

The Strength to Survive



In this unit, you will

- read about the amazing physical abilities animals developed to help them survive.
- learn how unique features of humans help them outrun animals.
- increase your understanding of the target academic words for this unit.

READING SKILLS

Self-Assessment

Think about how well you know each target word, and check (✓) the appropriate column. I have...

TARGET WORDS

AWL

- 🔑 achieve
- 🔑 area
- duration
- 🔑 element
- exceed
- facilitate
- 🔑 feature
- 🔑 maintain
- preliminary
- 🔑 release
- sole
- 🔑 transfer
- undergo
- welfare

[illegible]

Outside the Reading What do you know about physiology? Watch the video on the student website to find out more.



 Oxford 3000™ keywords

Read

In a sense, all animals are Olympians—they have skills at which they excel. This online article from the National Wildlife Federation discusses how animals would perform in five categories of Olympic competition: sprinting, long-distance running, diving, jumping, and weightlifting.

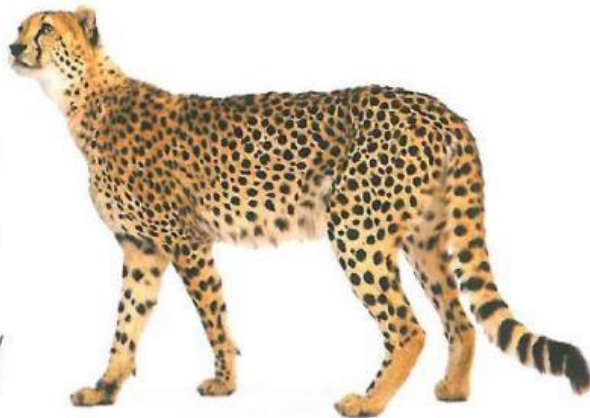
ANIMAL OLYMPICS

Athleticism, speed, strength, power, endurance: Humans celebrate these attributes in such events as the Olympic Games. In the animal kingdom, however, these qualities are necessary for the **welfare** and survival of the individual and society. Animals perform amazing feats every day, not with the purpose of winning or being named the best, but in order to eat, seek and catch prey, mate, escape predators, and endure the **elements**.

SPRINTING

The cheetah is said to be the fastest running mammal on earth, with a top sprinting speed of 70 miles per hour (mph). Why does it run so fast? To catch the fleet¹-footed gazelles and antelopes on which it feeds. In its natural habitat in the grasslands of Africa, the cheetah can outrun its fleetest prey. Like human sprinters, it cannot **maintain** its top speed for long and must take down its prey within a distance of about 300 yards. If the cheetah lived in North America, it might meet its match. The pronghorn antelope has been clocked at close to 70 mph and can run for long distances at 30 to 45 mph. Interestingly enough, these two animals run at these top speeds for different reasons: the cheetah runs in pursuit, whereas the pronghorn runs to escape.

The peregrine falcon is widely acknowledged to be the fastest moving bird, **achieving** astonishing speeds when it dives for prey. Some sources



The cheetah is the fastest animal on land.

cite a top speed of 200 mph, while others put the figure at about 120 mph. Either way, it would be hard for any other bird to escape it. On foot, the fastest bird is the ostrich, which can run about 40 mph. It outpaces the greater roadrunner, North America's fastest running bird, which tops out at about 25 mph. Coyotes, incidentally, can also outrun roadrunners, with a cruising speed of 25–30 mph and a top speed of 40 mph.

MARATHON

The Olympic Marathon, a paltry² 26 miles, doesn't come close to the marathons some animals endure. Take the Arctic tern, for instance. It migrates between the North and South Poles, covering a distance of as much as 30,000 miles each and every year. Some birds spend long **durations**, even most of their lives, in flight. Swifts, for example, have very underdeveloped legs and live almost entirely on the wing. Some seabirds, such as the sooty tern, fly for years without landing. The wandering albatross is named for its ability to fly thousands of miles on feeding trips.

¹ fleet: fast, quick, and light in movement

² paltry: small amount, mere

Fish can make long-distance migrations as well.

55 Some salmon, swimming between the ocean and the rivers in which they spawn, cover 2,000 miles. European eels are said to swim up to 3,700 miles to reach their breeding grounds in the Sargasso Sea, located in the Atlantic Ocean.

