

Teacher Manual

NORTH SLOPE & NORTHERN SEWARD PENINSULA IÑUPIAQ

Kiuḡuyat^{NS} / Kiuḡiyaq^{NP}

**The Northern Lights
Elementary**

LEARNING THROUGH
CULTURAL
CONNECTIONS

Dear 4th-5th Grade Teacher,

Thank you for using the Learning Through Cultural Connections: The Northern Lights activity 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 Iñupiat 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. All of the activities focus on the northern lights and include the Iñupiaq cultural and physical science perspectives. Activity-based assessments are provided for your convenience. We recommend teaching this kit during months when 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 related to the northern lights.
- Experience, discuss, analyze and practice Iñupiaq stories, songs and dances related to the northern lights.
- Observe and study the process by which the aurora is formed and provide evidence that transferring electrical energy to gas particles can produce light.
- Represent data in graphical displays to reveal patterns in when the aurora is visible from their location.

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

North Slope Iñupiaq (NS)	Northern Seward Peninsula Iñupiaq (NP)	English	Local Dialect
kaviqsaq	kawiaqtuaq	red	
kiuḡuyat	kiuḡiyaq	northern lights	
nipitchaja nunaqpaum		Earth's magnetic field	
Nunaqpak	Nunaqpak	Earth	
qaungich	kalait	colors	
siqifhatinniq	massam anuḡinja	solar wind	
siqiñiq	mazaq	sun	
siḷa	sila	sky	
suḡaaqtaaḡ	suḡaaqtaaḡ	green	
siaminniḡa siqiñḡum	aḡivlat	particles	
tatqiq	taqqiq	moon	
tigluuraaqtaaḡ	tigluuraaḡ	purple	
uvluḡiat	ubluḡiat	stars	
aqvaluaḡniḡa	kiuḡvaa	aurora oval	
Quliatḡuaḡutiyumiñaqpiḡa kiuḡuyatigun?	Sumik kulaiḡiupina kiḡiuqzraqmik?	Can you tell me about the northern lights?	

Standards Addressed:

Next Generation Science Standards:

- (Grade 4) Energy can be transferred from place to place by electric currents, which can then be used locally to produce light (NGSS DCI: Energy PS3.B: Conservation of Energy and Energy Transfer)
- (Grade 4) Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents. (NGSS 4-PS3 Energy: 4-PS3-2)
- (Grade 5) The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon and stars at different times of the day, month and year. (NGSS ESS1.B: Earth and the Solar System: 5-ESS1-2)

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:
 - [Emerging]E.e.1.5: Identifying and naming objects in the sky.
- Nature of the Cosmos E.e.3: The student demonstrates an understanding of the Iñupiaq worldview by:
 - [E]E.e.3.2: Expressing consciousness of the world that surrounds and encompasses him/her.
 - [E]E.e.3.3: Listening to stories in which the environment or its beings present themselves as sentient (e.g., “little people,” giants, geographic features, animals, etc.)
- The student seeks to understand the universe by:
 - [B]E.e.3.4: Observing 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:
 - [E]C.sd.1.1: Listening and moving to the rhythm or beat of the songs.
 - [E]C.sd.1.2: Following common dances and motion dances.
 - [B]C.sd.1.1: Learning songs and listening to the rhythm of the songs.
- Singing and dancing as expressions C.sd.3: The student demonstrates a knowledge of singing and dancing by:
 - [E]C.sd.3.2: Enjoying the acts of drumming, singing and dancing.

Storytelling:

- Storytelling and Language C.s.1: The student demonstrates an understanding of the relationship between storytelling and the Iñupiaq language by:
 - [E]C.s.1.2: Routinely hearing the storyteller's name at the beginning of a story.
- Storytelling: Spirituality C.s.2: The student uses knowledge of traditional Iñupiaq culture to:
 - [E]C.s.2.1: Engage in conversation about stories.
 - [B]C.s.2.1: Infer from stories what is important in the story.
- Stories as communication C.s.3: The student demonstrates an understanding of the role of storytelling and stories in communication by:
 - [E]C.s.3.1: Engaging in conversation about stories.
 - [B]C.s.3.1: Explaining the lessons in stories.
- Stories as dynamic C.s.4: The student demonstrates an understanding of the dynamic nature of stories by:
 - [E]C.s.4.1: Enjoying stories
 - [E]C.s.4.2: Having opportunities to identify with stories and their characters.
 - [B]C.s.4.1: Choosing a story and explaining why he/she likes it.

Relationships:

- Relationships: Spirituality C.r.2: The student uses knowledge of traditional Iñupiaq culture to:
 - [E]C.r.2.1: Listen to stories that describe a person's relationship with sil̄a and all living things; experience a respectful relationship with sila outdoors; observe adults enacting relationships with the environment.

Unipkaat, Quliaqtuat, Uqaluktuat:

- U, Q, U: Oral tradition H.uqu.3: The student uses knowledge of oral processes of handing down information to:
 - [E]H.uqu.4.1: Listen to stories.
 - [E]H.uqu.4.2: Begin to tell personal stories and retell stories s/he has heard.

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:

Cooperation

Knowledge of Language

Love for Children

Respect for Elders

Alaska English/Language Arts Content Standards:

- Reading Standards for Informational Text K-5: Grade 4 Students: 7. Interpret information presented visually, orally, or quantitatively (e.g. in charts, graphs, diagrams, time lines, animations or interactive elements on web pages) and explain how the information contributes to an understanding of the text in which it appears.
- Reading Standards for Informational Text K-5: Grade 4 Students: 9. Integrate information from two texts on the same topic or related topics in order to write or speak about the subject knowledgeably.
- Reading Standards for Informational Text K-5: Grade 5 Students: 9. Integrate information from several texts on the same topic or related topics in order to write or speak about the subject knowledgeably.
- Speaking and Listening K-5: Grade 4 Students: 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clarity.
 - a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
 - b. Follow agreed-upon rules for discussions and carry out assigned roles.
 - c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.
 - d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

- Speaking and Listening K-5: Grade 5 Students: 1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clarity.
 - e. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
 - f. Follow agreed-upon rules for discussions and carry out assigned roles.
 - g. Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
 - h. Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.
- Speaking and Listening K-5: Grade 4 Students: 4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

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Joan Reynolds, Shungnak; Rochelle Skelly, Kotzebue

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

Iñupiaq Region of Alaska



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Activity 1: Storytelling

Time: 2 or 3 class periods (1 class period = 45 min)

Materials:

- Videos of elder's northern lights stories—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Northern Lights: The Soccer Trails by Michael Arvaarluk Kusugak
- Storytelling Reflections worksheet (one per student)
- Be a Storyteller worksheet (optional)

Standards Addressed:

- Alaska Cultural Standards: A.3, B.2, *D.1, *D.3
- Iñupiat Learning Framework: [E]E.e.3.3, [E]C.s.1.2, [E]C.s.2.1, [B]C.s.2.1, [E]C.s.3.1, [B]C.s.3.1, [E]C.s.4.1, [E]C.s.4.2, [B]C.s.4.1, [E]C.r.2.1, [E]H.uqu.4.1, [E]H.uqu.4.2
- Iñupiaq Cultural Values: Love for Children, Respect for Elders
- Alaska Science Content Standards: F.2, F.3
- Alaska English/Language Arts Content Standards: *RSIT K-5 Grade 4: 9, SL K-5 Grade 4:1, SL K-5 Grade 5:1, SL K-5 Grade 4:4
(*addressed in extensions only)

Background Information:

Different cultures use different strategies for teaching and learning. Some rely 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 during this activity teach cultural knowledge about the northern lights and encourage positive behavior related to health and safety.

