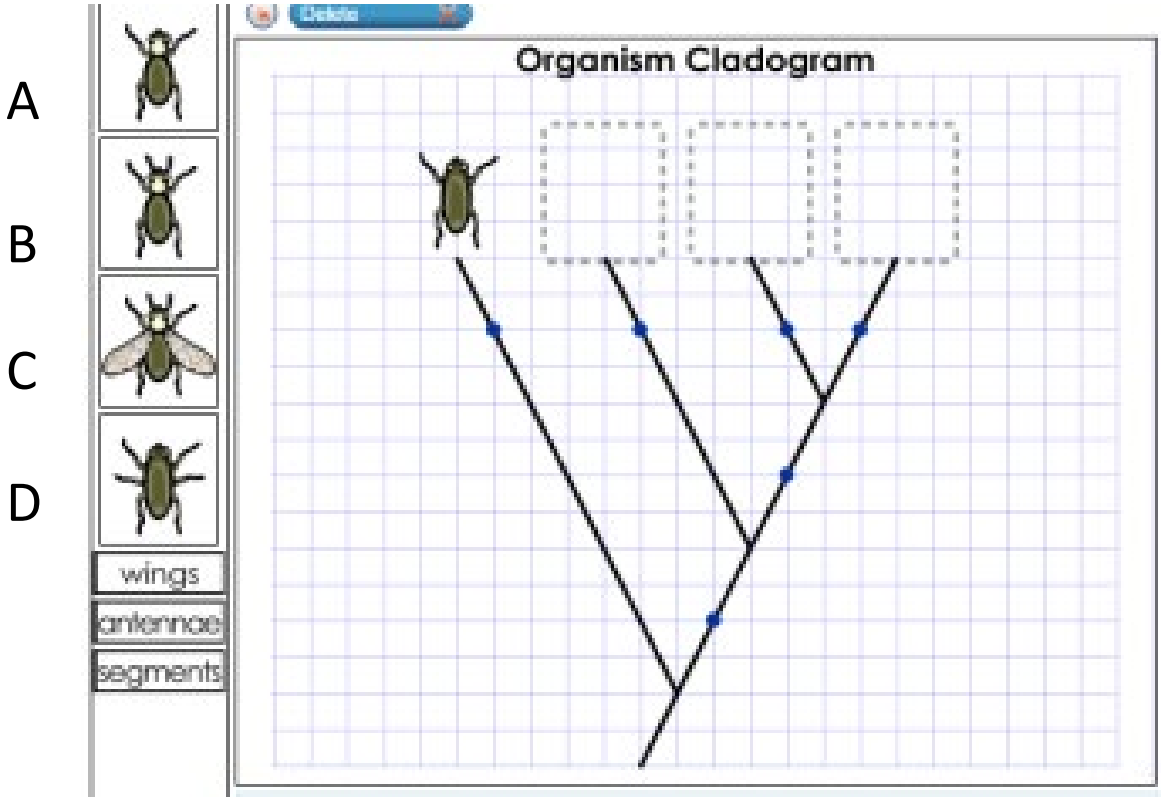
Biology

Name_____ Date_____

Question 1

Cladograms show evolutionary relationships among species. Several species of organisms, an incomplete cladogram and labels representing inherited traits are shown.



A. Place an organism label (A, B, C or D) in each of the blank boxes to show relatedness among the organisms.
B. Place a trait label on the cladogram to show when the traits appeared. Place the trait labels on or near the blue dots on the cladogram.

- You do **not** need to use all of the organisms.
- You should use all of the trait labels.
- There may be more than one correct answer.

Question 2

Which type of macromolecule stores energy and provides thermal insulation for thee body?

a. Lipid
b. Protein
c. Nucleic acid
d. Carbohydrate

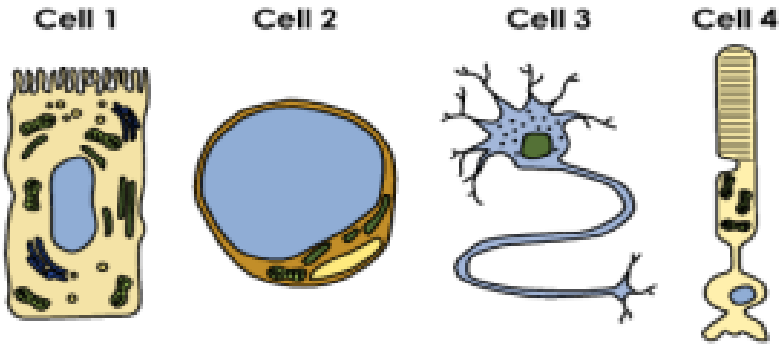
Question 3

From an evolutionary perspective, what is the significance of reproductive isolation developing between two populations within a species.

