

MCAS Questions: Populations and Ecosystems**Reporting Category: Life Science****Reproduction and Heredity**

Standard: 7 - Recognize that every organism requires a set of instructions that specifies its traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another.

Standard: 8 - Recognize that hereditary information is contained in genes located in the chromosomes of each cell. A human cell contains about 30,000 different genes on 23 different chromosomes.

Standard: 9 - Compare sexual reproduction (offspring inherit half of their genes from each parent) with asexual reproduction (offspring is an identical copy of the parent's cell).

Evolution and Biodiversity

Standard: 10 - Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Standard: 11 - Recognize that evidence drawn from geology, fossils, and comparative anatomy provides the basis of the theory of evolution.

Standard: 12 - Relate the extinction of species to a mismatch of adaptation and the environment.

Living Things and Their Environment

Standard: 13 - Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.

Energy and Living Things

Standard: 14 - Explain the roles and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.

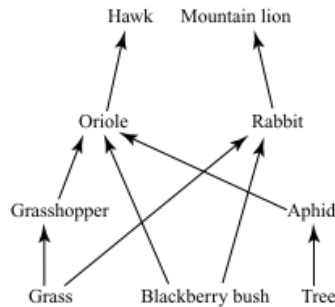
Standard: 16 - Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

Changes in Ecosystems over Time

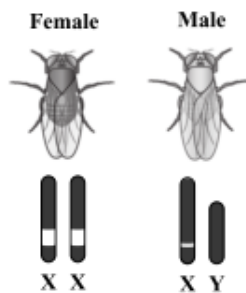
Standard: 18 - Recognize that biological evolution accounts for the diversity of species developed through gradual processes over many generations.

1. (2013) Which of the following observations **best** supports the conclusion that two animal species evolved from a common ancestor in recent geological history?
 - A. The species are both herbivores.
 - B. The species have similar bone structure.
 - C. The species live in the same environment.
 - D. The species both obtain oxygen from the air.

2. (2013) The diagram below shows a partial food web for some of the organisms in an area.



- If all the trees in the area were cut down, the energy supply of which population would be most directly affected?
- A. aphid
B. grasshopper
C. oriole
D. rabbit
3. The diagram below shows the X chromosomes in a female fruit fly and the X and Y chromosomes in a male fruit fly.



The two fruit flies are crossed with each other. The female offspring of the fruit flies will receive which pair of chromosomes?

A.

B.

C.

D.

4. (2012) Some types of bacteria can only live where oxygen is not present. These bacteria were well adapted to life on Earth over 2 billion years ago.
- Which of the following changes caused many of these bacteria to become extinct?

- A. the slow movement of tectonic plates
- B. the varying temperatures of each season
- C. an increase in volcanic activity under the oceans
- D. an increase in the number of photosynthetic organisms

5. (2011) The pictures below show two dogs of the same breed that have different coat colors.



The instructions that determine coat color are stored in the

- A. cytoplasm of skin cells.
 - B. membrane of every cell.
 - C. mitochondria of hair cells.
 - D. chromosomes of every cell.
6. (2011) Which of the following statements **best** describes photosynthesis?
- A. Carbon dioxide and water are turned into sugar and oxygen.
 - B. Sugar and oxygen are turned into water and carbon dioxide.
 - C. Oxygen and carbon dioxide are turned into water and sugar.

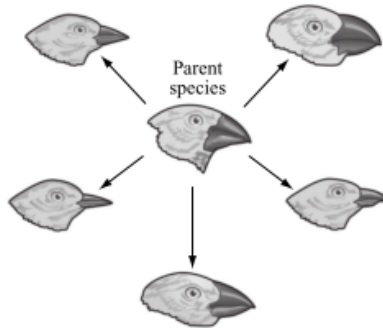
D. Water and sugar are turned into oxygen and carbon dioxide.

7. (2011) Jerome crossed two purple-flowered plants. The offspring produced from this cross had either white flowers or purple flowers, as shown in the table below.

Number of Offspring	Flower Color
10	Purple
3	White

Which of the following statements best explains why some of the offspring have white flowers?