60 The great annual migration of wildebeests and zebras in the African Serengeti covers about 2,000 miles. But the longest annual migration by a mammal is the 10,000-mile circuit made by the gray whale, from the Arctic to its warm winter
65 calving **areas** and back again.

DIVING

The sperm whale is generally acknowledged to be the deepest diving mammal, but the northern bottlenose whale is not far behind. The sperm whale is known to dive a mile (5,280 feet) or
70 deeper and to stay under for **durations exceeding** two hours. The bottlenose is said to dive at least 5,000 feet and is also able to remain submerged for two hours. If the two were competing in an Olympic event, the odds would be about even.

75 There is little competition for the deepest diving bird: it is the emperor penguin, which can dive to a depth of 1,770 feet. Outside of the penguin family, the thick-billed murre may be one of the emperor's nearest competitors; it is thought to
80 dive to 600–700 feet. Dovekies (300 feet), loons (250 feet), Atlantic puffins (160 feet), and long-tailed ducks (130 feet) are all superb divers but are no match for the emperor penguin.

JUMPING

Some types of kangaroos can leap a distance
85 of 30 feet. White-tailed deer, when bounding, can cover almost the same distance. But the true long-jump champion is probably the inch-long southern cricket frog, which makes leaps **exceeding** 60 times its body length.

90 As for the high jump, the red kangaroo can hurdle a ten-foot fence. North America's white-tailed deer can hurdle an obstacle eight and a half feet high. Those leapers have got nothing on the lowly spittlebug, though, which
95 jumps 115 times its body height. The deer and kangaroo would have to jump about 600 feet to compete with the spittlebug!

WEIGHTLIFTING

No animal on earth can lift as much weight as the African elephant, which can pick up
100 a one-ton weight with its trunk. Relative to body size, however, the elephant doesn't even come close to the strongest animal on earth. What is it? The rhinoceros beetle. This rather strange-looking little creature can transport
105 objects weighing 850 times its own body weight. The elephant, carrying only one fourth of its body weight, isn't even close in this contest.

At the Olympic Games, the fastest runners,
110 highest jumpers, and most skillful divers win medals and worldwide acclaim. In the animal world, no medals are awarded, and individuals don't often **achieve** fame for their accomplishments. Rather, the amazing
115 athletic feats performed by animals enable them to escape danger, catch food, impress a mate, and live another day.



The rhinoceros beetle is the strongest animal on earth.

Reading Comprehension

Mark each sentence as *T* (true) or *F* (false) according to the information in Reading 1. Use the dictionary to help you understand new words.

- ___ 1. Pronghorn antelopes are the cheetah's prey.
- ___ 2. A sperm whale can hold its breath for a duration of two hours.
- ___ 3. Peregrine falcons eat other birds.
- ___ 4. A cheetah can run a mile in less than a minute.
- ___ 5. Coyotes can run a mile in under two minutes.
- ___ 6. No animal can dive deeper than the emperor penguin.
- ___ 7. The southern cricket frog makes leaps exceeding 100 times its body length.
- ___ 8. Relative to body weight, a healthy human being can lift more than an elephant.

READING SKILL

Skimming and Scanning

How fast should you read? Here are typical words-per-minute ranges for each type of reading:

Purpose

for memorization
for learning
for comprehension/pleasure
for skimming
for scanning

Speed

very slow: under 100 words per minute
slow: 100–200 words per minute
moderate: 200–400 words per minute
fast: 400–700 words per minute
very fast: 700+ words per minute

Skimming is reading quickly to get a sense of the broad meaning of the article. You skim an article to see if the article is important to you. Naturally, comprehension can be low.

Scanning means looking for a specific piece of information without worrying about the broader meaning. You may be looking for a specific word or fact. General comprehension is also low.

Skimming and scanning work well when you know what you are looking for. You should not skim or scan a text if you need to comprehend and remember the material fully.

In small teams, search through the readings in this book to find answers to these trivia questions. The team that finds all the correct information first wins.

Team name: _____

Starting Time: _____ Finishing Time: _____ Elapsed Time (duration): _____

1. What was the first movie release to use Sensurround?

2. What is the pitch of a typical female voice?

3. What device or instrument features a bridge and a saddle?

4. What event does the National Sleep Foundation promote each year?

5. Did the NASDAQ stock exchange exceed 5,000 on March 10, 2000?

6. Which one of these is not a type of tulip: Semper Augustus, Charles II, Admiral Van Eyck, or Admiral Liefken?

7. What did the crowd think the ox weighed?

8. Without "googling" his name, identify the school that Larry Page attended.

You probably found much of the information more quickly than you thought you would. What tricks did you use to hunt down the answers?

