

-
1. Base your answer to the following question on the reading passage below and on your knowledge of biology.

Lyme Disease

Thousands of people have been bitten by deer ticks and infected with the bacterial spirochete *Borrelia burgdorferi*, the cause of Lyme disease. About half of these people will not realize that they have been infected. After the initial infection, their immune systems will begin to control the bacterium, but not eliminate it altogether. Up to several years after the tick bite, the victims may develop complications such as crippling arthritis, neurological damage, and cardiac malfunctions. Now, researchers think they have determined one way *B. burgdorferi* manages to elude an activated immune system.

Five white-footed mice were infected with *B. burgdorferi*. The blood of the mice was sampled shortly thereafter, and it was confirmed that the mice were producing large quantities of antibodies that attacked the invading bacteria.

Four months later, *B. burgdorferi* were extracted from the infected mice and mixed with the same type of mouse antibodies. This time the bacteria initiated only a weak response, indicating that the antibodies were less able to recognize the bacteria. Since antibodies recognize a bacterium by binding to specific protein molecules on the bacterial surface, these surface molecules may somehow have changed over time. In this way, the bacteria are better able to escape early recognition by antibodies produced by the human immune system.

The genus name of the organism that causes Lyme disease is

- A) *spirochete* B) *Bacterium* C) *burgdorferi* D) ***Borrelia***

Base your answers to questions 2 through 5 on the reading passage below and on your knowledge of biology.

Take Two and Call Me in the Morning

Hippocrates observed that pain could be relieved by chewing the bark of a willow tree. We now know that this bark contains salicylic acid, which is similar to acetylsalicylic acid, the active ingredient in aspirin. Over 2,300 years after this observation by Hippocrates, scientists have learned how aspirin works.

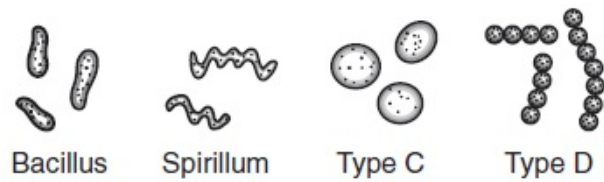
When people get the flu or strain their backs, the body responds by making prostaglandins (PG), a group of hormone-like substances. The presence of certain prostaglandins may result in fever, headaches, and inflammation. Scientists have determined that aspirin interferes with prostaglandin H2 synthase (PGHS-2), an enzyme that the body uses to make pain-causing prostaglandins. In 1994, the structure of this enzyme was found to be a crystal with a tube running up the middle of it. Raw materials move through this tunnel to reach the core of the enzyme, where they are transformed into prostaglandin molecules. Research has shown that aspirin blocks this tunnel. Part of the aspirin molecule attaches to a particular place inside the tunnel, preventing the raw materials from passing through the tunnel. This blockage interferes with the production of prostaglandins, thus helping to prevent or reduce fever, headaches, and inflammation.

The body makes two forms of the enzyme. PGHS-1 is found throughout the body and has a variety of uses, including protecting the stomach. PGHS-2 usually comes into play when tissue is damaged or when infections occur. Its action results in pain and fever. Aspirin plugs up the tunnel of PGHS-1 completely and often causes stomach irritation in some people. Aspirin plugs up the tunnel partially in PGHS-2, thus helping to relieve pain and fever.

Perhaps further research could result in a drug targeting PGHS-2 but not PGHS-1, relieving the aches, pains, and fever, but not irritating the stomach as aspirin does now.

2. How does aspirin relieve the symptoms of the flu?
 - A) It forms a barrier around the outer surface of PGHS-2 molecules, separating them from the prostaglandins.
 - B) It dissolves the crystal of the enzyme, preventing it from producing prostaglandins.
 - C) It is an acid that dissolves the prostaglandins that cause the symptoms.
 - D) It reduces the amount of raw material reaching the active site of the enzyme that produces prostaglandins.**
3. Why does aspirin irritate the stomach of some people who take it?
 - A) It interferes with the activity of an enzyme that helps to protect the stomach.**
 - B) It is the only acid in the stomach and irritates the stomach lining.
 - C) It stimulates prostaglandin production in the stomach.
 - D) It is obtained from willow bark, which cannot be digested in the stomach.
4. Using one or more complete sentences, describe the molecular structure of prostaglandin H2 synthase.
5. Using one or more complete sentences, explain why chewing the bark of a willow tree could help relieve the symptoms of headache and fever.

6. Base your answer to question on the diagram below and on your knowledge of biology. The diagram represents four types of bacteria.



A dichotomous key to these bacterial types is shown below. Complete the missing information for sections 3a. and 3b. so that the key is complete for all four types.

1a. Is rod shaped	bacillus
1b. Is not rod shaped	go to 2
2a. Is spiral shaped.....	spirillum
2b. Is not spiral shaped.....	go to 3
3a. _____	type C
3b. _____	type D

Base your answers to questions 7 through 11 on the information and data table below and on your knowledge of biology.

The Enzyme Catalase

Catalase is an enzyme found in nearly all living organisms that breathe or are exposed to oxygen. According to recent scientific studies, low levels of catalase may play a role in the graying process of human hair. The body naturally produces hydrogen peroxide, and catalase breaks it down into water and oxygen. If there is a dip in catalase levels, hydrogen peroxide cannot be broken down. This causes hydrogen peroxide to bleach hair from the inside out. Scientists believe this finding may someday be used in anti-graying treatments for hair.