a. Speciation due to reproductive isolation results in extinction of the ancestral species.
b. When two populations cannot interbreed, the flow of genetic information between them stops.
c. Ove time, reproductive isolation leads to increasing competition between the populations.
d. When the size of breeding populations decreases, the mutation rate decreases resulting in greater fitness.

Question 4

Thee diagram shows four different cells from the same animal.

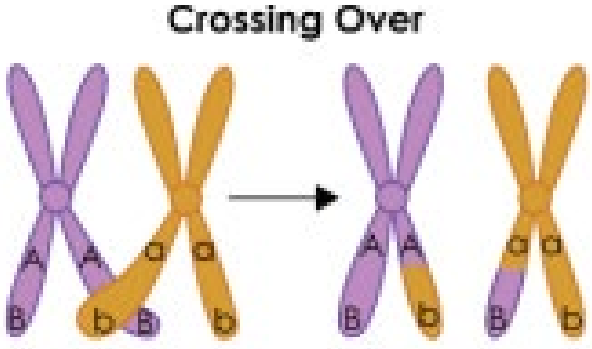


Which statement about the cells is accurate?

a. The four cells have identical DNA sequences
b. Cell 3 and cell 4 have the longest DNA sequences because they have longer shapes.
c. The four cells are different shapes because they come from different parent organisms.
d. Cell 1 and Cell 2 have all the same active genes even though they are from different body systems.

Question 5

The diagram depicts the process of crossing over, which occurs between homologous chromosomes during gamete formation.



What is the result of this process?

a. An increase in offspring variation
b. The deletion of amino acids in proteins
c. An increase in mutations in genetic material
d. The production of gametes that are genetically identical

Question 6

A scientist studies a population of lizards to determine whether or not the population is evolving.

A. **Population Condition(s)**

- ☐ Mating is random.
- ☐ The lizard population is small.
- ☐ No lizards migrate in or out of the population.
- ☐ A new mutation occurs within the population.
- ☐ Natural selection is not occurring in the population.

B. Allele frequencies _____ will _____ over time.

Allele frequency descriptions

for an individual	change
in a population	remain constant

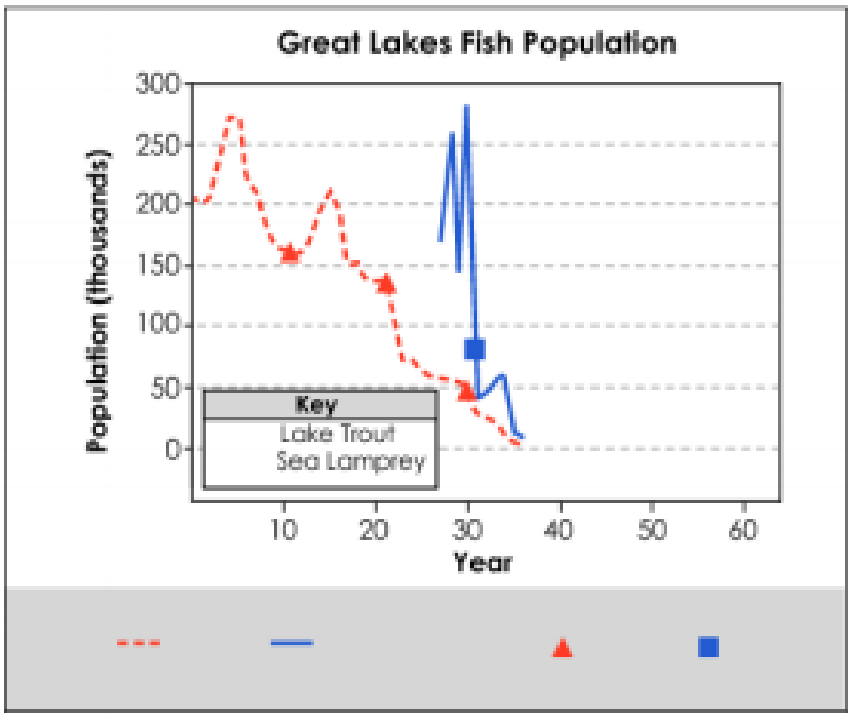
A. Place a check on the condition(s) that would cause the population to be in Hardy-Weinberg equilibrium.
B. Fill in the blank with the correct phrase to describe what occurs when Hardy-Weinberg conditions are met.