Vocabulary Activities

Noun	Verb	Adjective	Adverb/ Conjunction
achievement	achieve	achievable	_____
duration	_____	_____	_____
element the elements	_____	elemental elementary	elementally
excess	exceed	excessive excess	exceedingly excessively in excess of
maintenance	maintain	maintained	_____
welfare	_____	_____	_____

- A.** Read these comments on animal extremes. Fill in the blanks with a target word from the chart above that completes the sentence in a grammatical and meaningful way.
1. The pronghorn antelope can _____ speeds of 30–45 miles per hour over long distances.
 2. The normal swimming speed of emperor penguins is 4–6 miles per hour, but they can _____ speeds of more than 11 miles per hour in short bursts.
 3. Emperor penguins can endure the extreme cold of Antarctica, where temperatures can reach -60°C (-76°F) for long _____.
 4. By huddling together, emperor penguins can survive the Antarctic winter's _____ harsh conditions.

5. The bar-headed goose can reach heights in _____ of 29,000 feet as it migrates over the Himalayas to its nesting ground in Tibet.
6. Racing homing pigeons are taken to a distant location and released to race home. They _____ an average speed of about 30 miles per hour.
7. The National Wildlife Federation is concerned about the _____ of animals.
8. The arctic hare has several adaptations that help it battle _____.

B. Circle the alternative that best captures the meaning of the bold target word in each sentence.

1. During the debate, the biologist **maintained** that humans are the best runners in hot weather.
 - a. held his opinion
 - b. supported his opinion
2. The museum's collections are poorly **maintained**.
 - a. cared for
 - b. argued for
3. The students found the demonstration **exceedingly** helpful.
 - a. very
 - b. too
4. Some students complained that the amount of lab work was **excessive** and not very useful.
 - a. fast-moving
 - b. unnecessarily great
5. The otter's thick, dense fur helps it endure **the elements**.
 - a. weather
 - b. chemicals
6. To survive in cold weather, take these **elementary** precautions.
 - a. basic
 - b. essential
7. One **element** of the arctic wolf's success is its ability to consume huge amounts of meat.
 - a. small amount
 - b. part

The word *element* has many meanings, most related to the idea of something basic or fundamental.

- | | |
|------------------------------|--|
| a. a basic part of sth* | a key/necessary/essential/crucial/important <i>element</i> |
| b. the "basics" of a subject | the <i>elements</i> of bookkeeping, physics, grammar, etc. |
| c. a subgroup of people | a violent/radical/moderate/questionable <i>element</i> |
| d. a small amount | an <i>element</i> of truth/risk/surprise |
| e. the weather | exposed to/protected from/battle the <i>elements</i> |
| f. chemistry | a chemical <i>element</i> , such as gold, mercury, or oxygen |
| g. electronics | a heating/electrical <i>element</i> |

*Note: *sth* is a common dictionary abbreviation for *something*



C. Which meaning of the word *element* is expressed in each sentence? Match each sentence with a definition in the box above. Compare answers with a partner.

- 1. There is an element of risk in any investment.
- 2. The heating element in the oven was replaced.
- 3. A key element of survival is being able to escape from predators.
- 4. The course introduces students to the elements of wildlife management.
- 5. The more vocal element in the group shouted down the speaker.
- 6. A thick coat of fur is necessary to protect arctic animals from the elements.
- 7. The heaviest naturally occurring, non-radioactive element is bismuth.

D. Use information from Reading 1 to answer these questions in your notebook. Use the word or expression in parentheses in your answer.

1. How deep can the emperor penguin dive? (*depths exceeding*)
It can reach depths exceeding 1700 feet.
2. What speed can pronghorn antelope travel over long distances? (*maintain*)
3. How fast can a peregrine falcon fly? (*achieve*)
4. What special ability do wildebeests, terns, and salmon have? (*long durations*)

E. Read this trivia about other record-setting animals. Restate each sentence using the word or phrase in parentheses. Be prepared to read aloud or discuss your sentences in a small group.