- A. These offspring were created by asexual reproduction.
 - B. These offspring were produced in a dark environment.
 - C. These offspring inherited a DNA sequence coding for white flowers from each parent plant.
 - D. These offspring inherited a DNA sequence coding for white flowers from only one parent plant.
8. (2010) The diagram below shows the beaks of five species of birds that developed over time from one parent species. The five species of birds can be found living in the same area.



Which of the following best explains why the beak shape of each species of bird developed differently?

- A. Each beak shape helps the birds to produce different songs.
- B. Each beak shape is an adaptation to a specific source of food.
- C. Each beak shape is designed to construct a different type of nest.
- D. Each beak shape helps protect the birds from a different predator.

9. (2010) One of the most common types of adaptations in plants involves the shape and structure of each plant's leaves. The surface area of leaves is related to the amount of water a plant loses.

Based on this information, which of the following plants is probably best adapted for living in a hot, dry climate?

A.

B.

C.

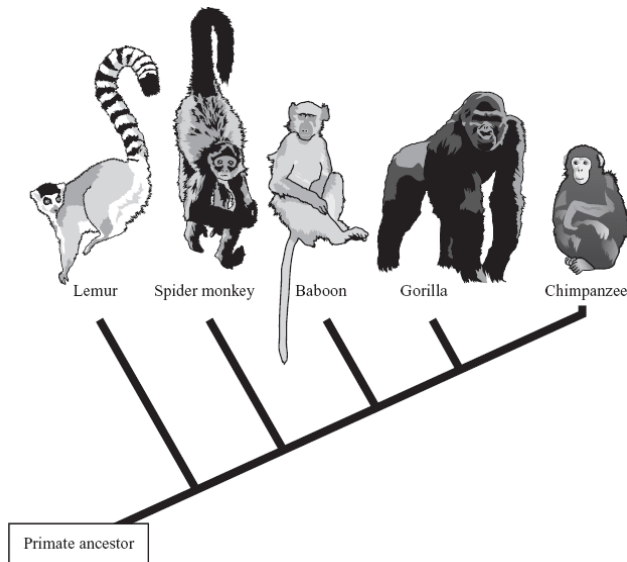
D.

10. (2009) Most of the bacteria in a forest ecosystem are **best** classified as which of the following types of organisms?

- A. consumers
- B. decomposers
- C. predators
- D. producers

11. (2009) Comparing the skeletons of which of the following fish would **best** show the evolution of a fish species?
- A. a male fish and a female fish that could produce offspring
 - B. the same fish just before it received a cut and after it healed
 - C. a fish that lived recently and a fish that lived a long time ago
 - D. the same fish just after it hatched and when it was full-grown
12. (2009) The cows in a rancher's herd of cattle have been selectively bred to produce milk. Which of the following will cause the next generation of cows to receive the trait for producing large quantities of milk?
- A. nutrients in the cows' food
 - B. essential minerals in the cows' water
 - C. electrical impulses in the cows' brains
 - D. information in the cows' chromosomes
13. (2009) Which of the following materials are direct products of photosynthesis?
- A. fats and starches
 - B. oxygen and sugar
 - C. proteins and amino acids
 - D. carbon dioxide and water

14. (2008) The diagram below shows the evolutionary relationship of several primates.



Based on the diagram, which of the following statements is true?

- A. Lemurs were the most recent to evolve.
 - B. Gorillas evolved directly from chimpanzees.
 - C. Spider monkeys and lemurs evolved at the same time.
 - D. Gorillas and baboons evolved from a common ancestor.
15. (2008) The diagrams below represent forms of reproduction. In which form of reproduction will the offspring differ most from the parent?

A.

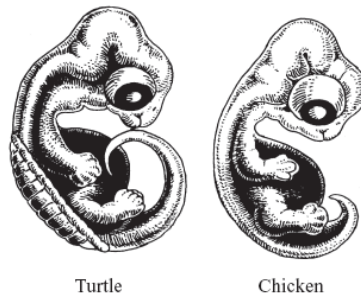
B.

C.

D.

16. (2008) The complete removal of decomposers from an ecosystem will have the **greatest** effect on which of the following?
- A. the spread of disease
 - B. the availability of water
 - C. the recycling of nutrients
 - D. the distribution of organisms
17. (2008) Which of the following organisms produces energy from sunlight?
- A. worm
 - B. rabbit
 - C. hawk
 - D. grass
18. (2008) Which of the following **best** describes the purpose of the chromosomes in the nucleus of a cell?
- A. to store the genetic instructions needed to specify traits
 - B. to release energy by breaking down food molecules
 - C. to transport nutrients into and out of the cell
 - D. to protect the cells from microorganisms

19. (2008) The drawings below show a turtle embryo and a chicken embryo.