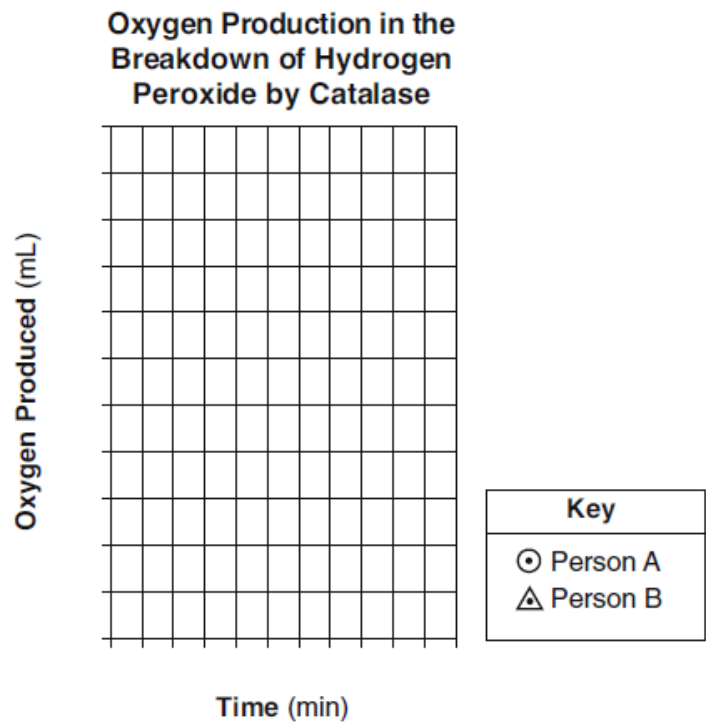
A pharmaceutical company, investigating ways to prevent hair from turning gray, took tissue samples from two different individuals. Both individuals were the same age. Each of the samples was placed in a solution of hydrogen peroxide. The volume of oxygen gas produced was measured every 5 minutes for 25 minutes. The data the company collected are shown below

**Oxygen Production in the Breakdown of
Hydrogen Peroxide by Catalase**

Time (min)	Sample from Person A (mL oxygen)	Sample from Person B (mL oxygen)
5	2.0	4.5
10	3.5	8.5
15	5.0	12.0
20	7.5	15.5
25	9.5	20.0

7. If the temperature of the tissue samples used in the experiment had been raised from 37°C (body temperature) to 50°C, the results would have been different because
- A) more enzymes are produced at higher temperatures, increasing the amount of hydrogen peroxide
 - B) more hydrogen peroxide is released at higher temperatures, increasing the activity of catalase
 - C) increasing temperatures altered the structure of catalase, decreasing oxygen production**
 - D) increasing temperatures decreased the synthesis of amino acids, increasing levels of hydrogen peroxide

8. Mark an appropriate scale, without any breaks in the data, on each labeled axis.



9. Plot the data from the data table for the sample from person *A* on the grid. Connect the points and surround each point with a small circle.



10. Plot the data from the data table for the sample from person *B* on the grid. Connect the points and surround each point with a small triangle.



11. According to the data provided, which person, *A* or *B*, is more likely to be the first to have gray hair? Support your answer.

Person: _____

Base your answers to questions **12** and **13** on the statement below.

The work of a cell is carried out by the many different types of molecules it assembles. Most of these molecules are proteins. Explain how the cell is able to make the many different proteins it needs.

12. Identify where in the cell the information necessary to construct a particular protein is located and the specific molecule that contains this information.

13. Identify *both* the cellular structure that assembles these proteins and the kinds of molecules that are used as the building blocks of the proteins
-
14. Base your answer to the following question on the illustration and information below and on your knowledge of biology. The illustration is of a Tasmanian devil.



Source: <http://www.statelibrary.tas.gov.au>

The Tasmanian devil is the largest surviving carnivorous marsupial in Australia. It is in danger of extinction due to an unusual type of cancer called Devil Facial Tumor Disease (DFTD). It can be passed from one individual to another through wounds that occur when they fight over food. Tumor cells in the mouth of an infected animal break off and enter the wound on an uninfected animal. The tumor cells multiply in the body of the newly infected devil, forming new tumors that eventually kill the animal.

Recent research has shown that the immune system of a Tasmanian devil accepts tumor cells from another devil as if they were cells from its own body. The tumor cells are ignored by the immune system. No immune response develops against them, and the cancerous cells multiply. Scientists predict that DFTD could wipe out all the remaining Tasmanian devils in 25 years, unless a treatment is developed.

Using the terms antigens and antibodies, explain why the tumor cells are ignored by the immune system in Tasmanian devils.

Base your answers to questions **15** through **18** on the information below and on your knowledge of biology.

The Control of Transpiration

Plants normally lose water from openings (stomates) in their leaves. The water loss typically occurs during daylight hours when plants are exposed to the Sun. This water loss, known as transpiration, is both beneficial and harmful to plants.

Scientists believe wind and high temperatures increase the rate of transpiration, but the size of each stomate opening can be regulated. Reducing the size of the openings during drought conditions may help reduce the dehydration and wilting that would otherwise occur.