1. Blue whales can weigh over 170 tons. (*in excess of*)
Blues whales can weigh in excess of 170 tons.
2. The sounds made by blue whales can reach beyond 150 decibels. (*exceed*)
3. To survive, a squirrel must remember where it has individually hidden thousands of nuts. (*welfare depends on*)
4. Dall's porpoise, the fastest sea mammal, can travel up to 56 miles per hour. (*achieve speeds*)
5. The marmot, a large rodent, can hibernate for up to nine months a year. (*durations*)

Before You Read

Read these questions. Discuss your answers in a small group.

1. Is physical fitness important for success in the modern world?
2. In Reading 1 we learned about animals that can outdo humans in many athletic categories. In what general athletic category or categories do you think humans would excel?

MORE WORDS YOU'LL NEED

biomechanics: the biological mechanisms that allow animals to move

center of gravity: the point in a body or mass where the weight is most concentrated

counterweight: a weight that helps balance an object that would be too heavy on one side

torso: the upper body except for the head and arms; also called the trunk



Read

This science magazine article discusses how humans run, and the advantage that this ability has given us.

Were Humans Born to Run?

Compared to cheetahs, whose bursts of speed reach 70 miles per hour, or migrating wildebeests that roam over 2,000 miles a year, we humans must seem lead-footed homebodies. As big as we are, we cannot seem to catch a cat or a mouse or even a chicken unless we can corner it or trick it.

But has our natural envy of a few fleet-footed species or our clumsiness in catching nimble escape artists caused us to underestimate ourselves? University of Utah biologist Dennis Bramble and Harvard University paleoanthropologist¹ Daniel Lieberman think so. In fact, they **maintain** that decades of research indicates that humans are very good runners indeed—perhaps the best in the world—when the distance gets long and the weather gets hot.

HOT TO TROT

To understand how they can make this claim, let's consider what humans can do. The very

best long-distance runners can run five-minute miles for several hours. These efforts are amazing **achievements**, but even the casual jogger can often keep up an eight to ten minute a mile pace for several miles. Only a few animals of similar weight—large dogs, hyenas, wolves, and wildebeests—are capable of **maintaining** such speeds, and actually prefer to trot a bit slower. Even a thousand-pound horse will not cover long distances any faster than a good recreational jogger.

And in hot weather, humans may hold a decided advantage. One of the most incredible feats of human endurance is the annual Badwater-to-Mt. Whitney run in the United States. The race begins in Death Valley, California, at an elevation 285 feet below sea level, in July, the hottest month of the summer. The runners run 135 miles, crossing several mountain ranges with a cumulative elevation gain of 13,000 feet, and finish at an elevation of 8,360 feet at the Whitney Portal trailhead, about halfway up the 14,440-foot mountain. Each year approximately 75 men and women enter the race with 60–80% finishing within 60 hours and with the winning time usually well under 30 hours. Despite temperatures reaching

¹ paleoanthropologist: one who studies the biological history of human beings

130°F,² there have been no fatalities so far. These men and women can probably outrun
50 any animal on the planet.



A volunteer hands a runner food during the annual Badwater-to-Mt. Whitney run.

What makes it possible for these people to **undergo** such an ordeal? It turns out that humans are beautifully designed to run long distances in hot weather. Long-distance running
55 requires the ability to keep from overheating, and we humans have several advantages in this regard. First, we **release** heat by sweating through millions of sweat glands³ rather than through panting. And because we have no fur,
60 our sweat evaporates quickly. Our upright posture also helps immensely by exposing less **area** to direct sunlight and more surface **area** to the cooling effect of the wind we create as we run. We excel at keeping cool, while most other
65 animals simply cannot shed heat fast enough to run long distances.

But cooling is not enough to explain our speed over long distances. A second advantage is our long stride. When Professor Bramble
70 filmed his student David Carrier running alongside a horse moving at an easy gallop, he noticed that Carrier took fewer strides than the horse, indicating that Carrier's strides covered more distance than the horse's. Bramble was
75 surprised by this and began considering what **elements** of human biomechanics make this possible. Working with Daniel Lieberman at Harvard, he realized that humans, like horses and rabbits, can run without their heads

80 bobbing up and down due to a piece of anatomy, the *nuchal ligament*, which links the head to the spine. This tendon-like⁴ band is not involved in walking, suggesting that it is an important anatomical **feature** for a species that
85 at one time needed to run, not walk, to find its dinner.