Question 7

The lake trout is a native species, and the sea lamprey is an invasive species of the Great Lakes. An effective chemical control program was begun on the invasive species in year 30.

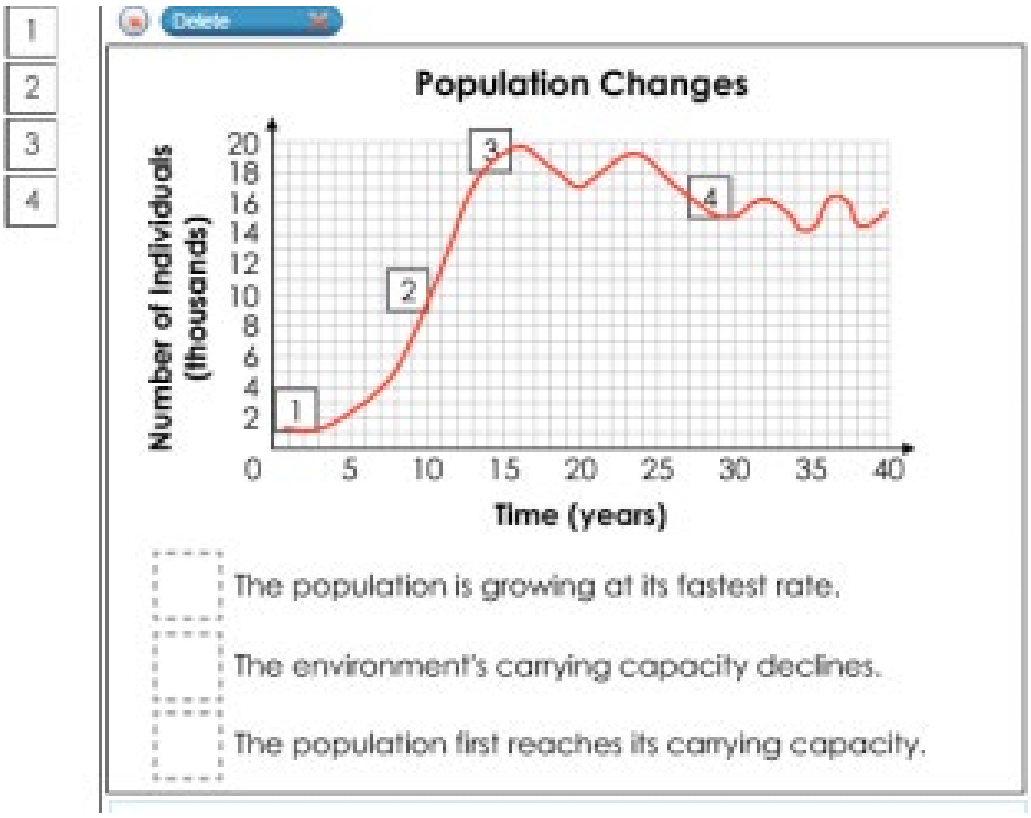
A. Draw in the dashed red line and the solid blue line into the Key at the bottom of the graph to show which fish species is represented by which color.
B. Draw the red triangle shape and the blue square shape onto the graph to predict the fish populations at year 50, following the control program.

- There may be more than one correct answer.



Question 8

The graph shows changes to a population over time. Four points on the graph are identified by number.



