

Unit 1 Assessment

Answers to Unit 1 Review Questions

1. DNA accounts for the similarities because all of the apples contain DNA that makes them apples, as opposed to the fruit of a different plant. The variation in DNA among the apples accounts for the different varieties. These varieties have been selectively bred for traits such as colour, taste, size, and resistance to frost, insects, or disease.
2. Homologous chromosomes are pairs of chromosomes that are similar in features such as length and centromere location but are not identical to each other. Chromosomes contain the cell's DNA. Genes are sections of DNA that contain genetic information for the inheritance of specific traits. Homologous chromosomes carry genes for the same traits, such as hair type, at the same location. The coloured bands represent these genes/alleles. The red band on the left chromosome represents an allele from one parent and the red band on the right chromosome represents the alleles for the same trait from the other parent. In this case, because both bands are the same red colour, this individual is homozygous for this trait. If the bands were different colours such as red and black, the individual would be heterozygous for the trait. I would add the labels of banding pattern, allele, and centromere.
3. The allele for yellow seeds is dominant to the allele for green seeds. When true-breeding parents are crossed, the offspring all have yellow seeds (they are all heterozygous dominant). When plants from the F₁ generation are crossed, a ratio of 3:1, dominant to recessive occurs (yellow seeds to green seeds).
4. The diagram shows the formation of new species through adaptive radiation. Adaptive radiation is the diversification of a common ancestral species into a variety of differently adapted species.
5. Check that students have defined the key terms in their own words and accept all reasonable sketches provided by students.
6. Students may choose to make a spider map with DNA in the middle and the other terms radiating out as spokes. On the spoke lines leading to each term, students may write a sentence about how DNA is related to the term.
7. The structure of DNA looks like a twisted ladder, or double helix. The sides of the ladder are made up of the sugar and phosphate groups. Each rung of the ladder is made up of two nitrogenous bases bonded together as a base pair. Adenine always pairs with thymine and guanine always pairs with cytosine. The ladder comparison does not show the full complexity of a DNA molecule.
8. Sample answer: These are like the same shape boxes with each box being smaller and fitting inside the previous larger box: chromosomes (largest box), DNA (next smaller box), genes (next smaller box), and nucleotides (smallest box).
9. The complementary nature allows for DNA to be copied and the copy of the bases to leave the nucleus so that proteins can be produced.
10. I agree. They are homologous in the sense that they both code for the genetic gender of an individual. Two X chromosomes are more homologous than an X and a Y chromosome, but they are still matched up together in a karyotype.
11. An individual who is homozygous for a trait has two of the same alleles for a particular trait (purple flowers = *PP*). An individual who is heterozygous for a trait has two different alleles for a particular trait (purple flowers = *Pp*). A dominant allele is the allele that is expressed, regardless of the identity

of the other allele for the characteristic, such as the colour purple for flower colour in pea plants. A recessive allele is the allele that is expressed only when two alleles are present; the expression of the allele or trait that is “hidden” or suppressed if the dominant allele is present, such as white coloured flowers in pea plants.

12. No, not always. You would need to know which allele is dominant or recessive or if the trait is controlled by more than two alleles or does not follow Mendel’s laws of inheritance.
13. Dominance—Mendel’s peas exhibited dominance/recessiveness. Tall is dominant over short, therefore heterozygous plants were tall.
 Incomplete dominance—Snapdragon flower colour exhibits incomplete dominance: white and red are both expressed and the heterozygote shows a blend of the two alleles (it is pink).
 Codominance—both alleles are expressed. Roan cattle show codominance in their hairs: some patches of fur are white and other patches are red. The phenotype is not a blend but is an intermediate.
 Sex-linked inheritance—the allele is carried on the portion of the X chromosome that does not have a homolog on the Y chromosome; this results in more males having characteristics such as colour deficient vision.
14. Natural selection occurs in nature where abiotic and biotic conditions place selective pressure on traits of organisms. Artificial selection occurs when human breed organisms to bring out desirable traits. Both involve traits being selected.
15. Without genetic variation there would be no natural selection, which is the mechanism by which evolutionary change occurs.
- 16.

Transgenic Organism	Practical Application
Corn	Modified to resist insect pests; can increase crop yield
Golden rice	Modified to contain vitamin A, could help reduce malnutrition
Milk-producing animals	Modified to produce medical protein products

17. Isolate the segment of DNA to clone, and choose a vector for cloning. → Insert the chromosomal DNA into the vector. → The resulting DNA molecule, which includes genetic material from different sources, is recombinant DNA. → Treat foreign cells, such as bacterial cells, so that they take in the recombinant DNA. This process is called transformation. → Once the recombinant DNA plasmid is taken into the cell, many copies of the cloned gene or DNA fragment will be made by the host cell.
18. Concept maps may include information about the benefits and concerns surrounding GMOs or gene therapy.
19. Students do not know that this is an X-linked trait, so in this example the Punnett square would look like the one below. All offspring are heterozygous and have red eyes.

	<i>R</i>	<i>R</i>
<i>r</i>	<i>Rr</i>	<i>Rr</i>
<i>r</i>	<i>Rr</i>	<i>Rr</i>

20. The houseflies have developed a resistance to the insecticide because when the population of flies was first exposed to the insecticide, some flies had a variation that allowed them to survive exposure. These flies reproduced and passed the allele for the variation on to the next generation of flies. After

many generations, the population of flies consisted of flies that were resistant to the insecticide. This is a selective advantage when insecticide is used to try to kill the flies.