A SPRING IN OUR STEP

In fact, walking, it turns out, is a distinctively different motion than running. When walking, the heel hits the ground first, the leg
90 straightens, and the body lurches forward a bit. As the weight **transfers** to the ball of the foot, the arch stiffens and then pushes the body forward, with the other foot moving forward to keep the stride going. With running, the legs
95 become large springs. You land more heavily on the arch of the foot and bend your knee, which causes the body's center of gravity to lower. The force from this hard landing is captured by the tendons of the foot and leg,
100 particularly the calf⁵ muscles, and you spring forward as the tendons recoil. According to Bramble, these huge, springy tendons are not necessary for walking.

Huge, springy tendons explain where the
105 energy comes from, but how do humans **maintain** their balance and keep from falling over? All other two-legged animals that run fast, such as kangaroos and roadrunners, have large tails that serve as a counterweight to keep the
110 animal balanced. Humans are obviously tailless, so how do they do it? Motion studies of runners on treadmills offer clues. Instead of a tail, we have a very large muscle, the *gluteus maximus*, that connects our hips to our lower back. This
115 muscle does not do much when we walk, but it works very hard when we run. Its role, it seems, is to act like a brake on our torso to keep it from lurching too far forward when our foot hits the ground.

120 Other anatomical **features** that **facilitate** running are our long necks and our shoulders. We are able to twist our shoulders without moving our head, allowing us to pump our arms

² 130°F: 130 degrees Fahrenheit, equal to 54 degrees Celsius (54°C)

³ *gland*: cells in the body that produce a specific substance

⁴ *tendon*: a tough fiber that connects muscle to bone and other muscles

⁵ *calf*: the back of the lower leg

as another steadying mechanism that helps
125 counterbalance our head and keep it upright.

There is no doubt, then, that humans are able to run, but why? Today most people are sedentary and run **solely** for pleasure or sport. Could it be that in our prehistoric past long-
130 distance running was necessary for survival? Sprinting fast allows an animal to drag down prey or escape a predator, but why would an ability to sustain a long run through hot weather be necessary? To hunt, perhaps? But
135 didn't prehistoric humans hunt by sneaking up on animals and spearing or clubbing them? That certainly seems more efficient than chasing an animal for miles until it drops from heat exhaustion. Or is our ability to run a
140 byproduct⁶ of some other ability? It seems running muscles also help us stand up quickly and climb things, and certainly our springiness helps us fight more effectively.

Any conclusions we draw at this point are

⁶ byproduct: something that happens as a result of something else

145 **preliminary**. But knowing that we can run long distances may point us in the right direction for further study. It gives us clues as to how prehistoric humans lived. Perhaps adult hunters needed to travel long distances to track a herd
150 and return before dark. Humans do not see well at night and by running could extend their hunting range without constantly breaking camp and uprooting a family or village. Perhaps they needed to move quickly in order to reach prey
155 killed by other animals and join in on the feast. Getting quickly to distant food sources before animal rivals could reach them is one clear advantage of our running ability.

The debate undoubtedly will continue, with those who dislike sweaty activity naturally
160 skeptical of any prehistory that forced us to move out of the shade. But those eighty or so people who attempt the Badwater-to-Mt. Whitney run and the hundreds of thousands who run 26.2-mile marathons each year make it
165 difficult to deny the obvious—some humans, if not all, are definitely born to run.

Reading Comprehension

Mark each sentence as *T* (true) or *F* (false) according to the information in Reading 2. Use the dictionary to help you understand new words.

- ___ 1. Humans have a unique way of running not found in other species.
- ___ 2. The reading encourages the reader to get more exercise.
- ___ 3. The reading sees running as a byproduct of walking.
- ___ 4. The experts agree on the reasons prehistoric humans were such good distance runners.
- ___ 5. The reading implies that most animals have trouble seeing clearly while they run.

LEARN

A good way to make sure you catch and understand the main points of a text is to *outline* them as you read. An outline is a diagram of the structure of the text.

APPLY

- A.** A simple outline shows the basic structure of the text. Complete this simple outline of Reading 1 on pages 3–4.

Introduction (Main idea: Some animals are capable of outstanding athletic performances.)

- I. Sprinting
- II. _____
- III. Diving
- IV. _____
- V. _____

Closing Remarks

- B.** An outline can also have subheadings. Complete this more detailed outline of Reading 1 on pages 3–4. Be careful: the method of categorizing animals and animal achievements changes throughout the article.

