

uring the Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

Weekly Focus: Reading Comprehension Weekly Skill: Reading for Speed

**Lesson Summary:** This week students will do a lot of reading. One activity is to read for comprehension about genetically modified organisms (GMOs). Then, students will continue reading for comprehension in a longer reading passage. The activities ask students to look for evidence from the passage to support their answers.

### Materials Needed:

- Comprehension Reading Unit 4.7 Handout 1
- Main Idea Reading <u>Unit 4.7 Handout 2</u>
- Extra Work/Homework <u>Unit 4.7 Handout 3</u> (Spectrum Science, Grade 8, pages 20 21)

Objectives: Students will be able to...

- Read comprehension passages with vocabulary related to genetics and selective breeding
- Practice citing evidence from the reading passages

College and Career Readiness Standards: RI, RST, WHST

### ACES Skills Addressed: EC, LS, ALS, CT, SM

**Notes:** Please review and be familiar with classroom routine notes for: handling controversial topics (**Routine 5**), reading for fluency strategies (**Routine 2**), 6-way Paragraphs reading techniques (**Routine 3**), summarizing techniques (**Routine 4**), and self-management skills (**Routine 1**). The notes for the different activities will help with making a smooth transition to each activity.

### GED 2014 Science Test Overview – For Teachers and Students

The GED Science Test will be 90 minutes long and include approximately 34 questions with a total score value of 40. The questions will have focus on three content areas: life science (~40%), physical science (~40%), and Earth and space science (~20%). Students may be asked to read, analyze, understand, and extract information from a scientific reading, a news brief, a diagram, graph, table, or other material with scientific data and concepts or ideas.

The online test may consist of multiple choice, drop down menu, and fill-in-the-blank questions. There will also be two short answer questions (suggested 10 minutes each) where students may have to summarize, find evidence (supporting details), and reason or make a conclusion from the information (data) presented.

The work students are doing in class will help them with the GED Science Test. They are also learning skills that will help in many other areas of their lives.



#### Activities:

### Warm-Up: KWL Chart Time: 10 - 15 minutes As students enter the class, have the following written on the board or overhead "GMO (Genetically Modified Organism) is an organism whose genetic material has been altered using genetic engineering techniques." Have students create a "KWL" chart on a piece of notebook paper (below). This helps to activate students' prior knowledge by asking them what they already **K**now (column 1); students (collaborating as a classroom unit or within small groups) set goals specifying what they Want to learn (column 2); and after reading students discuss what they have Learned (column 3). Students apply higher-order thinking strategies which help them construct meaning from what they read and help them monitor their progress toward their goals.

#### **KWL Chart:**

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K - What (else) do I KNOW?	W - What do I WANT to know?	L - What did I LEARN?

#### Activity 1: Comprehension Reading (Unit 4.7 Handout 1)

Time: 40 - 45 minutes

1) Hand out Unit 4.6 Handout 1 to students.

2) Explain to students they will read more about variations of traits, genes, and heredity. This information is important foundational knowledge for questions that may be on the 2014 GED Science module. This can be a somewhat controversial subject matter. It may be useful to refer to the classroom routines handout on this (Routine Handout 5).

3) Discuss with students that when reading for comprehension, there are many strategies to use: read the title to predict what the reading is about; look at the words in bold and their definitions on the left side of page; if there are images, look at them to get a better understanding; while reading remember to ask "What is this all about?"

4) Have students read the passages independently while answering the questions on each page.

5) Circulate class while they are reading to make sure they understand the information presented and see if there are any questions.

6) Review answers as a whole class. Ask students to point to the evidence from the reading passage that helped them determine the answer.

7) If there is time, students can summarize the reading or write a main idea.

8) Students can fill in the "L" portion of the KWL chart.

### **Break: 10 minutes**

Activity 2: Main Idea Reading (Unit 4.7 Handout 2)		Time: 45 - 50 minutes
<ol> <li>Hand out Unit 4.6 Handout 2 to students.</li> <li>Explain to students they will continue with readi</li> </ol>	na nassaaes or	traits genes and heredity. This
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4) Have students read the passages independently while answering the questions on each page.

5) Circulate class while they are reading to make sure they understand the information presented and see if there are any questions.

