

Section 4.1 Review Answers

Student Textbook page 121

1. An adaptation is a structure, behaviour, or physiological process that helps an organism survive and reproduce in a particular environment. Five adaptations of the grizzly bear would include claws and powerful muscles for subduing prey animals or digging up roots; long, sharp teeth and powerful jaw muscles for killing and consuming prey; varied diet (grizzlies are omnivores); powerful sense of smell to locate dead animals; fast running speed, which helps them catch prey; and hibernation during the winter to avoid having to find food during cold, winter months.

Note to the teacher.

A common misconception is that grizzly bears do not hibernate. However, the following rejects that misconception:

Grizzly bears do hibernate! Years ago some scientists didn't consider bears to be "true hibernators" because, unlike most hibernating mammals, bears only drop their body temperatures a few degrees (about 11 degrees to approximately 31 degrees C) during winter dormancy. Many mammals that hibernate drop their body temperatures to approximately 5 degrees C.

Today, most scientists refer to hibernating mammals that drop their body temperatures down to about 5 degrees C as "deep hibernators." Deep hibernators have to wake up periodically to eat, urinate, and defecate. Most bear biologists refer to bears as "super hibernators" because bears can hibernate the entire winter (as long as 6 months) without eating, urinating, or defecating. In addition, since bears maintain a relatively high body temperature during dormancy, they can fairly quickly wake up and defend themselves against threats.

2. A variation is a visible or invisible difference between individuals in a population. Any variation that helps an individual in a population survive is likely to be passed on from survivor to survivor. Through generations of survivors, this variation will become more common, perhaps so common that it is considered to be a characteristic, or trait, of the population. Variations arise in sexually reproducing organisms because the offspring have a combination of genetic material from both parents. Through sexual reproduction, parents pass on distinct units of hereditary information (genes) to their offspring. The number of possible combinations of genes that offspring can inherit from their parents results in a great genetic variation among individuals within a population.
3. Students could use the example of mutations in household flies, which made them resistant to the insecticide DDT, or they could discuss the California ground squirrels that have the mutation that makes them able to withstand the rattlesnake's venom.

4. (a) Population change over time. An abiotic environmental condition can be said to select for certain characteristics in some individuals and select against different characteristics in other individuals. In this way, the environment exerts selective pressure on a population. The selective pressure is being determined by the gardener. As she continually selects only the largest pumpkin and uses its seeds for the following year, the selective pressure is based on size.

(b) Possible student responses: No—this is an example of artificial selection in which desired traits are being selected for by people. This is not natural selection taking place in response to finding the most successful and fit individuals with their adaptive traits, but rather the pumpkin is being selected for size by humans. It is not being selected for its success within this environment.

Students may also answer yes—assuming the most successful pumpkins are the largest, then the gardener is selecting the adaptive trait that is most successful. By selecting for this trait and ensuring these most-fit pumpkins are given the opportunity to reproduce, natural selection is taking place.

5. This statement is very true; natural selection is not about introducing new genetic material, as mutations do, but rather selecting for the most advantageous traits within an existing gene pool. Within the existing gene pool in a population, certain genes coding for different adaptations will be selected for in certain environmental conditions. Editors have to work with what material is given to them, and, from this, select what is best suited to meet the demands of the task given. They select the most “fit” adaptations (resources) to work with.

6. The diversity within the species will allow for different adaptive traits to become selected for. For example, if the sparrows are feeding on the seeds of grasses and the optimal length of beak is 10 mm, these sparrows have an advantage. If grass supplies become short, and the sparrow population is forced to rely on tree seeds for their survival, longer beaks are an advantage. Birds with beaks that work well in the environment will be selected for because of their adaptive advantages. This in turn will result in an increased number of individuals in the population displaying this trait.

7. Variations within a population assume that many individuals of a population will be sampled so that the phenotypic and genotypic diversity of adaptive traits can be better measured. Measuring only one tree ensures that the same genetics are being measured again and again; it does nothing to identify the variability within the existing population.

8. Natural selection is a process that results when the characteristics of a population or organisms change because individuals with certain inherited traits survive specific local environmental conditions and, through

reproduction, pass on their traits to their offspring.

Natural selection takes place in the example presented in this question because populations of insects contain, among their vast numbers of individuals, considerable variation in their genetic material, primarily as the result of mutations. Some members of the population may have the gene(s) to resist pesticides such as DDT. These insects have a selective advantage in the population. In other words, the insects that have this resistance are more likely to survive and reproduce, thus potentially passing on this now-helpful mutation to their offspring.

9. Individuals in a population cannot change their genetic makeup and do not change even if local environmental conditions change. However, it is unlikely that all of the individuals in a population will be killed or adversely affected by this environmental change. These individuals will pass on the traits (genes) that enabled them to survive the changing conditions, resulting in the population changing over time. An abiotic environmental condition can be said to select for certain characteristics in some individuals and select against different characteristics in other individuals. In this way, the environment exerts selective pressure on a population.