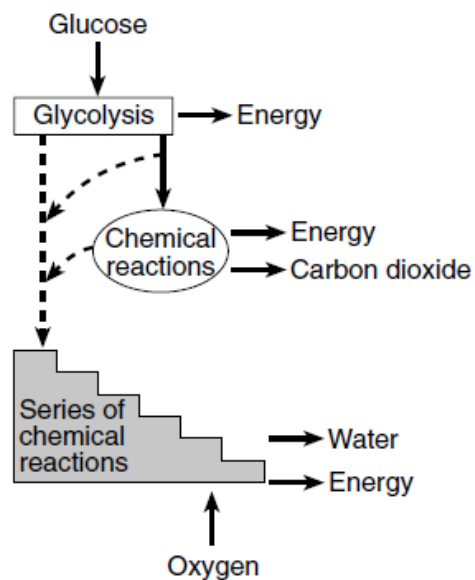
A leaf may lose more than its own weight in water each day. Transpiration also lowers the internal temperature of the leaf as water evaporates. On hot days, temperatures in the leaves may be from 3° to 15°C cooler than the outside air. With stomates open, vital gases may be exchanged between the leaf tissues and the outside environment.

Researchers have also found many plants that use another response when leaf temperatures rise. Special molecules known as heat shock proteins are produced by plant cells and help to hold enzymes in their functional shapes.

15. State *one* way transpiration is beneficial to plants.
16. Identify *two* of the "vital gases" that are exchanged between leaf tissues and the outside environment.
17. Identify the specific leaf structures that regulate the opening and closing of stomates.
18. Explain why it is important for plants to "hold enzymes in their functional shapes."

Part B and C

19. Base your answer to the following question on the diagram below and on your knowledge of biology. The diagram illustrates the steps in a process that occurs in the cells of many organisms.



Adapted from: Biology: A Community Context,
W. H. Leonard and J. Penick, 1998

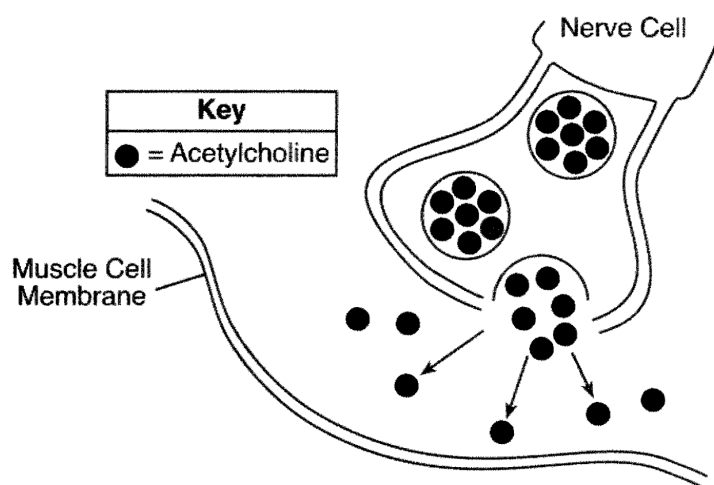
Identify *one* specific molecule used to store the energy being released during this process.

Molecule: _____

20. Base your answer to question on the information below and on your knowledge of biology.

Botulinum toxin is a protein produced by the bacterium *Clostridium botulinum*. It causes a serious form of food poisoning in humans. In a very dilute form, it is also commonly used to eliminate some signs of aging, such as wrinkles. It does this by preventing nerves from releasing a chemical messenger called acetylcholine into the synapse (space between a nerve cell and a muscle cell). The toxin affects the process that causes the muscle cell to contract and form wrinkles.

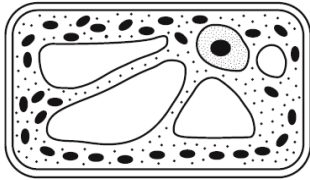
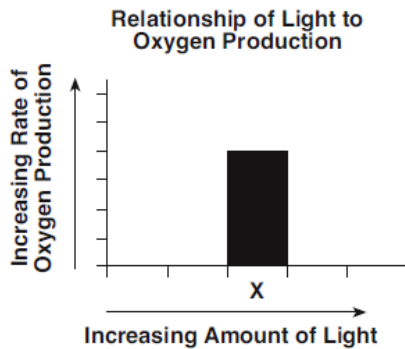
The diagram below represents a process that is involved in the formation of wrinkles. Complete the diagram by drawing an appropriate structure on the muscle cell membrane that would allow the nerve cell to communicate with the muscle cell.



Part B and C

Base your answers to questions 21 through 23 on the information and graph below and on your knowledge of biology.

A student conducts an experiment to determine how the amount of light affects the rate of oxygen production in a plant. The graph represents the rate of oxygen produced for one trial, *X*, in the experiment. By the end of the experiment, the plant had not reached maximum oxygen production.



21. If a student supplies more light than was received during trial *X*, a bar placed on the graph to represent the results would most likely be
- A) shorter than bar *X* and placed to the left of bar *X*
 - B) shorter than bar *X* and placed to the right of bar *X*
 - C) taller than bar *X* and placed to the left of bar *X*
 - D) taller than bar *X* and placed to the right of the bar *X***
22. The diagram above represents a cell from the plant being used in the study. Draw an arrow to a cell structure directly responsible for oxygen production in this cell. The tip of the arrow must touch the cell structure.
23. Identify the biochemical process occurring in this cell that produces the oxygen.

