound wave. The volume of the sound corresponds to the magnitude of the compression, represented by the amplitude of the wave. The sound's pitch corresponds to the wave's frequency, the distance between successive compressions. Humans can hear sounds with frequencies between 20 and 20,000 Hertz. Sound waves propagate in all directions from their source. The speeds at which sound waves travel depend upon the medium they are traveling through. In dry air, sound travels at 330 m/sec at 0Â°C. It travels 4 times faster through water, and 15 times faster through a steel rod.



Questions:

The sound produced by a drum is much louder and lower pitched than that produced by a bell. Which of the following statements is true about the sound wave produced by a drum compared to that produced by a bell?

a. The amplitude is smaller and the wavelength is longer.
b. The amplitude is greater and the wavelength is longer.
c. The amplitude is smaller and the wavelength is shorter.
d. The amplitude is greater and the wavelength is shorter.

Two sound waves of exactly the same frequency and amplitude are produced by sources that are in precisely the same position. If the sound waves are out of phase by one-half a wavelength, what will be heard by an observer standing a short distance away?

a. A sound twice as loud as either individual signal
b. A sound at twice the frequency of either individual signal
c. No sound at all
d. A sound at twice the wavelength as either individual signal

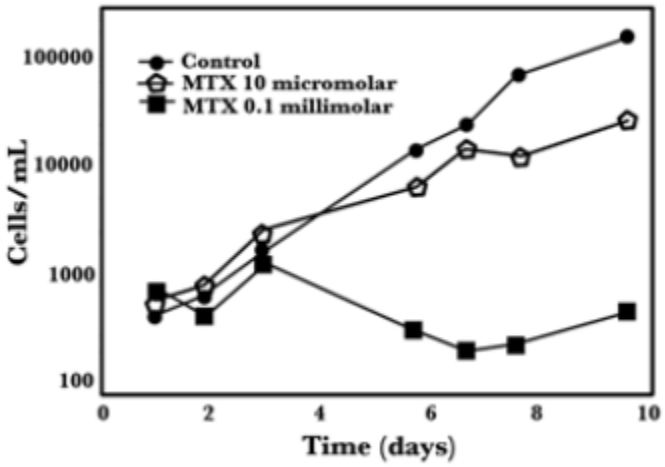
Week 9

Vocabulary:

Now that we are nearing the start of the school year I want you to go back and read through your vocabulary flashcards that you created in the earlier weeks of your summer assignment. This is to familiarize you with the terms again prior to seeing them when we meet in class.

ACT Passage

Cancer cells of the murine erythroleukemia (MEL) cell line were cultured in normal growth medium (control) and in two different concentrations of the anti-cancer drug methotrexate (MTX) for a period of ten days. Samples were removed periodically, and the number of cells per milliliter of culture was determined. Each point in the figure represents the mean of five determinations.



Questions

The growth of cells in the absence of drugs in this experiment can best be described as:

a. Exponential
b. Linear
c. Inhibited
d. Derivative

Which of the following statements is supported by the data?

a. Methotrexate does not inhibit cell growth.
b. 10 micromolar methotrexate effectively suppresses cell growth.
c. 100 micromolar methotrexate effectively suppresses cell growth.
d. 0.1 millimolar methotrexate inhibits the growth of bacteria.

*****The next question is based exclusively on your knowledge of biology.**

Which of the following animals displays the greatest fitness?

a. Male wolf that died young but has 4 cubs that are raised by an unrelated female
b. A female wolf that has 3 cubs and lives to be quite old
c. A male wolf that lives to old age and has 1 cub
d. A female wolf that died young after raising 3 cubs

Week 10

Vocabulary:

Now that we are nearing the start of the school year I want you to go back and read through your vocabulary flashcards that you created in the earlier weeks of your summer assignment. This is to familiarize you with the terms again prior to seeing them when we meet in class.

ACT Passage

The Earth's atmosphere is composed of multiple layers with very different temperature characteristics. Closest to the surface, the troposphere contains approximately 75 percent of the atmosphere's mass and 99 percent of its water vapor and aerosols. Temperature fluctuations cause constant mixing of air in the troposphere through convection, but it generally becomes cooler as altitude increases.

The stratosphere is heated by the absorption of ultraviolet radiation from the sun. Since its lower layers are composed of cooler, heavier air, there is no convective mixing in the stratosphere, and it is quite stable.

The mesosphere is the atmospheric layer directly above the stratosphere. Here, temperature decreases as altitude increases due to decreased solar heating and, to a degree, CO2. In the lower atmosphere, CO2 acts as a greenhouse gas by absorbing infrared radiation from the earth's surface. In the mesosphere, CO2 cools the atmosphere by radiating heat into space.

Above this layer lies the thermosphere. At these altitudes, atmospheric gases form layers according to their molecular masses. Temperatures increase with altitude due to absorption of solar radiation by the small amount of residual oxygen. Temperatures are highly dependent on solar activity, and can rise to 1,500Â˚C.Commercial jetliners typically cruise at altitudes of 9-12 km, in the lower reaches of the stratosphere.

Questions:

Which of the following might be the reason for this choice of cruising altitude?

a. All are possible reasons.
b. There is less air resistance than at lower altitudes.
c. Jet engines run more efficiently at colder temperatures.
d. There is less turbulence than at lower altitudes.

*****The next question is based exclusively on your knowledge of biology.**

The major advantage of sexual reproduction over asexual forms is that:

a. It promotes diversity.
b. It can be undertaken at any time of year.
c. It requires two individuals.
d. It produces more offspring.