Assessments:

- Storytelling Reflection worksheet provides a means of assessing student ability to:
 - acquire and share knowledge and insights from traditional stories;
 - apply Iñupiaq knowledge and lessons embedded in stories to the broader world of health and safety;
 - infer what is important in the story;
 - explain the lessons in stories;
 - identify the name and community of elders whose stories they listened to.
- Classroom discussion provides a means of assessing student ability to:
 - engage in conversation about stories;
 - 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

Activity Preparation:

1. Determine the best method for viewing the elders' northern lights stories in your classroom. The stories are available online at culturalconnections.gi.alaska.edu or can be pre-loaded on student computers using the Cultural Connections USB flash drive provided in the activity kit.

Storytelling:
Iñupiaq values: Love for Children, Respect for Elders

Visit culturalconnections.gi.alaska.edu (Multimedia) to hear stories about the **kiuguyat** from elders.

Choose and listen to two of the stories and discuss with a partner: What do the stories have in common? How are they different? Which did you like best? What are the lessons in these stories? What behaviors do they encourage and why are those behaviors important? What new Iñupiaq words did you learn, and what do they mean?

Pass it on: Retell one of the stories you heard to a friend or family member.



Activity Instructions:

1. Explain folklore is a combination of traditional stories, customs or beliefs passed down from generation to generation. Legends are part of folklore. Legends are traditional stories that often are believed by many people but cannot be proven to be true. Legends and folklore often encourage desirable behaviors or contain lessons for the listener. Ask students if they know any legends or folklore.
2. Distribute the Kiuḡuyat^{NS}/Kiuḡiyāq^{NP} The Northern Lights Elementary Guide and ask students to read pages 2-3. Explain to students that there are traditional Iñupiaq stories about the kiuḡuyat^{NS} / kiuḡiyāq^{NP}, or northern lights, and that they will watch videos of elders telling some of these stories.
3. Place students in small groups or pairs and ask each group to watch 3 or more stories and then compare and contrast the stories and discuss the behavior each story encourages.
4. Discuss as a class and write notes on the whiteboard, assisting with story interpretation as needed: What do the stories have in common? How are they different? Which story did you like best? What are the lessons in the stories? Why might parents and grandparents tell children these stories? What behaviors do these stories encourage and why are those behaviors important? (i.e. be home on time at night, wear your hood, be quiet when traveling in the country, don't walk alone, etc.) What do these stories tell us about the northern lights? 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.
5. Distribute the Storytelling Reflections worksheet. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet's title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet's title bar. Use the version that is most appropriate for your community. Ask students to complete the worksheets. Allow them to refer to the class discussion notes for ideas.

Extensions:

- Invite an elder into the classroom to tell his or her stories about the kiuḡuyat^{NS} / kiuḡiyāq^{NP}.
- Ask students to complete the Be a Storyteller worksheet to outline one of the kiuḡuyat^{NS} / kiuḡiyāq^{NP} stories. Ask students to practice retelling the story to a partner, and then tell the story to a family member.
- Read and discuss Northern Lights: The Soccer Trails—How is this story similar to and different from the stories that students heard from elders on the videos and in person?

Activity 2: Iñupiaq Northern Lights Vocabulary

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

ACTIVITY 2

Materials:

- Vocabulary card set (1 per group)
- Word Games Instruction Sheet (1 per group)
- Timers (optional)
- Iñupiaq multimedia (available online at: culturalconnections.gi.alaska.edu)
- iPads or computers
- Iñupiaq Northern Lights Vocabulary worksheet

Iñupiaq Northern Lights Vocabulary

Iñupiaq values: Knowledge of Language, Cooperation

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

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

Standards Addressed:

- Alaska Cultural Standards: B.1, 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 Preparation:

1. Pronunciation and spelling of Iñupiaq terms can vary depending upon the dialect spoken within a community. Ask your local Iñupiaq language teacher to check the vocabulary cards and multimedia to ensure they are accurate for your community. If schedules allow, invite the Iñupiaq language teacher to assist with teaching this activity.

Activity Instructions:

1. Ask students to try the Iñupiaq Vocabulary multimedia activity at culturalconnections.gi.alaska.edu to learn how to pronounce Iñupiaq words related to the northern lights.
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 groups of four.
 5. Provide each group with a printout of 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. Provide time for each group to play through the games.
 8. Discussion 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 difficult to guess, no matter what game you played?
 9. Distribute the Iñupiaq Northern Lights Vocabulary Worksheet and ask students to complete it. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet's title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet's title bar. Use the version that is most appropriate for your community. Provide review as needed.
 10. Consider asking students to practice the vocabulary words or play a vocabulary game for 10-15 minutes each day while teaching the Learning Through Cultural Connection: the Northern Lights unit.

Connections and Extensions:

- Ask students to create their own word games to help each other learn new Iñupiaq words.
- Using whiteboard 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.
- Create a Focus Wall in your classroom by printing the vocabulary terms and posting them on the wall, along with the Creating the Northern Lights poster and other key concepts and ideas from the activity kit.