Process: _____

Part B and C

Base your answers to questions **24** and **25** on the information below and on your knowledge of biology.

"Cancer is a disease of genes gone wrong. When certain genes mutate, they make cells behave in odd ways. The cells divide swiftly, they hide from the immune system that could kill them and they gain the nourishment they need to develop into tumors "

Source: Carl Zimmer, NY Times, February 6, 2014

24. Explain why certain chemicals and radiation sources are risk factors for cancer.
25. Explain why the body of a person infected with HIV, the virus that causes AIDS, would have a different immune response to the presence of cancer cells than a person *not* infected with HIV.
-

Base your answers to questions **26** through **30** on the information below, and on your knowledge of biology.

A student has a sandwich for lunch. The bread contains starch molecules and various other molecules. After chewing and swallowing some of the sandwich, the starch moves along the digestive system and is digested. The sequence below represents what takes place next.

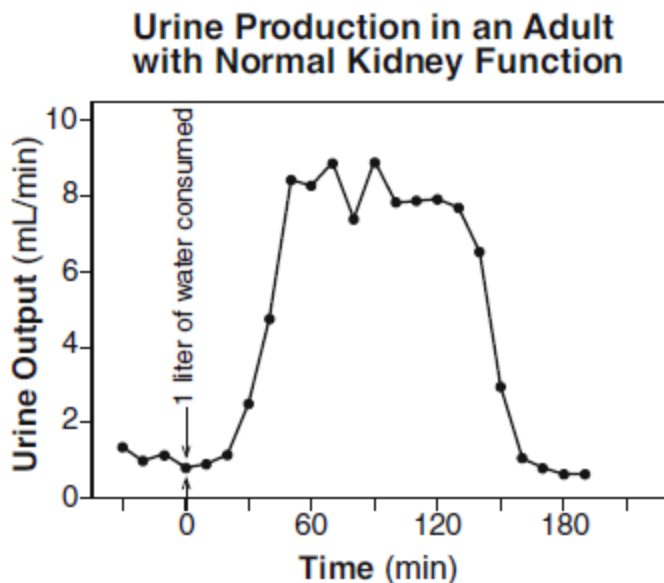
digested starch → bloodstream → cell → cell structure → ATP

Explain what occurs, beginning with the digestion of starch and ending with ATP production.

26. Identify the molecules that are used to digest the starch.
27. Identify the molecules produced when starch is digested.
28. Explain why starch must be digested before its building block molecules can enter the bloodstream.
29. Identify the structure in the cell that will produce ATP from the starch building blocks.
30. State why ATP is important to cells.

Base your answers to questions **31** through **34** on the information and graph below and on your knowledge of biology.

An investigation was carried out to determine the effect of drinking an excessive amount of water on urine flow. A subject drank 1 liter of water in 5 minutes, and then urine output was measured. The graph shows how the human adult kidneys responded to regulate water balance in the body. Urine output was measured every 10 minutes for a little over 3 hours. Normal output for an average adult is approximately 0.5–1 mL/min.



31. One half-hour after the liter of water was consumed, the urine produced by the kidneys was
- A) **between 2 and 3 mL/min** B) between 4 and 5 mL/min
C) eight times greater than normal D) below the normal range
32. The change in urine production during this 3-hour period was most likely the result of
- A) antibody production
B) **homeostatic feedback**
C) enzymatic breakdown of the water consumed
D) nerve cell malfunctions of the kidneys
33. Identify a structure, in organisms that do *not* have kidneys, that is adapted to regulate water balance.
34. Approximately how long did it take, in minutes, for the body to return to normal after the intake of water?

-
35. The information in the chart below represents the sex chromosome arrangement in humans and birds. Sex chromosomes contain genes involved in sex determination.

Sex Chromosomes in Animals

Animal	Female	Male
humans	XX	XY
birds	ZW	ZZ

In humans, it is the male gamete that is responsible for determining the sex of the offspring. Identify which type of gamete determines the sex of the offspring in birds. Support your answer.

Type of Gamete: _____

Base your answers to questions **36** through **38** on the information below and on your knowledge of biology.

Human reproduction is influenced by many different factors.

36. Identify *one* reproductive hormone and state the role it plays in reproduction.
37. Identify the structure in the uterus where the exchange of material between the mother and the developing fetus takes place.
38. Identify *one* harmful substance that can pass through this structure and describe the *negative* effect it can have on the fetus.

Part B and C

Base your answers to questions **39** through **41** on the Universal Genetic Code Chart below and on your knowledge of biology.

Universal Genetic Code Chart
Messenger RNA Codons and the Amino Acids for Which They Code

		SECOND BASE				
		U	C	A	G	
FIRST BASE	U	UUU } PHE UUC } UUA } LEU UUG }	UCU } UCC } SER UCA } UCG }	UAU } TYR UAC } UAA } STOP UAG }	UGU } CYS UGC } UGA } STOP UGG } TRP	U C A G
	C	CUU } CUC } LEU CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A	AUU } AUC } ILE AUA } AUG } MET or START	ACU } ACC } THR ACA } ACG }	AAU } ASN AAC } AAA } LYS AAG }	AGU } SER AGC } AGA } ARG AGG }	U C A G
	G	GUU } GUC } VAL GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G

