

# PROBLEM SOLVING

## OVERVIEW

Students will investigate and compare the variety of technologies used by explorers Amundsen and Scott as they each attempted to be the first to reach the South Pole. They will also contrast technologies used by Scott and Amundsen to the technologies used by scientists in Antarctica today.

## BACKGROUND FOR EDUCATOR

Totally cut off from the outside world, early Antarctic explorers faced great danger and unimaginable physical hardship. Scott and Amundsen adopted completely different strategies to deal with challenges that exploring Antarctica presented. Scott brought ponies and motorized vehicles, and, once on the polar plateau, relied on men in harnesses to pull long, heavy sleds. Adopting technologies learned from the Inuit, Amundsen wore loose-fitting fur clothing and skied alongside custom-designed dog sleds. Today's travelers to Antarctica arrive in airplanes instead of wooden ships; navigate by GPS instead of sextant and compass; wear moisture-resistant and windproof clothing instead of wool, canvas, and reindeer fur; and communicate with the world via satellite.

## BEFORE YOUR VISIT

### Class Discussion: What is Technology?

Discuss the meaning of technology with students. Ask:

- When we talk of technology in today's world what do we mean? (*Answers may include: It refers to high technology—use of computers, cell phones, space travel, etc.*)
- Now think back to humankind's early history—the use of controlled fire, the invention of the wheel, the first tools, such as hand axes. Would you consider this technology? Why or why not? (*Answers will vary, but may include: Yes, because these innovations allowed humans to complete tasks in a better way than they had before.*)
- Considering the innovations people developed thousands of years ago and those people are developing today, how would you define technology? (*Answers should include the idea that: the application of scientific knowledge for a variety of purposes, which has given rise to innovations ranging from stone tools to wind-proof clothing to telecommunications.*)

### Class Discussion: Cold Technology

Have students share what they know about the climate of Antarctica. Point out that at one weather station in Antarctica the yearly temperature ranges from a low of  $-61^{\circ}\text{C}$  ( $-78^{\circ}\text{F}$ ) to a high of  $-24^{\circ}\text{C}$  ( $-11^{\circ}\text{F}$ ). To further their understanding of the temperature ranges you might want to access Antarctic Weather Reports ([amnh.org/education/resources/rfl/web/antarctica/weather](http://amnh.org/education/resources/rfl/web/antarctica/weather)). Click on one of the stations to view temperature data for that area of Antarctica. Ask:

- How do these extreme temperatures affect how people travel, what they wear, what they eat, and what shelters they make for themselves? (*Answers will include: They would need to travel over snow and ice so sleds rather than cars would be suitable. Their clothing would need to be warm and windproof to withstand the cold and high winds. They would burn more calories because of the cold so they would have to eat more. Their shelters would need to be well insulated.*)

Call on students to suggest items they would need in order to survive on a journey to the South Pole. Write their responses on the board. Ask:

- What on the list is an example of a technology? (*Answers will vary.*)

## NYS Science Core Curriculum

### Interdisciplinary Problem Solving Standard

**7.1c:** Design solutions to problems involving a familiar and real context, investigate related science concepts to determine the solution, and use mathematics to model, quantify, measure, and compute.

**Plan how your students will explore *Race to the End of the Earth*.** In the exhibition, students can use their **student worksheets** to investigate the technology of one of these four categories: clothing, food, transportation, shelter. You may divide the class into four teams before you come to the Museum, or prefer to let them choose on site.

Distribute copies of the student worksheets to students before coming to the Museum.

Explain that the explorers Scott and Amundsen knew the challenges they faced in Antarctica and spent months planning their trips. Both explorers, for example, designed clothing to deal with the cold. Scott's team wore windproof trousers and tunics made of canvas over heavy wool clothing. Based on what he learned from the Inuit in the Arctic, Amundsen's men wore loose-fitting Arctic furs. Ask:

- How do the fabrics used in winter clothing today differ from those used in Scott and Amundsen's time?  
(Answers will include: Today's fabrics include synthetic and natural materials, such as wools, fleece, down, Thinsulate, lined gloves and boots, etc.)