- Which of the following statements is supported by the similarities between these embryos?
- A. The turtle is more advanced than the chicken.
 - B. The chicken has more offspring than the turtle.
 - C. The turtle and the chicken are similar as adults.
 - D. The chicken and the turtle share a common ancestor.
20. (2007) Which of the following groups of organisms uses sunlight to convert carbon dioxide and water into sugar and oxygen?
- A. carnivores
 - B. decomposers
 - C. herbivores
 - D. producers
21. (2007) Which of the following is the **primary** advantage of sexual reproduction when compared to asexual reproduction?

- A. There is a greater number of offspring.
- B. There is more food available to offspring.
- C. There is greater genetic variety in offspring.
- D. There is a longer development time for offspring.

22. (2007) Which of the following **best** describes the number of chromosomes in a normal human liver cell?

- A. 23 pairs of chromosomes
- B. 46 different types of chromosomes
- C. 46 male chromosomes and 46 female chromosomes
- D. 23 original chromosomes and 23 duplicate chromosomes

23. (2007) Which of the following **best** describes a role of mushrooms in ecosystems?

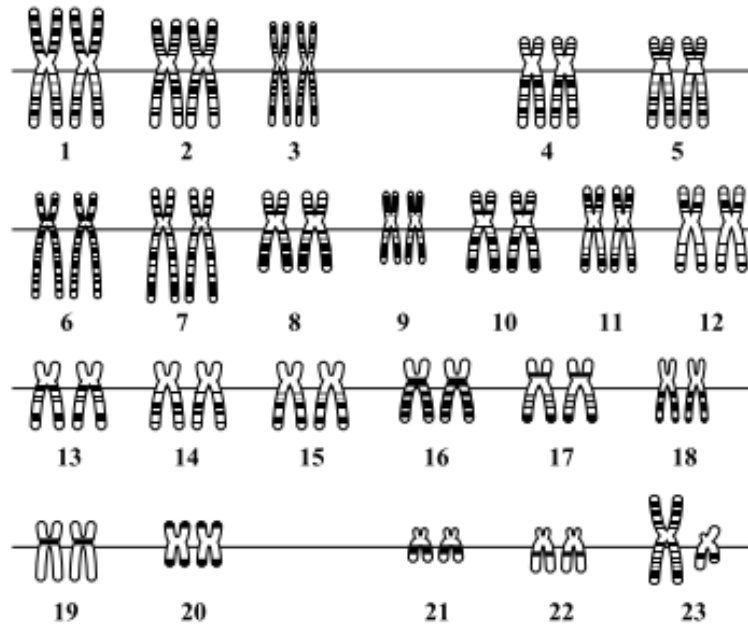
- A. capturing energy from sunlight
- B. consuming living plant material
- C. taking energy from animal hosts
- D. breaking down dead plant material

24. (2007) Lichens are symbiotic organisms made of green algae and fungi. What do the green algae supply to the fungi in this symbiotic relationship?

- A. carbon dioxide
- B. food
- C. protection
- D. water

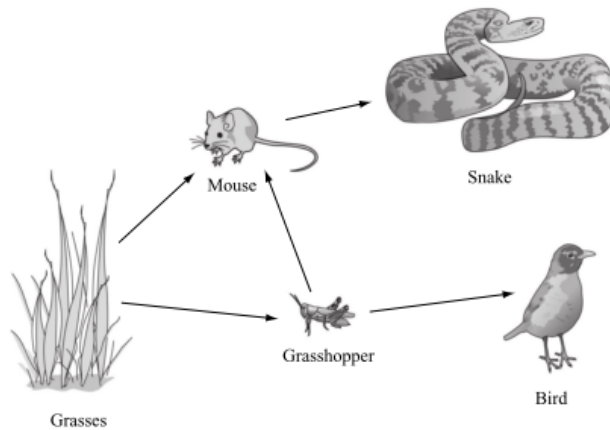
Open Response Questions

1. (2012) The diagram below represents 23 pairs of structures taken from the nucleus of a human body cell.



