

Teachers Guide for Kali: A Polar Bear's Story

Chapter 1

Vocabulary Use context cues or a dictionary to find the meaning of these words:

Parceled: _____

Enrichment: _____

Interact: _____

STEM: Polar Bear Calories

Students will: Do effective internet research and make calculations using basic mathematical skills.

Background Information:

Kali weighs 1,100 pounds and needs about 11,338 calories per day. A male dog, weighing 130 pounds needs about 2384 calories per day. A 13-pound male cat needs about 318 calories per day.

Activity:

Find the calories in one meatball, one capelin, one serving of carrots and lettuce, polar bear chow and lard. Based on the description of the meal Julie prepared for Kali, calculate how many times per day and the portions of each ingredient he would need to be fed to reach 11,338 calories.

SOCIAL STUDIES: Where is the Arctic

Students will: Identify the difference between latitude and longitude and use a world map to find locations identified by map coordinates.

Materials needed:

World map or globe for each student, with latitude and longitude lines, world country map.

Background Information:

The Arctic is the region north of the Arctic Circle, at 66 degrees, 33 minutes North denoted as 66° 33' N.

Remind students that latitude and longitude lines are an imaginary grid that has been placed over the globe.

The Equator is a latitude line that divides the Earth into two parts, the northern and southern hemispheres. All latitude lines run parallel to the Equator, which is the 0 point of latitude.

Longitude lines run the opposite direction, perpendicular to latitude lines. These are also called meridians. The Equator obviously divides the Earth into two parts, north and south, and serves as the starting line for latitude. But there is no obvious east and west dividing line on Earth. So, early geographers designated Greenwich, England as the Prime Meridian. This starting line for longitude divides Earth into two parts, the eastern and the western hemispheres. The Prime Meridian is the 0 point of longitude.

Activity:

Provide the world maps to your students. Have them find:

the Equator
the Prime Meridian
their School

Have your students use a phone or computer to find the latitude and longitude coordinates for your school. Write the information on the board.

Now write the latitude of the Arctic, which is 66 degrees, 33 minutes North, denoted as 66° 33' N, on the board and have the class find it on the maps.

Using a world country map have the students identify all countries that are crossed by or above the Arctic Circle.

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Chapter 1 (continued)

SOCIAL STUDIES: Arctic Sunlight

Students will: Demonstrate how the tilt of the Earth and its rotation affects day length in the Arctic and elsewhere.

Materials needed:

Construction paper for season signs, a portable globe, such as a blow up one, a flashlight, a straw and tape.

Background Information:

The Earth rotates on an imaginary axis that connects the North and South poles. Each day is a full revolution. Because the Earth is round, areas that are close to the Equator are also closer to the Sun, causing intense sunlight. Areas that are not as close to the Sun, those that fall further north and south of the Equator, get less intense sunlight.

The Earth's axis is at a constant tilted angle of 23.5 degrees. As the Earth travels its orbit around the Sun, this tilt causes shorter or longer days and gives us different seasons. The tilt also causes the Arctic to have months at a time when there is little to no sunlight during the winter and nearly 24 hours of sunlight per day through the short summer.

Preparation:

Attach a straw to the globe at the North Pole in line with the Earth's axis, 23.5 degrees. Choose an object near or on the ceiling towards which the stick will be pointed.

Write the names of the seasons on construction paper.

Activity:

To graphically display the impacts of the Earth's tilt:

Direct your students to sit in a large circle. The circle will represent the Earth's orbit around the Sun. Four students, equal distances apart from one another, should each be given a sign with the name of a season.

One person should sit in the center of the circle holding a flashlight, which represents the Sun. The flashlight should be pointed directly at the globe as it is passed around the circle

Hand a student the globe and have the class pass it around the orbit, noting where the Sun is at each season. Remind students that to accurately mimic the Earth's tilt, the straw must always point at the designated object.

Extension Activity:

Have your students consider the impacts of lack of sunlight on growing seasons and animals. What conclusions can they draw?

Newspaper Connections

Compare this chapter with an article in the newspaper. Take note of the 5 Ws and 1 H of journalism. Do these appear in both the newspaper article and this chapter? Why or why not?

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Chapter 2

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Subsistence: _____

Sow: _____

Revere: _____

Reading Comprehension:

Explain in your own words what the term “subsistence hunter” means.

What supporting information is given to show that James knew the bear had a cub?

How many polar bears had James shot in his life?

Discussion Question:

What animals are most hunted in your area? Do family members hunt and if so, is the meat used for food?

Writing Activities

Rewrite the paragraph about the cost of food in Alaska to make it more descriptive.

STEM: Arctic Wind and Trees

Students will: Analyze and draw conclusions and use evidence to support answers.