6) Review answers as a whole class. Ask students to point to the evidence from the reading passage that helped them determine the answer.

7) If there is time, students can summarize the reading or write a main idea.

#### Wrap-Up: Summarize

Have students turn to a partner (or write in their journals) about what they have learned today about genetics and selective breeding. Ask them to tell a partner one thing they learned today in one or two sentences. Note: Use Routine 4 Handout

#### Extra Work/Homework: Unit 4.7 handout 3

Students can continue work with another reading passage on the ethics of genetic modification. These are controversial subject areas and students may be asked to write about them on a test in the future.

Differentiated Instruction/ELL Accommodation Suggestions				
If some students finish early, they can turn their paper over and summarize the reading	Activity 1			
passage.	and 2			
Teachers should be aware that ELLs could have some difficulty with some of the vocabulary encountered in the handouts for Activity 1 & 2. Encourage them to look for context clues in the reading that will help them with interpreting the main idea of each reading passage.	Activity 1 and 2			



Time: 30 minutes outside of class

Time: 5 minutes

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### Online Resources:

If students have Internet connection, they can try their hands at selective dog breeding with the PBSkids.com site.

http://pbskids.org/dragonflytv/games/game\_dogbreeding.html

Another dog breeding site has this interactive work:

http://www.wolf2woof.com/EVOLUTIO/SELECTIO/INDEX.HTM

#### **Suggested Teacher Readings:**

• GED Testing Service – GED Science Item Sample (to get an idea of what the test may be like)

http://www.gedtestingservice.com/itemsamplerscience/

• Assessment Guide for Educators: A guide to the 2014 assessment content from GED Testing Service:

http://www.riaepdc.org/Documents/ALALBAASSESSMENT%20GUIDE%20CHAPTER%203.pdf

• Minnesota is getting ready for the 2014 GED test! – website with updated information on the professional development in Minnesota regarding the 2014 GED.

http://abe.mpls.k12.mn.us/ged\_2014\_2

• Essential Education's 2014 GED Test Curriculum Blueprint (PDF)

http://www.passged.com/media/pdf/educators/curriculum-blueprint.pdf



Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

#### Unit 4.7 Handout 1 (5 pages total)



Vocabulary

genetic modification juh-NET-ik mod-ih-fih-KAY-shun the process of altering the genes of an organism to change its traits

By creating genetically modified organisms (GMOs), scientists can increase positive traits and decrease negative ones. For example, scientists have genetically modified some soybean crops to resist certain chemicals so that farmers can spray to kill weeds without harming the soybean plants.

from one organism to another.



soybean plant

- **A.** Which genetic modification do you think each of the plant crops below has undergone? Write the correct letter next to the crop.
  - \_\_\_\_ **1. cotton a.** pest-resistant
  - **2. tomatoes b.** enhanced fragrance
    - \_\_\_\_ 3. potatoes c. slower rate of fruit softening
    - \_\_\_\_ 4. carnations
- d. bad starch eliminated
- **B.** Currently, most GMOs are plants. Why do you think there are fewer genetically modified animals?

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### Lesson 4.7: Life Science - Genetics & Selective Breeding

#### Name



## Weekly Question Are genetically modified foods safe to eat?

Genetic modification is different from other methods of changing an organism's traits, such as selective breeding. In selective breeding, people allow animals or plants with only certain traits to reproduce. But this process can take a long time and can have inconsistent results.

In genetic modification, scientists control an organism's traits by directly adding genes in a laboratory. This process is fast and specific, and it produces combinations that would never occur in nature. For example, to create a tomato plant that can withstand frost, scientists have added the gene of a flounder that lives in the Arctic Ocean. There is no way this would ever happen naturally. A fish couldn't possibly mate with a plant!





**A.** Name two ways that genetic modification is the same as selective breeding and two ways it is different.

Same:	1	intract next to the crist
	2	stress and an and an
Different:	1	2. tomatoes 6. enhage
	2	2. potatoes a situat

- **B.** Write either *genetic modification* or *selective breeding* to name the process used in each situation below.
  - **1.** A scientist uses genes from bacteria to create a new strain of corn plant.
  - **2.** Farmers replant seeds from tomato plants that produce very large tomatoes.
  - **3.** A jellyfish gene is inserted in a zebrafish nucleus to create a fish that glows.



