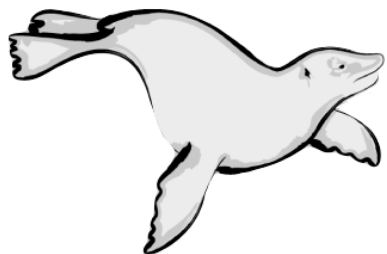


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ANSWERS

PENGUIN ENCOUNTER

Penguin keepers simulate the seasonal lighting changes in Antarctica. When it's summer here in San Diego, it's winter in Antarctica — and dark nearly 24 hours a day.

MANATEE RESCUE

$.04 \times 544 \text{ kg} = 22 \text{ kg}$

$.09 \times 544 \text{ kg} = 49 \text{ kg}$

An average-size adult manatee consumes 22 to 49 kg (48–108 lb.) of food daily.

SHARK ENCOUNTER

Sharks sense water movement with a lateral line system and sense weak electrical fields with their ampullae of Lorenzini.

A shark may attack a human to defend a territory or to investigate potential prey,

FLAMINGO COVE

Carrots contain beta-carotene. If a person consumes large quantities of carrots, his or her skin can take on an orange tinge.

FORBIDDEN REEF

A bat ray has spiracles behind its eyes that provide oxygenated blood directly to the eye and brain through a separate blood vessel.

SEAL AND SEA LION

Scientists gather data on where the seals are, how deep they dive, and how long they hold their breath.

OTTER OUTLOOK

AT ROCKY POINT PRESERVE
Sea otters are the “furryest” animals on the planet, with an average of 650,000 hairs per square inch. They rely on their dense fur to keep warm.

DOLPHIN BAY

AT ROCKY POINT PRESERVE

$181 \text{ kg} \times .04 = 7 \text{ kg of food daily}$

$181 \text{ kg} \times .06 = 11 \text{ kg of food daily}$

$7 \text{ kg divided by } 2.3 \text{ kg} = 3$

$11 \text{ kg divided by } 2.3 = 5$

A 181-kg (400-lb.) dolphin gets 3 to 5 multivitamins each day, depending on how much food it eats.

SHAMU CLOSE UP/

SHAMU STADIUM

The veterinarian's job is to keep the killer whales healthy. To do this, the veterinarian checks the whales' weight, eyes, ears, blowhole, and takes small blood samples to examine in the lab.

TURTLE BEACH

AT SHIPWRECK RAPIDS

Jellyfish resemble floating plastic bags.

Baby sea turtles are only a couple of inches long when they hatch.

BELUGA WHALES AT WILD ARCTIC

Sounds are produced by movements of air in nasal sacs below the blowhole. Belugas vocalize for communication and navigation.

POLAR BEARS AT WILD ARCTIC

Polar bears mainly prey on seals, especially ringed seals. They use their eyesight, hearing, and especially their sense of smell to find prey.

WALRUSES AT WILD ARCTIC

Walruses, seals, and sea lions are all pinnipeds.

$3,000 \text{ clams} \times 2 \text{ feedings} =$

$6,000 \text{ clams consumed daily.}$

$6,000 \text{ clams} \times 365 \text{ days} =$

$2,190,000 \text{ clams in one year.}$

HUSBANDRY AND TRAINING

FIELD TRIP GUIDE

WELCOME TO SEAWORLD!

Our education program is designed to introduce your students to marine life. Ensure a successful learning experience by visiting as many SeaWorld animal habitats as you can before and after your education show.

This booklet will help you and your students learn about the animals at SeaWorld. As you visit each exhibit, please encourage them to read the animal information in the booklet and try to answer the questions. (Answers are on the inside back cover.)

The learning does not stop at SeaWorld. Using the “DIVE DEEPER” conservation challenge at the bottom of each page, marine science also may be used to support the Reading/Language Arts Framework. Encourage students to research the answer at school, at home, at the library, or on the Internet and share their results.

Enjoy your SeaWorld Education Program!