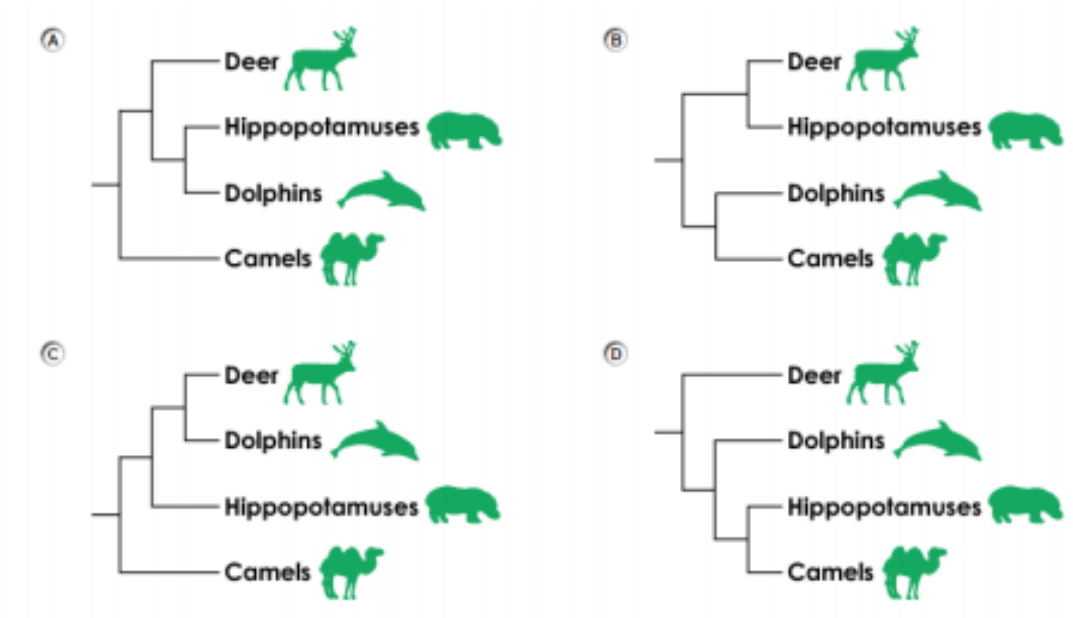
Place a graph position number label in each blank box next to the statement that correctly describes the population change at that point on the graph.

- Place only **one** label in each box.
- You do **not** need to use all the labels.
- You may use a label more than once.

Question 9

Some orders of land and marine mammals are closely related. Molecular data recently collected from dolphins, camels, deer, and hippopotamuses have shown that hippopotamuses are the closest living relatives of dolphins.

Which cladogram models this evolutionary relationship?



Question 10

The following question has 2 parts. First, answer part A. Then, answer part B.

Part A

A bacterium was discovered in several hot springs. The temperature of the springs can range from 50 to 80 degrees Celsius.

Scientists investigate an enzyme from this bacterium. They set up the data table shown to record their results.

Experimental Data to Be Collected

Tube of Enzyme Culture	Environmental Temperature (°C)	Reaction Rate at 0 Minutes	Reaction Rate at 5 Minutes	Reaction Rate at 10 Minutes	Reaction Rate at 20 Minutes
1	5				
2	22				
3	37				
4	60				
5	80				
6	100				

Which question could be answered using the data to be collected?

a. How does the enzyme's shape change over time?
b. How does temperature affect the reaction rate of the enzyme?
c. How does substrate concentration affect the reaction rate of the enzyme?
d. How does the active site of an enzyme change with different temperatures?

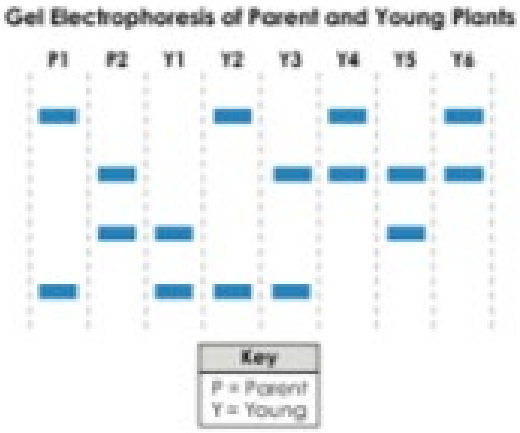
Part B

What is a reasonable hypothesis for this study?

a. Activation energy will be lowest in tubes 2 and 3.
b. The enzyme's shape will adapt to each temperature setting.
c. The enzyme's reaction rate will be greatest from 0 to 5 minutes.
d. The optimum reaction rate of the enzyme will be seen in tubes 4 or 5.