Materials needed:

Small fast-growing plants or seeds, potting soil, small clear containers, pipe cleaners, clay

Background Information:

The wind blows fiercely in the Arctic, sweeping across the landscape. Only a few inches of tundra thaws in the summer growing season. Below the tundra is permafrost, which is frozen soil. Trees have made adaptations to grow under these conditions. Roots must grow horizontally through the thawed tundra, instead vertically. Shallow roots do not anchor tall trees well, so tundra trees are normally 6 feet or less in height.

Activity:

Have students plant a fast-growing plant in about one inch of soil in a clear container. They should observe and record whether the plants grow in shallow soil, and the direction the roots grow.

Students should build two trees each by twisting two pipe cleaners together. One should be tall, with long pipe cleaner limbs and roots attached. The other should be short with dangly limbs and short roots. They should press the trees into clay or soil and then blow on the trees and note whether the trees can withstand their wind. Does one tree fare better than the other?

What conclusions can they draw about plants in the Arctic from these experiments?

Newspaper Connections

Have students check the local newspaper to find the time of sunrise and sunset and the average number of daylight hours for your town. Use the internet to find a newspaper for Point Lay, Alaska to find the same information and compare. Collect this information over several months and graph the range of daylight hours for comparison.

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Chapter 3

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Tundra: _____

Entity: _____

Borough: _____

Discussion Question:

Was it right for the two men to enter a cabin and take the ski pants? Why or why not?

Writing Activities:

Think of a name for the polar bear cub and write a paragraph explaining why that name should be given to him.

SOCIAL STUDIES: Find Point Lay on a map of Alaska.

Students will: Use information from map legends to determine distance between locations.

Materials needed: World maps

Using the scale, estimate the distances between Barrow, Anchorage, Lavrentiya, Russia, and your home town.

Newspaper Connections:

Use the weather map in the newspaper to check the temperature in Alaska and your town. Collect and graph this information over several months and make comparisons.

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Chapter 4

Vocabulary Use context cues or a dictionary to find the meaning of these words:

Concoction: _____

Predator: _____

Electrolyte: _____

Discussion Question

Do you think it would have been possible for the people of Point Lay to have raised Kali themselves to return him to the wild?

Writing Activities

Use your imagination to picture a “master of the arctic world” and then write a descriptive paragraph about it. Reach out to the Kali School, <https://www.nbsd.org/Domain/17>, in Point Lay to ask for pen pals, using this story about Kali as a starting point.

STEM: Blubber, Anyone?

Students will: Test the insulating properties of fats, understand how blubber keeps Arctic animals warm and analyze and draw conclusions.

Materials needed:

Bowls of ice-cold water, ice, water, container of lard or vegetable shortening, plastic sandwich bags, rubber gloves.

Background Information:

The veterinarian was excited when Kali started drinking the milk mixture. The rich concoction would begin building his layer of blubber. Blubber can be 4.5 inches thick and helps to keep the bear warm in the cold Arctic air and water. Blubber is animal fat and is like lard or shortening, which we use for cooking. Fats have high density and low thermal conductivity to help animals maintain a constant temperature.

Activity:

Have the students place one hand in an ice-cold bowl of water and explain what they feel. Pair up your students and give each pair a set of rubber gloves. One student should make a fist and put that hand into a plastic bag. Using the rubber gloves, the other student should coat the plastic bag with lard or shortening. The student should now place both the bare hand and the protected hand into the ice-cold bowl of water and explain what they feel. Once one student has experienced the insulating effect of blubber, have the pairs switch so the other may also feel it. Encourage students to alter the amount of lard or shortening to find the optimal depth to protect their hands from the cold.

Newspaper Connections

Look through your local newspaper for stories about your school. These could be about elections, students, sports or anything else. Use the internet to read stories about schools in the Point Lay area. The Arctic Sounder, <http://www.thearcticsounder.com>, is a newspaper for that area. Do the students participate in the same kind of activities as yours?

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Chapter 5

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Surrogate: _____

Kibble: _____

Journey: _____

Discussion Questions

In addition to eating and drinking, Kali needed to learn the “bear” necessities. What do you think these are and what are “human” necessities? Are there similarities and differences in how these are learned between the two species?

STEM: Snowshoes

Students will: Compare and contrast snowshoe types, compare snowshoe design with animal adaptations of animals and create sketches or diagrams comparing similar features.

Background Information:

Kali is a well-traveled bear, but long-distance travel is quite common for polar bears. Polar bears often range thousands of miles in one year. Polar bears migrate to follow the sea ice, which is their hunting grounds. As the Arctic Sea's ice melts due to climate change, polar bears must swim and walk further and further to reach the sea ice. Seals, polar bears' primary food, live in areas of sea ice, so the bears must be on the sea ice to hunt.