PENGUIN ENCOUNTER

- ✧ All five penguin species in the Penguin Encounter have reproduced here. Since the attraction opened in 1983, hundreds of chicks have been raised successfully. SeaWorld San Diego was the first zoological facility in the world to breed emperor penguins.
- ✧ Bands on each flipper identify individual penguins. Bands help SeaWorld aviculturists monitor each bird's food intake and health. It also helps identify breeding pairs, ensuring genetic variation within the colony.
- ✧ During summer, SeaWorld Penguin Keepers dim the lights inside the Penguin Encounter. Why?

SHAMU'S SECRET

SeaWorld San Diego participates in the Species Survival Plan (SSP) for Humboldt penguins, a vulnerable species. The SSP is a captive propagation and management program to preserve, in zoos and aquariums, species that are threatened or endangered in the wild.

DIVE DEEPER

Penguin habitats and food sources are threatened by global climate change. Use the library or Internet to discover which species are most at risk. Brainstorm, as a class, ways to help prevent the build-up of atmospheric carbon dioxide that leads to climate change.

JUST FOR TEACHERS

Did you know that SeaWorld has a Web site which offers a wide variety of online resources for teachers and other educators? Visit SeaWorld.org and click on *Just for Teachers* to find free curriculum guides, classroom activities, and links to the following teacher resources.

Land, Sea, & Air Mail.

Looking for current animal and conservation related information to bring into your classroom? Sign up for *Land, Sea, & Air Mail* — the SeaWorld/Busch Gardens monthly e-newsletter designed for teachers. It brings in-depth animal information, classroom activities, teaching tools, and animal news right into your classroom. Subscribe by clicking on *Land, Sea, & Air Mail*.

Shamu TV.

Bring SeaWorld, Busch Gardens, and Discovery Coves' award-winning environmental education series, **Saving a Species**, right into your classroom. Find out the Shamu TV broadcast schedule, show descriptions, satellite links, and more by clicking on the *Shamu TV* link.

SeaWorld & Busch Gardens Environmental Excellence Awards.

Each year, the SeaWorld & Busch Gardens Environmental Excellence Awards recognizes the outstanding efforts of K-12 students and teachers across the country who are working at the grassroots level to protect and preserve the environment. Discover how your group can win \$5,000 by clicking on the link for the *Environmental Excellence Awards*.

SHARK ENCOUNTER

- ✦ *Elasmobranchii* is a scientific subclass of cartilaginous fishes that includes sharks and rays. Like all fishes, sharks have fins. A caudal (tail) fin is used for propulsion; pectoral fins provide lift; dorsal, anal, and pelvic fins aid in stability.
- ✦ Sharks are excellent hunters. In addition, to the senses that we have, sharks have two other senses? What are a shark's two additional senses?
- ✦ Of about 400 species of sharks in the world, only a few have ever attacked people. Shark attacks are very rare, and when a shark does attack, it rarely eats its victim. Can you think of two reasons a shark might attack a human?

SHAMU'S SECRET

In 1996 the Association of Zoos and Aquariums (AZA) awarded SeaWorld San Diego the prestigious Significant Achievement Award. This award recognizes SeaWorld's elasmobranch breeding program. Cownosed rays, bat rays, swell sharks, Pacific blacktip sharks, whitetip sharks, leopard sharks, and bonnethead sharks have all reproduced at SeaWorld.

DIVE DEEPER

Each year, humans catch millions of sharks mostly for their valuable fins; the key ingredient in shark fin soup. Many people feel that this is not a problem since they believe that all sharks are dangerous. Yet, very few shark species are potentially dangerous to humans. Have your students find out why sharks are an important part of their ocean ecosystems and what is currently happening to shark populations. Then discuss whether sharks pose a larger threat to humans or humans to sharks.

POLAR BEARS AT WILD ARCTIC

- ✦ Polar bears are found throughout the circumpolar Arctic. They inhabit seasonal sea ice, water, islands, and continental coastlines. The scientific name for polar bear, *Ursus maritimus*, is Latin for "sea bear."
- ✦ Polar bears are one of the largest land carnivores. The largest polar bear ever recorded was a male weighing 1,002 kg (2,209 lb.) and measuring 3.7 m (12 ft.) long.
- ✦ Polar bears have a dense coat of fur that appears mainly white. In fact, the hairs are actually translucent and hollow and reflect light, giving a polar bear its white coloration.
- ✦ Polar bears are *apex* (top) predators in the Arctic. What is the main prey of polar bears? What senses do polar bears use to find their prey?