Activity 3: Welcome the Sun Dance

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

Materials:

- Video of Welcome the Sun Dance—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Globe
- Flashlight
- Drum recording (optional)
- Dance Reflections worksheet (one per student)

Standards Addressed:

- NGSS: ESS1.B: Earth and the Solar System: 5-ESS1-2
- Alaska Cultural Standards: A.3, B.2
- Iñupiat Learning Framework: [E]C.sd.1.1, [E]C.sd.1.2, [B]C.sd.1.1, [E]C.sd.3.2,
- Iñupiaq Cultural Values: Cooperation
- Alaska Science Content Standards: D.3, F.2, F.3
- Alaska English/Language Arts Content Standards: RSIT K-5 Grade 4: 7, SL K-5 Grade 4:1, SL K-5 Grade 5:1

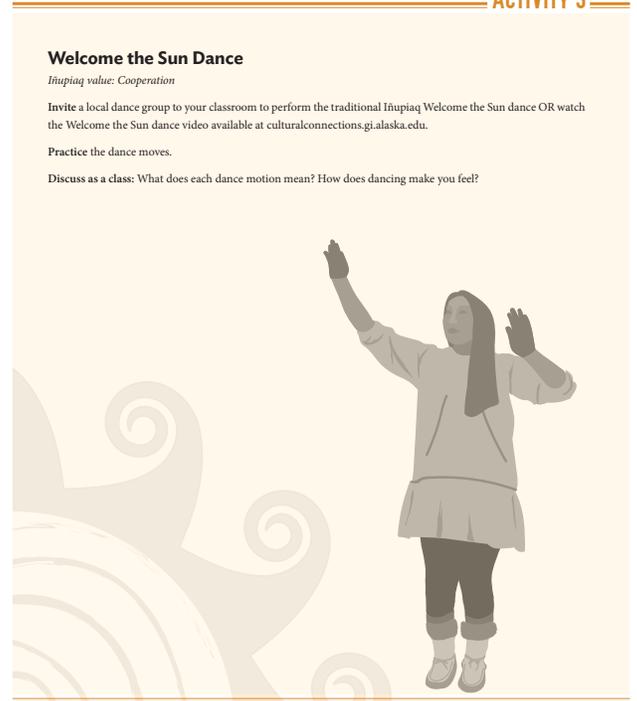
Background Information:

Winter in the far north is characterized by short days and long nights. If the sun is up, it remains close to the horizon, as Earth's tilt on its axis points the northern regions away from the sun during this season. In some areas, the sun sinks below the horizon and does not reappear for weeks or months at a time. During this period of darkness, natural light comes in the forms of moonlight, starlight, and sometimes the glow of the northern lights. The Iñupiaq Welcome the Sun dance celebrates the return of the sun. Each motion in an Iñupiaq dance has its own meaning. Some are specific to the individual dance theme, such as the sunrise hand motion. Others are of broader cultural significance and common to many dances, such as the eagle's heartbeat maintained by consistent knee bending to the rhythm of the drum.

Please Note: Iñupiaq communities do not dance for a period of time after someone in the community dies. Ensure that the timing of this lesson is culturally appropriate by asking a local dancer or knowledge bearer.

Assessments:

- Dance Reflection worksheet provides a means of assessing student ability to:
 - explain Earth's tilt on its axis causes darkness during the winter months;
 - illustrate and describe the meaning associated with traditional dance motions;
 - make connections between traditional dance and the position of the Earth relative to the sun;
 - illustrate and describe how dancing makes them feel.
- Classroom discussion and observation provides a means for assessing student ability to:
 - demonstrate understanding of the relationship between singing and dancing and the Iñupiaq language by viewing a dance and discussing;
 - demonstrate awareness and appreciation of the relationships and processes of interaction of all elements in the world around them by drawing connections between.



Activity Instructions:

1. Distribute the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide and ask students to read pages 4-5.
2. Use a flashlight and a globe to demonstrate how Earth's tilt on its axis causes a period of darkness during winter for communities in the far north.
3. As a class, discuss how seasonal differences in the amount of sunlight affect the things students do and how they feel. Explain the Iñupiaq Welcome the Sun dance celebrates the return of the sun.
4. Show your class the Welcome the Sun dance video and practice the song and dance moves together. Students can dance along with the video, or use the recorded drum music to dance without the video.
5. Start a class discussion. Encourage students to share how the dance makes them feel and what they believe each dance move means. Ask: How does this traditional dance help us understand scientific concepts related to the positions of sun and Earth? How do the motions of the dance illustrate motions of the sun? Were there any dance motions that were not explained? If so, what do you think those motions might illustrate?
6. Distribute the Dance Reflections worksheet and replay the video, pausing upon request to provide students with a model for sketching the dance moves. Clarify that students may draw a stick figure as their sketch.

Extension:

- Invite a local dance team to help students learn the Welcome the Sun dance or another traditional dance.
- Visit <https://www.brainpop.com/science/space/seasons/> to share a short animated video about seasons with your students.

Activity 4: Magnetic Fields

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

Materials:

- Navigational compasses
- Magnetic field viewers
- Magnets (assorted shapes and sizes)
- Earth's Magnetic Field vocabulary card OR Creating the Northern Lights poster
- Magnetic Fields Worksheet

Standards Addressed:

- Alaska Cultural Standards: B.1
- Inupiat Learning Framework: [B]E.e.3.4
- Inupiaq Cultural Values: Cooperation
- Alaska Science Content Standards: A.1
- Alaska English/Language Arts Content Standards: RSIT K-5 Grade 4: 7

Background Information:

Earth is surrounded by a powerful magnetic field generated by the movement of molten metal within its core. This magnetic field is known as the magnetosphere and is strongest near the north and south poles of Earth, much like the magnetic field that surrounds a bar magnet. The solar wind distorts Earth's magnetic field. It compresses it on the side that faces the sun and stretches it into a long tail on the side that faces away from the sun. This tail is known as the magnetotail.

Assessments:

- Magnetic Fields worksheet provides a means of assessing student ability to:
 - investigate scientific questions by making and recording observations;
 - observe and illustrate characteristics of magnetic fields within the world around them.
- Discussion provides a means of assessing student ability to:
 - acquire insights about from other cultures without diminishing the integrity of their own.

Activity Preparation:

1. Determine whether the navigational compasses in your Learning through Cultural Connections: the Northern Lights Activity Kit work in your classroom. Equipment and structures can sometimes prevent compasses from working reliably indoors. If this is the case, omit the compass portion of this activity or conduct it outdoors.

Activity Instructions:

1. Ask students to work with a partner to read pages 6-7 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide.
2. Discuss: Can we see Earth's magnetic field? How do we know it is there? Where is Earth's magnetic field strongest?

Magnetic Fields

Inupiaq value: Cooperation

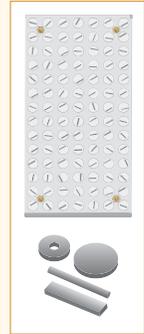
Did you know that every magnet has an invisible magnetic field around it? You can place magnets on a magnetic field viewer to see the shape of the field around different magnets.

Materials:

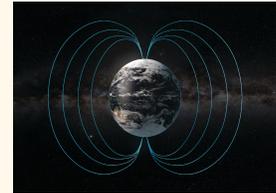
- Magnetic field viewer
- Magnets of different shapes

Procedure:

1. Working with a partner or small group, set the magnetic field viewer on a flat surface.
2. Place a magnet on top of the viewer. Do not move the magnet.
3. Watch the iron rods in the viewer align with the magnetic field.
4. Sketch what you see.
5. Repeat steps 2-4 with magnets of different shapes and sizes.