Plant Species Table

Endangered plant species	DNA base sequence	AAT	CCG	AGT	GGA
	mRNA base sequence	UUA	GGC	UCA	CCU
	amino acid sequence	LEU	GLY	SER	PRO
Plant species A	DNA base sequence	AAC	CCA	AGT	GGA
	mRNA base sequence	UUG	GGU	UCA	CCU
	amino acid sequence	_____	_____	_____	_____
Plant species B	DNA base sequence	ATA	CCC	AGG	GGA
	mRNA base sequence	_____	_____	_____	_____
	amino acid sequence	TYR	GLY	SER	PRO
Plant species C	DNA base sequence	CAT	CCT	ATA	GGA
	mRNA base sequence	GUA	GGA	UAU	CCU
	amino acid sequence	VAL	GLY	TYR	PRO

39. Complete the missing amino acid sequences for plant species *A* in the table above.
40. Complete the missing mRNA base sequences for plant species *B* in the table above.
41. Based on the information provided in the completed table, which plant species is most closely related to the endangered species? Support your answer.

Species: _____

Base your answers to questions **42** and **43** on the information below and on your knowledge of biology.

Female mosquitoes need a meal of blood from a person or other animal in order to produce eggs. It has been discovered that mosquitoes have cells on their antennae that can detect the insect repellent known as DEET. The repellent is not harmful to mosquitoes, but when mosquitoes detect DEET, they will not land on the surface where the DEET has been applied. This protects people from being bitten by mosquitoes.

Recently, scientists found some mosquitoes that are resistant to DEET because they do not detect its presence. They bred these mosquitoes and eventually produced a population consisting of about 50% DEET-resistant insects.

42. Identify the process most likely responsible for a mosquito initially becoming resistant to DEET.

43. Mosquitoes with DEET resistance have been found in natural environments. Explain how the continued use of this repellent may cause the percentage of these resistant mosquitoes to increase in the future.

44. Base your answer to the following question on the passage below and on your knowledge of biology.

Most animal fossils include hard body parts such as teeth and bones. Until recently, scientists had little hope that soft tissue could be preserved in the bones. A team of scientists has removed soft tissue containing a collagen protein from the leg bone of a 68-million-year-old fossil from a dinosaur, *Tyrannosaurus rex*. The technique of mass spectrometry was used to identify the sequences of certain molecules in several small fragments of the dinosaur collagen protein.

The molecular sequences were compared to those of modern animals. The scientist found that the collagen protein of the *Tyrannosaurus rex* more closely resembled the collagen protein found in modern chickens than that in some other modern animals.

State *one* kind of evidence that would support the conclusion that birds evolved from dinosaurs like *Tyrannosaurus rex*.

45. The number of amino acid differences in the protein cytochrome c between chimpanzees and some other animals is shown in the table below.

**Comparison of Chimpanzee Cytochrome c
to that of Other Animals**

Animal	Number of Amino Acid Differences
Chimpanzee	0
Dog	8
Dogfish shark	24
Rattlesnake	12
Rhesus monkey	1

Explain how the data in the table can be used to determine possible evolutionary relationships.

Base your answers to questions **46** through **49** on the passage below and on your knowledge of biology.

Dandelions are weeds that are very common in many grassy areas of New York State. Dandelion flowers first open up in a bright-yellow stage, and later turn a fluffy white when they are ready to release their seeds. The seeds are carried by the wind, and can sometimes travel great distances before landing and growing into new plants. The stems of dandelions are usually very long, typically about 20–30 centimeters (cm), and stand high above the surrounding grass.

A science teacher in Niagara County discovered an area in her lawn where nearly every dandelion had a stem less than 1 cm long. These short dandelions were replacing large amounts of grass in the lawn surrounding her house. They were growing much more thickly than the taller dandelions in other nearby areas. The short dandelions appeared to be growing very successfully in one area of her lawn, but did not appear to have spread to other areas of her lawn. The science teacher noticed that every time she mowed her lawn, the short dandelions were left untouched by the mower blades, and that their numbers were steadily increasing.

46. State *one* possible cause of the genetic variation in dandelion height.
47. State *one* possible explanation for the fact that the short dandelions had not yet spread to other areas of her lawn.
48. State *one* possible reason why the amount of grass was decreasing, while the number of short dandelions was increasing in the lawn of the science teacher.
49. State *one* possible advantage the short dandelions may have over the tall dandelions in this yard.

Base your answers to questions **50** through **52** on the information below and on your knowledge of biology.

Nature Will Have to Clean Up Hawaii Molasses Leak That Killed Thousands of Fish

A massive spill of thick molasses has turned Honolulu Harbor into a watery wasteland where thousands of fish have been suffocated - a disaster that officials say Mother Nature will have to clean up.

"There's nothing alive there at all," diver Roger White told NBC affiliate KHNL after making a seven-minute video of dead sea life blanketing the bottom of the harbor

... "Unlike with an oil spill, it's a sugar product so it will dissipate on its own," Matson spokesman Jeff Hull told NBC News on Thursday. "There's not an active cleanup."

"The molasses is not toxic but it's heavier than water so it's spreading around on the sea floor, displacing the oxygen-rich water down there, and the fish are suffocating," said Keith Korsmeyer, a professor of biology at Hawaii Pacific University.