SHAMU'S SECRET

SeaWorld's polar bears have taken part in a groundbreaking study. Scientists from the Hubbs SeaWorld Research Institute are studying polar bear hearing in hopes of helping wild polar bears adjust to climate change related shifting of their populations to areas near humans.

DIVE DEEPER

Polar bears and other arctic wildlife are vulnerable to changes in seasonal sea ice and other effects of global climate change. Divide the students into groups and have them research on the Internet to discover which arctic animals may be affected by climate change. Have them present their findings to the class.

WALRUSES AT WILD ARCTIC

- ✧ Walruses belong to the mammalian Order *Pinnipedia*. What other kinds of mammals are pinnipeds?
- ✧ The *vibrissae* (whiskers) located on the face of a walrus help locate prey on the dark ocean bottom. A walrus may have as many as 700 vibrissae on its face. A substantial nerve network transmits tactile information from the vibrissae to the brain.
- ✧ Walruses are benthic (bottom) feeders, preferring molluscs such as clams. An adult walrus may eat as many as 3,000 to 6,000 clams at a single feeding. Observations have indicated that walruses fill their stomachs twice daily. How many clams might a single walrus consume in one year?

SHAMU'S SECRET

The walrus exhibit in Wild Arctic has a scale built into the floor in the back area. The walruses are trained to go on the scale so they can be weighed on a regular basis.

DIVE DEEPER

The United States has laws that protect different animals. Walruses are protected by the Marine Mammal Protection Act of 1972, which bans commercial hunting of marine mammals, allowing only native subsistence hunting. In your school library or online, find out which animals are protected by law in your state.

MANATEE RESCUE

- ✧ A typical adult Florida manatee weighs about 544 kg (1,200 lb.). Maximum weight is 1,590 kg (3,500 lb.).
- ✧ Manatees are herbivores—they eat only plants. Florida manatees eat more than 60 species of aquatic vegetation including manatee grass, turtle grass, water hydrilla, and mangrove leaves. At SeaWorld, manatees eat romaine lettuce, cabbage, and spinach as part of their diet. An average adult Florida manatee eats 4% to 9% of its body weight daily.
- ✧ Using this information, estimate how much food an average adult manatee consumes daily.

SHAMU'S SECRET

SeaWorld Orlando rescues and rehabilitates manatees that are sick or injured due to entanglement, pollution, or watercraft strikes. When possible, manatees are returned to their natural habitat. SeaWorld has rescued nearly 400 manatees and has successfully released about half of these.

DIVE DEEPER

Learn more about protecting manatees by becoming pen pals with students from a classroom in Florida. What are some endangered animals that live in the your part of the U.S.? What are some things that you can do to help protect these animals? Exchange information with your pen pals on how you help protect endangered species.

BELUGA WHALES AT WILD ARCTIC

- ✦ Belugas live in the Arctic Ocean and surrounding seas. During certain times of the year, they may swim into cold rivers like the St. Lawrence and Yukon rivers of Canada. Arctic water temperatures may be as low as 0°C (32°F).
- ✦ Unlike most whale species, the seven neck vertebrae of a beluga whale are not fused. This greater mobility and flexibility of the neck allows the head a wide range of motion.
- ✦ Belugas are extremely vocal and are called “sea canaries.” Their vocalizations are heard above water and through ship hulls. Yet, toothed whales do not have vocal cords. How do you think belugas produce sound? Find the sound box and listen to beluga vocalizations. Why do belugas make these vocalizations?

SHAMU’S SECRET

To assist with the beluga whales’ care at SeaWorld, a ledge surrounds the pool, making it easier for veterinarians to take blood and other samples during examinations.

DIVE DEEPER

At school, locate the Cook Inlet on a map of North America (hint: it’s located on the coast of the only U.S. state that lies in the Arctic.) The Cook Inlet population of beluga whales was hunted to the brink of extinction. Even though hunting no longer occurs, this beluga population is not growing as much as it should be. Research online what factors may be keeping this beluga population from recovering.