Discuss: Where was the magnetic field strongest around each magnet? How were the fields different around different magnets? How were the fields similar? Which magnet's field most closely resembled the shape of Earth's magnetic field?



3. Distribute compasses. Explain the needle on a compass is attracted to Earth's magnetic north pole because of the magnetic field that surrounds Earth. Ask students to work with a partner or small group to use their compass to find the direction of Earth's magnetic north pole. Ask each group to point in the direction their compass indicates as North.
4. Collect compasses and distribute magnetic field viewers, magnets, and Magnetic Field Worksheets to each group of students. Ask students to use the viewers to discover the shape of the magnetic field around magnets of different shapes, and sketch their observations.
5. When sketches are complete, discuss the shape of the field around each magnet. Which most closely resembles the magnetic field around Earth? Show students the vocabulary card featuring Earth's Magnetic Field or the Creating the Northern Lights poster if they need a visual of Earth's magnetic field. How is Earth's magnetic field connected to the northern lights?

Connections and Extensions:

- Exploring Magnets! Distribute magnets to pairs of students and ask them to learn about the magnets by using them. What do they stick to? Do they have to touch something to attract it? Are magnets always attracted to each other?

Activity 5: Ask an Elder

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

Materials:

- Video or audio-recording device
- 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
- Iñupiat Learning Framework: [E]E.e.3.3, [E]C.s.1.2, [E]C.s.2.1, [B]C.s.2.1, [E]C.s.3.1, [B]C.s.3.1, [E]C.s.4.1, [E]C.s.4.2, [B]C.s.4.1, [E]C.r.2.1, [E]H.uqu.4.1, [E]H.uqu.4.2
- Iñupiaq Cultural Values: Love for Children, Respect for Elders
- Alaska Science Content Standards: F.2, F.3

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. Some schools host lunch for the elders, or have elder visitors in the building frequently. This is a good resource for elder input. If you are new to the community, ask your school secretary, administrator or Iñupiaq language teacher 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. Consider the weather when planning for elder interviews. Cold weather can make it more difficult for elders to come to school, and for students to go out into the community. It is important that students prepare a thank you card or small 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;
 - demonstrate understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.
- Elder interviews and role playing provide a means of assessing student ability to:
 - communicate respectfully 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.

Activity Preparation:

1. Determine the best method for interviewing elders in your community at this time of year, and prepare accordingly. Consider in-class interviews, student visits to elder homes, or asking students to discuss the northern lights with the elders and knowledge bearers in their families (without a worksheet) and then compile a consensus via class discussion afterward.

Ask an Elder

Iñupiaq value: Respect for Elders

Visit an elder in your community.

Ask in Iñupiaq: **Qullaqtuaġutlyumifacpija kluġuyatigun?** (Can you tell me about the northern lights?)

Record the interview if possible.

Ask the elder if they have any stories, songs or dances about the northern lights. When are the northern lights visible? What colors has the elder seen in the northern lights? Which colors are most common? Which are most unusual?

Activity Instructions:

1. Ask students to share their experiences, knowledge and stories related to the northern lights. Explain that elders are an excellent resource for learning more about the northern lights and that students will ask elders about their knowledge of the northern lights in a classroom interview or by visiting elders in the community (If no elders are available, show students the **Kiuḡuyat: The Northern Lights** video provided in the activity kit).
2. Teach students to ask about the northern lights in Iñupiaq:
Quliaqtuaḡutiyumiñaqpiḡa kiuḡuyatigun?^{NS} (Can you tell me about the northern lights?)
Sumik kulaiqḡiupina kiḡiuqzraqmik?^{NP} (Can you tell me about the northern lights?)
3. Remind students that when interacting with elders, it is very important to be respectful, caring and appreciative. Ask students to work in small groups to role-play respectful, caring and appreciative interactions with elders.
4. Distribute the Ask an Elder worksheet to guide student interviews with elders. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet's title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet's title bar. Use the version that is most appropriate for your community. Ask students to take notes on the worksheet as they are talking to elders about the northern lights. Do they have any stories that were told to them? Did they learn any dances? What colors has the elder seen in the northern lights? Which colors are most common? Which are most unusual?
5. After elder interviews are complete, ask students to share what they learned. Create a concept map about the northern lights as a class, to summarize northern lights information from local elders.
6. Ask students to make and deliver thank you cards to the elders they interviewed. Chalk pastels are available in the northern lights learning kit.

Connections and Extensions:

- Introduce the Data Collection worksheet associated with the Where are the Northern Lights Visible in Your Area? activity. Students can practice recording data using this worksheet. Follow-up with the Where are the Northern Lights Visible in Your Area? activity and combine data.
- Write about it! Encourage students to write journal entries about their experiences interviewing elders. What were some things they didn't understand? What were some questions they still had after the interview?

Activity 6: Diagramming the Northern Lights

Time: 1 class period for activity plus 1-3 class periods to build background knowledge if your class has not yet studied the solar system (1 class period = 45 min)

Materials:

- Laptop or tablet device
- **Kiuḡuyat: The Northern Lights** video
- Creating the Northern Lights poster
- Sticky notes
- Colored pencils or other art materials
- Diagramming the Northern Lights worksheet

Standards Addressed:

- NGSS DCI: Energy PS3.B Conservation of Energy and Energy Transfer
- Alaska Cultural Standards: B.1, E.4
- Iñupiat Learning Framework: [E]E.e.1.5, [E]E.e.3.2,
- Iñupiaq Cultural Values: Knowledge of Language
- Alaska Science Content Standards: B.2
- Alaska English/Language Arts Content Standards: RSIT K-5 Grade 4: 7

Background Information:

There are three things necessary for a planet to have aurora ovals. It must: 1) be in the path of the solar wind; 2) have a magnetic field, and 3) have a thick atmosphere of gases.

Solar wind: The sun is a bright star at the center of our solar system. It is the source of nearly all of the energy on Earth. The sun constantly blows charged particles out into space, in what is known as the solar wind. Huge explosions on the sun (known as coronal mass ejections) can send many more particles hurtling into space, sometimes in Earth's direction.

Magnetic field: The movement of molten metal deep within Earth produces a magnetic field. This magnetic field surrounds Earth and protects it from the solar wind. The constant pressure of the solar wind distorts Earth's magnetic field. It compresses the field on the side that faces the sun, and stretches it out on the dark side of Earth, much like the wake left behind a boat as it passes through water. Earth's magnetic field acts as a buffer. It protects Earth from most of the charged particles the solar wind carries, by deflecting the wind around Earth. Some charged particles get caught in Earth's magnetic field. They travel along the magnetic field toward Earth's poles. This causes the aurora ovals to form around the magnetic poles.

