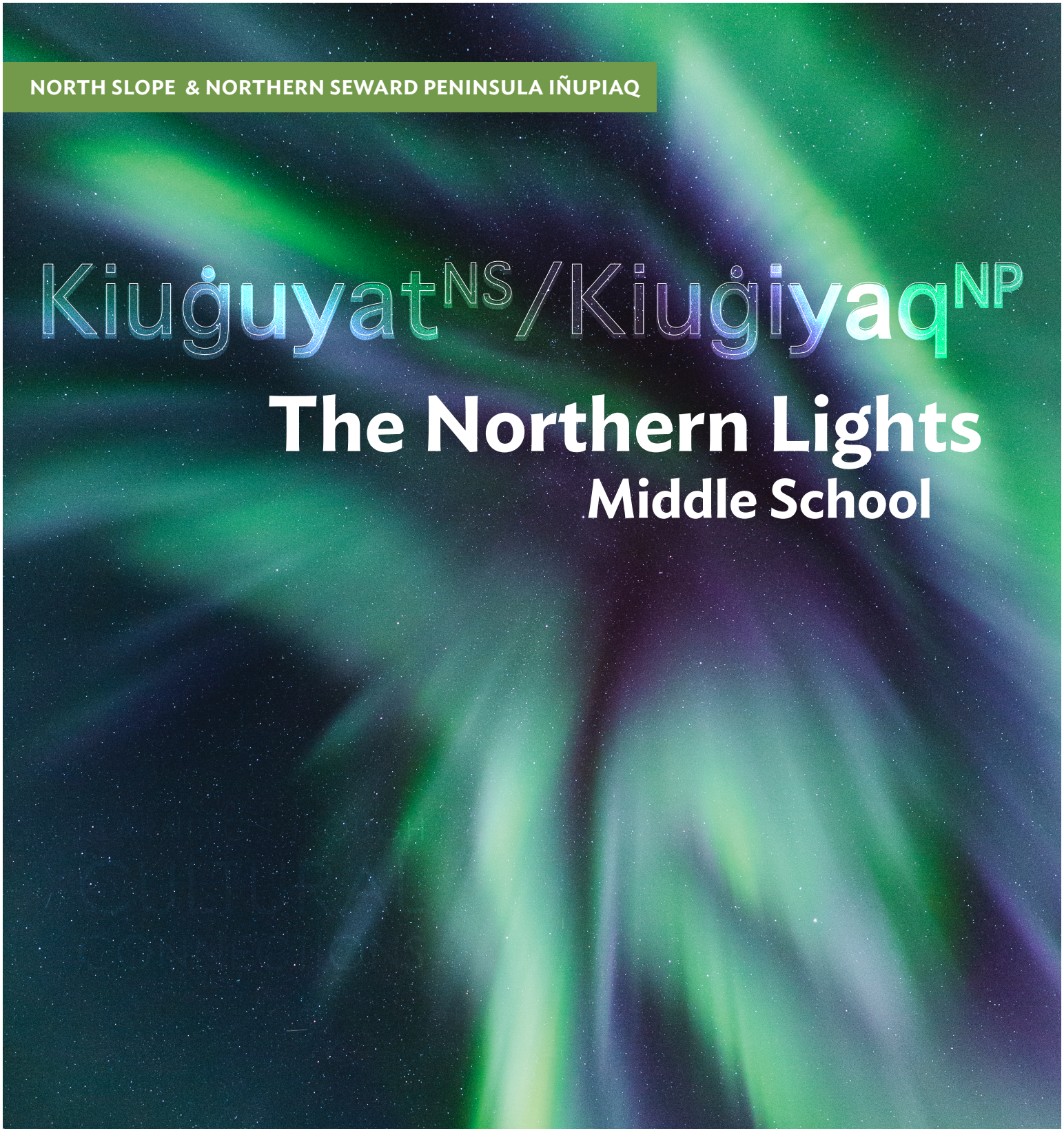
Teacher Manual



Dear Middle School Teacher,

Thank you for using the Learning Through Cultural Connections: The Northern Lights kit in your classroom!

This kit is backwards designed to address the Next Generation Science Standards, Alaska Science Content Standards, Alaska Standards for Culturally Responsive Schools, the Iñupiaq Learning Framework, Iñupiaq Values and Alaska's English/Language Arts Standards.

You can teach this supplemental kit in full, or pick and choose which activities fit with your classroom needs. If you teach in a school with more than one teacher, consider dividing the lessons among science, language arts, social studies and Iñupiaq language teachers to instruct.

The activities focus on the northern lights and include the Iñupiaq cultural and physical science perspectives. Key Iñupiaq terminology related to the northern lights is included throughout to help students learn to read, speak and write Iñupiaq language terms and phrases related to this science theme. Activity-based assessments are provided for your convenience.

We recommend teaching this kit during the months that the northern lights are visible in your area.

Objectives:

By completing the activities in this kit, students will:

- read, speak and write Iñupiaq language terms and phrases.
- observe, analyze and practice Iñupiat stories, songs and dances.
- demonstrate understanding of the process by which the aurora is formed, including the role of Earth's magnetic field in this process.
- analyze and interpret data to create scale models of the sun and Earth.
- use solar activity (cause) data to predict aurora activity (effect).

Vocabulary: An Iñupiaq pronunciation guide is available at: culturalconnections.gi.alaska.edu

North Slope Iñupiaq (NS)	Northern Seward Peninsula Iñupiaq (NP)	English	Local Dialect
kiuġuyat	kiuġiyaq	**northern lights**	
siqiñiq	mazaq	**sun**	
Nunaqpak	Nunaqpak	**Earth**	
siqiłhatinniq	massam anuġiŋa	**solar wind**	
nipitchaŋa nunaqpaum		**Earth's magnetic field**	
uyumiŋa nunam	sila	**atmosphere**	
quliaqtuaġniq	unipkaaġniq	**storytelling**	
apqusaaq	uuktaaqtaq	**experience**	
Suuvat kiuġuyait?	Kiuġiyat suuvat?	**What are the northern lights?**	
Quliaqtuaġutiyumiñaqpiŋa kiuġuyatigun?	Sumik kulaiqłiupina kiġiuqzraqmik?	**Can you tell me about the northern lights?**	
Qanuqłutiŋ kiuġuyat qiñiġnaqsisuuvat?	Kiuġiyat suami pamani itpat?	**How did the northern lights get there?**	

Standards Addressed:

Next Generation Science Standards:

- (Middle School) Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (Source: NGSS MS-PS2: Motion and Stability: Forces and Interactions MS-PS2-5)
- (Middle School) Forces that act at a distance (electric, magnetic and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (Source: NGSS DCI: Motion and Stability: Forces and Interactions: PS2.B: Types of Interactions)
- (Middle School) Cause and effect relationships may be used to predict phenomena in natural or designed systems. (Source: NGSS CC: Motion and Stability: Forces and Interactions: Cause and Effect)
- (Middle School) Analyze and interpret data to determine scale properties of objects in the solar system. (Source: NGSS MS-ESS1: Earth's Place in the Universe: MS-ESS1-3)
- (Middle School) All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (Source: NGSS DCI: ESS2.A: Earth's Materials and Systems)

Alaska Cultural Standards:

- A: Culturally-knowledgeable students are well grounded in the cultural heritage and traditions of their community. Students who meet this cultural standard are able to:
    - A.3. Acquire and pass on the traditions of their community through oral and written history.
- B: Culturally-knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:
    - B.1. Acquire insights from other cultures without diminishing the integrity of their own.
    - B.2. Make effective use of the knowledge, skills and ways of knowing from their own cultural traditions to learn about the larger world in which they live.
- D: Culturally-knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:
    - D.1. Acquire in-depth cultural knowledge through active participation and meaningful interaction with elders.
    - D.3. Interact with elders in a loving and respectful way that demonstrates an appreciation of their role as culture-bearers and educators in the community.
- E: Culturally-knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:
    - E.4. Determine how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.

Iñupiat Learning Framework:

Environment:

- Language E.e.1: The student demonstrates an understanding of the relationship between the environment and the Iñupiaq language by:
    - [Beginner]E.e.1.5: Identifying and naming objects in the sky.
- Nature of the Cosmos E.e.3: seeks to understand the universe by:
    - [B]E.e.3.2: Expressing consciousness of the state of the weather and environmental conditions.
    - [B]E.e.3.4: Observing and describing the world around her/him.
    - [Novice]E.e.3.2: Exploring through unipkaat how Iñupiat become ever more aware of their physical and spiritual surroundings.
    - [N]E.e.3.3: Explaining and showing how unipkaat, quliqtuat and uqaluktuat (stories) illustrate the worldview of the Iñupiaq people in which animals and the environment are sentient and powerful beings.
    - [N]E.e.3.4: Observing, studying, and describing the world around her/him.

Song and Dance:

- Language C.sd.1: The student demonstrates an understanding of the relationship between singing and dancing and the Iñupiaq language by:
    - [B]C.sd.1.1: Learning songs and listening to the rhythm of the songs.
    - [B]C.sd.1.2: Understanding and following common dances and motion dances.

Storytelling:

- Storytelling and Language C.s.1: The student demonstrates an understanding of the relationship between storytelling and the Iñupiaq language by:
    - [B]C.s.1.2: Recalling the storyteller's name and where or from whom the storyteller learned the story.
- Storytelling: Spirituality C.s.2: The student uses knowledge of traditional Iñupiaq culture to:
    - [B]C.s.2.1: Infer from stories what is important in the story.
    - [N]C.s.2.2: Infer from stories what is important spiritually to the characters in the story.
- Stories as communication C.s.3: The student demonstrates an understanding of the role of storytelling and stories in communication by:
    - [B]C.s.3.1: Explaining the lessons in stories.
    - [N]C.s.3.1: Inferring the storyteller's purpose in telling the story.
- Stories as dynamic C.s.4: The student demonstrates an understanding of the dynamic nature of stories by:
    - [B]C.s.4.2: Retelling stories heard in class.
    - [B]C.s.4.3: Listening to an Iñupiaq story and explaining how it relates to his/her life on the North Slope.
    - [B]C.s.4.4: Analyzing the elements in a story that make it interesting or compelling.

Relationships:

- Relationships: Spirituality C.r.2: The student uses knowledge of traditional Iñupiaq culture to:
    - [B]C.r.2.1: Retell stories that describe a person's relationship with siḷa and all living things.

Unipkaat, Quliaqtuat, Uqaluktuat:

- U, Q, U: Oral tradition H.uqu.3: The student uses knowledge of oral processes of handing down information to:
    - [B]H.uqu.4.1: Learn stories through the aural/oral method.
    - [B]H.uqu.4.2: Engage in storytelling in various genres as both a listener and a storyteller.
    - [N]H.uqu.4.1: Learn stories through the aural/oral method and retell them.

Alaska Science Content Standards:

- A: Science as Inquiry and Process: A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should:
    - A.1. Develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.
    - A.3. Develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.
- B: Concepts of Physical Science: A student should understand and be able to apply the concepts, models, theories, universal principles, and facts that explain the physical world. A student who meets the content standards should:
    - B.2. Develop an understanding that energy appears in different forms, can be transformed from one form to another, can be transferred or moved from one place or system to another, may be unavailable for use, and is ultimately conserved.
- D: Concepts of Earth Science: A student should understand and be able to apply the concepts, processes, theories, models, evidence, and systems of earth and space sciences. A student who meets the content standards should:
    - D.3. Develop an understanding of the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system.
- F: Cultural, Social, Personal Perspectives and Science: A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives. A student who meets the content standards should:
    - F.2. Develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world;
    - F.3. Develop an understanding of the importance of recording and validating cultural knowledge.