The die-off also could lure predators like sharks, barracuda and eels to the harbor and neighboring Keehi Lagoon, experts warned

... Korsmeyer said marine life would probably repopulate the harbor, after the lowoxygen water moves out, but that could take months or even years

Source: <http://www.nbcnews.com/news/other/nature-will-have-cleanhawaii-molasses-leak-killed-thousands-fish-f8C11137030>

50. Predict what will most likely happen to this ecosystem in 20 years if no other disasters occur.

Part B and C

51. Explain why it is important to preserve the biodiversity of the Honolulu Harbor ecosystem.
52. Identify *one* group of organisms responsible for the recycling of dead sea life that is *not* mentioned in the article.
-

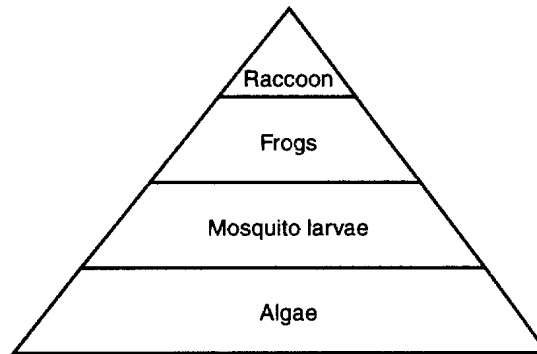
Base your answers to questions **53** through **55** on the passage below and on your knowledge of biology.

The lake sturgeon is a fish that often grows over six feet long and can weigh close to two hundred pounds. It is currently an endangered species in the Great Lakes area, although the species has lived in those lakes and rivers for millions of years. Now, there is a program to increase the sturgeon population by reintroducing lake sturgeon to areas where they have disappeared.

Like the lake sturgeon, bloater fish are also found in the Great Lakes. Both find their food on or near the bottoms of lakes. They eat a variety of small organisms, including insect larvae, worms, and clams. These small organisms feed on algae.

53. State what the arrows in the food web represent.
54. Identify which population, other than lake sturgeon, will increase in size after the lake sturgeon are added to the new ecosystems. Support your answer.
55. Identify *one* population that will *decrease* in size after the lake sturgeon are added to the new ecosystems. Support your answer.
-

Base your answers to questions **56** through **58** on the diagram below.



56. State *one* reason that algae form the base of this pyramid.
57. Which term best describes the mosquito larvae?
A) producer B) parasite C) carnivore **D) consumer**
58. Explain why each level of the pyramid *decreases* in area from bottom to top.

Part B and C

Base your answers to questions **59** through **61** on the information below and on your knowledge of biology.

Ticks, such as deer ticks and dog ticks, feed on the blood of humans and other animals. Part of the feeding process involves the tick injecting its saliva to help make blood flow. In the process, they sometimes spread disease organisms to their host. Sometimes ticks get on clothing, and can remain there for a few days before actually biting their host.

A scientist found that ticks might be able to survive even when exposed to hot water and detergent in a washing machine.

Students designed the experiment below to test how well ticks survive a hot-water washing machine cycle with detergent. Note that some details of the design are incorrect

Hypothesis: Can ticks survive a hot water and detergent wash cycle in a washing machine?	
Data to be Collected:	Number of ticks surviving the cold-water wash cycle

	Control Group	Experimental Group
Test Subjects:	deer tick	dog tick
Experimental Setup:	ticks in washing cycle with cold water and detergent	ticks in washing cycle with hot water and detergent
Number Used:	10	100

59. Identify *one* error with the hypothesis.
- _____
- _____
60. Explain why the students' proposed data to be collected would not likely test what the students intended.
- _____
- _____

61. Identify *one* error in the students' design in the shaded area of the table and explain how the students should change the experiment to correct the error.

Error : _____

Correction : _____

62. Base your answer to the following question on the information below and on your knowledge of biology.

Help for Aging Memories

As aging occurs, the ability to form memories begins to decrease. Research has shown that an increase in the production of a certain molecule, BDNF, seems to restore the processes involved in storing memories. BDNF is found in the central nervous system and seems to be important in maintaining nerve cell health. Researchers are testing a new drug that seems to increase the production of BDNF.

Design an experiment to test the effectiveness of the new drug to increase the production of BDNF in the brains of rats. In your answer be sure to:

- state the hypothesis your experiment will test
- describe how the control group will be treated differently from the experimental group
- identify *two* factors that must be kept the same in both the experimental and control groups.
- identify the dependent variable in your experiment.

63. Plants respond to their environment in many different ways. Design an experiment to test the effects of *one* environmental factor, chosen from the list below, on plant growth.

Acidity of precipitation

Temperature

Amount of water

In your answer, be sure to:

- identify the environmental factor you chose
- state *one* hypothesis the experiment would test
- state how the control group would be treated differently from the experimental group
- state *two* factors that must be kept the same in both the experimental and control groups
- identify the independent variable in the experiment
- label the columns on the data table below for the collection of data in your experiment

Data Table

64. Many plants can affect the growth of other plants near them. This can occur when one plant produces a chemical that affects another plant.