Atmosphere of gases: Earth is covered by a thick atmosphere of gases, made mostly of nitrogen and oxygen. The charged particles follow Earth's magnetic field lines to enter the atmosphere near Earth's poles. The charged particles slam into and transfer energy to gas particles in Earth's atmosphere, causing them to glow like a neon sign. This creates the northern lights. In the far north, the aurora can be seen on most dark, clear nights, but an especially strong aurora usually occurs after a storm on the sun. It takes one to four days for the solar wind to reach Earth.

Assessments:

- Class discussion will provide a means of assessing student ability to:
 - acquire insights from other cultures without diminishing the integrity of their own;

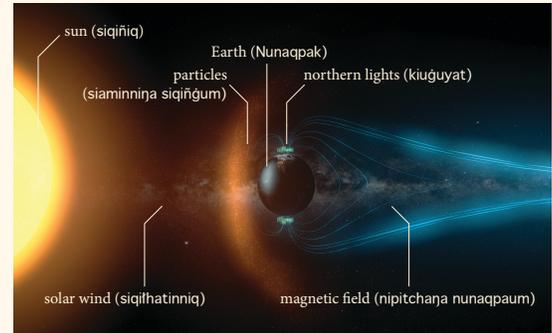
Diagramming the Northern Lights

Iñupiaq value: Knowledge of Language

Watch the video *Kiuḡuyat: The Northern Lights*.

Create a drawing of how the northern lights are formed. Include and label the following in English and Iñupiaq:

- Northern lights/**kiuḡuyat**
- sun/**siqĩñiq**
- Earth/**Nunaqpak**
- solar wind/**siqĩhatinniq**
- particles/**siaminnija siqĩḡum**
- Earth's magnetic field/**nipitchaja nunaqpaum**



- explain how ideas and concepts from one knowledge system relate to those derived from other knowledge systems.
- Student diagrams on the Diagramming the Northern Lights worksheet will provide a means of assessing student ability to:
 - demonstrate 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 by drawing a diagram of the northern lights;
 - demonstrates an understanding of the relationship between the environment and the Iñupiaq language by identifying and naming objects in the sky.

Activity Instructions:

1. Hang the Creating the Northern Lights poster where everyone in the classroom can see it.
2. Ask students to work with a partner to read pages 4-9 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide. Discuss the diagram on page 9 and the role of each labeled item in creating the northern lights. Emphasize that the northern lights occur when energy from solar particles is transferred to gas particles in Earth's atmosphere, causing them to light up. As a class, practice pronouncing each vocabulary term on the diagram in English and Iñupiaq.
3. Explain students will watch a video that shares cultural and science information about the northern lights, and then use what they have learned from their student guide and the video to draw and label a picture illustrating the scientific process that causes the northern lights.
4. Show the video Kiuḡuyat: The Northern Lights (available as a DVD in this Activity Kit and online at culturalconnections.gi.alaska.edu)
5. Discuss as a class: What was something new that you learned from the video? How are the things you learned in the video related to what you learned from the elders? How is energy transferred from one place to another in the creation of the northern lights? What does Earth need in order to have northern lights near the poles (solar wind, magnetic field, atmosphere of gases)?
6. Distribute the Diagramming the Northern Lights worksheet and colored pencils. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet's title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet's title bar. Use the version that is most appropriate for your community. Ask students to create a drawing of how the northern lights are formed. Include and label the following in English and Iñupiaq. Show poster and repeat video science animations as needed. Model labeling using sticky-notes on the poster.

northern lights/ kiuḡuyat^{NS} / kiuḡiyaq^{NP}

sun/siqiñiq^{NS}/mazaq^{NP}

Earth/Nunaqpak^{NS/NP}

solar wind/siqiḡhatinniq^{NS}/massam anuḡiḡa^{NP}

particles/siaminnina siqiḡḡum^{NS}/aḡivlat^{NP}

Earth's magnetic field/nipitchaḡa nunaqpaum^{NS}/Northern Seward Peninsula Iñupiaq term not available

Connections and Extensions:

- Act it out! Conduct a talk show featuring an “on-the-scene news report.” Interview solar particles, oxygen atoms (high- and low-altitude), nitrogen atoms, the sun, Earth, and people on the ground about their experiences with creating the northern lights.
- Build background knowledge about the atmosphere! Find The Dr. Bincos Show video titled Layers of

Atmosphere online and share this short animated video about the atmosphere with your students.

- Act it out! Act out the process of the solar wind, magnetic field and atmosphere.
- Label the solar system! Build background knowledge about the solar system by discussing themes such as: 1) the position of the planets (Mnemonic device for planet order: My Very Educated Mother Just Served Us Nine Pizzas); 2) Pluto's downgrade to a dwarf planet; 3) the length of years and temperatures found on planets. Ask students to label the planets on a diagram of the solar system.

Activity 7: Like a Neon Sign

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

Materials:

- Laptop, computer or iPad
- Glowing Gases multimedia activity—available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit
- Colored pencils
- Like a Neon Sign worksheet

Standards Addressed:

- NGSS: (Grade 4) DCI: Energy PS3.B: Conservation of Energy and Energy Transfer
- Alaska Cultural Standards: B.1
- Inupiat Learning Framework: [E]E.e.3.2
- Alaska Science Content Standards: B.2
- Alaska English/Language Arts Content Standards: RSIT K-5 Grade 4: 7

Background Information:

Energized particles get caught in Earth's magnetic field and travel along the magnetic field lines to enter Earth's atmosphere near the poles. The charged particles slam into and energize gas particles in the atmosphere. This transfers energy to the gas particles and causes them to glow like a neon sign. This glow is known as the northern lights. Different gases glow different colors. High altitude oxygen glows red. Oxygen that is lower in the atmosphere glows green, and nitrogen glows a pale purple. Pale purple northern lights often appear white or pale blue because it is difficult for the human eye to perceive their purple color.

Assessments:

- Student responses on the Like a Neon Sign worksheet provide a means of assessing student ability to:
 - explain that energy transferred by electrical current into a tube containing gas particles can be used to produce light;
 - identify the colors associated with different gases in the atmosphere.
- Class discussion will provide a means of assessing student ability to:
 - express consciousness of phenomena such as the northern lights and neon signs in the world that surrounds them.

Activity Instructions:

1. Ask students to work with a partner to read page 10 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide.
2. Ask students to visit culturalconnections.gi.alaska.edu and try the glowing gases multimedia activity.
3. Discuss how charged particles cause gas particles to glow. Distribute colored pencils and the Like a Neon Sign worksheet, and ask students to complete the worksheet.
4. Discuss as a class: Have you seen the northern lights? What colors have you witnessed? Where have you seen a neon sign in our community? Other communities? How are the northern lights similar to a neon sign? Where does the energy come from that creates the northern lights? Where does the energy come from that lights up a neon sign?