Tell students that in the *Race to the End of the Earth* exhibition, they will explore how both teams of explorers used different technologies to solve the problems of clothing, transportation, food, and shelter.

### Activity: Fabric Test

[amnh.org/resources/rfl/pdf/aa\\_a11\\_fabric.pdf](http://amnh.org/resources/rfl/pdf/aa_a11_fabric.pdf)

In this hands-on experiment, students test the insulation and waterproof properties of a variety of fabrics in order to understand how protective gear is chosen for people working in Antarctica. Based on their findings, have students determine which fabric would be best suited for Antarctic clothing.

## DURING YOUR VISIT

### *Race to the End of the Earth* Exhibition

4th floor (30–45 minutes)

Have students explore the exhibition and select one of the following categories to explore: clothing, transportation, food, or shelter for their **student worksheet** investigation. Students can explore clothing and shelter in the *Two Teams: One Goal* section; food and transportation can be examined in the *To the Pole!* Section.

**Just beyond the theater, students can “Meet the Men.”** As students go through the exhibition, encourage them to pay close attention to the decisions the British and Norwegian teams made about clothing, transportation, and timing, and to the consequences of those choices.

### Hall of Northwest Coast Indians

1st floor (15–20 minutes)

Here students can observe how the Northwest Coast people devise technology using natural resources to live in their environment. Have students observe the model of the Kwakiutl village, the clothing worn by the Kwakiutl, Thompson, and Tsimshian people, the canoe and snowshoes, and curing of salmon in the Kwakiutl of Vancouver Island display. Have students work with a partner to explore the hall and look for technologies used by the Northwest Coast people, and to compare and discuss their findings.

## BACK IN THE CLASSROOM

### Class Activity: Technology at the South Pole

Have students who have chosen the same category work in small groups to compare that used by Scott and that used by Amundsen. As they discuss their findings they should answer the following questions:

- How did the technology work for Scott's team? What could have Scott done better?  
(Answers may include: Clothing: Worked well, but the wool made the men sweat. Cotton clothing under the wool would have been less sweaty. Transportation: The motorized sledges, and the ponies did not work at all. Man-hauling was exhaustive and wore the men down. The dogs and sleds did work. Scott should have considered skis. Food: The food rations were adequate, but the men burned more calories when man-hauling, so they needed almost double the amount they were rationed. Only 4 men should have gone to the pole. Taking 5 men depleted the food supply. Shelter: Scott's shelter met all the needs of the people living there.)
- How did the technology work for Amundsen's team? What could have Amundsen done better? (Answers may include: Clothing: the fur clothing worked well, but at times proved to be too warm and not windproof. Amundsen might have looked at additional covering for the wind. Transportation: The sledges pulled by the dogs with men skiing proved to be the most efficient way to travel. Amundsen could not have done better. Food: The food was adequate. Amundsen didn't believe in loading down the sledges with food so they often ate dog meat which prevented them from getting scurvy. Shelter: The system of tunnels under the snow provided good housing. They even had a sauna and bathroom.)

When students are done create a chart on the board listing the four categories: transportation, clothing, shelter, food and two columns showing what each explorer used. Fill in the chart as groups share their findings. Discuss with students what role technology played in the race to the Pole. Ask:

- Suppose you were a member of one of the teams, what changes would you make and why? (*Answers will vary.*)

#### Activity: Research on the Web: Living and Working in Antarctica

[amnh.org/resources/rfl/web/antarctica/r\\_living.html](http://amnh.org/resources/rfl/web/antarctica/r_living.html)

Students will examine images of living and working spaces in order to understand the technology that humans have developed for living and working in extreme Antarctic conditions.