Iñupiaq Cultural Values:

Knowledge of Language

Love for Children

Respect for elders

Respect for Nature

Cooperation

Sharing

Alaska English/Language Arts Standards:

- Alaska Reading Standards for Literacy in Science and Technical Subjects:
    a. Grade 6-8 students: Standard 3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

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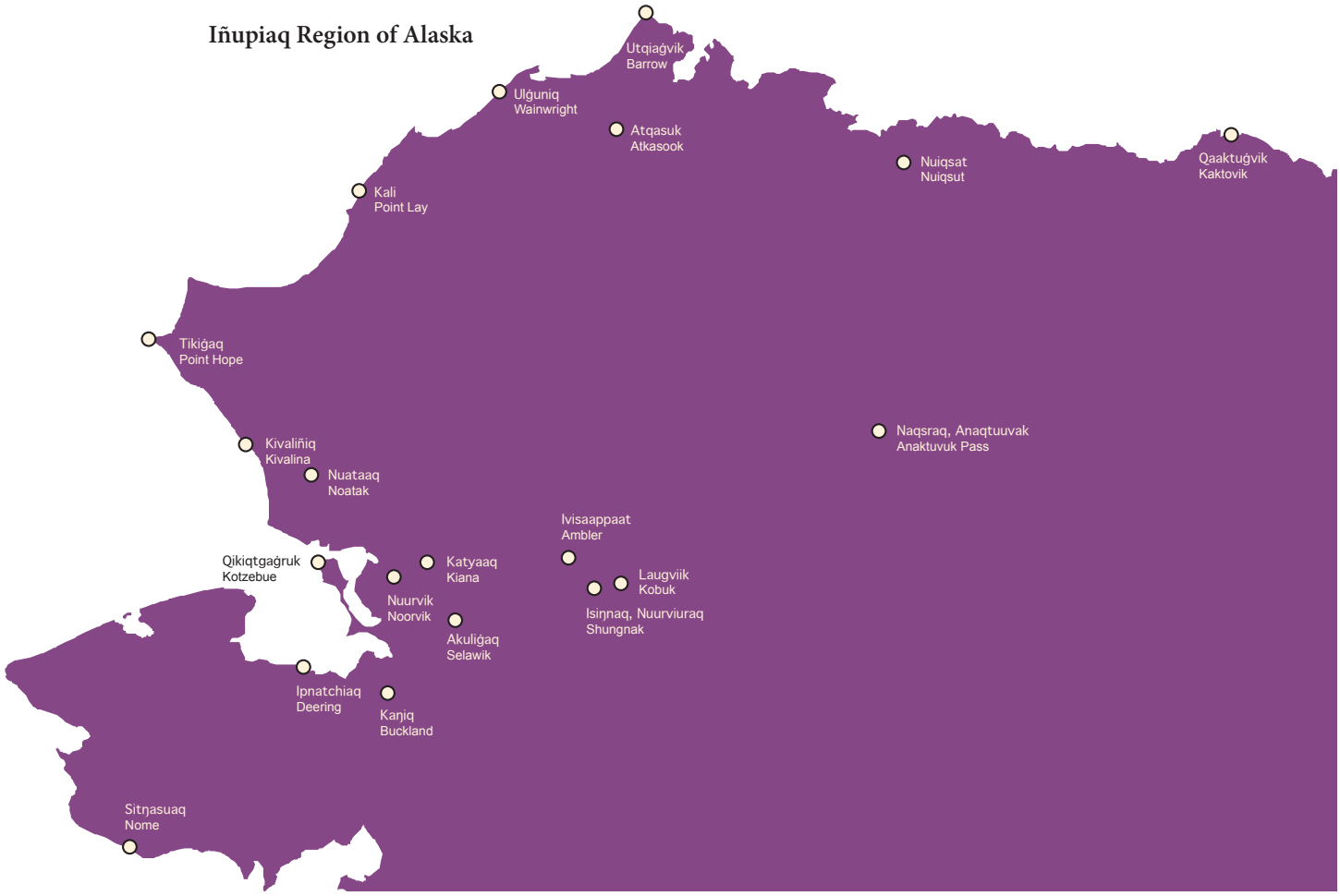
Janet Parks, Barrow
Jay Denton, Buckland
Jill Exe, Kaktovik
Kathleen Fisher, Kaktovik
Lucia Ramirez, Kotzebue

These teachers tested the Learning through Cultural Connections: Northern Lights lessons in their classrooms. Many of their revisions and extensions have been incorporated to improve the materials in this manual.

Visit culturalconnections.gi.alaska.edu for a complete list of project participants.



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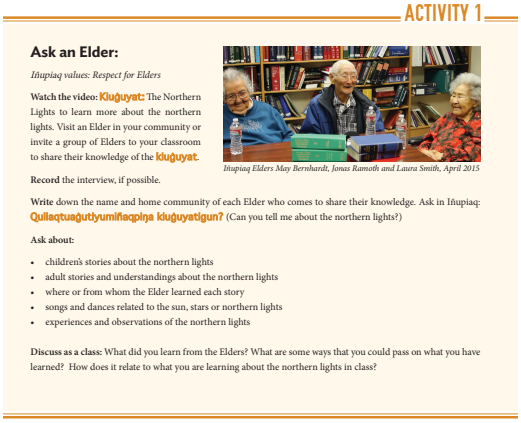
Activity 1: Ask an Elder


ACTIVITY 1

Ask an Elder:

Iñupiaq values: Respect for Elders

Watch the video: Kiuġuyat: The Northern Lights to learn more about the northern lights. Visit an Elder in your community or invite a group of Elders to your classroom to share their knowledge of the **kiuġuyat**.

Iñupiaq Elders May Bernhardt, Jonas Ramoth and Laura Smith, April 2015

Record the interview, if possible.

Write down the name and home community of each Elder who comes to share their knowledge. Ask in Iñupiaq: **Quliaqtuaġutiyumiñaqpiŋa kiuġuyatigun?** (Can you tell me about the northern lights?)

Ask about:

- children's stories about the northern lights
- adult stories and understandings about the northern lights
- where or from whom the Elder learned each story
- songs and dances related to the sun, stars or northern lights
- experiences and observations of the northern lights

Discuss as a class: What did you learn from the Elders? What are some ways that you could pass on what you have learned? How does it relate to what you are learning about the northern lights in class?

Time: 1-2 class periods (1 class period = 45 min)

Materials:

- Kiuġuyat: The Northern Lights video
- Video or audio-recording device (optional)
- Ask an Elder worksheet
- Paper, markers, crayons, pencils, etc. to make cards

Standards Addressed:

- Alaska Cultural Standards: A.3, B.2, D.1, D.3, E.4
- Iñupiat Learning Framework: [B]E.e.1.5, [N]E.e.3.2, [B]C.sd.1.1*, [B]C.sd.1.2*, [B]C.s.1.2, [B]C.s.4.3 (*fulfillment of this standard will depend on what elders share)
- Iñupiaq Cultural Values: Love for Children, Respect for Elders
- Alaska Science Content Standards: A.3, F.2

Background Information:

Iñupiaq elders have a wealth of knowledge and experience related to the region where they live. Within the Iñupiaq culture, elders serve as keepers and instructors of traditional, cultural and experiential knowledge. Inviting elders to the classroom or asking students to visit and interview elders in the community is a culturally appropriate way to help students learn. If you are new to the community, ask your school secretary or administrator about the areas of expertise among the elders in your community.

When inviting an elder to the classroom, provide a chair for the elder and ensure that refreshments such as coffee, tea, water and sometimes a light snack are available. If students are visiting elders outside of school, refreshments are not necessary. It is important that students prepare a thank you card or gift to deliver to the elder after their visit.

Assessments:

Ask an Elder worksheet provides a means of assessing student ability to:

- acquire and pass on the traditions of their community through oral and written history;
- use cultural knowledge of the northern lights to introduce the physical science processes behind them;
- acquire in-depth cultural knowledge through active participation and meaningful interaction with elders;
- interact with elders in a loving and respectful way that demonstrates an appreciation of their role as culture-bearers and educators in the community;
- understand that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world; and
- communicate respectfully with elders during interviews.

Activity Preparation:

1. Watch the Kiuġuyat: The Northern Lights video to become familiar with the information shared in the film.

2. Determine whether your class will invite elders to the classroom, or if they will visit the elders in the community. Consider contacting elders in advance to let them know that students will have several questions prepared to ask them.

3. If elders are coming to the classroom, arrange for coffee, tea or other beverages for the elders, and a light snack if possible. Ensure that you have a comfortable chair available for each elder. Thank them for coming and plan to remain in the classroom to listen as they share their knowledge of the northern lights.

Activity Instructions:

1. Distribute the Kiuġuyat^{NS} / Kiuġiyaq^{NP} Middle School Guide. Explain that these guides are going to be used by future students as well, so students are not to write in the guide. Ask students to work with a partner to read pages 2-3 of the Kiuġuyat^{NS} / Kiuġiyaq^{NP} Middle School Guide, or work through the booklet as a group, asking students to take turns reading the sentences aloud.

2. Discuss students' experiences, knowledge and stories related to the northern lights. Ask if students have heard any stories about the lights from their parents or elders.

3. Show the Kiuġuyat: The Northern Lights video to students. Discuss the stories and other knowledge shared in the video and review it in segments or in full as needed. Ask students to work with a partner to retell something they learned from the video.

4. Explain that local elders are an excellent resource for learning more about the northern lights and that students will invite (or visit) elders from the community to ask about the northern lights. Practice writing and speaking an Iñupiaq sentence: (Can you tell me about the northern lights?)

Quliaqtuaġutiyumiñaqpiŋa kiuġuyatigun? (North Slope Iñupiaq)

Or

Sumik kulaiqłiupina kiġiuqzraqmik? (Northern Seward Peninsula Iñupiaq)

5. Distribute the Ask an Elder worksheet that will guide the interview with elders. As a group, brainstorm additional questions for elders. If a group interview is planned, decide which student will ask each question. Encourage students to ask their question in Iñupiaq if they are able.

6. Ask students to practice interviewing an elder by role-playing with their peers. Emphasize caring and respectful behavior and ensure students are prepared to interact appropriately with the elders.

7. If students will be inviting elders to the classroom, work with students to create invitations for local elders or practice verbal invitations. Ask students to deliver the invitations to (or visit) their elders.

8. If elders visit the classroom, welcome each elder and provide them with a comfortable chair, beverage, etc. Thank them for coming and explain that the students have some questions about the northern lights for them. Listen as the elders share their knowledge. Prompt students to ask questions as needed.

9. After elders visits are complete, discuss as a class: What did you learn from the elders? What are some ways you could pass on what you have learned? How does what you learned from elders relate to what you are learning about the northern lights in class?

10. Have students prepare and deliver a thank you card to each elder who participated. There is a template following this lesson plan.

Connections and Extensions:

- Record it! Offer students extra credit for recording the elder interview to share with the class or place in the kit for future classes.
- Write about it! Encourage students to write journal entries about their experience interviewing elders. What were some things they didn't understand? What were some questions they still had after the interview?
- *Challenge* Extend it! Interview elders about other science topics such as weather prediction, climate change, sea and land mammal biology and habitat, plant life in the local ecosystem, etc.
- Learn and perform! Offer students extra credit for learning and performing a northern lights song or the Welcome the Sun Dance featured in the video, or other songs and dances relevant to the northern lights.

Ask an Elder

Name: _____

Invite a group of elders to your classroom to share their knowledge about the northern lights. **Take notes** on what you learn. If the elders share stories, be sure to note where or from whom the elder learned each story.

Elder's Names:	Where Elder is From:

NOTES:
Children's stories about the northern lights:

_____

_____

_____

Adult stories and understandings about the northern lights:

_____

_____

_____

Songs and/or dances related to the sun, stars or northern lights:

_____

_____

_____

Experiences and observations of the northern lights:

_____

_____

_____

Question:
How do the stories and information that the elders shared relate to your life in northern Alaska?

_____

_____

_____

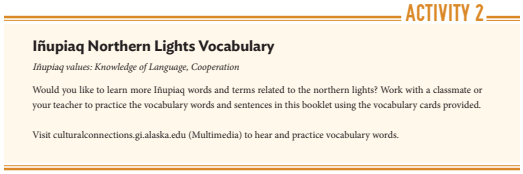
CULTURAL
CONNECTIONS
The Northern Lights

Thank you for sharing your knowledge about the northern lights with us!

Activity 2: Iñupiaq Northern Lights Vocabulary

Time: 1 class period + 10-15 minutes practice twice a week during unit (1 class period = 45 min)

Materials:


ACTIVITY 2

Iñupiaq Northern Lights Vocabulary

Iñupiaq values: Knowledge of Language, Cooperation

Would you like to learn more Iñupiaq words and terms related to the northern lights? Work with a classmate or your teacher to practice the vocabulary words and sentences in this booklet using the vocabulary cards provided.

Visit culturalconnections.gi.alaska.edu (Multimedia) to hear and practice vocabulary words.

- Vocabulary card sets (1 per group of students)
- Word Games Instruction Sheet (1 per group of students)
- Iñupiaq Northern Lights Vocabulary worksheet
- Iñupiaq vocabulary multimedia—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Computers or tablets with Internet access
- Timers (optional)

Standards Addressed:

- Alaska Cultural Standards: B.2
- Iñupiat Learning Framework: [E]E.e.1.5
- Iñupiaq Cultural Values: Knowledge of Language

Background Information:

Based on the Visual Iñupiaq Vocabulary Acquisition (VIVA) Program of the North Slope Borough School District, these vocabulary cards have both the Iñupiaq and English term and an associated image. The games suggested are meant to promote fluency through repeated practice. Other vocabulary cards can be easily integrated into the games. This will extend potential length of the games and add a greater challenge. By working with the words through different games, students can develop greater fluency with the Iñupiaq vocabulary.

Assessments:

Vocabulary fluency games provide a means of informally assessing student ability to:

- build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life by making effective use of the knowledge, skills and ways of knowing from their own cultural traditions to learn about the larger world in which they live by associating Iñupiat words with their English counterparts;
- understand the relationship between the environment and the Iñupiaq language by identifying and naming objects in the sky;
- read and speak Iñupiaq language terms and phrases.

Activity Instructions:

1. Ask students to try the Iñupiaq Vocabulary multimedia activity at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit to learn how to pronounce Iñupiaq words related to the Northern Lights. Identify which of the provided dialects students should use for your community.