ACTIVITY 7

Like a Neon Sign:

Visit culturalconnections.gi.alaska.edu.

Try the Glowing Gases multimedia activity.

Discuss: How are the northern lights like a neon sign?



Connections and Extensions:

- Public education poster: Have students design a poster illustrating how the northern lights are like a neon sign. Work with a local business to display the poster near a neon sign.
- Watch the Aurora Borealis/Educational Video from NASA Connect for more information about legends and science surrounding the northern lights. The video is available online via YouTube.

Activity 8: Northern Lights in a Tube

Materials:

- Tube cartridges filled with different gases (neon, nitrogen, carbon dioxide)
- Spectrum Tube Carousel Power Supply to transfer electrical energy to gas tubes
- Northern Lights in a Tube worksheet (3 pages)
- Colored pencils
- Spectrum lenses (optional)
- Creating the Northern Lights poster

Standards Addressed:

- NGSS: (Grade 4) DCI: Energy PS3.B: Conservation of Energy and Energy Transfer, 4-PS3 Energy: 4-PS3-2
- Alaska Cultural Standards: B.1
- Inupiat Learning Framework: [E]E.e.3.2
- Alaska Science Content Standards: A.1, B.2

Background Information:

The solar particles blasting toward Earth on the solar wind are highly charged with energy. When these particles enter Earth's atmosphere, they encounter gas particles. Some of the energy from the solar particles is transferred to the gas particles, exciting the gases and causing them to glow. This glow is known as the northern lights. The process that causes the northern lights is very similar to the process that causes neon signs to glow. In a neon sign, electrical energy enters a tube filled with gas particles. As the energy transfers to the gas particles in the tube, it excites the particles and they give off light. The inquiry activity below will help students understand that electrical energy can be transferred to gas particles to produce light. Different gases produce different colors of light.

Most of Earth's atmosphere consists of nitrogen (~78%) and oxygen (~21%). Nitrogen produces pale purple northern lights. Oxygen at different altitudes produces green or red northern lights. A nitrogen gas tube is provided to conduct this activity, along with neon and carbon dioxide (no oxygen gas tube was available). When charged with energy, other gases produce light as well. Carbon dioxide makes up 0.04% of Earth's atmosphere (NOAA: <http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html>). Neon makes up .0018% (NASA: <http://spacemath.gsfc.nasa.gov/astrob/10Page8.pdf>).

Assessments:

- Class discussion will provide a means of assessing student ability to:
 - acquire insights from other cultures without diminishing the integrity of their own;
 - explain that energy transferred by electrical current into a tube containing gas particles can be used to produce light.
- Student responses on the Northern Lights in a Tube worksheet will provide a means of assessing student ability to:
 - explain that energy transferred by electrical current into a tube containing gas particles can be used to produce light;
 - make observations to provide evidence that energy can be transferred by electrical currents;
 - express consciousness of the world that surrounds and encompasses him/her by drawing connections between the effects of a charge on gases in discharge tubes and the effects of charge on gases in the atmosphere;

Northern Lights in a Tube:

What happens when electrical energy is transferred to different types of gas particles? You can use tubes of gas and a power supply to find out. We've learned that the bright lights we see in northern lights are mostly caused by energized oxygen and energized nitrogen. In this experiment, we will see how nitrogen glows, and we will also test two other gases: neon and carbon dioxide. Perform this experiment with the gas tubes and power supply that has been included in your northern lights learning kit.

Materials:

- Tubes filled with different gases (neon, nitrogen, carbon dioxide)
- Power supply to transfer electrical energy to gas tubes
- Northern Lights in a Tube worksheet
- Spectrum slides (optional)
- Colored pencils

Procedure:

1. Make a hypothesis (educated guess) — what do you think will happen when different gas tubes are plugged into the power supply so that electrical energy is transferred to the gas particles in the tube?
2. Test your hypothesis by asking your teacher to insert each tube into the power supply. It will help to turn off the classroom lights.
3. What happened with each tube? Record your observations by sketching and writing about what you see. Look at the tube through a spectrum slide to add more detail to your observations.
4. Form a conclusion: What did you find out? What evidence supports this conclusion? Was your hypothesis proved or disproved?

Connect it: How does this relate to the northern lights?

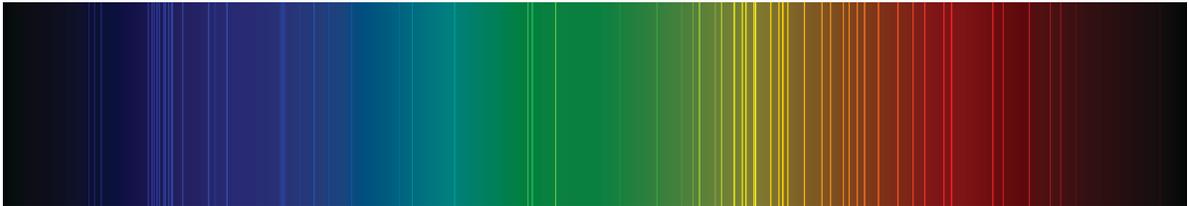


- understand that energy appears in different forms, can be transformed, and can be transferred or moved from one place or system to another, and may be unavailable for use.

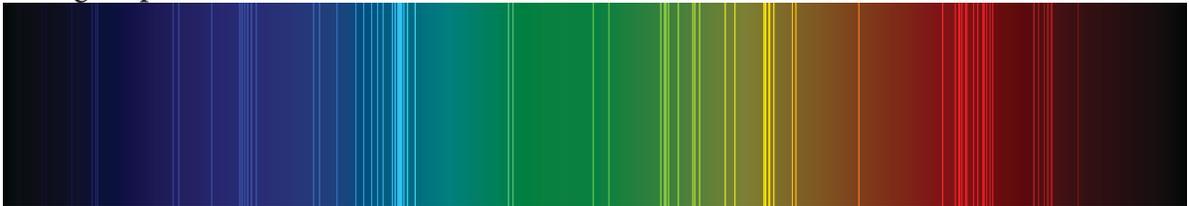
Activity Preparation:

1. Load the gas tubes into the carousel power supply by turning the carousel until an empty location aligns with the tube insertion hole. Insert the tube with the round magnet cover on the back of the tube facing down. Turn the carousel and repeat until all three tubes are loaded. Test the gas tubes by plugging in the power supply and rotating each tube to the front of the carousel (opposite the power switch). Turn the switch on for each test. Tubes should light up.
2. Decide whether or not to use the spectrum lenses with your students. *To use the spectrum lenses*, turn off all lights in the classroom and close the window shades if possible. Turn on the power supply so that one of the tubes lights up. Standing 3-8 feet from the tube, cover one eye with your hand and hold the lens close to your other eye. Look through the lens at the gas tube. If you are using your right eye, you should see a spectrum pattern of diffracted light to the right of the tube. If you are using your left eye, the pattern will be to the left of the tube. Some parts of the spectrum will be bright, while others are dim or dark (see sample images below). Change gas tubes and observe how the parts of the spectrum that are bright and dark change when different gases are excited. **Warning: Do not touch the tube. It gets very hot and will burn.**

Neon spectrum



Nitrogen spectrum



Nitrogen spectrum graphic from Wikimedia at https://commons.wikimedia.org/wiki/File:Nitrogen_spectrum_visible.png. Neon spectrum graphic from Wikimedia at from Wikimedia at https://commons.wikimedia.org/wiki/File:Neon_spectrum_visible.png. Both graphics by McZusatz, produced for Matlab by Neill Tucker (not copyrightable). Obtained September 13, 2016.