Polar bears have quite a few adaptations that allow them to live in the Arctic region. Their feet are large and act as snowshoes while the bears are on land. The large feet spread their weight, which helps them move across soft snow and thin ice. Their footpads are covered by papillae, which are small soft bumps, which keep the bears from slipping by providing more traction. Their paws are covered in fur, which also helps with traction, and keeps their feet warm.

Polar bears swim. In fact, their scientific name is *Ursus maritimus*, which means sea bear. Their partially webbed feet help to propel them through the water like fins help people. They use their front paws to swim and their back legs as a rudder to guide them through the water.

Snowshoes were developed to help people walk through and over snow. Animals could move quickly through the snow, so people developed different designs based on their needs, type of snow, available materials and the animals they observed.

Activity:

Have students research the four main snowshoe designs and answer the following questions.

How are the four main styles of snowshoes alike and different?

What advantages and disadvantages might each style present?

While looking at the different designs, think about how each style might perform in different types of snow: heavy wet snow, light fluffy snow, deep snow and shallow snow.

What animal adaptations are like snowshoes?

Finally, have students compare snowshoe design with adaptations of arctic animals. Students should draw or print pictures of the animals and use labels and diagrams to highlight the similarities between the animal's adaptation and the snowshoe.

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Chapter 5 (continued)

SOCIAL STUDIES: Begin to chart Kali's travels.

Students will: Compile data from written and internet sources, design a method of graphically displaying data in a usable form.

Have students review this and previous chapters to collect the data.

Each student should consider the task and develop a graphic method of displaying this information. It should begin with Kali's den outside of Point Lay and eventually end when he reaches his forever home.

Newspaper Connections

There are many stories about Kali in newspapers and from television stations across the country. Have your students research, then read and watch several of each and answer the following questions.

What are the key similarities and differences between print and television journalism?

Does either have an apparent advantage or disadvantage when giving the news?

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Chapter 6

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Robust: _____

Vocalize: _____

Bond: _____

Reading Comprehension

Describe in your own words what a “howdy mesh” is and how it works.

Writing Activities

Luna was excited to see Kali but the feeling wasn't returned right away. Choose one of the bears and write a story of how you think that bear felt during the first few days of seeing one another.

Newspaper Connections

Kali's story is unusual and interesting. Have your students review several weeks' worth of your community newspaper for animal stories. Based on their review, they should develop categories for the types of stories that appear in the newspaper and place each story within one.

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Chapter 7

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Inseparable: _____

Enclosure: _____

Solitary: _____

STEM: Wind Chill

Students will: Measure temperature and wind speed, calculate wind chill, understand the importance of wind chill, understand the nature of scientific inquiry, understand basic and advanced procedures while performing the processes of computation, understand and apply the basic and advanced properties of the concept of measurement.

Materials needed:

Thermometers, anemometer, wind chill calculation table, wind chill factor equation and wind chill rule of thumb, pen and paper.

Activity:

Take your class outside with the equipment. Have them measure and record the outdoor air temperature with the thermometer. Have them measure and record the outdoor wind speed with the anemometer. Go back inside and divide your class into three groups. Each group will use a different method to calculate the wind chill temperature; wind chill calculation table, wind chill factor equation or the wind chill rule of thumb. *Classroom wind chill calculation table attached.*

Wind chill factor equation:

$$\text{Wind Chill} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

T is the air temperature in degrees Fahrenheit, and V is the wind speed in miles per hour.

Wind chill rule of thumb equation:

$$\text{Wind Chill Temperature} = \text{Outside Temperature} - 1.5 * \text{Wind Speed in mph}$$

Wind chill calculation table:

		Air Temperature (degrees F)															
		45	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30
Windspeed (mph)	5	43	37	32	27	22	16	11	6	0	-5	-10	-15	-21	-26	-31	-36
	10	34	28	22	16	10	3	-3	-9	-15	-21	-27	-34	-40	-46	-52	-58
	15	29	22	15	9	2	-5	-12	-18	-25	-32	-38	-45	-52	-59	-65	-72
	20	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-53	-60	-68	-75	-82
	25	22	15	8	0	-7	-15	-22	-30	-37	-44	-52	-59	-67	-74	-82	-89
	30	20	13	5	-3	-10	-18	-25	-33	-41	-48	-56	-64	-71	-79	-87	-94
	35	19	11	3	-5	-12	-20	-28	-36	-44	-51	-59	-67	-75	-83	-90	-98
	40	18	10	2	-6	-14	-22	-30	-38	-46	-53	-61	-69	-77	-85	-93	-101
45	17	9	1	-7	-15	-23	-31	-39	-47	-55	-63	-71	-79	-87	-95	-103	
50	17	9	1	-7	-15	-23	-31	-40	-48	-56	-64	-72	-80	-88	-96	-104	