2. Show students the vocabulary cards. Hold up each card. Discuss what each card depicts.
3. Say the Iñupiaq word for the illustration depicted on the card. Ask students to repeat the word. Repeat this once or twice, then ask students to call out the correct word as you hold up each card.
4. Divide the class into four groups.
5. Provide each group with the Word Games Instruction sheet, a stack of Vocabulary cards, and a timer (optional).
6. Students can commit to one game for a period of time or mix and match.
7. Encourage students to play the vocabulary games and practice the vocabulary words during free time throughout the duration of the northern lights unit. If possible, schedule 10-15 minutes twice per week to practice the vocabulary terms.
8. Discuss as a class: Which games were hard to do with only a few Iñupiat words in your vocabulary? What games did you enjoy most? What words were most challenging to learn, no matter what game you played?
9. Distribute the Iñupiaq Northern Lights Vocabulary Worksheet and ask students to complete it. Provide review as needed.

Connections and Extensions:

- *Challenge* Create a game! Ask students to create their own word games to help each other learn new Iñupiaq words.
- Write on a slate! Using slates and markers, have students write an Iñupiaq word on their slate after prompting with the word's associated image or English term. Have students show what they wrote to see who is retaining the vocabulary and who might need more practice.
- Draw it! Ask students to create a diagram of how the northern lights are created, then label their diagram in English. Write the Iñupiaq words tabs and put the tabs over the English word.

Word Games Instruction Sheet

VOCABULARY SWAP:

1. Distribute one card to each person.
2. Practice the word on your card, then find a classmate. Teach them the word on your card and learn the word on their card. Trade cards.
3. Find another classmate and repeat.

FIND THE CARD:

1. Divide into small groups. Each group will need a set of vocabulary cards. Spread the cards in front of you so that everyone in your group can see the pictures.
2. Listen as your teacher says a word aloud from one of the cards.
3. Work with your group to find and hold up the correct card.

VOCABULARY SLAP

1. Select one student to serve as the "caller" for this game. That student should make a list of the Iñupiaq vocabulary words on a separate sheet of paper. The words can be found on the back of the cards.
2. Place the cards in a circle, picture-side-up, in the middle of the playing area.
3. The caller should call out a word from their list. Everyone else should quickly place their hand on the picture that they believe represents that word.
4. Turn over the card or cards that students selected to see who chose correctly. Each student who placed his or her hand on the correct card earns a point.
5. Put the card(s) back in the circle and play again.
6. Play for a designated period of time. At the end of the time, the person with the most points wins.

TEAMWORK

1. Divide your group into two teams. Each team will need a pencil and paper.
2. Shuffle the vocabulary cards and place them picture-side up in the middle of the table.
3. Work with your team to write down the Iñupiaq and English words for the picture on the card.
4. After both teams have written answers, turn the card over to check. Teams get 1 point for the correct Iñupiaq word and 1 point for the correct English word.
5. Repeat until all cards are gone. The team with the most points wins.

ACT IT OUT

1. Shuffle the vocabulary cards and deal them out to each player. Keep your cards a secret!
2. Take turns acting out your cards using motions and sound effects, but no words.
3. Whoever guesses the Iñupiaq word first takes the card as a point.
4. The game is over after all cards have been acted out.
5. Optional: Add a timer to the mix! See if you can get your classmates to guess the word in 30 or 60 seconds.

Iñupiaq Northern Lights Vocabulary

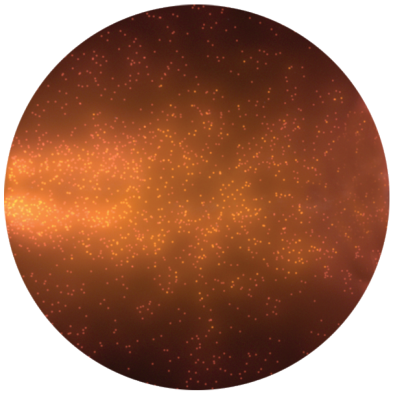
Name: _____

Write the Iñupiaq word or phrase for each image:

northern lights

_____

solar wind



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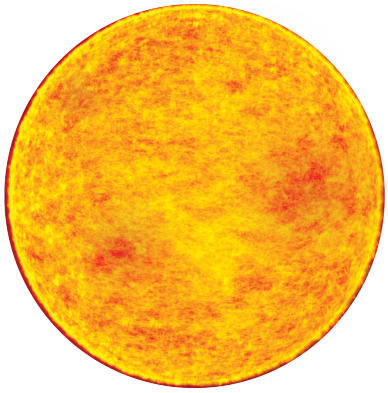
sun



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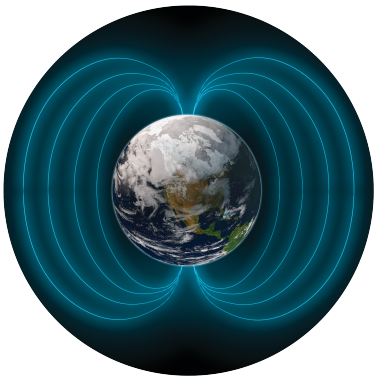
Earth's magnetic field



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Earth

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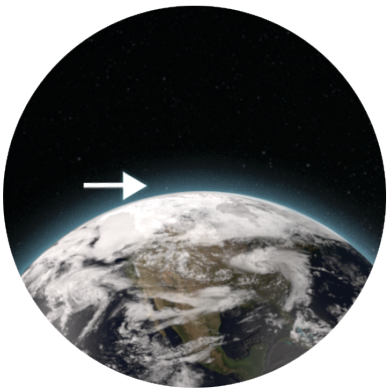
atmosphere



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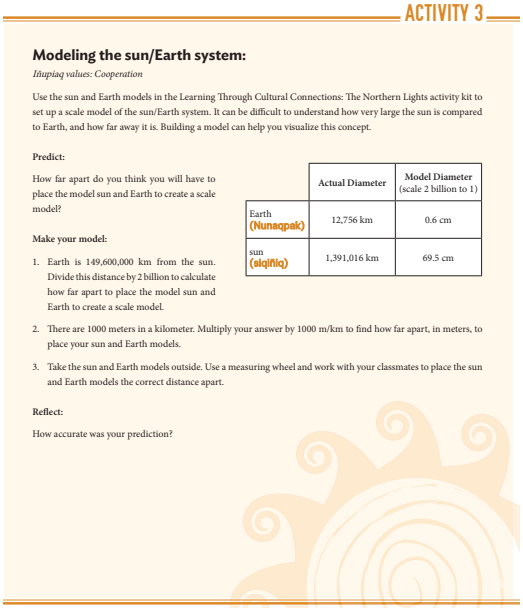
Activity 3: Modeling the Sun/Earth System



ACTIVITY 3

Modeling the sun/Earth system:

Iñupiaq values: Cooperation

Use the sun and Earth models in the Learning Through Cultural Connections: The Northern Lights activity kit to set up a scale model of the sun/Earth system. It can be difficult to understand how very large the sun is compared to Earth, and how far away it is. Building a model can help you visualize this concept.

Predict:

How far apart do you think you will have to place the model sun and Earth to create a scale model?

	Actual Diameter	Model Diameter (scale 2 billion to 1)
Earth (Nunaqpak)	12,756 km	0.6 cm
sun (siqiñiq)	1,391,016 km	69.5 cm

Make your model:

1. Earth is 149,600,000 km from the sun. Divide this distance by 2 billion to calculate how far apart to place the model sun and Earth to create a scale model.
2. There are 1000 meters in a kilometer. Multiply your answer by 1000 m/km to find how far apart, in meters, to place your sun and Earth models.
3. Take the sun and Earth models outside. Use a measuring wheel and work with your classmates to place the sun and Earth models the correct distance apart.

Reflect:

How accurate was your prediction?

Time: 2 class periods (1 class period = 45 min)

Materials:

- Solar system model
- Sun poster (optional)
- Rolling measuring wheel or 100-meter measuring tape
- Modeling the Sun/Earth System Worksheet
- Calculators (optional)

Standards Addressed:

- NGSS: MS-ESS1: Earth's Place in the Universe: MS-ESS1-3
- Alaska Cultural Standards: B.1
- Iñupiat Learning Framework: [B] E.e.1.5, [N] E.e.3.4
- Iñupiaq Cultural Values: Cooperation
- Alaska Science Content Standards: D.3
- Alaska Reading Standards for Literacy in Science and Technical Subjects: Grades 6-8 Students: Standard 3.

Background Information:

Earth and the other planets in our solar system are affected by solar weather. Some even have their own northern lights. Each planet has a unique orbit, tilt and rotation. These determine the length of a year, season and day. Scale models are a useful tool to help students understand and visualize the relative sizes of the sun and Earth, and how far apart they are. Use the sun and Earth models in the Learning Through Cultural Connections: The Northern Lights activity kit to set up a scale model of the sun/Earth system.

	Actual Diameter (NASA data)	**Model Diameter (Scale 2 billion to 1)**
Earth (Nunaqpak$^{NS/NP}$)	12,756 km	0.6 cm
sun (siqiñiq^{NS}/mazaq^{NP})	1,391,016 km	69.5 cm

Assessments:

- Modeling the Sun/Earth System worksheet responses and activity will provide a means of assessing student ability to:
  - analyze and interpret data to create scale models of the sun and Earth and other objects in our solar system;
  - follow precisely a multistep procedure when taking measurements and performing a technical task;
  - cooperate with peers to accomplish a task.
- Classroom discussion will provide a means for assessing student ability to:
  - acquire insights about our solar system from other cultures without diminishing the integrity of their own;
  - read and speak Iñupiaq words related to the northern lights;
  - observe, study and describe the world around him by identifying where outer planets would need to be placed if the solar system model were completed.

Activity Preparation:

Find a place in your classroom to display the model sun (poster or wooden). Assemble the planet models so that each is attached to the correct base.

Activity Instructions:

1. Ask students to work with a partner to read pages 2-7 of the Kiuġuyat[NS] / Kiuġiyaq[NP] Middle School Guide, or work through the booklet as a group, asking students to take turns reading the sentences aloud. Discuss the content and check for comprehension. Ask students: Why is it important to learn about topics from more than one perspective, such as a cultural perspective and a physical science perspective?

2. Show students the model sun. Explain that this is a model sun or (siqiñiq[NS]/mazaq[NP]). Ask students to practice the appropriate Iñupiaq word for sun. Ask: If the sun were this size, what size do you think Earth (Nunaqpak) would be? Ask them to draw their predictions on the whiteboard or chalkboard.

3. Explain that this model sun is based on a 2 billion to 1 scale. For every 2 billion meters a planetary body has in actuality, 1 meter was used. As a class, perform the calculations to determine the diameter of the model Earth (12,756 km ÷ 2,000,000,000 x 100,000 cm/km = .6 cm)

Model distance from the sun in meters:	
Scale of 2,000,000,000:1	
Mercury	29 meters – 2˚
Venus	54 meters – 177.36˚
Earth	74.8 meters – 23.4˚
Mars	114 meters – 25.19˚
Jupiter	389.2 meters – 3.13˚
Saturn	715 meters – 26.73˚
Uranus	1440 meters – 97.77˚
Neptune	2250 meters – 28.32˚
Pluto – Kuiper Belt	2850 meters – 122.5˚
Moon	.192 meters from Earth
Io	.211 meters from Jupiter
Europa	.335 meters from Jupiter
Ganymede	.535 meters from Jupiter
Callisto	2.940 meters from Jupiter
Titan	2.611 meters from Saturn
Triton	2.177 meters from Neptune

4. Show students the model Earth that is .6 cm in diameter. Find the closest prediction sketched on the chalkboard/whiteboard.

5. Distribute the Modeling the Sun/Earth System worksheet. Ask students to predict how far apart they will need to place the sun and Earth to create a scale model. Ask students to write their prediction in meters, then perform the calculations on their worksheet to determine the answer. If your students are new to calculating distance using a scale, consider working through the calculations as a class, or placing students in small groups with a strong math student in each group.

6. Students will determine that the model sun and Earth should be 74.8 meters apart. That is roughly the length of 2 ½ basketball courts! Ask students to discuss with a partner how this compares to their prediction. Were they close? Far off? Are they surprised by the results of their calculations?

7. Ask students to repeat their calculations to determine the scale distance for other planets in our solar system.

8. Show students the planet models and explain that they are accurate, but FRAGILE. As a class, take the sun, inner planet models (Mercury, Venus, Earth, Mars) and the measuring wheel or tape outside. If you are in an area without daylight, consider also taking 5 flashlights outside or choosing a well-lit parking lot or schoolyard for this activity. Place the sun and Earth 74.8 meters apart. Assign groups of students each of the other inner planets and ask them to work together to correctly place their planet (Mercury: 29 meters, Venus: 54 meters, Mars: 114 meters). A student will need to stand in place holding each planet, as they are lightweight and may blow away in the wind.

9. Once the near planets are placed, direct students to look around at their mini solar system. If it is dark, have one student turn on a flashlight at the site of each model. What do they notice? Why did we choose not to place the outer planets? If we had placed them, where would they be? Use landmarks such as people's homes, businesses, and features of geography to help students understand how far away each of the outer planets would be for their model to remain to scale (Jupiter: 389 meters, Saturn: 700 meters, Uranus: 1.45 kilometers, Neptune: 2.25 km, Pluto & Kuiper Belt: 2.95 km). A good way to estimate distance is by thinking about how long it takes to walk there: about 100 meters per minute.

10. Return to the classroom.

11. Discuss as a class: How does the tilt of a planet affect the seasons or weather? What if Earth was tilted 90°, laying on its side? What patterns in your area might change? What month might you plan to look for berries? What month might you expect to bring in a whale?