Activity Instructions:

1. Ask students to work with a partner to read pages 10-11 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide. Review the process by which the northern lights are created using the Creating the Northern Lights poster. Emphasize the collision of charged particles with gas particles that creates the lights.
2. Distribute Northern Lights in a Tube worksheets, colored pencils and spectrum lenses (optional) to students. Place the carousel in an area that is visible to all students.
3. Ask students to complete the Hypothesis sections of their worksheets.
4. Turn off lights in the room and close the window shades if possible. Assist with the experiment by installing each gas tube in the carousel and turning it on. **Warning: Do not touch or allow students to touch the tube. It gets very hot and will burn.**

5. If using the spectrum lenses, have students gather near the carousel. Demonstrate and explain how to use the lenses, and give all students time to observe the tube with the naked eye and through the spectrum lens before changing tubes.
6. Assist students as they complete their observations and form their conclusions.
7. Discuss as a class: What inferences can you make about gases in the atmosphere now? How is what happens in the gas tubes similar to what happens in Earth's atmosphere during an aurora display? Encourage students to identify which parts are playing the key roles in simulating the northern lights. How did your hypothesis compare to the results?

Connections and Extensions:

- Publish Results! Part of the scientific method is sharing results. Encourage the students to find a lesson in their results and use it to tell a story or compose a song that can be shared.

Activity 9: Kiuguyat^{NS}/Kiugiyaq^{NP} Karaoke

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

Materials:

- Laptop, computer or iPad
- Projector and screen
- Elder Interview multimedia (available online at culturalconnections.gi.alaska.edu or on the Cultural Connections USB flash drive provided with the activity kit)
- Kiuguyat^{NS}/Kiugiyaq^{NP} Karaoke worksheet

ACTIVITY 9

Kiuguyat Karaoke

Iñupiaq values: Respect for Elders, Knowledge of Language

Visit culturalconnections.gi.alaska.edu (Multimedia) to hear songs from elders.

Discuss with your class: What do these songs have in common? How are they different? Why did Fannie and Laura sing to the northern lights?

Learn one of the songs and sing it next time you are watching the lights dance.



Standards Addressed:

- Alaska Cultural Standards: B.2. *D.1
- Iñupiat Learning Framework: [E]E.e.1.5, [B]C.sd.1.1, [E]C.sd.3.2, [E]C.s.2.1, [B]C.s.2.1
- Iñupiaq Cultural Values: Respect for Elders
- Alaska Science Content Standards: A.3, F.2, F.3 (*addressed in extensions only)

Background Information:

Karaoke is a digital, sing-along accompanying device. It uses prerecorded musical accompaniments and a slideshow of lyrics. The words highlight as it comes time to sing them. On top of the accompaniment, the melody of the vocals usually plays lightly as a guide. The songs in this karaoke experience cannot be found on other karaoke software. These traditional songs about the northern lights have been sung by children across the Iñupiaq region for generations. A transcription and translation of each song follows:

Fannie Akpik's song:

Iñupiaq: Kiguyakkii, kiguyakkii, aanjyanjyaa

English: Northern lights, northern lights, aanjyanjyaa

Iñupiaq: Qalutaqpiiññaq qalutaqpiiññaq aanjyanjyaa iiq!

English: Get dipped by the dipper, get dipped by the dipper aanjyanjyaa, scary!

Laura Smith's song:

Iñupiaq: Kiguyakkii! kiguyakkii! Aa yu gi, yu gi ya! Aa yu gi, yu gi ya!

English: Northern lights! Northern Lights! Aa yu gi, yu gi ya! Aa yu gi, yu gi ya!

Assessments:

- Participation in the Karaoke activity will provide a means of assessing student ability to:
 - learn an Iñupiaq song and listen to the rhythm of the song;
 - demonstrate knowledge of singing by enjoying the act of singing;
 - show respect for the elders performing the songs in the video.

- Student responses on the Kiuḡuyat^{NS}/Kiuḡjyaq^{NP} Karaoke worksheet will provide a means of assessing student ability to:
 - learn Iñupiaq words related to objects in the sky (northern lights, big dipper);
 - compare and contrast two northern lights songs.
- Class discussion will provide a means of assessing student ability to:
 - make effective use of knowledge, skills and ways of knowing about the northern lights from a cultural perspective to learn about the northern lights as a whole.

Activity Instructions:

1. Ask students to work with a partner to read pages 12-13 of the Kiuḡuyat^{NS}/Kiuḡjyaq^{NP} The Northern Lights Elementary Guide.
2. Visit culturalconnections.gi.alaska.edu or use the USB flash drive provided with the activity kit to hear songs from elders:
 - a. Fannie Akpik of Barrow
 - b. Laura Smith of Selawik
3. Share the songs with the class without other distractions and encourage students to listen.
4. Discuss as a class: What words can students pick out of the songs? What do these songs have in common? How are they different? Why did Fannie and Laura sing to the northern lights?
5. Distribute the Kiuḡuyat^{NS} / Kiuḡjyaq^{NP} Karaoke worksheet. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet's title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet's title bar. Use the version that is most appropriate for your community. Play the songs again and ask students to complete their worksheets.
6. Use the multimedia to learn one of the songs as a class. Encourage students to sing it next time they are watching the lights dance. Consider performing the song for a group of elders, community members, or a class of younger students.

Connections and Extensions:

- Make it! Using PowerPoint and the animation applications, students can make karaoke slides for their own aurora songs.
- Extend! Develop a dance to accompany the northern lights song. Perform it for elders in your community. Ask local elders to share any songs they know about the northern lights.

Activity 10: When are the Kiuguyat^{NS}/Kiugiyaq^{NP} Visible in Your Area?