Design an experiment to determine if a solution containing ground-up goldenrod plants has an effect on the growth of radish seedlings. In your experimental design be sure to:

- state a hypothesis to be tested

- describe how the experimental group will be treated differently from the control group
- explain why the number of seedlings used for the experiment should be large
- identify the type of data that will be collected
- describe experimental results that would support your hypothesis

Answer Key

PART B and C migED

1. D

2. D

3. A

4. The molecule is a crystal with a tube running up the middle of it.

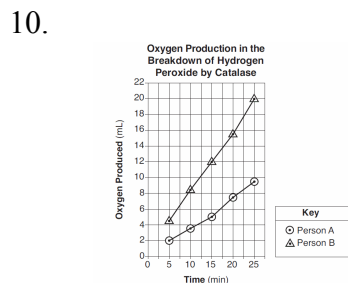
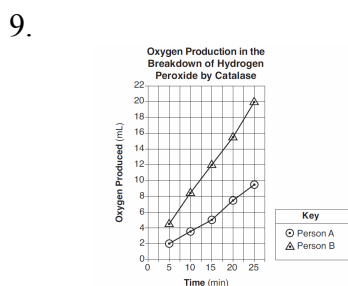
5. The willow tree bark contains salicylic acid, which is similar to acetylsalicylic acid, the active ingredient in aspirin.

6.

1a. Is rod shaped.....	bacillus
1b. Is not rod shaped.....	go to 2
2a. Is spiral shaped.....	spirillum
2b. Is not spiral shaped.....	go to 3
3a. Exists singly or single cells.....	type C
Exists in a group or colony or Clumps of cells or	
3b. Chains of cells.....	type D

7. C

8. — marking an appropriate scale, without any breaks in the data, on each labeled axis.



11. — because their tissue sample produced a lower amount of oxygen, indicating a lower amount of catalase — They have less catalase than person B because less oxygen is being released. — They have less catalase so more peroxide is present.

12. — The information is in DNA molecules in the nucleus of the cell. — The nucleus contains the DNA molecules where the information is found. — The information is located on a chromosome, which contains DNA.

13. — Ribosomes construct proteins out of amino acids. — Ribosomes use amino acids to assemble proteins. — Ribosomes use amino acids.

14. — The tumor cells might lack antigens that the antibodies can recognize and attack. — The antigens on the surface of the tumor cells could be interpreted by the immune system as being on cells that are not harmful and therefore do not form antibodies to attack them. — The cancer cells might not have any antigens on their surfaces. Without antigens, antibodies will not attack.

15. — Transpiration helps plants cool off on hot days. — While transpiration is occurring, the stomates are open, allowing the exchange of important gases.

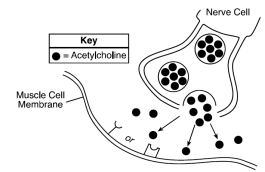
16. -oxygen -water vapor -carbon dioxide

17. Guard cells

18. —If the shape of an enzyme changes, it may not function or it may function differently- . —Key activities may slow down or stop. —The shape of an enzyme determines its function

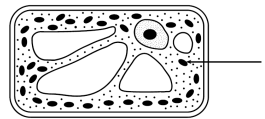
19. — ATP/ADP *or* NADH/NAD

20.



21. D

22.



23. photosynthesis *or* autotrophic nutrition *or* photolysis

24. — Mutations are sometimes a cause of cancer and exposure to radiation increases the occurrence of mutations. — Radiation, such as UV, can cause cells to mutate and cause skin cancer. — Certain chemicals may increase the rate of mutations. — Radiation can alter the genetic information in cells. — Radiation weakens the immune system.

Answer Key

PART B and C migED

25. — HIV/AIDS attacks the immune system directly and the body is unable to deal with the invaders. — AIDS damages the immune system so it does not respond as effectively. — AIDS damages the immune system so it cannot produce antibodies/enough antibodies to fight disease or cancer.
26. — enzymes, — biological catalysts, — amylase molecules
27. — glucose molecules, — simple sugars, — monosaccharides, — sugars
28. — Starch molecules are too large. — They are too big to get from the digestive tract into the blood. — Large molecules cannot diffuse through cell membrane.
29. — Mitochondria
30. — ATP is the molecule that supplies usable energy for all the activities of a cell. — ATP molecules provide energy for cells.

33. — cell membrane — guard cells/stomate — vacuole/contractile vacuoles
34. between 150 minutes and 190 minutes.
35. female *or* egg *or* zw and—Female gametes have one of two different types of sex chromosomes.—The egg may contain one of two different types of sex chromosomes.
36. *Examples:* — Testosterone influences the formation of sperm cells. — Testosterone influences the formation of gametes.
37. placenta
38. — drugs — fetal addiction; — alcohol — low birth weight *or* premature birth or brain damage *or* fetal alcohol syndrome
- 39.

Plant Species Table					
Endangered plant species	DNA base sequence	AAT	CGG	AGT	GGA
	mRNA base sequence	UUA	GCC	UCA	CCU
	amino acid sequence	LEU	GLY	SER	PRO
Plant species A	DNA base sequence	AAC	CCA	AGT	GGA
	mRNA base sequence	UUG	GCU	UCA	CCU
	amino acid sequence	LEU	GLY	SER	PRO
Plant species B	DNA base sequence	ATA	CGG	AGC	GGA
	mRNA base sequence	UUA	GCC	UCG	CCU
	amino acid sequence	TYR	GLY	SER	PRO
Plant species C	DNA base sequence	CAT	CCT	ATA	GGA
	mRNA base sequence	GUA	GGA	UAT	CCU
	amino acid sequence	VAL	GLY	TYR	PRO