# the Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

Name



### Weekly Question Are genetically modified foods safe to eat?

When scientists transfer genes from one organism to another to create a GMO, they begin by identifying the gene for a particular trait in the **donor** organism. They then **isolate** the gene from the donor. Next, scientists produce many copies of the gene. The gene copies are transferred to the "target" (the organism that is receiving the new trait). The new gene is then incorporated into the target's **genome**. This transforms the target organism into a GMO with the new traits.



- A. Number the steps below in the correct order to show how a GMO is created.
  - \_\_\_\_ Gene copies are transferred to the target organism.
  - \_\_\_\_\_ Scientists identify the segment of DNA in a donor organism.
  - \_\_\_\_ The target organism is transformed.
  - \_\_\_\_ Many copies of the gene are produced.
  - \_\_\_\_ Scientists extract the DNA segment from the donor.
- B. Write the vocabulary word that matches each underlined definition.
  - 1. The person contributing an organ was ready for surgery.
  - 2. Mr. Lee had to separate the troublemaker from the class.
  - 3. Scientists examined the gene set of the flower.







### Vocabulary

#### donor

DOH-ner an organism that contributes a part for transplanting into another organism

#### genome

JEE-nohm the complete set of genes in an organism

#### **isolate** EYE-suh-layt to place or set apart



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Name			paily Science
Day 4	Weekly Question Are genetically in foods safe to eat		Big Idea 1
taste bette plants may	s have many benefits. Some gene er, last longer, and contain more n be more resistant to drought, dis	utrients. Some modified sease, and freezing. And	WEEK 4
But th modified f also be ha and introd entire pop GMOs are not known	Os remove pollutants from soil an ere are uncertainties with GMOs a oods may cause allergic reactions rmful to the environment. If they b uce new genes into the <b>gene poo</b> ulations and cause the extinction entirely new kinds of organisms, . However, it is estimated that 759 ontains at least one genetically mo	as well. Genetically in people. GMOs could preed with wild species <b>ol</b> , they might change of these species. Because their long-term effects are 6 of all processed food in	<b>Vocabulary</b> <b>gene pool</b> JEEN pool the entire collection of genes in a population of a species at a particular time
A. Che	ck the box next to the phrase th	at completes the analogy.	
Gen	e pool is to population as	L. L.	
	<b>genome</b> is to <b>individual</b>	🗖 organism is to po	pulation
	<b>species</b> is to <b>organism</b>	<b>genome</b> is to <b>spe</b>	cies
	he benefits and drawbacks of G ch do you think are the most imp		-
Bigg	gest benefit:	tists identify the segment of	statem
Bigg	gest drawback:	appear of the generative proc	Many
			a white the up
Be	cause they are artificially created netically modified foods are ofte		nonor of the



# ing the Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

Day Ar	kly Question e genetic ods safe		dified		Big dea 1
A. Use words		o complete the p etic modificatic e pool genoi	on i	next to the total of to	WEEK 4
Scient	sts can alter an c	organism's gene	s in a process	called	
nationa	. 1	Гһеу		_ genes from	
a		organism and	transfer them	to a target orga	nism.
The new a	ene gets added	to the target or	aanism's		
<b>B.</b> In the oute breeding a		iagram, write tw	vo separate fe	eatures of select	
	Selective B	Bot	h	Modification	нт з 0

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# Sharing the Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