### SUGGESTED READINGS

#### Letter from Stephanie (from her friend Carole): Antarctic Hazards

[amnh.org/resources/rfl/pdf/aa\\_ss09\\_hazards.pdf](http://amnh.org/resources/rfl/pdf/aa_ss09_hazards.pdf)

#### Let's Talk with David Nold about Safety and Wintering Over in Antarctica

[amnh.org/resources/rfl/pdf/aa\\_i03\\_nold.pdf](http://amnh.org/resources/rfl/pdf/aa_i03_nold.pdf)

#### Let's Talk with Donal Manahan about Antarctica's Early Explorers

[amnh.org/resources/rfl/pdf/aa\\_i10\\_manahan\\_expl.pdf](http://amnh.org/resources/rfl/pdf/aa_i10_manahan_expl.pdf)

#### Excerpt: The Last March by Robert Falcon Scott

[amnh.org/resources/rfl/pdf/aa\\_e02\\_scott.pdf](http://amnh.org/resources/rfl/pdf/aa_e02_scott.pdf)

#### Excerpt: At the Pole by Roald Amundsen

[amnh.org/resources/rfl/pdf/aa\\_e03\\_amundsen.pdf](http://amnh.org/resources/rfl/pdf/aa_e03_amundsen.pdf)

### ONLINE RESOURCES

#### Antarctica: The Farthest Place Close to Home

[amnh.org/resources/antarctica](http://amnh.org/resources/antarctica)

This award-winning curriculum connects students to the continent's biology and geology, and helps them master important science skills. Easily tailored to your time frame and grade level.

**1 Explore the Technology that Amundsen and Scott Used**

Both Scott and Amundsen used the newest technology available when planning their journeys to Antarctica. Check the box of the category that you will investigate in the exhibition.

- Transportation
- Clothing
- Shelter
- Food

Find objects in the exhibition in your category. (For example, if you chose transportation, you might look for the sleds.)

**What did Scott's team use?**

Pick an object. Sketch and label it.

**What did Amundsen's team use?**

Pick an object. Sketch and label it.

How is this technology suited for Antarctica?

How is this technology suited for Antarctica?

---

---

---

---

---

---

---

---

**2 Explore Modern Technology**

Go to the *Antarctica Today* section. Pick a modern technology in your category. How does it compare to the ones used by Amundsen and Scott?

Sketch and label it.

---

---

---

---

ANSWER KEY

**1 Explore the Technology that Amundsen and Scott Used**

Both Scott and Amundsen used the newest technology available when planning their journeys to Antarctica. Check the box of the category that you will investigate in the exhibition.

- Transportation
- Clothing
- Shelter
- Food

Find objects in the exhibition in your category. (For example, if you chose transportation, you might look for the sleds.)

**What did Scott's team use?**

**What did Amundsen's team use?**

Pick an object. Sketch and label it.

Pick an object. Sketch and label it.

How is this technology suited for Antarctica?

*(Sample answer: clothing: British wore mostly wool— like woolen shirts with long woolen underwear. A large knitted piece covered their chests to their hips. On top they wore woolen wind-proof shirts and pants. They used wool mittens underneath fur mitts. On their feet they wore 3-4 pairs of socks and reindeer skin fur boots.)*

How is this technology suited for Antarctica?

*(Sample answer: transportation: Hickory wood sledge had broad runners that acted like skis. The rest of the sledge was made of ash wood. It was tied together with cord rather than nails or screws. That allowed the sledge to "give" as is traveled over the ice. A sledge meter made from bicycle wheels recorded the distance the team traveled each day.)*

**2 Explore Modern Technology**

Go to the *Antarctica Today* section. Pick a modern technology in your category. How does it compare to the ones used by Amundsen and Scott?

Sketch and label it.

*(Answers will vary. Boots are waterproof and have treads on the bottom to prevent slipping. They have double walls for insulation and there is room for three to four layers of socks.)*

# Race to the End of the Earth • New York State Science Core Curriculum

**KEY:** LE = Living Environment  
PS = Physical Setting

● = Content alignment addressed in-depth in exhibition section  
○ = Content alignment addressed in some depth in exhibition section