Question 11

A farmer wants to know which plants come from two given adult plants. Using gel electrophoresis, the farmer tests the same specific sections of DNA of the two adult parent plants. Then, he tests the same section of DNA on six individual young plants to determine their relatedness to the two adult parent plants. The electrophoresis gel results are shown.



A. Identify one young plant in an offspring of the adult parents, and explain how the results suggest your choice.
B. Describe how the parents of the electrophoresis get from the adult parent and young individual plant demonstrate the movement of chromosomes during meiosis.

Write your answer on the white lined paper provided.

Question 12

Students investigate how onion cells react to salt (NaCl) solutions of different concentrations. They observe onion cells in three salt solutions under a microscope. The image of an onion cell in a 3% salt solution is shown.

Onion Cell in 3% Salt Solution

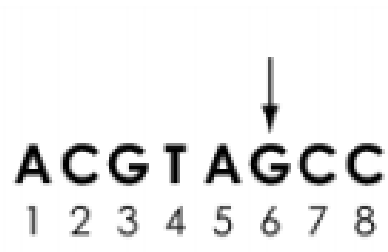
Salt Concentration (%)	Onion Cell Image
	
	

Enter a salt concentration for each of the two onion cell images shown in the table.

- There may be more than one correct answer.

Question 13

A coding strand of DNA is shown.



A substitution mutation occurs at the nucleotide position six on the DNA strand during replication.

A. Enter the DNA sequence for the coding strand of DNA with a substitution mutation at position six.
B. Enter the mRNA sequence that is a result of the substitution mutation on the coding DNA strand.

- There may be more than once correct answer.

	Sequence
DNA sequence after substitution at position six	
Resulting mRNA sequence	

Question 14

Which structural feature of the cell membrane allows molecules such as oxygen and carbon dioxide to diffuse into and out of the cell.

a. The cell membrane contains protein molecules.
b. The cell membrane contains cholesterol molecules.
c. The cell membrane is made up of two layers of phospholipids.
d. The cell membrane is anchored to the cytoplasm by the cytoskeleton.

Question 15

How does natural selection affect population?

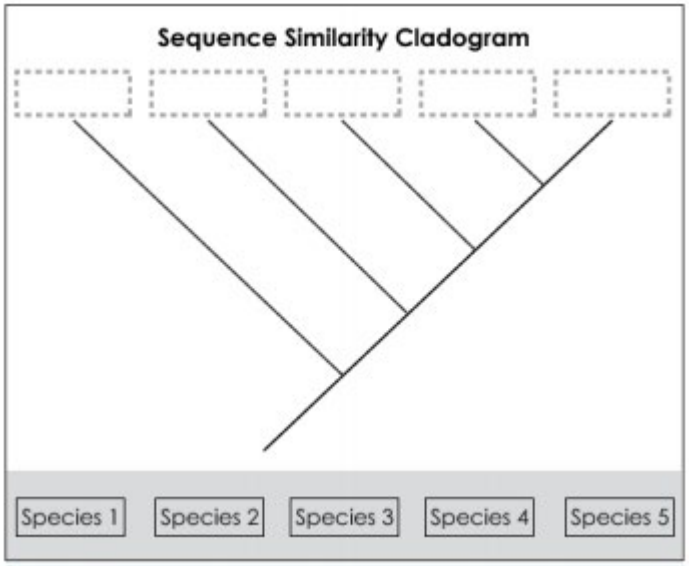
a. By creating variation in individuals that allows them to better adapt to changing environmental conditions.
b. By increasing the rate of beneficial mutations which allow individuals to increase their rate of reproduction.
c. By reducing variation between individuals in a population thereby making the population more homogeneous and likely to survive
d. By acting on variations between individuals that make some better adapted to their environment and more likely to survive and reproduce.

Question 16

A biologist sequences a gene shared by five different species. The percentage of sequence similarity for four different gene segments, A, B, C, and D are shown in the table.

Percentages of Gene Sequence Similarities

Species	A	B	C	D
1	100	100	100	100
2	97	93	98	97
3	99	98	99	99
4	99	99	99	99
5	90	87	81	93



Using the data in the table fill in the blanks with the correct species label on the cladogram to show the relationships among the species.

Use only **one** species label in each blank box.