Unit Review	Comprehension Focus on Her	edity	Big Idea 1
-ill in the b	ubble next to the correct	answer.	WEEK 5
	nans play a role in all of the	-	
A	genetic modification	© random mutation	
Bs	elective breeding	D creating hybrids	
	roup of closely related org create fertile offspring is o	anisms that can reproduce wit called a	h one another
A	genus	© hybrid	
B	species	D donor	
<b>3.</b> The	gene that controls the ap	pearance of a trait is	
Ac	dominant	© superior	
® r	ecessive	D competitive	
<b>4.</b> Hun	dreds of genes are found	in the, which in turn ma	akes up the
A D	DNA, species	© nucleus, DNA	
Bc	chromosome, nucleus	DNA, chromosomes	3
<b>5.</b> Corr	n plants have many variabl	le traits because corn has a lot	of
A	genetic modification	© dominant genes	
	cernels	D genetic variation	
<b>6.</b> The	basic unit of heredity is _		
	DNA	© the gene	
® t	he chromosome	D the nucleus	
<b>7.</b> Wha	at kind of trait is left-hande	edness?	
(A) r	ecessive	© dominant	
	elective	D isolated	
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Unit 4.	7 Hando	ut 1				TEAC	HE	R ANS	WER	KEY			
Page 1													
Α.	1	. А	. 2	2.	С	3.	D	4.	В				
В.	Answers will vary: An example: Genetic modification is controversial and people would be more offended by changes in animals than in plants.												
Page 2													
Α.	Same	1	. They	are bo	th cont	rolled b	y pe	eople					
		2	. They	both c	hange	organis	ms'	traits.					
	Different	1	. Gene	etic mo	odificati	on is fas	st, bı	ut select	ive bi	reeding is s	low.		
	ir	<b>2</b> n nature		etic mo	odificatio	on proc	duce	es trait co	ombir	nations tha	t woulc	l never ha	Ippen
В.	1. Gene	tic mod	lificatio	'n		2. Sele	ective	e breed	ing	<b>3</b> . G	enetic I	modificati	on
Page 3													
Α.	4, 1, 5, 3,	2											
В.	1. Donor	-	2	<b>2.</b> Isola	ite		<b>3</b> . (	Genome	Э				
Page 4													
Α.	genome	is to inc	dividual	l									
В.	Answers	will vary	v. One	examp	ole:								
	<u>Benefit:</u> environm		GMOs c	an rem	nove po	ollutants	s fror	n soil ar	nd wa	ter, which	makes	them bett	er for the
	Drawback: If GMOs introduce new genes to the gene pool, they could cause many species to become extinct.												
Page 5													
Α.	Genetic	modific	ation, i	solate,	donor,	genom	ne, g	iene po	ol				
В.	Selective breeding: farmers breed organisms with positive traits, takes a long time												
	<u>Genetic</u>	modific	<u>ation</u> : s	scientis	sts transf	fer gen	es in	a lab, f	ast ar	nd specific			
	Both: ch	ange a	n orgar	nism's t	traits, hu	umans d	are ii	nvolved					
Page 6													
	1. C	2	. В		<b>3.</b> A		<b>4</b> . [	C	5.	D	<b>6.</b> C		<b>7.</b> A

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Unit 4.7 Handout 2 (6 pages total)

#### **ReadWorks**

Selective Breeding

### **Selective Breeding**



Charles Darwin, a British naturalist who lived in the 19th century, is best known for his book On the Origin of Species. In it, Darwin established the idea of evolution that is widely accepted today. This idea proposes that all species alive have resulted from an adaptation to their surroundings. Natural selection, the process by which traits are handed down over time, is probably the most famous principle from the book.

The process of artificial selection, however, is perhaps not as well known. And yet it remains one of the most important concepts in our understanding of human, plant and animal behavior.

Today artificial selection is more often called "selective breeding." Selective breeding involves breeding animals or plants for a specific, typically desirable trait. By doing so, the desired genes from the plant or animal will be passed onto its offspring.

Dog breeding is one of the most popular examples of artificial selection. You need only to tune into a dog show on TV to see the power of selective breeding at work. Crossbreeds, for example, are dogs born from parents of two different breeds. Mixed breeds were born from parents of more than two breeds, and pure breeds born from a single, recognizable breed. All three varieties are featured in most dog shows.

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#### Literacy Storing the Power of Learning Sharing the Power of Learning Lesson 4.7: Life Science – Genetics & Selective Breeding

Dogs are a particularly interesting example of selective breeding. After all, we call dogs "man's best friend" for a reason. Dogs evolved from wolves and feral dogs. But it was a trait known as "tamability," or a dog's ability to be tamed, that resulted in humans keeping dogs as pets.

Tamability, which can also be defined as a dog's willingness to fetch a stick or lay down on command, was not always the most desirable trait for humans. In the past, a dog was valuable if it could hunt well, or herd cattle, or protect you from intruders. Now that many people live relatively quiet, domestic lives, how well a dog can herd sheep is not of huge importance. What matters most is whether a dog makes a good companion.