Plant Species Table						
Endangered plant species	DNA base sequence	AAT	CGG	AGT	GGG	
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Plant species A	DNA base sequence	AAC	CCA	AGT	GGG	
	mRNA base sequence	UUG	GCU	UCA	CCC	
	amino acid sequence	LEU	GLY	SER	PRO	
Plant species B	DNA base sequence	ATA	CGG	AGC	GGG	
	mRNA base sequence	UAT	GCC	UCG	CCC	
	amino acid sequence	TYR	GLY	SER	PRO	
Plant species C	DNA base sequence	CAT	CCT	ATA	GGG	
	mRNA base sequence	GUA	GGA	UAT	CCC	
	amino acid sequence	VAL	GLY	TYR	PRO	

41. — It is most closely related to the endangered species because their amino acid sequences are identical. — It is most closely related to the endangered species because the DNA sequences are the most similar.
42. — mutation — recombination during fertilization — sexual reproduction
43. — Mosquitoes resistant to DEET will land on people and bite them and be able to reproduce successfully, while some of those not resistant will not be able to get blood and reproduce. — Mosquitoes that do not detect the presence of DEET will land on people and bite them and then be able to reproduce.

44. —The collagen protein of *Tyrannosaurus rex* more closely resembles the collagen protein of chicken than other animals. —similar bone structures —Similar proteins were identified in both.
45. — The more closely related the organisms, the fewer amino acid differences. — A greater number of differences probably means that they are not closely related.
46. — mutation — changes in DNA — recombination/recombining of genes
47. — The seeds from plants with shorter stems are less likely to be carried by the wind. — The short dandelions do not have an adaptation needed for survival in other areas of the lawn. — The seeds from the shorter dandelions did not land there.

31. A
32. B

Answer Key

PART B and C migED

48. — The dandelions out-compete the grass for the same limited resources. — The dandelions are better adapted for survival. — The dandelions shade the grass.
49. — Short dandelions are less likely to be cut down by a lawnmower. — Short dandelions will be left to reproduce.
50. — Marine life would repopulate the harbor. — The ecosystem would recover on its own. — The ecosystem might not recover due to the degree of destruction that occurred. — It would recover due to ecological succession/reach a climax community.
51. — Biodiversity increases the chances that at least some organisms will survive in the event of environmental change. — Biodiversity increases the stability of the ecosystem. — Biodiversity increases the variety of genetic material present in an ecosystem. — Humans rely on the ecosystem for fishing, food, and tourism.
52. — fungi, — decomposer- s,— bacteria
53. — The arrows show the direction of energy movement from one organism to another. —The arrows show the flow of energy. — movement of nutrients through the food web, — what each organism feeds on
54. — Algae, because there will be fewer organisms that feed on them. — More algae will survive and reproduce because populations of insect larvae, clams, and worms that eat the algae will decrease in size because they will be eaten by both lake sturgeon and bloaters fish.
55. — Populations of insect larvae [or clams or worms] will decrease in size because they will be eaten by both lake sturgeon and bloaters fish. —The bloaters fish population will decrease in size because it will have to compete with the lake sturgeon for food resources. — clams because they are eaten by the sturgeon
56. *Examples:* — They are producers — They contain the most energy
57. **D**
58. *Examples:* — There is less energy available at each succeeding level. — Energy is lost as heat at each level.
59. — It is written in the form of a question. — It is not a prediction
60. — The students wanted to see if the ticks would survive a hot-water wash. The students are collecting data only for cold water. — There is no hot water data being collected, so the students could not support their hypothesis. — The data on only cold water could never support their hypothesis.
61. Error: two different kinds of ticks
Correction: Use the same species for each group.
Error: number of subjects used
Correction: The student used 10 in one group and 100 in the other. Use 100 in both groups.
Error: number used
Correction: Use the same amount in both groups.
62. (essay)

Answer Key
PART B and C migED

63. - Acid rain will cause a decrease in the number of seeds that germinate.
Note: Do not allow credit for a hypothesis written in the form of a question.
- The control group would be watered with water at pH 7, while the experimental groups would be watered with water at pH less than 7.

Data Table

pH	Number of Seeds that Germinate

64. (essay)
-

Answer Key
PART B and C migED

62. • stating the hypothesis the experiment will test.
— Rats that are given the drug will show an increase in BDNF in their brains.— The drug affects memory formation in rats.
- describing how the control group will be treated differently from the experimental group.
— The control group will not get the drug; the experimental group will.— The control group will get a placebo.
- identifying *two* factors that must be kept the same in both the experimental and control groups.
— Both groups should have the same number of rats. — rats of the same age — kept in same conditions — given the same food
- identifying the dependent variable in the experiment.
— amount of BDNF found in their nerve tissue— ability to form/store memories
64. *Examples:*
- — Radish seedlings grow faster when exposed to goldenrod solution. — Radish seedlings treated with the solution will not grow as tall as the control group. — The solution will not affect the height of radish seedlings.
- —The experimental group will be given the solution while the control group is given plain water. — The experimental group will have ground up goldenrod in the soil.
- — A large sample will increase the validity of the results. — Since some may die, there will be enough left to do the experiment.
- — The number of seedlings that survive in each group will be counted. — the height of the seedlings
- — Radish seedlings exposed to goldenrod solution were twice as tall as the control group in two weeks. — If the radish seedlings treated with the solution do not grow as tall as those in the control group, the hypothesis is supported. — If there is no difference between the height of the group treated with the solution as compared to the control group, the hypothesis will be supported.
-