FLAMINGO COVE

- ✦ These tall pink birds are Caribbean flamingos. They are filter feeders. They hang their heads upside down in the water and sweep their heads from side to side to filter flies and brine shrimp out of the water.
- ✦ A flamingo gets its color from an organic compound called beta-carotene. This substance, found in the food a flamingo eats, keeps the feathers pink. Without its regular diet, a flamingo’s feathers will grow in white or gray. Can you think of any foods that people eat that contain beta-carotene?

SHAMU’S SECRET

To keep our flamingos healthy and looking their best, SeaWorld bird keepers feed these birds a commercial flamingo food. This food was developed to meet their nutritional needs and provide them with the compounds necessary to maintain their color.

DIVE DEEPER

These flamingos are pinioned — portions of their wings were removed so they can’t fly. This procedure prevents the flamingos from flying away. Why is that important? In San Diego, the flamingo is not a native species. If released here, flamingos could damage native San Diego habitats and outcompete native wildlife. Use the library or Internet to find out more about *exotic* versus *native* species.

FORBIDDEN REEF

- ✦ Reach in the water and touch a bat ray. Bat rays feel smooth because a thick layer of mucus covers their skin. Mucus is part of a bat ray's immune system. Mucus protects the rays from bacteria and other parasites. Similarly, people have mucous layers in their respiratory tract to protect them from bacteria that they inhale.
- ✦ Most fishes swim with their mouths open to allow water to freely flow across their gills for respiration. Since bat rays rest on the bottom, they have an additional way to bringing oxygen-carrying water to its gills. What adaptation does it use?

SHAMU'S SECRET

Bat rays are born with sharp spines on their tails. They use these to defend themselves from predators. Members of the SeaWorld Fish Department remove the rays' spines to protect themselves and SeaWorld guests from being accidentally stung by the rays.

DIVE DEEPER

We enjoy some of the same foods that marine animals, like bat rays, need to survive (clams, fish, etc). Overfishing and irresponsible harvesting can damage fish and shellfish populations and even entire ecosystems. Research online about how choosing to eat only sustainable seafood protects various species of aquatic animals and their habitats.

TURTLE BEACH AT SHIPWRECK RAPIDS

- ✦ A sea turtle is a type of reptile that spends nearly its entire life in the ocean. Like reptiles that live on land, sea turtles have to breathe air, but they can hold their breath for a long time. A green sea turtle can hold its breath and stay under water for as long as five hours.
- ✦ Some sea turtle species occasionally eat plastic bags floating in the water, mistaking them for food. Eating plastic can make sea turtles sick and can even be fatal. What ocean animal might look like a plastic bag?
- ✦ A female sea turtle comes ashore to lay eggs. First, she digs a nest with her flippers. Then she lays as many as 200 round eggs that are about the size of a golf ball. She covers the nest and eggs with sand and returns to sea. Two months later the baby turtles hatch, dig their way out of the sand, and crawl into the sea. How big do you think a baby sea turtle is when it hatches?

SHAMU'S SECRET

The SeaWorld & Busch Gardens Conservation Fund provided a grant that helped fishermen replace the j-shaped hooks that they traditionally used with circle-hooks that are designed catch fish but not sea turtles. This simple change in fishing hooks dramatically reduced the numbers of sea turtles that were accidentally caught throughout the Atlantic and Pacific oceans.

DIVE DEEPER

Did you know that sea turtles may accidentally become entangled in trash that washes into their ocean home. Have your class organize or participate in a local beach or waterway clean up. Visit www.ocean-conservancy.org to learn how.

SHAMU CLOSE UP

- ✦ Since 1985, SeaWorld parks have had more than 20 successful killer whale births. These births include a second-generation birth — the first killer whale born and raised in the care of humans is now a mother herself. From these births, scientists have learned about killer whale reproductive physiology — information virtually impossible to gather from studying whales in the wild.
- ✦ SeaWorld veterinarians and trainers conduct regular examinations of the whales. Based on what you learned at your education presentation today, what do you think might be some common examination procedures?

SHAMU'S SECRET

Through husbandry training, milk samples have been collected from lactating killer whales at SeaWorld. The fat content of the mother's milk ranges from about 28% to 48%. This fat-rich milk helps a killer whale calf develop a thick, insulating layer of blubber.