And yet it's only over the last 50 years that scientists have come to understand tamability as a result of selective breeding. And even then, through experiments with foxes, not dogs. In 1959, a Russian geneticist named Dmitry K. Belyaev conceived of an experiment with silver foxes. He collected dozens of them from various pet farms throughout Russia. Over the years, researchers under his command have determined that selectively breeding silver foxes for tamability changes the way they look and behave.

By breeding for tamability, Russian researchers have observed that traits such as white patches, colored spotting, and even floppy ears, appear on tame foxes. Wild foxes, on the other hand, tend not to exhibit these traits. Similarly, the floppy-eared, white-patched foxes tend to be better at socializing and responding to sound than their wild counterparts. What the researchers found is that wild foxes, like wild dogs, are capable of being bred for tamability. This ongoing study is known as the Fox Farm Experiments.

Of course, selective breeding has long been performed on more than just dogs and foxes. In the early 1900s, the English bred pigeons to produce a certain type of long feather that looked good in women's hats. Today farmers breed chickens to have extra-large breasts, and to lay a lot of eggs. A wild fowl—a chicken that lives in the woods—lays between 20 and 30 eggs per year. In contrast, a chicken born out of selective breeding can lay as many as 300.

In the same way that hens are selectively bred for eggs, cows are often selectively bred for meat or milk. Breeding a cow for both meat and milk, though, is not realistic. Cows bred for meat tend to produce only enough milk for a single calf. Over the course of the 1700s, the size of bulls sold for slaughter increased dramatically—from around 300 pounds (about 140 kilos) to nearly 800 pounds (about 360 kilos)—as a result of selective breeding. The dairy cow, on the other hand, which does not display a lot of girth or muscle, can produce enough milk for 10 calves. The way to identify such a cow is by the udders, which can hold over 20 liters of milk.

Often, selective breeding can benefit from genetic mutations in animals. The Belgian Blue, for instance, is an unusually muscular cow; it contains something called the double muscling gene. A muscular cow is valuable for the amount of meat found on its frame. A few hundred years ago,

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farmers capitalized on this particular cow's muscle mass by trying to breed more of them. Over time, and with effort, a new breed of muscular cows was born.

Charles Darwin may have been the first to describe the process of selective breeding. But the practice may be more than 2,000 years old. The Romans are said to have practiced selective breeding among their livestock, showing favor to cows that produced a lot of milk. But it wasn't until the 18th century that farmers began practicing it on a large, industrial scale.

Any discussion of selective breeding would be incomplete without pigs. Pigs are extremely valuable to the food supply of the planet in general, and the U.S. in particular. Americans eat an average of around 18 lbs (about 8 kilos) of bacon every year. That's about 5,608,654,506 pounds for the entire U.S. As such, producing the highest number of pigs for the lowest cost has long been a top concern for American pig farmers.

The pigs you see in a pen at a country farm descended from wild pigs. According to wildlife biologists, a wild sow—an adult female swine—typically gives birth to around five piglets at a time. This has been true for thousands of years. With the introduction of selective breeding, however, sows raised on industrial farms often give birth to 15 or 20 piglets at a time.

Having so many piglets puts an enormous strain on the mother pig. Likewise, the act of rearing so many piglets can exhaust a sow, and make her incapable of becoming pregnant again. But for farmers trying to increase their profits, a tired sow that cannot get pregnant is not worth very much. Their solution has been to remove the piglets from their mother at an early age. This gives the mother more time to recover from giving birth to 20 piglets.

But it also causes some problems for these same piglets. Having been pulled away from their mother too soon, some of them do not mature properly. They often suffer later in life. The upside, for farmers and supermarkets that sell their products, at least, is that sow can become pregnant more quickly. Consequently, they can produce more bacon, ham, and other pork products more cheaply, keeping farmers in business.

Naturally, there are dangers to selective breeding. Temple Grandin, an animal welfare advocate, notes that breeding animals for size and strength interferes with natural animal processes. Breeding roosters for muscle, say, can make them top-heavy and unsteady on their feet, interfering with their courtship dances. This can, in turn, alienate them from hens.

