INVESTIGATION 3 I-CHECK
HEREDITY AND ADAPTATION

1. “Mutations are random. Natural selection is not.” Which of the following statements support this conclusion?
Mark an X next to each statement that supports the conclusion.

- Mutations for positive traits are more likely to be passed on to the next generation.  
- Mutations are caused by changes in the environment.  
- The environment determines if a mutation is positive, negative, or neutral.  
- Natural selection favors some mutations and not others.

2. Sickle cell anemia is a disease in humans caused by a mutation to the HBB gene that helps make hemoglobin, the protein that carries oxygen in blood cells. A person must inherit the recessive allele for sickle cell from both parents to become sick with sickle cell anemia. People with one mutated allele do not normally suffer symptoms of the sickle cell disease.

Scientists discovered that people who carry one mutated allele are more resistant to malaria, a serious disease that kills thousands of people every year.

Nearly half the world’s population is at risk of malaria. In parts of the world with high malaria exposure, 10 to 40 percent of the population carry one recessive HBB allele. The percent is much lower in areas without risk of malaria exposure.

a. What is the probability that two people who carry the recessive allele will have a child that suffers from sickle cell anemia?

- A 100%  
- B 75%  
- C 50%  
- D 25%

b. Why are people who live in areas with higher exposure to malaria more likely to have a recessive HBB allele?
(Mark the one best answer.)

- F Having one recessive allele increases your chances for survival from malaria.  
- G Having one recessive allele causes more disease in areas without malaria.  
- H The probability of people having two recessive alleles is lower in areas with malaria.  
- J Malaria cures people who have two recessive alleles.
3. Organisms such as bacteria usually reproduce asexually. This means that their cells simply copy their DNA and when the cells divide in two, each new cell receives a copy of the DNA. Yet bacteria evolve over time. How can that happen?

4. The finches below are different species of finches that live on the Galápagos Islands. The current theory is that 13 different species evolved from one species of finch that flew to the islands from mainland Ecuador hundreds of thousands of years ago.

Write T if the statement is true; write F if the statement is false.

_____ The original population of finches had variation in size and shape of beaks.

_____ Different environments select for different beak adaptations.

_____ Finches must adapt their beak to the environment or they will die.

_____ If the environment changes, finches must mutate a new beak.

_____ Finches flew to a different island because their beak was better adapted to food there.

_____ If the environment changes, finches with beaks that are better adapted have a better chance of surviving to reproduce.

_____ Speciation occurred when populations of finches became isolated from each other and after a long time could no longer mate.
5. Compare two breeds of wheat, Wheat A and Wheat B. Within Wheat A, there is a wide variation in individual wheat seedlings' ability to live in salty soil. Wheat B does not have a lot of individual variation in its ability to live in salty soil. Both of these breeds are grown in Australia where the soil is becoming more and more salty.

Which breed of wheat, A or B, is more likely to survive? Explain why.

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6. Write T if the statement is true; write F if the statement is false.

_____ Mutations can be beneficial.

_____ Mutations are a change in the genotype of an organism.

_____ Mutations are adaptations to the environment.

_____ Mutations are always a change in an organism's DNA.

_____ Mutations occur when DNA comes from another source other than the parents.
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7. Bacteria become resistant to antibiotics when a few individual resistant bacteria survive and reproduce, passing their resistance on to the next generation. This process is called _____.

(Mark the one best answer.)

❍ A adaptation
❍ B mutation
❍ C natural selection
❍ D speciation

8. Which of the following must exist in a population in order for natural selection to occur?

(Mark the one best answer.)

❍ A variation of traits
❍ B sexual reproduction
❍ C individuals that can adapt
❍ D common ancestors

9. How does the theory of evolution explain the diversity of life that exists today? Include observations and examples as evidence to support your response.

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