Connections and Extensions:

- Walk it indoors! Is it too cold and dark to do this activity outside? Find the average distance of each student's pace and then have them "walk off" the distance from the sun to each of the inner planets
- *Challenge* Move it! Do this activity outside where you have enough space to model the orbits. Assign each student a pace to walk. For instance, Earth travels 940 million kilometers during its orbit. For our scale, that would be 470 meters at 1.3 meters a day or 5.3 centimeters an hour. Call out special events such as the Spring Equinox and note where other planets are in their orbit.

Modeling the sun/Earth System[NS]

Name: _____

Follow the steps below to create a scale model of objects in our solar system. This will help you to understand the vast distance between the sun and Earth.

	Actual Diameter (NASA data)	**Model Diameter** (Scale: 2 billion to 1)
Sun (siqiñiq)	1,391,016 km	69.5 cm
Earth (Nunaqpak)	12,756 km	0.6 cm

Predict:

How far apart do you think you will have to place the model sun and Earth to create a scale model?

_____

Make your model:

1. Earth is 149,600,000 km from the sun. Divide this distance by 2 billion to calculate how far apart to place the model sun and Earth to create a scale model.

   149,600,000 km ÷ 2,000,000,000 = _____ km

2. There are 1000 meters in a kilometer. Multiply your answer by 1000 m/km to find out how far apart, in meters, to place your sun and Earth models.

   _____ km x 1000 m/km = _____ m

3. Take the sun and Earth models outside. Use a measuring tape and work with your classmates to place the sun and Earth models the correct distance apart.

Reflect: How accurate was your prediction?

_____

Extend: Use what you have learned and the data below to determine the scale distance from the sun to each planet in our solar system. Add the remaining inner planets (Mercury, Venus, Mars) to your scale model. (Scale: 2 billion to 1)

Planet	**Approximate distance from sun** (in kilometers)	**Scale distance from sun** (in kilometers)	**Scale distance from sun** (in meters)
Mercury	58,000,000		
Venus	108,000,000		
Earth	149,600,000		
Mars	228,000,000		
Jupiter	778,000,000		
Saturn	1,400,000,000		
Uranus	2,900,000,000		
Neptune	4,500,000,000		
Pluto	5,900,000,000		

Modeling the sun/Earth System[NP]

Name: _____

Follow the steps below to create a scale model of objects in our solar system. This will help you to understand the vast distance between the sun and Earth.

	Actual Diameter (NASA data)	**Model Diameter** (Scale: 2 billion to 1)
Sun (mazaq)	1,391,016 km	69.5 cm
Earth (Nunaqpak)	12,756 km	0.6 cm

Predict:

How far apart do you think you will have to place the model sun and Earth to create a scale model?

_____

Make your model:

1. Earth is 149,600,000 km from the sun. Divide this distance by 2 billion to calculate how far apart to place the model sun and Earth to create a scale model.

   149,600,000 km ÷ 2,000,000,000 = _____ km

2. There are 1000 meters in a kilometer. Multiply your answer by 1000 m/km to find out how far apart, in meters, to place your sun and Earth models.

   _____ km x 1000 m/km = _____ m

3. Take the sun and Earth models outside. Use a measuring tape and work with your classmates to place the sun and Earth models the correct distance apart.

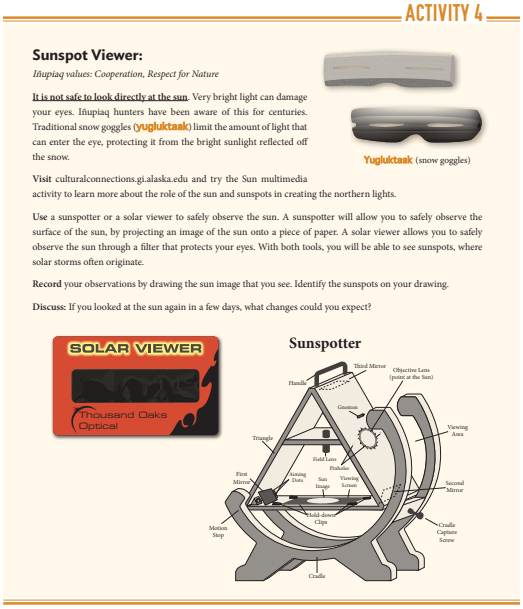
Reflect: How accurate was your prediction?

_____

Extend: Use what you have learned and the data below to determine the scale distance from the sun to each planet in our solar system. Add the remaining inner planets (Mercury, Venus, Mars) to your scale model. (Scale: 2 billion to 1)

Planet	**Approximate distance from sun** (in kilometers)	**Scale distance from sun** (in kilometers)	**Scale distance from sun** (in meters)
Mercury	58,000,000		
Venus	108,000,000		
Earth	149,600,000		
Mars	228,000,000		
Jupiter	778,000,000		
Saturn	1,400,000,000		
Uranus	2,900,000,000		
Neptune	4,500,000,000		
Pluto	5,900,000,000		

Activity 4: Sunspot Viewer


ACTIVITY 4

Sunspot Viewer:

Iñupiaq values: Cooperation, Respect for Nature

It is not safe to look directly at the sun. Very bright light can damage your eyes. Iñupiaq hunters have been aware of this for centuries. Traditional snow goggles (**yugluktaak**) limit the amount of light that can enter the eye, protecting it from the bright sunlight reflected off the snow.

Yugluktaak (snow goggles)

Visit culturalconnections.gi.alaska.edu and try the Sun multimedia activity to learn more about the role of the sun and sunspots in creating the northern lights.

Use a sunspotter or a solar viewer to safely observe the sun. A sunspotter will allow you to safely observe the surface of the sun, by projecting an image of the sun onto a piece of paper. A solar viewer allows you to safely observe the sun through a filter that protects your eyes. With both tools, you will be able to see sunspots, where solar storms often originate.

Record your observations by drawing the sun image that you see. Identify the sunspots on your drawing.

Discuss: If you looked at the sun again in a few days, what changes could you expect?

Sunspotter

Time: 2-4 class periods (1 class period = 45 min)

Materials:

- Computers or tablets with Internet access
- Sun multimedia activity—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Sunspot Viewer Worksheet
- White graph paper
- Rulers
- Build a Sunspot Viewer Instruction Sheet
- Sunspotter (Check this out from your district)
- Solar Viewing Slides
- OR: Materials to build your own sunspot viewers:
    - Binoculars or telescope
    - Cardboard or posterboard
    - Tripod or other stable surface
    - Wall or screen
    - Paper
    - Tape

Standards Addressed:

- NGSS: MS-ESS1: Earth's Place in the Universe: MS-ESS1-3, DCI: ESS2.A: Earth's Materials and Systems
- Alaska Cultural Standards: B.1
- Iñupiat Learning Framework: [B]E.e.1.5
- Iñupiaq Cultural Values: Respect for Nature
- Alaska Science Content Standards: A.1, D.3
- Alaska Reading Standards for Literacy in Science and Technical Subjects: Grades 6-8 Students: Standard 3.

Background Information:

WARNING: It is not safe to look directly at the sun unless using protective Solar Viewing Slides. Very bright light can permanently damage your eyes. Look through the Solar Viewing Slides provided in this kit or use instruments such as telescopes, binoculars and scopes to project an image of the sun onto a piece of paper. **DO NOT LOOK THROUGH THE INSTRUMENT AT THE SUN.**

Sunspots are temporary disturbances in the sun's magnetic field. They appear as dark spots on the surface of the sun and often are the source of solar storms that send charged particles hurtling into space. The spots appear dark because they are cooler than the rest of the sun's surface. Sunspots usually last about one week, and the number of sunspots varies, following a cycle that averages 11.1 years.

Sunspots are the most visible advertisement of the solar magnetic field. Sunspots usually exist in pairs and behave like the opposite ends of a horseshoe-shaped magnet. They contain a concentration of magnetic field lines, which can fill up with solar particles and erupt like volcanoes to send charged particles into space.

When these particles travel toward Earth, they increase the chances of northern lights occurring over Earth. The ancient Chinese first recorded observations of sunspots 2000 years ago. Tracking sunspots is one way to observe solar rotation.

Check out your school district's sunspot viewer for this activity, or make your own sunspot viewer(s). This activity can be done as a whole class, in small groups or as individuals. Combining data from multiple instruments can help build a more thorough and accurate scientific study.

Assessments:

Sunspot Viewer worksheet responses will provide a means of assessing student ability to:

- analyze and interpret data to determine scale properties of objects in the solar system;
- explain the connections between sunspots and the northern lights;
- follow precisely a multistep procedure when taking measurements and performing a technical task;
- read and write Iñupiaq words related to the northern lights;
- understand and use the processes of science to investigate a question;
- understand the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system.

Activity Preparation:

1. Determine if you will check out your district's Sunspotter, gather materials listed above to build your own sunspot viewer, construct pinhole sunspot viewers using directions on the National Geographic website, OR rely on the Solar Viewing Slides provided in your kit for this activity.

2. Identify an indoor or outdoor space that will have a clear view of the sun during the time of day that you wish to do this activity.

3. If needed, practice setting up the Sunspotter or building and using the sunspot viewer as shown on the Sunspot Viewer Worksheet. If the projection is not clear, try creating a darkened space, such as a draped table or unlit room.

Activity Instructions:

1. Ask students to partner-read or group-read pages 2-7 of the Kiuġuyat^{NS} / Kiuġiyaq^{NP} Middle School Guide. Discuss the content and check for comprehension.

2. Ask students to visit culturalconnections.gi.alaska.edu (or use the USB flash drive provided with this kit) and try the sun multimedia activity to learn more about the role of the sun and sunspots in creating northern lights.

3. As a class, discuss what students have learned using the multimedia. Create a list of things students know about the sun on the whiteboard or chalkboard. Practice using the Iñupiaq term for sun:

   siqiñiq^{NS} / mazaq^{NP} (sun)

4. If your class will be setting up a sunspot viewer, distribute the Build a Sunspot Viewer handout and assist students as they set up the Sunspotter, or build their own sunspot viewer(s). Refer to the handout for set up instructions.

5. Distribute the Sunspot Viewer worksheet and the Solar Viewing Slides. Go outside or to the designated viewing area. If using a sunspot viewer, select a student to carefully trace the circumference of the sun's shape on the viewing screen with a pencil and then carefully fill in any dark areas inside of the circle with the pencil. These are sunspots! Post this tracing in an area of the classroom where everyone can observe and sketch it.

6. Ask students to carefully observe the sun through their Solar Viewing Slide and sketch their observations on their worksheet. Provide guidance as needed. Discuss the locations of the sunspots and the role sunspots play in creating the aurora.

7. Return to the classroom. Ask students to look at the NASA images of the sun on their worksheet. Explain that these images were taken three days apart. Discuss: What is different about the images? Why?

8. Ask students to complete their worksheets. Consider working as a class to measure the sun image and the largest sunspot. Discuss student findings.

Connections and Extensions:

- Cultural Connections! Very bright light can damage your eyes. Iñupiaq hunters have been aware of this for centuries. They developed snow goggles to limit the amount of light that can enter the eye, protecting it from the bright sunlight reflected off of the snow. Create snow goggles using black construction paper, cardboard, leather or other materials. How do the ideas and concepts related to developing snow goggles relate to those used in the sunspot viewer?

- Do it Yourself! Have students work in small groups to make and use their own sunspot viewers. National Geographic has published plans online for building a pinhole sunspot viewer using a box, paper and aluminum foil. Observe the sun on more than one day to see the sun rotate!

- Write About It! Have students write their observations and inferences about why sunspots move the way they do.

- *Challenge* Math Extension! Find the actual diameter of the sun using the scale model as follows.
    - Using one of your sun projections, find the center of the circle by folding the circle twice, making sure the outer edges of the circle line up. Place a dot in the exact center before unfolding.
    - Use a ruler to measure the distance from the center of the circle to one side of the circle in centimeters. This is the radius. Diameter = radius x 2.
    - Use a ruler to measure the distance from the pinhole to the paper in centimeters.
    - Divide the diameter of your sun image by the distance from the pinhole to the paper. Convert this number to kilometers, then multiply it by the distance from Earth to the Sun, approximately 149,600,000 kilometers. This will give you the diameter of the sun.

Build a Sunspot Viewer

WARNING! Do not look directly at the sun. The sun's rays can damage your eyes. Look through a solar viewing slide or use instruments to project an image of the sun onto a piece of paper.