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

ACTIVITY 10

Materials:

- Creating the Northern Lights poster
- Data Collection worksheet
- Data Analysis worksheet
- Large paper or whiteboard/chalkboard
- Markers/chalk

Standards Addressed:

- NGSS: ESS1.B: Earth and the Solar System: 5-ESS1-2
- Alaska Cultural Standards: B.1, B.2, D.1, D.3
- Iñupiat Learning Framework: [E]C.s.4.1, [E]H.uqu.4.1
- Iñupiaq Cultural Values: Respect for Elders
- Alaska Science Content Standards: A.1, A.3, D.3, F.2, F.3
- Alaska English/Language Arts Content Standards: RSIT K-5 Grade 4: 7

Background Information:

Earth's rotation and tilt on its axis as it orbits the sun impact when and where the northern lights can be seen. The aurora oval hovers around the geomagnetic north pole year-round, but in order for the lights to be visible (even directly beneath the oval) the sky must be dark and clear. Earth is always rotating, and this rotation causes periods of daylight and darkness that we know as day and night. The side of Earth facing the sun experiences day, while the side facing away from the sun experiences night. During periods of daylight, the northern lights cannot be seen because the bright light of the sun obscures them. During the night, skies are dark enough to reveal the aurora. During winter, the far northern regions of Earth are tilted away from the sun. Days grow shorter, and nights longer, until in some areas the sun sinks below the horizon and does not appear again for weeks at a time. Times of darkness are good times to look for the northern lights. Other factors, such as cloud cover, geography and urban lighting also can affect whether people can see the northern lights when they are overhead. In this activity, students will interview community members to collect data on when the northern lights are visible from their area, then graph and look for patterns in the data that are the result of Earth's rotation and tilt as it orbits the sun.

Assessments:

- Student responses on Data Collection worksheets will provide a means of assessing student ability to:
 - engage effectively in learning activities that are based on traditional ways of knowing and learning;
 - collect data to investigate a scientific question.
- Student responses on Data Analysis worksheets will provide a means of assessing student ability to:
 - 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;
 - acquire insights from other cultures without diminishing the integrity of their own;
 - understand of the processes of science used to investigate problems, including conducting a repeatable scientific investigation;
 - understand how Earth's rotation, tilt and orbit affect cause observable patterns and affect when the aurora is visible.

When are the kiuguyat visible in your area?

Iñupiaq Values: Cooperation

Collect data from your parents, school staff or other community members about when they see the northern lights. Ask:

1. During which months are the northern lights visible?
2. What colors have you observed in the northern lights?
3. Where is a good place nearby to go to view the northern lights?

Create a class graph of all of the data. When is the aurora visible in your community? What colors were reported? Where can you go for the best views? What do the areas with the best views have in common?



Activity Instructions:

1. Briefly review the process that causes the northern lights. Refer to the Creating the Northern Lights poster.
2. Ask students which months are the best months to view the northern lights. Make a bar graph on the board or a large paper to show which month is preferred.
3. Discuss whether the experience from the class on its own is enough to determine the best month. Introduce the term “sample size” and explain how a larger sample size grants greater insight.
4. Ask students to read pages 12-14 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary Guide.
5. Distribute the Data Collection worksheet and ask students to communicate with elders, parents or others in their community to ask which months the northern lights are visible, what colors most often appear, and where are the best local places to view the northern lights. If you wish to complete this activity in one class period, ask students to interview adults in the school for this activity. Local administrators, principals, janitors, librarians, aides, maintenance workers, teachers and even high school students can be great resources to interview for this lesson. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet’s title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet’s title bar. Use the version that is most appropriate for your community.
6. After students have gathered their data, ask them to compile and analyze it as a class. Create a class bar graph showing which months were reported as best for seeing the northern lights. Create a class tally showing how many people reported night versus daytime as best for seeing the lights. Print or draw a map of your community and ask students to mark the locations that people reported as best for viewing the northern lights.
7. Discuss as a class: How does Earth’s rotation affect when the northern lights are visible? How does Earth’s tilt and orbit affect when the northern lights are visible? How does the information about Earth’s rotation, tilt and orbit connect to the information we learned from our community about when the northern lights are visible? What else affects when we can see the northern lights (i.e. clouds, lighted streets or homes etc.)?
8. Distribute the Data Analysis worksheet. Please note: There are two versions of the worksheet. The North Slope Iñupiaq version is indicated by the superscript ^{NS} in the worksheet’s title bar. The Northern Seward Peninsula Iñupiaq version is indicated by the superscript ^{NP} in the worksheet’s title bar. Use the version that is most appropriate for your community.
9. Ask students to answer the questions on their worksheet.

Connections and Extensions:

- Incorporate technology by marking favored locations to observe the northern lights in Google Maps or Google Earth.
- Visit <https://www.brainpop.com/science/earthsystem/solsticeandequinox/> to share a short animated video about seasons with your students.
- Watch the night sky near Fairbanks, Alaska by visiting <http://allsky.gi.alaska.edu>. This website shares live footage of the northern lights using an all-sky camera located at Poker Flat Research Range outside of Fairbanks. The camera feeds footage to the website only when skies are dark.

Activity 11: Illustrating the Northern Lights

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

ACTIVITY 11

Materials:

- Black or other dark construction paper
- Oil or Chalk Pastels
- Strips of white paper (for captions)

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: RSIT K-5 Grade 5:9, SL K-5 Grade 4:1, SL K-5 Grade 5:1

Illustrating the Northern Lights

Materials:

- Black construction paper
- Oil or chalk pastels

Illustrate the northern lights using pastels on black paper. Include something new that you learned about the northern lights in your illustration.

Caption the illustration with a sentence that begins: *I learned that...*



Background Information:

The Learning through Cultural Connections: The Northern Lights activity kit emphasizes physical and Earth science processes as well as Iñupiaq stories, dances, songs and terminology related to the northern lights. This final lesson is designed to serve as cumulative review of the unit. For additional background information about the northern lights from both knowledge systems, please see the “Background Information” sections of the previous lessons in this manual.

Assessments:

- Student illustrations, captions 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 work with a partner to read page 14-15 of the Kiuḡuyat^{NS}/Kiuḡiyaq^{NP} The Northern Lights Elementary 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, and a strip of white paper to each student. Ask students to illustrate the northern lights using the pastels on the black paper. Ask students to include in their illustration at least one thing that they learned during this unit, then write a short caption (on the white paper) that begins with the words: *I learned that...*

4. Display student 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 daring friends who find themselves walking home beneath the northern lights.
 - Write a comic about an energetic solar particle's journey through space.
- Aurora Reflections! Ask students to create their own concept maps about the northern lights and then work with a peer to expand them.
- Glow-In-The-Dark Aurora! Use glow-in-the-dark paint to create aurora scenes on dark paper. Hang the scenes in a school hallway and then turn off the lights to see the northern lights glow!