- Identify the structures shown in the diagram.
- Identify the information that is contained within these structures.
- Describe how the structures from this cell would compare to the structures in the nucleus of another body cell from the same person.
- Explain why the structures are in pairs.

2. (2010) The partial food web below shows five different organisms that are found in a prairie ecosystem.

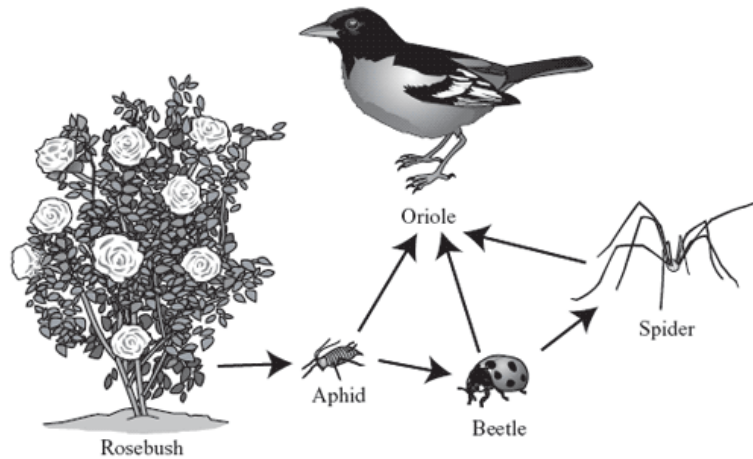


- Identify **each** organism in this food web as a producer, a primary consumer, or a secondary consumer.
- Using only the organisms from this food web, describe one change in this prairie ecosystem that would result in a decrease in the grasshopper population. Explain the reasoning for your answer.

3. (2008) A forest ecosystem in New Hampshire contains a large area where berry plants grow naturally. The berry plants help some organisms in the forest survive and grow. Other organisms in the forest help the berry plants survive and grow.

- Describe two different ways that the berry plants help some organisms in the forest survive and grow.
- Describe two different ways that other organisms in the forest help the berry plants survive and grow.

4. (2007) The organisms in an ecosystem interact in many ways to survive. For example, a rosebush, aphids, beetles, spiders, and orioles all interact in a rosebush ecosystem. The diagram below shows how these organisms interact in a partial food web.



- Identify the producer organism in this food web. Explain the reasoning for your answer.
- Identify the primary consumer organism in this food web. Explain the reasoning for your answer.
- Describe what would **most likely** happen to each of the other organisms in the food web if the beetle population were suddenly destroyed. Explain the reasoning for your answer for each organism.

MCAS Questions: Populations & Ecosystems

Multiple Choice Answers

1. B	13.B
2. A	14.D
3. A	15.C
4. D	16.C
5. D	17.D
6. A	18.A
7. C	19.D
8. B	20.D
9. C	21.C
10.B	22.A
11.C	23.D
12.D	24.B

Open Response Answers

1. Human Chromosomes

Score Point 4

a.) The structures shown in the diagram are chromosomes.

b.) The information contained in the chromosomes are DNA.

DNA is what defines the traits in each individual person.

Each chromosome pair tells the cells to do a certain job, or create a certain trait.

c.) The chromosomes in this cell would be exactly the same as the chromosomes in another cell from the same person. All the cells in the body, no matter what type, would have the same pairs of chromosomes in their nuclei.

d.) The structures are in pairs because the person gets one of each number chromosome

from each parent. Their DNA

combines to create an

entirely new, original set of

DNA shared with no one else.

The selection of which

chromosome the parent gives

is totally random, and the

combination possibilities are

virtually endless.

Score Point 4

- A. These structures are chromosomes.
- B. The chromosomes each contain a strand of DNA (deoxyribonucleic acid).
- C. The structures would be completely identical. The chromosomes would be like a clone of these ones shown, and the DNA would be the same as well.
- D. The structures are in pairs because this human got half of their chromosomes from their father and half from their mother. When these two halves were combined, it created this person's own unique DNA.