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		Air Temperature (degrees F)															
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	10	34	28	22	16	10	3	-3	-9	-15	-21	-27	-34	-40	-46	-52	-58
	15	29	22	15	9	2	-5	-12	-18	-25	-32	-38	-45	-52	-59	-65	-72
	20	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-53	-60	-68	-75	-82
	25	22	15	8	0	-7	-15	-22	-30	-37	-44	-52	-59	-67	-74	-82	-89
	30	20	13	5	-3	-10	-18	-25	-33	-41	-48	-56	-64	-71	-79	-87	-94
	35	19	11	3	-5	-12	-20	-28	-36	-44	-51	-59	-67	-75	-83	-90	-98
	40	18	10	2	-6	-14	-22	-30	-38	-46	-53	-61	-69	-77	-85	-93	-101
	45	17	9	1	-7	-15	-23	-31	-39	-47	-55	-63	-71	-79	-87	-95	-103
	50	17	9	1	-7	-15	-23	-31	-40	-48	-56	-64	-72	-80	-88	-96	-104

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Chapter 7 (continued)

Newspaper Connections:

Kali and Luna Cartoon or Comic

Students will: Use writing skills to tell a story, write and edit text for conversation, and will create a cartoon or comic.

Background Information:

Comics strips are several panels or boxes together that tell a story. A cartoon is a single box or panel, sometimes without words.

Activity:

Have students read and study the comics and cartoons in their local newspaper. Discuss what is similar and different among the types of comics and cartoons. Students should consider the following questions.

Is there dialogue? How is it presented? Are there speech bubbles or captions? How does a reader know which character is talking?

What are the characters doing? How is that shown?

Does each character have a specific style or characteristics? How are these shown?

What is the shape of the comic frames? Do they look like a box? Are the corners rounded? How is action, like movement, shown?

What happens from one frame to the next?

Why do you think the illustrator or cartoonist made these choices?

Now it is time to put what they've observed and learned about comics and cartoons to use. They will create a comic or cartoon about Luna and Kali's first interactions.

They should first develop a list of characteristics for each bear that they would like to display. They need to consider how they intend to handle dialogue.

They should then outline the story arc. Once this is developed, they can begin the drawing process. They can draw, cut pictures from the newspaper or magazines or print images from the Internet. Once done, they should share their work with the class.

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Chapter 8

Vocabulary

Use context cues or a dictionary to find the meaning of these words:

Naturalistic: _____

Grotto: _____

Curator: _____

STEM: Citizen Scientists

Students will: Learn the importance of field biologists and botanists journaling, practice the skill of field journaling through descriptive writing and develop questions and conclusions based on their observations.

Background Information:

Meriwether Lewis and William Clark kept detailed and meticulous field notes about plants and animals they encountered on their travels from Missouri to the Pacific Ocean and back in 1804 to 1806. Charles Darwin kept notes of his journey aboard the Beagle from 1831 to 1836. Jane Goodall began studying chimpanzees in Africa in 1960, keeping extensive notes. Scientists keep notes. An observation or thought noted today may bring about an answer in the future.

Activity:

Have students perform Internet researches on the above or other scientists to see those journals. They will then choose a species, plant or animal, that lives outside at their home or school and begin their own field journal. They will observe behavior, draw sketches and describe the organism in their field journal. They can start by creating list of the types of things their famous predecessors noted and follow that example. A list of questions or thoughts they may have about their subject will also give them guidance. Sketches should be from several angles and distances. Descriptions of the organism and behavior should be as detailed and expressive as possible.

Newspaper Connections: Zoo Thoughts

Students will: Use oral language to achieve a purpose, be familiar with formulating opinions based on reasons, and understand the difference between facts and opinions.

Background Information:

Zoos have been in existence for thousands of years. Ancient Egyptian kings and queens maintained zoos, with animals captured during expeditions. The era of the modern zoo, with naturalistic habitats and moated instead of barred displays began in the late 1800s and have continued evolving into the present day. With the evolution of exhibit design came a new purpose, conservation. Zoos had focused on recreation, science and education for decades but now conservation has also been brought into their missions.

Activity:

While the zookeepers in Kali's life clearly care for him and other animals, explain to your students that people have different opinions of the ethics of keeping animals in zoos. Have your students research pros and cons about zoos and use an organizer to track the arguments. Once they feel they understand the two points of view, they should write a persuasive letter to the editor of their community newspaper from their own viewpoint about why zoos should or should not exist. Their reasons should be based on facts, not opinions.