DIVE DEEPER

If fishes swim and feed in polluted waters, certain contaminants build up in their bodies. A killer whale who eats these fish may build up an even greater load of contaminants. Because they feed at the top of the ocean food chain, killer whales are very susceptible to pollution. How can people keep pollution out of the ocean?

SEAL AND SEA LION

- ✦ Although they look similar, seals and sea lions are very different animals. One of the easiest ways to figure out whether an animal is a seal or a sea lion is to look at its ears. Sea lions have external ear flaps; seals do not. Look for other differences by watching the way each moves on land and in the water, and listening to their vocalizations.
- ✦ Scientists study seals and sea lions in a number of ways. They can observe animals on land during the breeding season, but for most of the year, the animals are at sea and difficult to study. Scientists at the Hubbs-SeaWorld Research Institute use satellite transmitters to track seals at sea. What kind of data do you think scientists obtain from these transmitters?

SHAMU'S SECRET

Each year, SeaWorld's animal rescue team rescues dozens of ill or injured seals and sea lions from San Diego County beaches. They care for these animals in a behind-the-scenes area, with the goal of returning them to sea when they are able to survive on their own. If you're at the beach and spot a marine mammal you think needs to be rescued, let a lifeguard or park ranger know or contact the local marine mammal rescue organization (such as SeaWorld in San Diego County.)

DIVE DEEPER

What are some other types of wildlife that may need to be rescued? As a class, make a list of some of the reasons that these animals might need to be rescued and cared for. Which reasons are caused by humans? How we can protect wildlife from from these human-caused dangers?

ROCKY POINT PRESERVE

OTTER OUTLOOK

- ✦ SeaWorld San Diego was involved in the rehabilitation of Alaska sea otters affected by the 1989 Valdez oil spill. Hubbs-SeaWorld Research Institute scientists helped coordinate the rescue. About 360 otters were rescued and treated at nearby rehabilitation facilities. Of these, 195 were successfully rehabilitated and released back into the wild.
- ✦ Damage to a sea otter's internal organs, particularly the liver, was caused from ingesting crude oil. Scientists administered an activated charcoal treatment, given orally, to bind to the oil hydrocarbons in the intestine and allow them to pass.
- ✦ Most marine mammals have a thick layer of blubber to keep them warm in cold ocean water. Sea otters don't have a blubber layer. How do sea otters keep warm?

SHAMU'S SECRET

Following the 1989 oil spill in Alaska, scientists at the Hubbs-SeaWorld Research Institute discovered the best way to clean sea otters with oil in their fur. They discovered that dishwashing detergent removed the oil from an otter's fur without hurting the otter. If there is an oil spill, dishwashing detergent is still used to clean the fur or feathers of oiled animals.

DIVE DEEPER

The California sea otter population is not recovering as much as it should. Research on the Internet to find out what's keeping their population low and how people can help sea otters recover.

ROCKY POINT PRESERVE

DOLPHIN BAY

- ✦ Animal studbooks are tools for monitoring and managing captive animal populations. Studbooks contain the past and present information on all births, deaths, and international transfers of a particular species. SeaWorld maintains the bottlenose dolphin studbook. Studbook information is often used to make breeding decisions that ensure genetic variation.
- ✦ Veterinarians prescribe vitamins on a per-pound-of-food intake basis. A bottlenose dolphin gets one multivitamin with every 2.3 kg (5 lb.) of food (fish and squid). Adult bottlenose dolphins eat about 4% to 6% of their body weight each day.
- ✦ Using this information, estimate how many multi-vitamins a 181-kg (400-lb.) adult bottlenose dolphin receives each day.

SHAMU'S SECRET

More than 70 bottlenose dolphins have been born at SeaWorld San Diego since the 1970s. Many of the dolphins you see in Dolphin Bay are a result of this successful breeding program.

DIVE DEEPER

Many people think it would be fun to interact with dolphins in the wild. But it's not a good idea — for the people or the dolphins. As a class, list reasons why. Visit this Web site for more information: www.nmfs.noaa.gov/pr/education/protectdolphins.html