Score Point 3

- a. The structures in the diagram are chromosomes.
- b. The information stored in the chromosomes is DNA.
- c. The two sets of structures would be identical in every way, because all the cells in your body carry the same DNA.
- d. The structures are in pairs because that cell is going through interphase. During the cell cycle, the cell will split and turn into two identical daughter cells. The pairs will split, and one end will go into one cell while the other end will go into the other.

Score Point 2

- A) The structures are chromosomes of the nucleus.
- B) The information in these chromosomes are the person's genes.
- C) If you compare them to another person's cell, it would be different. No one has the same kind of genes.
- D) The chromosomes are in pairs because every chromosome has 2 genes in it.

Score Point 1

a) There are pairs of chromosomes in the human body cell. Some are big and some are small.

b) In the first row there are 5 pairs of chromosomes. In the second row there are 8 pairs, in the 3rd row there are 6 pairs, and in the last row there are 5 pairs.

c) They would not match up because everyone is different and their cells would not look alike.

d) They are in pairs because it takes a certain amount to build up a cell and they needed to group up in order to function. That's why they are in pairs.

Score Point 0

A.) The white structures are the white blood cells, and the dark are the red blood cells.

B.) Within these structures it shows how many white and red blood cells they have.

C.) It would compare the differences between how many blood cells the person has.

D.) The structures are in pairs because it shows you the different kind of cells.

2. Prairie Ecosystem

Score Point 4

A. The grass is a producer. The grasshopper and mouse are primary consumers. The mouse is also secondary, because it eats the grasshopper. The bird and snake are secondary consumers.

B One way the grasshopper population could decrease is by the bird population increasing. This is because if there were more birds they would need more food - the grasshoppers. It is like supply and demand, if the demand increases the supply decreases.

Score Point 4

a. Producer	Primary consumer	Secondary consumer
Grasses	Mouse	Snake
	Grasshopper	Bird

b. A change in the prairie ecosystem that would result in a decrease in the grasshopper population could be that grass started died and grasshoppers have no food.

Score Point 3

A) Grasses = Producer
 mouse = Primary consumer
 Grasshopper = primary consumer
 Snake = secondary consumer
 bird = secondary consumer

B) If there was no grass there would be a decrease in the grasshopper population.

Score Point 2

Grasses - producer / Grasshopper - primary consumer
 Bird - Secondary consumer / mouse primary consumer
 and secondary consumer. Snake is a
 Secondary consumer.

Score Point 1

- a) The grass hopper and mouse eats grass, The mouse eats grass hoppers, The bird eats grass hoppers and the snake eats the mouse.
- b) If there was no grass.

Score Point 0

- A.) The snake is a primary consumer.
The bird is a primary consumer.
The grasshopper is a secondary consumer.
The mouse and the grass are secondary consumers.
- B.) If all the animals in this partial food web and other animals ate the grasshoppers.

3. New Hampshire Ecosystem

Score Point 4

Ⓐ Berry plants help some organisms in the forest survive and grow because first of all they are a ^{good} food for bees and many other wild life. They give them energy or stored up food for hibernation. Also a berry plant would help small bugs and caterpillars have a shelter, they might make a nest on the bush or live on the leaves.

Ⓑ Other organisms in the forest help berry plants survive and grow. First of all earthworms in the soil help ^{decompose and} create nutrients and rich soil beneficial to the berry plant which needs nutrients to grow. Also animals in the forest give off carbon dioxide (CO_2) which the berry plant needs ^{in order} to do photosynthesis. Without photosynthesis the plant would have no glucose sugar for energy. There for living things in the forest are needed to help plants, and plants are needed to help animals in the forest!

Score Point 4

① One way berry plants help other organisms is food for animals. Also berry plants give nutrients to other plants from the berries that dissolved into the ground.

② Other organisms in the forest help the berry plant spread the seeds by eating them and dropping them far away to make new berry plants. Also other organisms help the plant get food by dying next to the plant or leaving behind droppings that the plant could use as nutrients.

Score Point 3

① Berry plants help organisms in the forest survive and grow. One way it does this is by feeding organisms, so they don't die of hunger. Another way it helps organisms is by nourishing them, so they can survive and reproduce.

③ Although berry plants help organisms survive, organisms help the berry plants survive as well. One way decomposers help, is by making the soil fertile. Another organism might pick up a berry, and drop a seed somewhere else, creating a new plant.

