Big Idea:
The sun has different effects on the Earth's surface.
How can we use science to keep a playground cool in the summertime?

Guiding Questions:
How does sunlight affect the playground?
Imagine that we have been asked to design a new playground. How would we keep the sand, soil, rocks, and water found on the playground cool during the summer?
21st Century Themes/Skills:

DCI (Disciplinary Core Ideas)	Science and Engineering Practices	Cross Cutting Concepts	Student Learning Objectives	Differentiated Activities (Consider the 5 Es)	Resources/Technology	Formative Assessments	Benchmark Assessment
Sunlight warms Earth's surface. (K-PS3-1),(K-PS3- 2) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)	Make observations (firsthand or fr Ask questions based on observatio more information about the natura designed world(s). (K-2-ETS1-1)	Events have causes that generate o Scientists use different ways to stu (K-PS3-1)	Students will explore attributes of sand, soil, water and rock. Students will explore and communicate why certain areas of the playgroud are hotter than others on a sunny day.	Engage: Introduce sand, soil, water and rocks as four common materials on Earth' s surface. Elicit prior knowledge through a turn and talk: "where do we have you soil, water, rocks and sand around the school?" If possible show pictures using books or computer projector of where else these materials are found on Earth (difference landscapes/scenes).		Class discussion and accurately completed graphic organizers	
				Explore: In small groups, students will observe one material (sand, soil, water or rock) at each center. After touching and observing the materials students will draw and color it on the graphic organizer. Students will then move to the next station until they complete all four (5 min at each station).			
				Explain: Teacher will move around the stations and encourage students to participate in discussions to communicate their observations, by taking turns, listening to each other, sharing ideas and following rules of conversation.			
				Elaborate: Ask each group to share one observation about one material with the class, rotating around the student groups. Record their shared observations on chart paper set up in same the graphic organizer that students used. Emphasize the color of each material (and possible variations) for the next lesson as well as key vocabulary of: material, soil, sand, water, and rock. On the class chart, assign specific colors for each material to create a color key that will be used in the next lesson (e.g.,			
Sunlight warms Earth's surface. (K Asking questions, making observat gathering information are helpful i about problems. (K-2-ETS1-1)	Make observations (firsthand or fr Ask questions based on observatio more information about the natura designed world(s). (K-2-ETS1-1)	Events have causes that generate o Scientists use different ways to stu (K-PS3-1)	Students will explore and map the schoolyard or playground to describe different types of materials on Earth's surface. Students will be able to identify different surfaces based on the types of materials present through exploration and collaboratuve discussion.	Engage: Introduce the basic map of the schoolyard/playground. Orient them to the different components, structures, or areas that are included on the map. Tell students that they will be collecting information to create a map for use tomorrow. Outline today's activity and model how to match and color (using the color key created yesterday) an area on the map to indicate a particular surface (composed of a material or set of materials). For example, show a sandbox on map and color that area yellow.		Class discussion and accurately completed maps	
				Explore: **In pairs, students will identify playground surfaces looking for the materials that they explored in Lesson One. Students color their maps using the color keys from their graphic organizers. Additional colors may be needed for additional materials (such as grass or wood chips) or combinations of materials.**			
				Explain: **Introduce essential question #1: Why are different areas of the playground hotter than others on a sunny day? Ask students to consider whether the type of material might affect how hot a particular area of the schoolyard/playground can be.**			
				Elaborate:			
"Sunlight warms Earth's surface. (K-PS3-1),(K-PS3- 2) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) "	Make observations (firsthand or fr Ask questions based on observatio more information about the natura designed world(s). (K-2-ETS1-1)	Events have causes that generate o Scientists use different ways to stu (K-PS3-1)	Students will identify areas of the playground that have different temperatures and explore why some are warmer than others.	Engage: To elicit prior knowledge, have students turn and talk: Is sand the sand in the sandbox on the playground the same temperature all the time? How could you find out? a. Discuss concept and terms of temperature, warmer and cooler. For example: You can see the weatherman on television telling us what areas in New England will be warmer and cooler. The weatherman uses a thermometer to measure how warm or cold the weather is. The temperature tells us exactly how warm or cool it may be. b. Read Go Away, Sun by Pam Bull		Class discussion and teacher observation	
				Explore: Take children with their maps outside to an area on the playground that has the same surface in the sun and shade. Have a few students come forward and touch both the sunny and shady surface. Ask them which is warmer and which is cooler. Once students understand the activity, challenge them to find other places on the playground that have the same surface but different temperatures and mark them on their map.			