I. SPRINTING

- A. Mammals
- B. _____

II. MARATHON

- A. _____
- B. _____
- C. _____

III. DIVING

- A. _____
- B. _____

IV. JUMPING

- A. _____
- B. _____

V. WEIGHTLIFTING

- A. _____
- B. _____

- C.** When a formal outline is unnecessary or too difficult, you can take quick notes using bullet points and indentation. Look at how one student took notes for a short section of Reading 2 on pages 9–11. Then make a quick outline of the key points of the whole text in your notebook.

ways humans lose heat

- *millions of sweat glands release heat*
- *no fur. Sweat evaporates quickly.*
- *upright posture*
 - *less area exposed to the sun*
 - *more area exposed to cooling wind*

Vocabulary Activities

Noun	Verb	Adjective	Adverb
area	_____	_____	_____
facilitation facilitator facility	facilitate	facilitating	_____
feature	feature	featured featureless	_____
preliminaries	_____	preliminary	_____
release	release	released	_____
_____	_____	sole	solely
transfer	transfer	transferable	_____
_____	undergo	_____	_____

- A.** Read this information on other human abilities. Fill in the blanks with a target word from this unit (in the chart above or the chart on page 6) that completes the sentence in a grammatical and meaningful way. Words may be used more than once.

Humans are impressive distance haulers, but to carry a load uphill successfully, your stride must (1) _____ some changes. On flat surfaces, your calf muscles greatly (2) _____ fast walking, providing forward push. You (3) _____ momentum from one stride to the next by rocking forward as your back foot (4) _____ from the ground. On a steep hill, this method quickly tires you out. To (5) _____ a steady pace, lift one leg and plant it a short distance uphill. Straighten it while leaning slightly forward. Raise your back leg, but don't swing it forward until your front leg is straight.

This method may sound slow, but your uphill speed and endurance will improve noticeably.

One (6) _____ where humans excel is throwing. In the (7) _____ stage of a throw, the arm moves up and back to capture energy in the muscles of the shoulder, back, and legs. The torso moves slightly ahead to build more energy. The arm then springs forward and (8) _____ energy to the object. Just before the (9) _____, the wrist and fingers snap forward to add velocity. The best athletes can throw objects at speeds (10) _____ 100 mph.

B. Which meaning of the word *feature* is expressed in each sentence? Match each sentence on the left with a definition on the right. Compare answers with a partner.

- | | |
|--|-------------------------------------|
| — 1. The feature lasted nearly three hours. | a. an important part |
| — 2. Her research featured strongly in the report. | b. parts of a face (usually plural) |
| — 3. The car features a GPS navigation system. | c. a movie |
| — 4. His rugged features helped him land many parts. | d. a special program or article |
| — 5. The wandering albatross's most obvious feature is a wingspan of about 3.5 meters. | e. to include sth special |
| — 6. They will run several features on endangered animals next week. | f. to play an important part |

C. The word *facilitate* means to make something easier to do. What tools or practices facilitate these things?

1. trade between countries

A knowledge of local business practices can facilitate trade between countries.

2. learning a language

3. childhood development

4. keeping in contact with friends

5. the healing of a muscle injury

Collocations Chart			
Verb	Adjective	Noun	Noun Compound
_____	<i>elementary</i>	school, knowledge, laws, approach, mistakes, stage	_____
_____	<i>elemental</i>	truth, changes, force, aspect, characteristics, part, meaning	_____
<i>exceed</i>	_____	expectations, authority, limits	_____
_____	<i>excessive</i>	force, amount, noise, use, talking, demands	_____
_____	<i>sole</i>	survivor, purpose, heir, authority, objective	_____
_____	<i>preliminary</i>	report, findings, remarks, research, results, inquiry, approval	_____
promote, improve	social, personal, child	(the) <i>welfare</i> (of sth)	state, benefits, services, agency
<i>undergo</i>	_____	change, operation, test, ordeal, transformation, examination, review, evaluation	_____

D. The chart above shows common collocations, or word partners, for selected target vocabulary. Using the chart, complete these sentences with the correct form of an appropriate word.

- The actress is devoted to promoting the _____ of animals.
- Last year, the company's policies _____ an intensive review.
- The _____ purpose of the review was to find ways to cut costs.
- The manager _____ his authority when he fired the worker.
- _____ findings show the cause of the accident was human error.
- The bridge collapsed under the pressure of _____ weight.
- He wanted to play basketball, but he had to face an _____ truth: he would never be tall enough to play professionally.
- Her love of animals began in _____ school, when her class visited the zoo.