Speaking of hens, what about those that lay 300 eggs per year? Clearly this is not natural behavior. Laying one egg a day makes a hen's bones brittle, since the eggs soak up the bird's calcium supply. And what about so-called Broiler chickens—the ones that are bred for their large breasts? Often, they are born so muscle-bound their skinny legs can't support them. And in the drive to only produce farm animals that can create a marketable product, many animals are simply tossed aside. Since male chicks will never lay eggs, they are not raised by most industrial chicken

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farmers. According to animal rights activists, Britain kills around 30 million male chicks per year, simply because they will never produce eggs.

Cows required to produce enough milk for 10 calves, tend to burn out quickly. Regular cows meaning those not subject to selective breeding—can live up to 30 years. But prolific dairy cows tend to make it just four or five years before they are considered worthless and sent to slaughter.

As you can see, selective breeding comes with an equal number of benefits and drawbacks. Think of all the joy that dogs have offered humans in the form of companionship over the last 100 years. Selective breeding is to thank for man's best friends. And yet the pain and suffering that livestock endure, makes us think twice. In the future, it is important to keep in mind that, in some cases, the negative consequences of selective breeding outweigh the positive. How we treat our animals, in other words, should be more important than how much bacon we eat.

### **Comprehension Questions**

1. What is another term for "artificial selection"?

- A. natural selection B. evolution C. selective breeding D. desirable traits
- 2. The cause of bulls with more muscular frames is selective breeding. What is the effect?
  - A. Farmers have to buy more grain to feed the larger cows.
  - **B.** The cows develop larger udders and produce more milk.
  - C. The bulls cannot be selectively bred for other traits.
  - **D.** Farmers can obtain more meat from the slaughtered bulls.

**3**. Traits such as floppy ears, white patches, and colored spotting can indicate that a fox has been successfully bred for tamability. What evidence from the passage best supports this conclusion?

- A. The foxes with white patches are better at socializing than their wild counterparts.
- **B.** Dmitry K. Belyaev collected dozens of silver foxes from pet farms across Russia.
- C. Wild foxes tend to not exhibit floppy ears, white patches, or colored spotting.
- **D.** Selectively breeding silver foxes for tamability changes the way they look and behave.

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4. Read the following sentences: "Temple Grandin, an animal welfare advocate, notes that breeding animals for size and strength interferes with natural animal processes. Breeding roosters for muscle, say, can make them top-heavy and unsteady on their feet, interfering with their courtship dances. This can, in turn, alienate them from hens."

How do animal welfare advocates likely feel about selective breeding?

- A. positive B. negative C. indifferent D. confused
- 5. What is this passage mostly about?
  - A. breeding for "tamability" in silver foxes
  - B. the history of selective breeding from the Romans to today
  - C. the pros and cons of selective breeding
  - D. the problems associated with selective breeding in industrial farms
- 6. Read the following sentences: "Having so many piglets puts an enormous strain on the mother pig. Likewise, the act of rearing so many piglets can exhaust a sow, and make her incapable of becoming pregnant again. But for farmers trying to increase their profits, a tired sow that cannot get pregnant is not worth very much." What does "incapable" mean?
  - A. not able to do something B. exhausted from too much effort
  - C. not willing to do something D. not worth much money
- 7. Choose the answer that best completes the sentence below.

A wild sow typically gives birth to five piglets at a time; \_\_\_\_\_, a sow that has been selectively bred will give birth to 15 or 20 piglets at a time.

- A. for example B. as a result C. most importantly D. in contrast
- 8. Give an example of a positive effect of selective breeding.

9. Give an example of a negative effect of selective breeding.



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10. Should the practice of selective breeding be continued?

Support your answer with information from the passage.



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Unit 4.7 handout 2

### **TEACHER ANSWER KEY**

1. С 2. D 3. А 4. В 5. С 6. А 7. D 8. Answer will vary. Possible answers:

The tame dogs we have as pets and companions.

We will have an increased supply of milk and meat from cows.

9. Answer will vary. Possible answers:

There will be a shorter life of the dairy cow.

Chickens that are bred for their large beasts cannot support the extra weight on their legs.

**10.** Answer will vary, as long as they are supported by the evidence from the passage.