Score Point 2

A. The berries are food to some organisms.
The berry plants are shelter to some organisms.

B. Some organisms protect the plant from threats or harm that could happen to it.
Other organisms are the reason it still exists, by keeping it growing.

Score Point 1

a. One is that the berry plant is a source of food for animals

b.

Score Point 0

A) The two different ways that the berry plants help some organisms in the forest survive and grow is if it rains and if the sun comes out. Those are two different ways.

B) The two different ways that other organisms in the forest help the berry plants survive and grow is if the soil is good and water every day that can help the berry plants survive and grow.

4. Rosebush Ecosystem

Score Point 4

- a.) The producer organism in this food web is the rosebush. It is the base of the food web because ^{as a plant,} it produces its own food, and then serves as the primary source of energy for the other organisms.
- b.) The primary consumer in this food web is the Aphid. It is the consumer that feeds off the producer, the rosebush. Since it's the only herbivore, everything else would die if it wasn't there, because the other organisms are primarily ^{eating} carnivores, who wouldn't be able to obtain energy from the rosebush.
- c.) If the beetle population was destroyed, the spider population would soon follow, because in this food web, the only source of food for the spider is the beetle. The Oriole would have lost two of its three food sources, and would have to live off only the Aphids, which would decrease the population of orioles. The Aphids, having lost the beetle as one of their two predators, would have a(n) increase in population until the spider dies off, and the Orioles come looking for them as food. The rosebush would be devoured by the sudden increase of the Aphid population, then begin to grow back as the Aphid population becomes the primary food source of the Orioles.

Score Point 4

A.) The producer in the food web is the rosebush. The rosebush is the producer because it makes its own food and is the basis of the entire food web.

B.) The primary consumer in this food web is the aphid. It consumes producers and is an herbivore.

C.) If the beetle population were suddenly destroyed it would affect the entire ecosystem. The most severe thing that would happen is the spider population would die off. This is because the spiders are secondary consumers and their only source of food are the beetles. It would affect the Oriole in the sense that 2 of its 3 sources of food would be gone. With both the beetles and spiders gone it could only eat aphids. There wouldn't be enough food so some Orioles would die of starvation. This would affect the aphids because they would be eaten more than before so their population would decrease. With less aphids there would be a surplus in rosebushes, but that's not good because no one else eats them. If the beetles suddenly were not there the entire ecosystem and food web would be changed for the worst.

Score Point 3

A. In this diagram, the Rosebush is the producer organism. It's at the bottom of this food chain, because it gets eaten; it doesn't eat another one. The rosebush, is really what starts the food web.

B. The primary consumer in this diagram is the Oriole. It's like the opposite of the rosebush. It eats almost everything there, except for the bush. All the arrows (almost all) point to it, and the oriole doesn't get eaten by any other organism in the food web. It's the predatory that gets the aphid, beetle, and spider. The Oriole is the last animal in this food web.

C. The whole food web would go completely wrong if you were to take the beetle out of it. The Aphids would overpopulate because the beetles used to eat them, but there not there now, the spiders wouldn't be seen around there that much either. The beetle is pretty-much the only thing that spiders eat in this chain. If you take away their primary food supply, then they'll starve, and eventually die off. All the aphids around, would destroy all the rose bushes, because now there would be more aphids to eat them. Last the Oriole would lose two of its prey, so orioles would die off just like the spiders. The web would be destroyed.

Score Point 2

Ⓐ The producer in this system is the rose bush that feeds the spiders that feed the beetles that feed the spiders that all feed the orioles.

Ⓑ The primary consumer is the orioles because they eat all three types of bugs.

Ⓒ If the beetle population got destroyed then the aphid population would increase and the spider population would decrease. This would cause more rose bushes to be eaten and die. With two of the three insects the orioles eat gone, they would start dying too because they would only have one third of the food they had before.

Score Point 1

a. The rose bush. the, all eat it.

b. the oriole. it eats everything

c. the spider would get hungry and die out. and the Aphid would become abundant

Score Point 0

- a. The aphid, beetle, spider, and Oriole could eat the rose bush.
- b. The Rose Bush might not be healthy for the creatures.
- c. Most likely the other creatures would need help from beetles. It would be bad if beetles were destroyed.