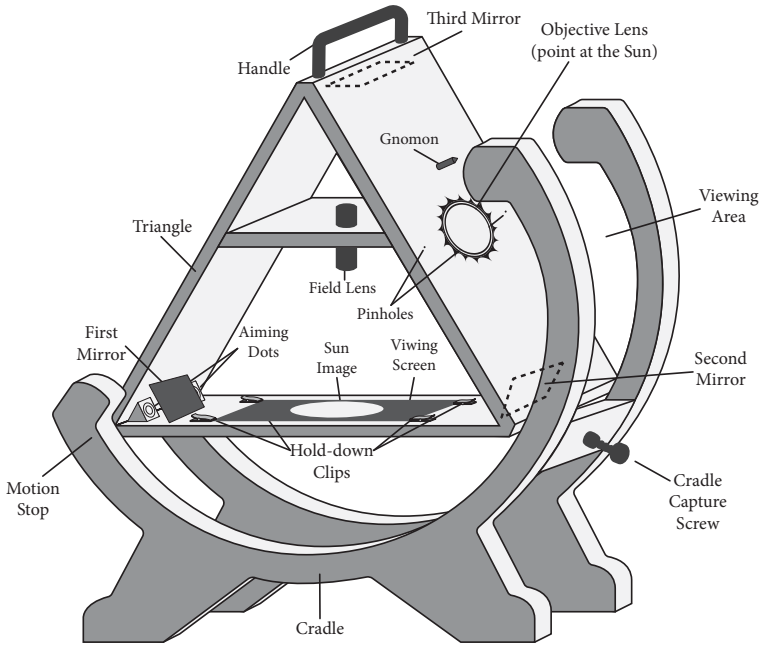
Make it!

Set up your district Sunspotter or make your own sunspot viewer using the steps below.

Use it!

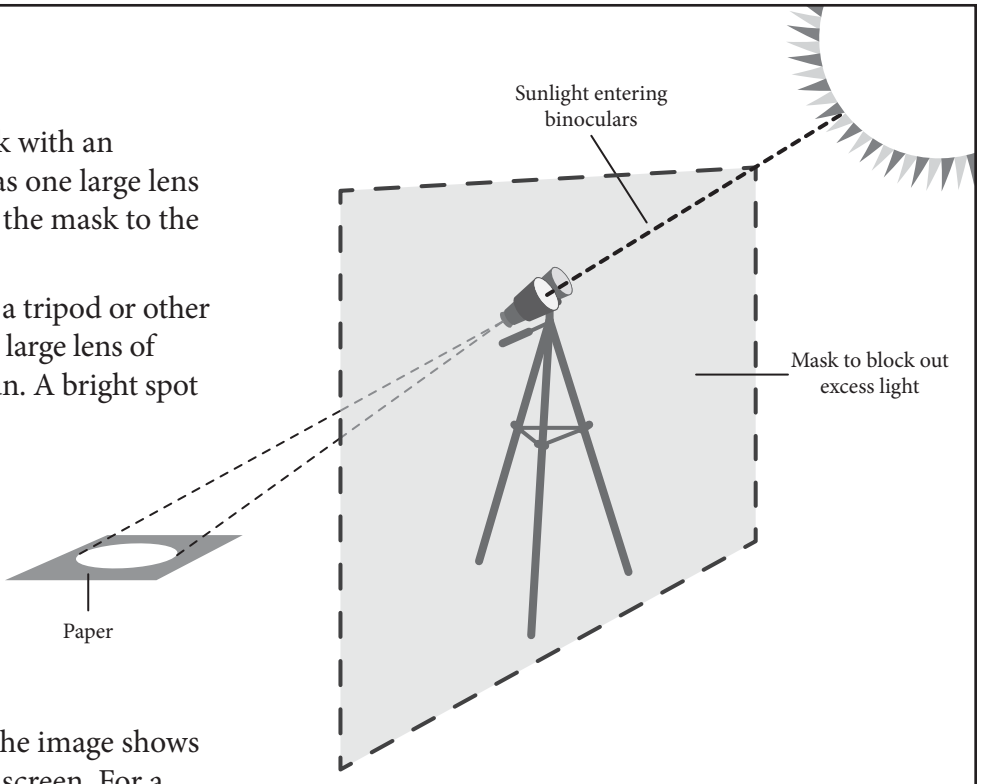
Work with classmates to carefully trace the sun image that appears on the viewing screen. Be sure to include any dark areas that are inside of the circle. These are sunspots!

Sunspotter



Sunspot Viewer Setup

1. Make a cardboard mask with an opening the same size as one large lens of the binoculars. Tape the mask to the binoculars.
2. Place the binoculars on a tripod or other stable surface. Point the large lens of the instrument at the sun. A bright spot should form on the wall or floor.
3. Place a piece of paper where the image of the sun appears. This is your viewing screen. Adjust your instrument until the image shows sharply on the viewing screen. For a clearer image, darken the room, or place the instrument under a draped table.



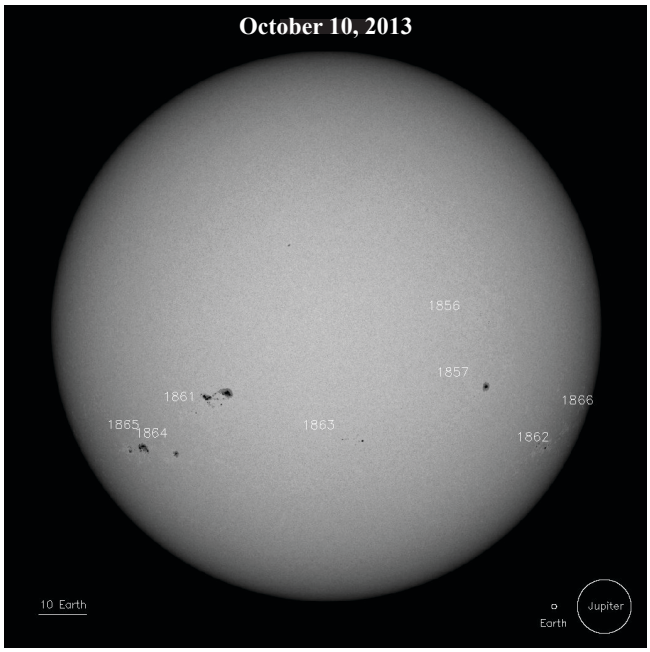
Sunspot Viewer (1 of 2)

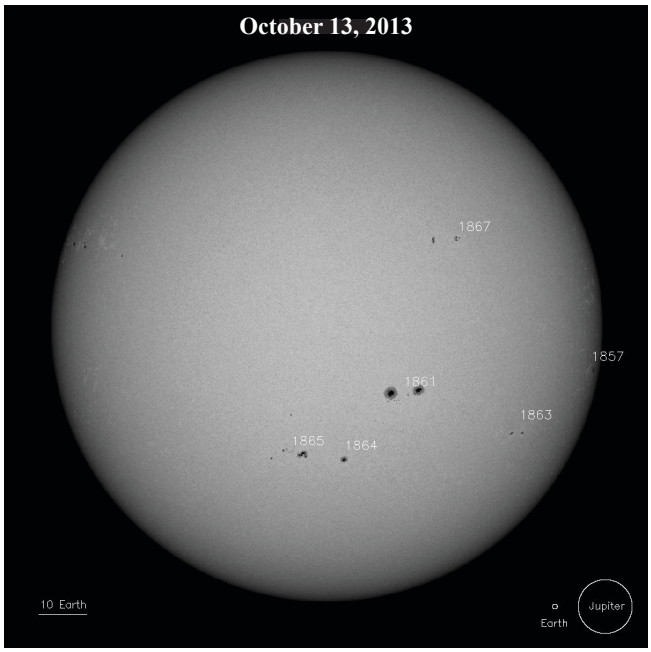
Name: _____

1. Use a sunspot viewer or the solar viewing slide to observe the sun. **Sketch** what you see. **Label** the sun in your drawing in English and Iñupiaq. **Include the date** that the image represents. **Draw arrows** pointing at the sunspots.

Date of observation: _____

2. Study the sun images below from NASA's Solar and Heliospheric Observatory. Compare the images. **Draw an arrow** below the images to show which way the sun is rotating.





3. How do you know which way the sun is rotating?

_____

_____

Sunspot Viewer (2 of 2)

Name: _____

4. Each sun image is a scale model of the sun. The scale can be used to estimate the diameter of the sunspots.

   The sun's actual diameter is about 1,391,000 kilometers (864,000 miles).

   Use a ruler to measure one of the sun images above in centimeters.

   The diameter of the model sun is _____ cm.

5. Find out how many kilometers are represented by each centimeter in your model:

   1,391,000 km ÷ _____ cm = _____ km/cm scale

6. Use a ruler to measure the largest sunspot on the sun image above.

   The diameter of the largest sunspot on the model sun is _____ cm.

7. Estimate the diameter of the sunspot using your scale.

   I estimate the diameter of the largest sunspot I observed is about _____ km.

8. The diameter of Earth is about 12,700 kilometers (8,000 miles). How does the diameter of the sunspot you observed compare to that of Earth?

   _____

   _____

Connect it!

9. How do sunspots relate to the northern lights? Use what you have learned from the student guide and the sun multimedia to help you answer.

   _____

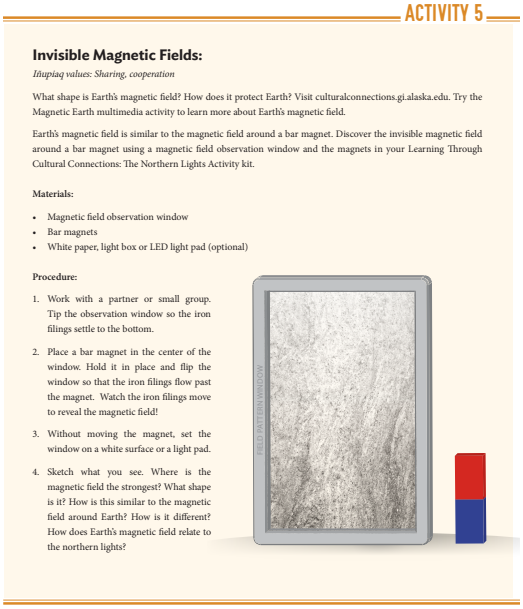
   _____

   _____

   _____

10. What is the Iñupiaq name for the northern lights? _____

Activity 5: Invisible Magnetic Fields


ACTIVITY 5

Invisible Magnetic Fields:

Iñupiaq values: Sharing, cooperation

What shape is Earth's magnetic field? How does it protect Earth? Visit culturalconnections.gi.alaska.edu. Try the Magnetic Earth multimedia activity to learn more about Earth's magnetic field.

Earth's magnetic field is similar to the magnetic field around a bar magnet. Discover the invisible magnetic field around a bar magnet using a magnetic field observation window and the magnets in your Learning Through Cultural Connections: The Northern Lights Activity kit.

Materials:

- Magnetic field observation window
- Bar magnets
- White paper, light box or LED light pad (optional)

Procedure:

1. Work with a partner or small group. Tip the observation window so the iron filings settle to the bottom.
2. Place a bar magnet in the center of the window. Hold it in place and flip the window so that the iron filings flow past the magnet. Watch the iron filings move to reveal the magnetic field!
3. Without moving the magnet, set the window on a white surface or a light pad.
4. Sketch what you see. Where is the magnetic field the strongest? What shape is it? How is this similar to the magnetic field around Earth? How is it different? How does Earth's magnetic field relate to the northern lights?

Time: 1 class period (1 class period = 45 min)

Materials:

- Computers or tablets with Internet access
- Magnetic Earth multimedia activity—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Magnetic Field Pattern Windows
- Clear sealed iron filing cases
- Bar magnets
- Iron filings, paper clips and/or staples (use closed staples)
- Assorted Magnets (optional)
- Paper
- Pencils
- Invisible Magnetic Fields worksheet

Standards Addressed:

- NGSS: MS-PS2: Motion and Stability: Forces and Interactions MS-PS2-5, DCI: Motion and Stability: Forces and Interactions: PS2.B: Types of Interactions
- Alaska Cultural Standards: E.4
- Iñupiat Learning Framework: [B]E.e.3.2
- Iñupiaq Cultural Values: Sharing, Cooperation
- Alaska Science Content Standards: A.1

Background Information:

Earth is surrounded by a powerful magnetic field that extends far into space. The organized movement of the molten iron and nickel within Earth's outer core generates this field. If there were no solar wind, Earth's magnetic field would be shaped like the field around a bar magnet. The constant pressure of the solar wind distorts Earth's magnetic field, compressing it on the side that faces the sun and stretching it into a long magnetotail on the side that faces away from the sun. In this activity, students will use bar magnets to model Earth's magnetic field.

Assessments:

- Invisible Magnetic Fields worksheet will provide a means of assessing student ability to:
    - conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact;
    - understand that magnetic forces that act at a distance and can be explained by fields that extend through space and can be mapped by their effect on a test object.

- Observation of student participation in the inquiry activity and class discussions will provide a means of assessing student ability to:
    - understand the processes of science used to design and conduct repeatable scientific investigations and defend scientific arguments;
    - share resources with a group of peers;
    - cooperate with a group of peers to complete the activity;
    - observe environmental conditions such as Earth's magnetic field.

Activity Instructions:

1. Ask students to partner-read or group-read pages 8-9 of the Kiuġuyat[NS] / Kiuġiyaq[NP] Middle School Guide. Discuss the content and check for comprehension. Ask students if they have used a compass, and if so to share their observations. Discuss why a compass works. Explain that a compass makes use of the Earth's magnetic field, or nipitchaŋa nunaqpaum[NS].
2. Ask students to visit culturalconnections.gi.alaska.edu and try the magnetic earth multimedia activity to learn more about Earth's magnetic field. Review the Earth's magnetic field portion of the Kiuġuyat video as needed.
3. Divide the class into small groups and distribute the Invisible Magnetic Fields worksheet. Explain that students will conduct an experiment to find the magnetic field around a bar magnet. Ask students to use what they already know about magnetic fields to write a hypothesis on their worksheet.
4. Distribute materials to each group. Allow students 5 minutes to freely explore the materials, then ask them to work through the worksheet to conduct their experiment. Provide guidance throughout the lab as needed.
5. Allow students time to work with the materials and record their observations.
6. Discuss as a class: What were your conclusions? Where was the magnetic field the strongest? What evidence supports this? How does the magnetic field around a bar magnet compare to that around Earth? What were the strengths and weaknesses of this experiment? How could it be improved (i.e. with different supplies, more time, stronger magnets etc)?