ELEMENTARY SCHOOL									
Standard	Major Understandings	Introduction	First Glimpses	The Race Begins	Two Teams: One Goal	To the Pole!	Back from the Pole	Aftermath	Antarctica Today
LE 4	1.1a: Animals need air, water, and food in order to live and thrive.								●
	3.1a: Each animal has different structures that serve different functions in growth, survival, and reproduction.	●			●				●
	3.1c: In order to survive in their environment, plants and animals must be adapted to that environment	●			●				●
	5.1b: An organism's external physical features can enable it to carry out life functions in its particular environment.	●			●				●
	5.3a: Humans need a variety of healthy foods, exercise, and rest in order to grow and maintain good health.						○	○	
PS 4	1.1a: Natural cycles and patterns include the length of daylight and darkness varying with the seasons.				●				
	3.1b: Matter has properties color, hardness, odor, sound, taste, etc. that can be observed through the senses.	●			●				
PS 7	Connections: The knowledge and skills of mathematics, science, and technology are used together to make informed decisions and solve problems, especially those relating to issues of science/technology/society, consumer decision making, design, and inquiry into phenomena.				●	●	●		
	Strategies: Solving interdisciplinary problems involves a variety of skills and strategies, including effective work habits; gathering and processing information; generating and analyzing ideas; realizing ideas; making connections among the common themes of mathematics, science, and technology; and presenting results.				●	●	●		

# Race to the End of the Earth • New York State Social Studies Core Curriculum

**KEY:** LE = Living Environment  
PS = Physical Setting

● = Content alignment addressed in-depth in exhibition section  
○ = Content alignment addressed in some depth in exhibition section

## ELEMENTARY SCHOOL

Standard	Major Understandings	Introduction	First Glimpses	The Race Begins	Two Teams: One Goal	To the Pole!	Back from the Pole	Aftermath	Antarctica Today
2: World History	2.1a: Read historical narratives, myths, legends, biographies, and autobiographies to learn about how historical figures lived, their motivations, hopes, fears, strengths, and weaknesses.		●	●	●	●	●		
	2.2d: Compare important events and accomplishments from different time periods in world history		●	●	●	●	●		●
	2.3a: Understand the roles and contributions of individuals and groups to social, political, economic, cultural, scientific, technological, and religious practices and activities.		●	●	●	●	●	●	
	2.4c: View historic events through the eyes of those who were there, as shown in their art, writings, music, and artifacts.		●	●	●	●	●		
3: Geography	3.1c: Locate places within the local community, State, and nation; locate the Earth's continents in relation to each other and to principal parallels and meridians		●	●	○				●
	3.2a: Ask geographic questions about where places are located; why they are located where they are; what is important about their locations; and how their locations are related to the location of other people and places.	●	●	●					

## MIDDLE SCHOOL

Standard	Major Understandings	Introduction	First Glimpses	The Race Begins	Two Teams: One Goal	To the Pole!	Back from the Pole	Aftermath	Antarctica Today
2: World History	2.1c: Interpret and analyze documents and artifacts related to significant developments and events in world history		●	●	●	●	●		
	2.4a: Explain the literal meaning of a historical passage or primary source document, identifying who was involved, what happened, where it happened, what events led up to these developments, and what consequences or outcomes followed.		●	●	●	●	●		
	2.4c: View history through the eyes of those who witnessed key events and developments in world history by analyzing their literature, diary accounts, letters, artifacts, art, music, architectural drawings, and other documents		●	●	●	●	●	●	

3: Geography	3.1a: Map information about people, places, and environments		•	•	o				•
	3.1b: understand the characteristics, functions, and applications of maps, globes, aerial and other photographs, satellite-produced images, and models		•	•	o				•

## HIGH SCHOOL

Standard	Major Understandings	Introduction	First Glimpses	The Race Begins	Two Teams: One Goal	To the Pole!	Back from the Pole	Aftermath	Antarctica Today
2: World History	2.2c: Analyze evidence critically and demonstrate an understanding of how circumstances of time and place influence perspective		•	•	•	•	•		
	2.4b: Interpret and analyze documents and artifacts related to significant developments and events in world history		•	•	•	•	•		
3: Geography	3.1a: Understand how to develop and use maps and other graphic representations to display geographic issues, problems, and questions		•	•	o				•
	3.1b: Describe the physical characteristics of the Earth's surface and investigate the continual reshaping of the surface by physical processes and human activities			•					•
	3.1e: Analyze how the forces of cooperation and conflict among people influence the division and control of the Earth's surface								•