21. Sample answer: Collect data on the amount of milk each cow produces. Choose cows that produce more milk to breed. With each generation more cows can produce more milk. In each generation, breed the cows that produce the most milk.
22. Answers will vary depending on which animal students choose. Sample answer: A cheetah can run fast and has sharp teeth. Both help it capture prey. Capturing prey is critical to the survival of an animal. A sketch may include a label of the cheetah's sharp teeth and show it running.
23. Answers will vary depending on which drug or medical treatment students choose to research. Insulin is made using recombinant DNA. People with Type 1 and some people with Type 2 diabetes need insulin so their cells can take in glucose for energy. The insulin produced is purified and does not cause allergic reactions.
24. Breed what is believed to be a true-breeding homozygous dominant individual with what is believed to be a true-breeding homozygous recessive individual. If all of the offspring exhibit the same phenotype, this would be the dominant allele being expressed. If the offspring are bred and their offspring exhibit a 3:1 ratio of dominant to recessive phenotype, then the recessive allele can be identified using Mendel's laws of inheritance.
25. Sample answer: The plot could involve using gene therapy to treat or cure a genetic disorder. The steps for gene therapy should be accurate. Possible benefits and consequences should also be addressed as part of the plot.
26. 1:2:1; red : purple : white
27. a) artificial selection; A human is breeding cats for a desired trait.
b) artificial selection; A human is breeding plants for a desired trait.
c) natural selection; Plants with a trait that allows them to survive exposure to a herbicide pass on the alleles for that trait to future generations; they have a selective advantage over plants that do not have the trait
d) artificial selection; A human is breeding plants for a desired trait.
28. Check that students have used reliable resources to write their article. Articles should include an explanation of the social and environmental implications of one of the topics listed in the text: gene cloning, transgenic crops to reduce hunger, in vitro fertilization, or gene therapy.
29. a) black
b) *BB* and *bb*
c) All offspring are heterozygous *Bb* and have black hair.
30. The probable genotypes of the parents are *Bb* and *Bb*. The probable genotypes of the offspring are *Bb* and *bb* in a 1:1 ratio. Breed two heterozygous individuals and if the phenotypic ratio is 3:1 in favour of one colour, then the allele for that colour is the dominant allele.
31. a) $Hb^S Hb^S$
b) $Hb^A Hb^S$
c) $Hb^A Hb^A$
32. The woman is a carrier. She has the allele for hemophilia on one of her X chromosomes. Her son inherited an X chromosome with the allele on it. No, they could not have a daughter with hemophilia, because for a female to have hemophilia both X chromosomes have to have the allele for hemophilia on them.
33. Drawings should show the idea that sea stars with stronger muscles are naturally selected (because they can pry open more clams). Sea stars with the trait of stronger muscles are more successful and reproduce, passing the trait (alleles for the trait) to future generations. The later population will have more sea stars with stronger muscles than earlier populations.
34. Adaptive radiation would be more likely to occur on islands that are remote, because there would be less chance of organisms from nearby continents arriving and competing for resources.

35. This example of natural selection favouring greater bill depth was due to the fact that finches with greater beak depth were better able to eat the remaining larger seeds compared to varieties of finches with smaller beaks, and thus large-beaked finches survived and the small-beaked finches died.
36. a) The waste from these pigs would cause less harm to the environment.
b) The reduction of the amount of phosphorus in their waste might just be one result of the genetically modified pigs. They might have other changes to their body chemistry that could be harmful.
c) Statements in favour or against should include information from this chapter to support the position.
37. a) Grizzlies (or the opportunity to see them) are a tourist attraction, so economically there could be reduced tourist dollars. Politically, grizzlies are a symbol of the Canadian wilderness, so many people would be upset about their extinction and would push for different and improved species-at-risk plans and legislation. Socially, again grizzlies are a symbol of the Canadian wilderness, and it would diminish the Canadian identity if grizzlies no longer existed in the wild.
b) Wildlife corridors would allow gene flow among different populations of grizzlies, increasing their genetic diversity and reducing the impact of genetic drift.
38. a) There is a connection between the amount of ultraviolet radiation to which a person is exposed and the risk of developing skin cancer. Students might also note that wearing sunscreen is recommended whenever someone is exposed to sunlight, which contains ultraviolet radiation.
b) Answers should include a brief paragraph summarizing the student's research on regulations in Canada, a clear statement of his/her own opinion, and an explanation of the reasoning behind that opinion.
39. Students may say that society has benefited from GMO crops because they have increased crop yield and made more food available to the marketplace, a positive impact. Students should support their answers with examples and facts.
40. Answers will vary depending on which crop they choose. They may support growing this GM crop because it means that farmers have higher crop yield and can make better profits. They may feel that growing the crops does not have any environmental impacts. Check that students have supported their opinions with evidence from their research.
41. Students can investigate a significant study of Tsimshian people in Metlakatla, BC. DNA from an archaeological site near the community was compared with the DNA of Tsimshian volunteers. (The *National Post* article from 2013 is currently available on its website.) The community continues to collaborate with scientists in the Metlakatla DNA Project. Through investigating this project, students will appreciate how the research confirms the continuity of habitation of Tsimshian people in their territories for thousands of years, as recounted in their oral histories.