Connections and Extensions:

- Watch a video! Find the Bill Nye video on magnetism online and share it with students.
- Write about it! Record observations in a science journal, notebook or loose sheet of paper while experimenting with the magnets.
- Draw it! Draw what each magnetic field looks like, making sure to use appropriate scale. Write about any differences or similarities between different magnets.
- Extend your discussion! Why do the materials in the window work to show the magnetic field of magnets? What would happen if you left a magnet on the window for a longer period of time? What happens to increase the effect of the magnetic field? Is the magnet stronger now? How have iron shavings farther from the magnet become affected?

Invisible Magnetic Fields (1 of 4)

Name: _____ Date: _____

Discover the magnetic field around a bar magnet.

Materials:

- Magnetic field observation window
- Iron filings
- Bar Magnets
- Paper clips or staples (use closed staples for safety)
- Experiment Recording Sheet
- Pencil
- Sheet of white paper

Hypothesis:

Use what you know about magnets to make a hypothesis. What shape is the magnetic field around a bar magnet? **Sketch the shape** that you predict around the bar magnet below, and **explain your hypothesis** in the space provided. Where is the magnetic field strongest? Where is it weakest?

_____

_____

_____

_____

Invisible Magnetic Fields (2 of 4)

Name: _____

Experiment:

Work with a partner to test your hypothesis. Here are two ways to find the magnetic field around a bar magnet using the materials provided. **Put a check** next to the method you use.

☐ Method 1: Use a magnetic field observation window to view the magnetic field around a bar magnet. The observation window is full of iron filings and mineral oil. Iron is attracted to magnets.

1. Tip the iron filings to the bottom of the window.
2. Hold a magnet against the window.
3. Flip the window so that the iron filings move toward the magnet.
4. Sketch your observations.
5. Repeat the trial at least three times, recording your observations each time.

☐ Method 2: Use iron filings, staples or paper clips to reveal the magnetic field around a bar magnet.

1. Place a bar magnet flat on a desk or table, on top of or underneath a sheet of white paper.
2. Sprinkle iron filings, paper clips or closed staples around the magnet. Watch as the objects are pulled toward the magnet before they actually touch it.
3. Sketch your observations.
4. Repeat the trial at least three times, recording your observations each time.

TRIAL 1

Sketch your observations.

Describe your observations. Where was the field strongest? Where was it weakest?

_____

_____

Invisible Magnetic Fields (3 of 4)

Name: _____

TRIAL 2

Sketch your observations.

Describe your observations. Where was the field strongest? Where was it weakest?

_____

_____

TRIAL 3

Sketch your observations.

Describe your observations. Where was the field strongest? Where was it weakest?

_____

_____

Invisible Magnetic Fields (4 of 4)

Name: _____

Conclusion:

What did you find out? **Draw and describe** the magnetic field around a bar magnet. What shape is it? Where is the field strongest? Where is it weakest?

_____

_____

_____

What evidence supports this conclusion?

_____

_____

_____

Think about what you learned about Earth's magnetic field. How is the magnetic field around a bar magnet similar to the magnetic field around Earth? How is it different?

_____

_____

_____

Evaluate your experiment: How well did it test your hypothesis? How could you improve the experiment?

_____

_____

Which statement is correct? Circle one.

a. Magnetic fields extend into the space around the magnet.
b. Magnetic fields do not extend beyond the surface of the magnet.

Activity 6: Aurora Ovals

Time: 1 class period (1 class period = 45 min)

Materials:

- Computer or tablet with Internet access
- Aurora Ovals and Glowing Gases multimedia activity--available online at: culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Aurora Ovals worksheet

Standards Addressed:

- NGSS: DCI: ESS2.A: Earth's Materials and Systems
- Alaska Cultural Standards: B.1
- Iñupiat Learning Framework: [B]E.e.3.2
- Iñupiaq Cultural Values: Respect for Nature
- Alaska Science Content Standards: B.2

Background Information:

Earth is surrounded by a powerful magnetic field. The field acts as a buffer, protecting Earth from most of the charged particles the solar wind carries by deflecting the wind around Earth. Some of the charged particles get caught in Earth's magnetic field. They travel along the magnetic field lines to enter Earth's atmosphere near the poles. The charged particles slam into and energize gas particles in Earth's atmosphere, causing them to glow like a neon sign. This creates the northern lights (aurora). The aurora forms ovals around Earth's geomagnetic north and south poles. The oval forms a boundary between Earth's open and closed magnetic field lines. The aurora oval glows during the day and at night, but Alaskans can only see it when Alaska is under the oval and the night skies are clear. Storms on the sun send more charged particles hurtling toward Earth. The solar wind bombards and distorts Earth's magnetic field. The size of the oval changes as the magnetic field fluctuates.

Assessments:

- Student responses on Aurora Ovals Worksheet provide a means of assessing student ability to:
  - acquire insights about the northern lights from another culture or perspective;
  - accurately diagram where aurora ovals form;
  - understand that the aurora is the result of energy transferred from the sun via the particles carried by the solar wind.
- Class discussion will provide a means of assessing student ability to:
  - reflect on recent weather and environmental conditions.

Activity Preparation:

1. Optional: The elementary Learning through Cultural Connections: Northern Lights kit includes gas tubes and a power supply to help illustrate how the northern lights are similar to a neon sign. If you would like to demonstrate this in association with this aurora ovals activity, please borrow the power supply and gas tubes from your local elementary school.

Identify an indoor or outdoor space that will have a clear view Activity Instructions:

2. Ask students if they have seen the northern lights recently. Remind students that the northern lights also are known as the aurora, or in Iñupiaq kiuġuyat^{NS}/kiuġiyaq^{NP}. Discuss student observations of the northern lights.

3. Ask students to partner-read or group-read page 10 of the Kiuġuyat^{NS} / Kiuġiyaq^{NP} Middle School Guide. Explain that the northern lights form an oval-shaped crown above Earth. Explain that this crown is visible from space as well as from the ground. If Internet connectivity allows, show the NASA UHD Video: Stunning Aurora Borealis from Space in Ultra-High Definition (4K). This video is available on YouTube.

4. Use a Smartboard as a class, or ask students to try the Aurora Ovals multimedia activity at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit to learn about why the aurora forms an oval over Earth's geomagnetic north pole. Revisit the Magnet Earth multimedia or video animation and the Glowing Gases multimedia as needed to review the processes leading up to the formation of the aurora and how different gases produce different colors of aurora.

5. Discuss: How does what you have learned about aurora ovals explain why people living near Earth's equator very rarely see the aurora, while those who live in the far north can see it often?

6. Distribute the Aurora Ovals worksheet and ask students to complete it using what they learn from the multimedia activity.

Connections and Extensions:

- Model it! Cut an oval ring out of green paper. Using a globe, center the oval over the geomagnetic north pole. Identify an object in the classroom to serve as the "sun" and rotate the globe, challenging students to identify times when the northern lights are visible from their area. Hint: the oval must be over Alaska and it must be night time—Alaska must be facing away from the "sun."

- View Southern Lights! Visit the NOAA website and search for Aurora Australis. View the photo gallery of images of the southern lights.

- Draw it! Encourage students to draw a picture of the northern lights next time they observe them.

Aurora Ovals

Name: _____

Visit culturalconnections.gi.alaska.edu to learn about why the aurora forms an oval over Earth's geomagnetic north pole. Use what you learn to answer the questions below.

1. The aurora forms an oval around Earth's _____ magnetic field lines.

2. Draw and label the open magnetic field lines, the closed magnetic field lines and aurora ovals in their correct locations on the Earth image below:

3. Where does the energy that produces the aurora come from?

   a. The sun b. Earth c. A power plant

4. What is an Iñupiaq word for Earth? _____

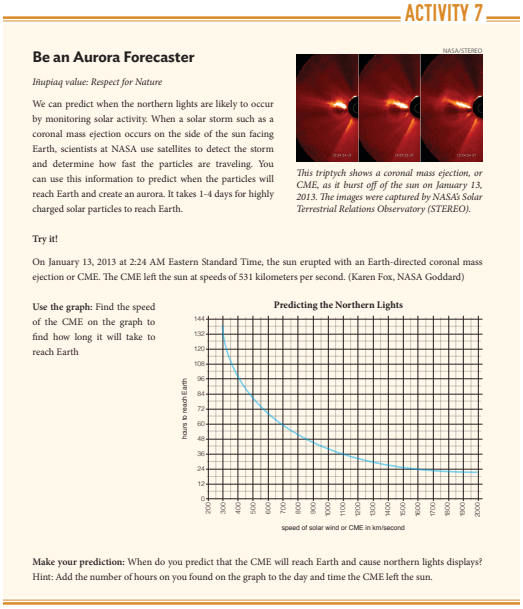
5. Why do people living near Earth's north and south poles have more opportunity to see the aurora than people living near Earth's equator?

   _____

   _____

   _____

Activity 7: Be an Aurora Forecaster


ACTIVITY 7

Be an Aurora Forecaster

Iñupiaq value: Respect for Nature

We can predict when the northern lights are likely to occur by monitoring solar activity. When a solar storm such as a coronal mass ejection occurs on the side of the sun facing Earth, scientists at NASA use satellites to detect the storm and determine how fast the particles are traveling. You can use this information to predict when the particles will reach Earth and create an aurora. It takes 1-4 days for highly charged solar particles to reach Earth.

NASA/STEREO

This triptych shows a coronal mass ejection, or CME, as it burst off of the sun on January 13, 2013. The images were captured by NASA's Solar Terrestrial Relations Observatory (STEREO).

Try it!

On January 13, 2013 at 2:24 AM Eastern Standard Time, the sun erupted with an Earth-directed coronal mass ejection or CME. The CME left the sun at speeds of 531 kilometers per second. (Karen Fox, NASA Goddard)

Use the graph: Find the speed of the CME on the graph to find how long it will take to reach Earth

Predicting the Northern Lights

hours to reach Earth

speed of solar wind or CME in km/second

Make your prediction: When do you predict that the CME will reach Earth and cause northern lights displays? Hint: Add the number of hours on you found on the graph to the day and time the CME left the sun.

Materials:

- Be an Aurora Forecaster worksheet
- Computer or tablet with Internet access

Standards Addressed:

- NGSS: MS-CC: Motion and Stability: Forces and Interactions: Cause and Effect
- Alaska Cultural Standards: E.4
- Iñupiat Learning Framework: [B]E.e.3.2
- Iñupiaq Cultural Values: Respect for Nature
- Alaska Science Content Standards: A.1, D.3

Background Information:

Scientists predict when the northern lights are likely to occur by monitoring solar activity. They look at the strength, density and speed of solar wind coming toward Earth. When a solar storm such as a coronal mass ejection occurs on the side of the sun facing Earth, scientists at NASA use satellites to detect the storm and determine how fast the particles are traveling. This information, combined with Earth's distance from the sun, can be used to predict when the particles will reach Earth and likely create an aurora.

Assessments:

- Class discussion will provide a means of assessing student ability to:
  - understand the cyclical changes controlled by energy from the sun and by Earth's position and motion in our solar system;
  - understand the world that surrounds and encompasses him/her.
- Student responses on Be an Aurora Forecaster worksheets provide a means of assessing student ability to:
  - use solar activity (cause) data to predict aurora activity (effect);
  - understand the process by which the aurora is formed.

Activity Instructions:

1. Ask students to partner-read or group-read pages 4-11 of the Kiuġuyat[NS] / Kiuġiyaq[NP] Middle School Guide.
2. Ask students if they have seen the northern lights recently. Encourage students to share personal stories and experiences viewing the northern lights.
3. Explain that scientists can predict when the aurora is likely to be active. Visit the Geophysical Institute Aurora Forecast website at gi.alaska.edu/auroraforecast to find out if the aurora oval is likely to be overhead tonight.

4. Discuss: What information might we need in order to predict when the northern lights will occur? Explain that while scientists use many variables to predict the northern lights, a basic prediction can be made with just a few pieces of information:
   - The time that an earth-directed storm left the sun.
   - The speed the particles ejected by the storm were traveling.
   - The distance between the sun and Earth.

5. Distribute the Be an Aurora Forecaster Worksheet. As a class, read the NASA quote near the top of the page. Explain that a coronal mass ejection is a giant solar storm. Discuss the information provided in the quote (i.e. day and time of the CME, speed of travel). How fast was the CME traveling? (531 km/second). How far apart are the sun and Earth? (149,600,000 km) How long do you think it will take for the CME to reach Earth?

6. Demonstrate how to use the graph provided to determine how long it will take for the CME to reach Earth. Discuss: What day will the charged particles ejected by the CME reach Earth?