				Explain: **When students return from outdoors, have students sit at their tables and participate in discussions about these questions: "Was every surface the same temperature? Where were there differences?" Note that they should be taking turns, listening to each other, sharing ideas and following rules of conversation.**			

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"Sunlight warms Earth's surface. (K-PS3-1),(K-PS3- 2) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) "	Make observations (firsthand or fr Ask questions based on observatio more information about the natura designed world(s). (K-2-ETS1-1)	Events have causes that generate o Scientists use different ways to stu (K-PS3-1)	Students will compare the relative temperature of different colored (light/dark) materials placed in the sun. Students will explain why darker colored material get hotter than lighter colored materials.	**Engage:** **To elicit prior knowledge, show students picture men painting a roof white: http://www.examiner.com/images/blog/wysiwyg/image/painting-roof-white.jpg. Tell the students there a new movement to paint roofs of building in hot climates white like this. Do a Think-Pair-Share focused on "Why do think that is?"**	Class discussion of pictures or charts created in closing Quality of collaborative conversation		
				Explore: **Part 1, early in the day: Place white and black rocks in the sunny window. Students feel with their hands that the two rock piles start at the same temperature. Place some rocks in one container (large enough for students to put their palms in) in the sun and one container (large enough for students to put their palms in) in the shade. Do the same with soil. Students feel with their hands that the two containers of rocks start at the same temperature, as do the two containers of soil. Record their observations (drawings or descriptions).** **Part 2, later in the day: Later, have students feel the two rock piles to observe and change in temperature (the black should be warmer) and feel the remaining containers to discover that the rocks and soil in the sun are warmer and the ones in the shade are cooler.** **Give pairs of students 4 sticky notes: on first sticky note draw rocks in sun, second: rocks with no sun, third: soil in sun, fourth: soil with no sun. Challenge pairs of students to put the sticky notes in order from coolest to warmest.** **On the board, make 4 column chart labeled coolest to hottest. Have student stick their notes in the columns they think are appropriate. Review the set to articulate the relationship between warmth of each material and sun/shade.**			
				Explain: **Orchestrate a share out that focuses on the fact that each surface in the sun was warmer than the one in the shade. However, the effect of the sunlight's heat may be to a different degree depending upon the surface.** **Discuss: Why may that be? There are many variables (ex. how much air or water is in the soil sample) but color is also a factor. Have students use evidence from the activity as they explain their thinking.**			
				Elaborate: **Discuss with students that the color black or darker colors absorb more sunlight than lighter colors or white does. White and lighter colors reflect, or have the light bounce off, more**			
"Sunlight warms Earth's surface. (K-PS3-1),(K-PS3- 2) *Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)* "	Make observations (firsthand or from Ask questions based on observations t more information about the natural a designed world(s). (K-2-ETS1-1)	Events have causes that generate obse Scientists use different ways to study t (K-PS3-1)	Students will explore and observe different materials that warm up from sunlight in different amounts and at different rates	**Engage:** **Discuss the findings of yesterday that rocks and soil do not warm at the same rate when placed in the sunlight. To elicit prior knowledge, ask students to predict whether water and sand will warm at the same rate. Students may have more background knowledge to draw upon for this scenario. On chart paper note why they think the particular material will become the warmest in the sunlight. Elicit their reasoning for their thinking.**			
				Explore: **Part 1, early in the day: Place some sand in one container in the sun and one container in the shade. Do the same with water. Students feel with their hands that the two containers of sand start at the same temperature, as do the two containers of water. Record their observations (drawings or descriptions).** **Part 2, later in the day: Have students feel the containers to observe that the sand and water in the sun are warmer and the ones in the shade are cooler.** **Give pairs of students 4 sticky notes: on first sticky note draw sand in sun, second: sand with no sun, third: water in sun, fourth: water with no sun. Ask pairs of students to put the sticky notes in order from coolest to hottest.** **On the board, make 4 column chart labeled coolest to hottest. Have students stick their notes in the columns they think are appropriate.**			
				Explain: **Orchestrate a share out that focuses on the fact that each surface/material in the sun was warmer than the shade, however, the sunny sand (or even the shady sand) may be warmer than the sunny water. (Even if the shady sand is warmer than the sunny water, the sunny sand is warmer than the sunny water. Both of the following orders would be correct: shady water, sunny water, shady sand, sunny sand OR shady water, shady sand, sunny water, sunny sand.)** **Students describe their results and explain their thinking as to why that order.**			

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				Elaborate: **Compare previous predictions with actual outcomes of observations.**			
"Sunlight warms Earth's surface. (K-PS3-1),(K-PS3- 2) *Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)* *"*	Make observations (firsthand or from Ask questions based on observations t more information about the natural ar designed world(s). (K-2-ETS1-1) Develop a simple model based on evid represent a proposed object or tool. (K Analyze data from tests of an object or determine if it works as intended. (K-2	Events have causes that generate obse Scientists use different ways to study t (K-PS3-1)	Students will compare water and sand in the sun and shade to observe that these materials warm at different rates in sunlight.	**Engage:** **Have students close their eyes and imagine that they are at the beach. What do they see? Students turn and talk about what they imagine. Now show students a power point of various images of different types of beaches. Tell students that they will be working in groups, and they will be given a bag of tools and materials with which to design and build their beach model. Tell students that they are not making a real beach but a model of a beach.**		Class discussion with scientific language, and teacher observation. Observations of safe use of tools and materials.	