7. Ask students to complete the worksheet, providing support as needed.

8. Discuss student predictions: When do students predict that the CME would have been likely to cause northern lights displays? Who might use a northern lights forecast? What cause and effect relationship makes forecasting the northern lights possible? What is the weather like today? If there were a northern lights display tonight, would we be able to see it? Why or why not (cloud cover blocks northern lights from view)?

K index	nT difference
0	0-5
1	5-10
2	10-20
3	20-40
4	40-70
5	70-120
6	120-200
7	200-330
8	330-500
9	>500

Connections and Extensions:

- Present it! Ask students to give their aurora forecast in front of the class.

- Calculate! Use math to find out how long it will take for the CME to reach Earth. Follow these steps:
  - Earth is 149,600,000 km from the sun. Divide this distance by the speed of the CME to learn how many seconds it will take for the CME to reach Earth.
  - There are 3,600 seconds in an hour (60 seconds/minute x 60 minutes/hour = 3,600 seconds). Divide your answer by 3,600 to learn how many hours it will take for the CME to reach Earth.

- *Challenge* Step it up! Use real time data to develop an aurora forecast for today by following these steps:
  - Print off a days-worth of XYZ data from a THEMIS magnetometer as close to your school as possible from: http://ds9.ssl.berkeley.edu/themis/classroom_geons_data.html. Select the XYZ plot.
  - Looking at the top graph, for the X-direction, use a clear metric ruler to draw a horizontal line across the plot that intersects with the highest point.
  - Draw a horizontal line that intersects with the lowest point in the same graph. What is the distance between these two lines in millimeters?
  - Each millimeter equals 5 nT difference. Multiply the number of mm you found by 5.
  - Using the table at right, find the K index for the northern lights. The index tells us how active the aurora will be. The higher the number, the more active it is predicted to be.
  - Check the Geophysical Institute forecast page at: gi.alaska.edu/AuroraForecast and see how accurate your predictions are.

- Once you find the K index, you can use it to find where the aurora will be visible. Determine the latitude of the southern-most border of the northern lights by using the quadratic equation. Put your K index into this equation and the result will be a longitude. Y = -0.25 (X) 2 + 0.8 (X) + 48.95. Work with a partner to check your answer for accuracy.

Be an Aurora Forecaster (1 of 2)

Name: _____

The National Aeronautics and Space Administration (NASA) tracks space weather, including solar wind and the storms on the sun that cause the northern lights. Scientists use the data that NASA collects to help predict when the northern lights are likely to occur over Earth.

Read each quote below.

U**se the graph** on the following page to predict when the storm will reach Earth and potentially cause northern lights displays. **Find the speed** of the CME on the graph to find how long it will take to reach Earth.

Add the number of hours to the time that the CME occurred to estimate when the CME will reach Earth.

1. *"On January 13, 2013 at 2:24 AM Eastern Standard Time, the sun erupted with an Earth-directed coronal mass ejection or CME. The CME left the sun at speeds of 330 miles (531 kilometers) per second..."* (Karen C. Fox, NASA Goddard Space Flight Center)

When do you predict that the CME will reach Earth and likely cause northern lights displays?

_____

2. "*On Jan. 23, 2013, at 9:55 a.m. EST, the sun erupted with an Earth-directed coronal mass ejection, or CME...[T]he CME left the sun at speeds of around 375 miles (603 kilometers) per second, which is a fairly typical speed for CMEs.*" (Karen C. Fox, NASA Goddard Space Flight Center)

When do you predict that the CME will reach Earth and likely cause northern lights displays?

_____

3. "*At 5:24 a.m. EDT on May 17, 2013, the sun erupted with an Earth-directed coronal mass ejection... Experimental NASA research models, based on observations from NASA's Solar Terrestrial Relations Observatory, show that the CME left the sun at speeds of around 745 miles (1199 kilometers) per second.*" (NASA/SDO/Goddard, ESA&NASA SOHO)

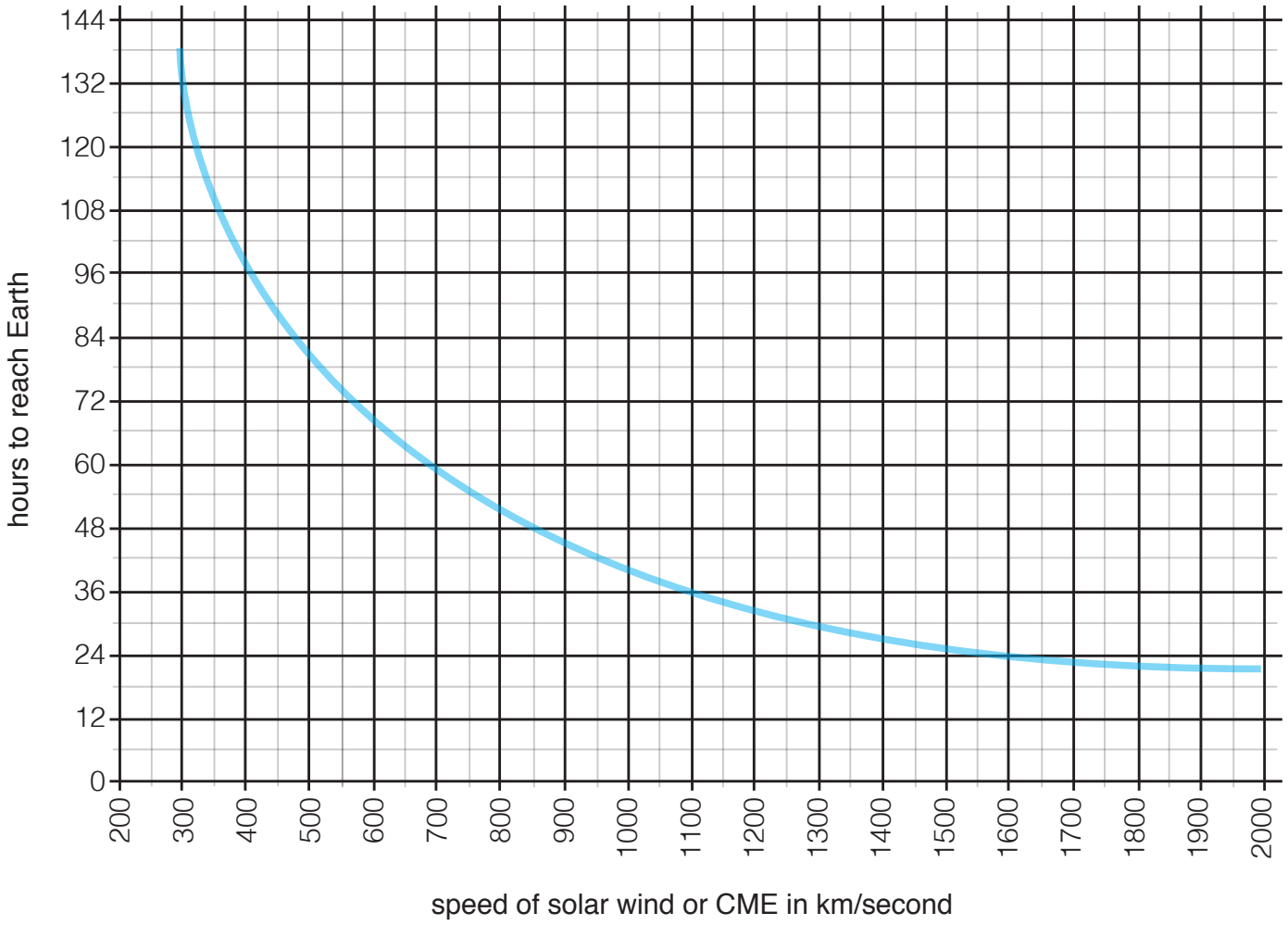
When do you predict that the CME will reach Earth and likely cause northern lights displays?

_____

Be an Aurora Forecaster (2 of 2)

Name: _____

Predicting the Northern Lights



Use complete sentences to answer the questions below:

Who in your community might like to have an aurora forecast? Why?

_____

_____

What cause and effect relationship makes it possible to forecast the northern lights?

_____

_____

Activity 8: Knowledge and Stories of the Kiuġuyat[NS]/Kiuġiyaq[NP]

Time: 1-2 class periods (1 class period = 45 min)


ACTIVITY 8

Traditional Knowledge and Stories of the Kiuġuyat

Iñupiaq value: Love for Children, Respect for Elders

Visit culturalconnections.gi.alaska.edu (Multimedia) and listen to Iñupiaq elders and others share their knowledge based on experience as well as spiritual stories about the **kiuġuyat**. Read Elijah Kakinya's story about the northern lights.

Diana Martin
Barrow
Ron Brower, Sr.
Barrow
Elmer Goodwin
Kotzebue
Mary Ahkivgak
Barrow
Helen Allen
Kotzebue
Elijah Kakinya
Anaktuvuk Pass
(no photo available)
Annie Conger
Brevig Mission

Discuss: What do the stories have in common? How are they different? Which are spiritual, and which are based on experiences? How can travelers make use of the northern lights when they appear during travel? What can the northern lights often indicate about the weather? What do these stories tell you about Iñupiaq spiritual understanding of the northern lights?

Try it: Go outside and observe the sky, weather and environment around you. Describe your observations and experience. Include: time of day, what you saw in the sky (northern lights, clouds, sun, moon, stars etc), and weather descriptions (snowing, windy, cold, clear etc).

Pass it on: Learn to retell or develop a song or dance about one of these stories in the traditional Iñupiaq style. Present to an audience. Be sure to introduce yourself, and share where you learned the story.

Materials:

- Videos of elders sharing knowledge and stories—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Traditional Knowledge and Stories worksheet (one per student)
- The Northern Lights by Elijah Kakinya (originally published in Nunamiut Unipkaaŋich: Nunamiut Stories Told by Elijah Kakinya and Simon Paneak)
- Computers or tablets with Internet access

Standards Addressed:

- Alaska Cultural Standards: A.3, B.2, E.4
- Iñupiat Learning Framework: [B]E.e.3.2, [N]E.e.3.3, [B]E.e.3.4, [N]E.e.3.4, [B]C.s.1.2, [B]C.s.2.1, [N] C.s.2.2, [B]C.s.3.1, [N]C.s.3.1, [B]C.s.4.2, [B]C.s.4.3, [B]C.s.4.4, [B] C.r.2.1, [B]H.uqu.4.1, [B]H.uqu.4.2, [N]H.uqu.4.1
- Iñupiaq Cultural Values: Love for Children, Respect for Elders
- Alaska Science Content Standards: A.3, F.2, F.3

Background Information:

Different cultures use different strategies for teaching and learning. Some rely most on books, others on institutions of education and others on one-on-one methods of communication. Iñupiat culture emphasizes oral tradition, as well as demonstration and practice to convey knowledge. Traditional storytelling serves many purposes. The stories shared in this activity demonstrate some of the traditional Iñupiaq observations and uses for the northern lights and allow students to explore how the northern lights are incorporated into traditional Iñupiaq spirituality.

Assessments:

- Knowledge and Stories worksheet provides a means of assessing student ability to:
  - observe, study and describe the weather and environmental conditions in the world around them;
  - infer a storyteller's purpose in telling the story;
  - demonstrate understanding of the lessons and helpful information in a story;
  - describe how the knowledge in a traditional story relates to student life;
  - engage in storytelling as a listener;
  - explain how stories illustrate the Iñupiaq worldview in which animals and the environment are sentient and powerful beings;
  - analyze the elements of a story that make it interesting or compelling;
  - read and write an Iñupiaq language term or phrase;
  - identify the name and community of elders whose stories they listened to.

- Classroom discussion provides a means of assessing student ability to:
    - infer from stories what is important in the story;
    - understand that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world;
    - understand the importance of recording and validating cultural knowledge.
- Pass it on activity provides a means of assessing student ability to:
    - learn and retell a story, or develop and practice a song or dance.

Activity Instructions:

1. Ask students to partner-read or group-read pages 12-13 of the Kiuġuyat[NS] / Kiuġiyaq[NP] Middle School Guide. Explain to students that there are Iñupiaq spiritual stories and experiential knowledge about the kiuġuyat[NS]/kiuġiyaq[NP] or northern lights and that they will see videos of elders telling some of these stories, and read one of these stories in class.

2. Discuss the difference between experiential knowledge and spiritual stories. Experiential knowledge is based on experiences. In the videos, elders share some of their own experiences as well as knowledge and experiences passed down from their ancestors. Spiritual stories also are passed down from one generation to the next, but are based at least partially on beliefs rather than experiences.

3. Place students in small groups or pairs and distribute Traditional Knowledge and Stories worksheet and The Northern Lights by Elijah Kakinya. Iñupiaq and English versions of this story are included in your Teacher's Manual.

4. Read Elijah Kakinya's story aloud, then ask groups to choose and watch 3 videos of elders sharing knowledge and stories—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit. Explain that students may need to watch each video more than once to understand the information shared. Provide time accordingly.

5. Work as a class to create a Venn diagram which identifies the knowledge or story that each person shared as experiential, spiritual, or both. Discuss why each story fits into the category selected.

6. Discuss as a class: What do the stories have in common? How are they different? Why might elders share this information? What is important about each person's story or the information they shared? What are some ways that the northern lights can be used? How do these stories illustrate the Iñupiaq worldview that animals and the environment are sentient beings (sentient means aware, conscious)? What is important spiritually to the characters in Elijah's story? Which story did you find most interesting? Why? Why would you hear a story about the kickball players in the northern lights when you are younger and a different story later? Why is it important to understand cultural knowledge related to the northern lights? (Students who do not feel comfortable sharing their own insights can share an interesting peer insight and explain why it was so interesting to them.)

7. Explain that careful observation is an important skill from a scientific and Iñupiat cultural perspective. Take students outside. Ask students to carefully observe the sky, weather and environment. Return to the classroom and ask students to record their observations in the Try It section of their worksheet.

8. Compile a list of keywords and phrases from student observations on the whiteboard/chalkboard or chart paper. Encourage students to contribute descriptive words that would help someone who had not been outside today to clearly understand the conditions.

9. Ask students to work in small groups to develop a way to share one of the stories or some of the spiritual knowledge of the aurora that they learned. They can learn to retell the story or develop a song or dance about one of the stories in the traditional Iñupiaq style. Arrange for students to present their story, song or dance to an audience. Before presenting, students should introduce themselves and share where and from whom they learned the story.

Connections and Extensions:

- Practice the Aural Method! Invite an elder into the classroom to teach students a story about the Kiuġuyat^{NS}/Kiuġiyaq^{NP} using the aural method.
- Extend it! Invite an elder into the classroom to tell his or her experiential stories about the kiuġuyat^{NS}/ kiuġiyaq^{NP} or about other features of the night sky such as the moon and stars.
- Make a video! Film and edit student presentations and share them with the local senior center or as a cultural exchange project with a classroom in another region.
- Weather journal! Repeat the observation exercise as a journaling activity once or twice a week to develop observation and descriptive writing skills.

Traditional Knowledge and Stories (1 of 2)

Name: _____

Read Elijah Kakinya's northern lights story. **Watch and Listen** to at least three of the following people share traditional knowledge and stories about the northern lights:

Helen Allen
Kotzebue

Mary Ahkivgak
Barrow

Ronald Brower Sr.
Barrow

Annie Conger
Brevig Mission

Elmer Goodwin
Kotzebue

Diana Martin
Barrow

What do the stories have in common?

_____

_____

How are the stories different?

_____

_____

What do these stories tell you about traditional Iñupiat spiritual understandings of the northern lights?

_____

_____

How can travelers make use of the northern lights when they appear during travel?

_____

_____

What can the northern lights often indicate about the weather?

a) it is warm b) it is cold c) it is cloudy

Share one Iñupiaq word or phrase that you learned during this activity.

Iñupiaq: _____ English translation: _____

Traditional Knowledge and Stories (2 of 2)

Name: _____

Use the space below to **illustrate the story** or video you liked best.

Try it:

Go outside and observe the sky, weather and environment around you. **Describe your observations** and experience. Include time of day, what you saw in the sky (clouds, sun, stars, moon, northern lights, etc). Describe the weather (snowing, windy, cold, cloudy, clear etc.).

_____

_____

_____

_____

_____

_____

Pass it on:

Work with a partner or a small group of classmates to **choose one** of the following ways to pass on one of these stories:

- Learn to retell the story.
- Develop a song about the story in a traditional Iñupiat style.
- Develop an Iñupiat dance about the story.

Present your story, song or dance to an audience. Be sure to introduce yourself and share where you learned the story.

The Northern Lights by Elijah Kakinya (1 of 2)

Now I shall tell Qasuniq's story about the northern lights up there, a story made about one of the people living here a long time ago, a story about them.

A long time ago there were people living in a big village, probably here at the head of the Killiq River. They used to remove the children's teeth when a tooth became loose. A child's teeth would become loose when the child was five years old. Then they used to remove the child's teeth. Or when they were four years old, the children's teeth would become loose, their milk teeth. They used to remove the teeth when they become loose.

Among the people living in that big village, there was a girl. Her teeth-she was four years old and one tooth had become loose, but her parents didn't pay attention to that tooth, a canine tooth, so the didn't remove it! Although all the people watched their children and removed their teeth, the parents of that girl didn't watch their daughter and that one tooth of hers, her canine tooth. Then it wasn't loose any more. Then they were unable to do anything to it, for there were no white men around, no forceps, so when it tightened, they left it there.

That woman grew up, and her canine tooth came out through her upper lip. When she got married and became able to work, she used it to twist thread on, tying sinews to her canine tooth. When she made lengths of sewing thread, she always tied them on and used her tooth to twist them on.

Those people used to hunt and trap, setting snares for caribou, and hunting in kayaks, and with corrals; they made a living in every possible way. And that woman set out with her child on her back. While she was busy putting the snares in order, having left her husband behind- that was how they lived- she went to the ptarmigan snares. As she was taking her snares and what she had caught, as she was removing the snare from the tenth ptarmigan, suddenly a hot, feverish feeling came over her! She suddenly felt hot, just as when we get a fever. The fever came over her as she was taking the tenth ptarmigan. She made holes in their wings with a little awl of marrowbone, and she had a thing for them. Stabbing them between the wings, in the bones, she packed them under the child on her back.

When the fever suddenly came over her, she thought, "What's happening to me?" Just as she was about to pack up her ptarmigan, the northern lights got her. The northern lights got her and rose with her! The northern lights had many people who played football. They played football with a human head that smiled whenever they kicked it! They were many and used to play football and have a good time, many of them. Then the people of the northern lights scooped her up from here; they took that woman to be one of them. When her relatives followed her tracks to the snare, having become worried about her, at one of her snares, the tenth one, her tracks ended.

The Northern Lights by Elijah Kakinya (2 of 2)

Some time afterward, a very long time afterward, a man was checking his snares, one of those people, a man. Taking the ptarmigan he had caught, he pierced them in the same way in the wing and packed them, using a little awl of marrowbone. While he was doing this, a hot feeling all of a sudden cam over him too! As he was getting the fever, he thought, "How strange! What's happening to me?" and looked upward. Look! The northern lights were just about to seize him! Then he suddenly recognized that women with her pack of ten ptarmigan, with the sinew-twisting tooth! "Oh, there's that woman, right there!" He gave a start at that, recognizing the one with the tooth like a little horn to twist on. "Too bad that both of us, I and my kinswoman with the twisted tooth, should be taken up there in the sky! If they take me, our people will have no one to tell about us," he thought with apprehension. Becoming anxious, he got into the dirt gathered by the wind, falling on his belly into a little hollow in the wind-gathered dirt. When the football players had come upon him unawares, and he realized it and recognized the woman with the sinew-twisting tooth, he abruptly crouched down into that dirt. They felt regret right away: "Alas, we didn't get that one! We let him get stuck in the dirt," they said. That woman burst out, "Alas, you didn't hold onto the only one I'd be happy with!" So the woman said, but he thought, "If both of us are taken, my kinswoman and I, our people won't know what has become of us, so for me, let me not be taken. I'll tell about that kinswoman of mine to her relatives, to her siblings and her husband, telling them that I have seen her."

And the woman, shouting, "Alas!" was becoming inaudible. "Alas, you didn't hold onto the only one I'd be happy with!" she shouted, but that man too wanted to be safe and to report back. He wanted to return to his relatives in order to tell the real story of the one with the sinew-twisting tooth.

When the northern lights were gone, he looked for her, after the northern light had disappeared; then he started homeward with his ptarmigan packed on his back. Then he arrived with something to tell: "I've seen that kinswoman of mine. The northern lights took her, and they also have a human head, and it smiles whenever they kick it. That's how they have fun. The northern lights took that kinswoman of mine away, they took possession of her. I was on the point of being taken too, but I really wanted to tell the story about her. To avoid being taken, I hid in the dirt gathered by the wind."

That's the end of the story.

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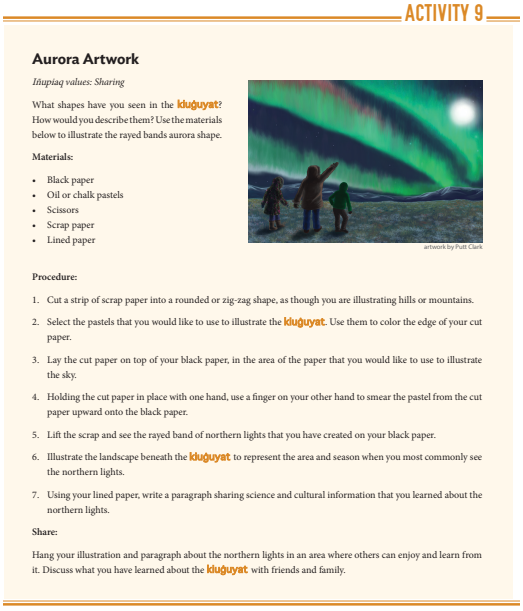
Activity 9: Aurora Artwork



ACTIVITY 9

Aurora Artwork

Iñupiaq values: Sharing

What shapes have you seen in the kiuġuyat? How would you describe them? Use the materials below to illustrate the rayed bands aurora shape.

Materials:

- Black paper
- Oil or chalk pastels
- Scissors
- Scrap paper
- Lined paper

artwork by Putt Clark

Procedure:

1. Cut a strip of scrap paper into a rounded or zig-zag shape, as though you are illustrating hills or mountains.
2. Select the pastels that you would like to use to illustrate the kiuġuyat. Use them to color the edge of your cut paper.
3. Lay the cut paper on top of your black paper, in the area of the paper that you would like to use to illustrate the sky.
4. Holding the cut paper in place with one hand, use a finger on your other hand to smear the pastel from the cut paper upward onto the black paper.
5. Lift the scrap and see the rayed band of northern lights that you have created on your black paper.
6. Illustrate the landscape beneath the kiuġuyat to represent the area and season when you most commonly see the northern lights.
7. Using your lined paper, write a paragraph sharing science and cultural information that you learned about the northern lights.

Share:

Hang your illustration and paragraph about the northern lights in an area where others can enjoy and learn from it. Discuss what you have learned about the kiuġuyat with friends and family.

Time: 1-2 class periods (1 class period = 45 min)

Materials:

- Black paper
- Oil or chalk pastels
- Scissors
- Scrap paper
- Lined paper

Standards Addressed:

- NGSS: (standards addressed by this lesson will vary based on class discussion emphasis)
- Alaska Cultural Standards: E.4 (additional standards will vary based on class discussion emphasis)
- Iñupiat Learning Framework: [B]E.e.3.4 (additional standards will vary based on class discussion emphasis)
- Iñupiaq Cultural Values: Cooperation
- Alaska Science Content Standards: F.2 (additional standards will vary based on class discussion emphasis)
- Alaska English/Language Arts Content Standards:

Background Information:

The northern lights come in a dazzling array of shapes. The shapes often occur in a similar pattern. First a quiet arc stretches like a ribbon across the sky. Next, rayed bands of light curl and buckle. If the aurora is directly overhead, these rayed bands appear as a corona--a starburst of light which can fill the entire sky. As the rayed bands fade, patches of aurora, resembling puffs of smoke or faint clouds light the night. Finally, long aurora rays appear as vertical bars of light, signaling the end of the show.

Assessments:

- Student illustrations, paragraphs and discussion will provide a means of assessing student ability to:
  - Relate ideas about the northern lights from different knowledge systems;
  - Illustrate and describe the northern lights as they occur in the world around them;
  - Understand that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the northern lights.

Activity Instructions:

1. Ask students to partner-read or group-read pages 14-15 of the Kiuġuyat^{NS} / Kiuġiyaq^{NP} Middle School Guide.
2. Work with the class to create a cumulative concept map about the northern lights on the whiteboard or an easel pad. Title the map: "What have we learned about the northern lights?" Categories of knowledge that emerge might include: cultural knowledge, science processes, vocabulary etc.

3. Distribute a piece of black paper, pastels, scissors and scrap paper to each student. Explain that students will illustrate the northern lights and then write a paragraph about what they have learned about the northern lights to display with their illustration.

4. To create illustrations, demonstrate the following steps:
    - Cut a strip of scrap paper into a large scalloped or zig-zag shape, as though you are illustrating hills or mountains.
    - Select the pastels that you would like to use to illustrate the northern lights. Use them to color the edge of your cut paper.
    - Lay the cut paper on top of your black paper in the area of the paper that you would like to use to illustrate the sky.
    - Holding the cut paper in place with one hand, use a finger on your other hand to smear the pastel from the cut paper upward onto the black paper.
    - Lift the scrap and see the rayed band of northern lights that you have created on the black paper.
    - Illustrate the landscape beneath the northern lights to represent an area and season when you most commonly see the northern lights.

5. Ask students to use their lined paper and the class concept map to write a paragraph about the northern lights. It should include science and cultural information and at least two Iñupiaq terms related to the northern lights.

6. Display student writing and artwork in the classroom or hallway.

Connections and Extensions:

- Create a Comic Strip! Provide students with story starters to help them create a comic strip about the northern lights. Story starters might include:
  Describe the adventures of two brave travelers who find themselves traveling by snow machine beneath the northern lights.
  Write a comic about a gas particle hanging out in Earth's atmosphere when it suddenly encounters a energetic particle from the sun.

- Be the teacher! Invite students to record themselves using a smart board to teach how the northern lights are created, as well as Iñupiaq terminology and cultural information related to the northern lights.