				Explore: **In groups of no more than 3, give students a bag of materials such as: sand, spoon, popsicle sticks, scissors, plastic knives, paintbrush to spread glue, straws, pipe cleaners, pieces of cloth, tape/glue, play-dough/clay to simulate rocks, black marker, cocktail sticks, a piece of cardstock or cardboard and a container of water to represent the ocean. Children working in groups need to agree with each other on the design of the beach, and all need to participate in the building.**			
				Explain: **Ask each group to explain the rationale for their design and why they chose the materials they did (e.g., Why did you use a rock face? Stony beach? White sand? Rock pools? Grasses?).**			
				Elaborate: **Carousel: Groups of students walk around to see each other's beach scenes.**			
Students will use tools and materials to build a model of a beach.	Make observations (firsthand or from Ask questions based on observations t more information about the natural ar designed world(s). (K-2-ETS1-1) Develop a simple model based on evid represent a proposed object or tool. (K Analyze data from tests of an object or determine if it works as intended. (K-2	Events have causes that generate obse Scientists use different ways to study t (K-PS3-1)	Students will use tools and materials to build a model of a beach.	Engage: Yesterday, you all built a model of a beach scene. Today we will be using that beach scene to solve a problem for two brothers, Harry Hot and Cool Carl. Story to Frame Task Two brothers, Harry Hot and Cool Carl, are spending the day at your beach. Harry is happy being hot. Carl likes to stay cool. Using what you have learned in this unit, how can you create an area where Harry can be hot and an area where Carl can be cool? Directions: Remind the students that there may be more than one solution to this problem. Walk them through the contents of the materials bag and tell them that they are not required to use these items but can use any of the items or tools in the bag that they want. However, they are required to use both Harry Hot and Cool Carl and predict and observe the different temperature in two areas. Do not hand out the bag until they have had time to discuss their plan in small groups. They also have to be able to explain why their solution would work. Tell students that scientists call the models they built prototypes. Tell them that a prototype is a model that works like the real thing. Encourage students to say and use the word throughout the lesson, including when describing their solution and presenting their explanation of why they built it as they did.			
				Explore: Students discuss collaboratively and design an initial plan in their groups (without bag of materials). When they can explain their plan, provide them with materials. Students create their prototype. When solution is ready and the two men are in position, place their beach scenario in the sun. For example, Cool Carl may be under a structure, under the cardboard (tunnel/burrow), or in a container of water next to their scene. As they wait (about 10-15 minutes, students should prepare their presentation: Explain to students that their task during their presentation is to answer the essential question: How can we stay cool at the beach on a sunny day? Their presentation must include: • The scientific reasoning for their design (What was the thinking behind your design?) • If their prototype worked (Did it work?) • How they know their prototype worked or didn't work [did they reduce temp] (How do you know?) • Scientific vocabulary (Use science words we've learned) After a period of time, have the students feel the temperature of the areas where the two men are and state which is warmer and which is cooler.			
				Explain: Groups of students present their solutions to the class using their beach scene to explain why it was or was not a viable solution. Encourage all students in the group to participate and answer questions using complete sentences. Possible strategies may include: • block sunlight (structure, tent, umbrella, cave, burrow, tunnel) • utilize materials that do not warm up as quickly (eg water)			
				Elaborate: If some solutions are not created the teacher can discuss those missing options with class.			