**Unit Essential Question:** *How do people use technology to survive in regions with different climates?*

**Introduction**

In some regions of the world, nature can be pretty extreme! Despite these extreme climate conditions, humans are somehow able to survive seemingly inhospitable regions on Earth. In this Lift-Off Task, students analyze photos of humans living in extreme climates and begin to generate questions about this phenomenon. These questions will guide students throughout the unit as they continue to make sense of extreme climates and use scientific ideas to design products that make living in these regions more bearable.

**Alignment Table**

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| **Performance Expectations** | **Scientific and Engineering Practices** | **Disciplinary Core Ideas** | **Crosscutting Concepts** |
| **MS-ETS1-1***.* **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** | **Asking Questions and Defining Problems**   * Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. | **ETS1.A: Defining and Delimiting Engineering Problems**   * The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. | **No CCC listed** |
| **Additional Crosscutting Concepts (\*depending upon student-generated questions)**   * Scale, Proportion, and Quantity   + Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. * Systems and System Models   + Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. * Energy and Matter   + Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.   + The transfer of energy can be tracked as energy flows through a designed or natural system. | | | |
| **Equity and Groupwork**   * Share and listen to broad and diverse student contributions. * Make connections between each other’s ideas. * Work together to co-construct a concept map. | | | |
| **Language**   * Use connector words to link ideas. * Generate and write questions about the phenomenon. * Organize key questions in a concept map. | | | |

**Learning Goals**

This learning task introduces students to the phenomenon of humans surviving in extreme climates and prompts them to begin generating questions that will guide them through the unit. More specifically, the purpose is to:

* Individually generate a list of questions about humans living in extreme climates, using observations from the images.
* Make connections between related questions.
* Generate possible answers to questions, using prior knowledge.
* Research and select a region with extreme weather and define the problem, including criteria and constraints.

**Content Background for Teachers**

In this task, students are introduced to examples of humans living in extreme climate conditions. While there are other extreme climate conditions besides temperature, we focus on extreme heat and extreme cold in this unit because of the thermal energy focus of the physical science content. Humans that live in extreme heat need to use various technologies to survive in this type of climate. For example, some people wear robes that allow air to flow through and cool the body. Others build homes surrounded by boulders, with large eaves for shading and insulated windows, so the house stays cool throughout the day. Humans that live in extreme cold also use technologies to survive in this type of climate. Most relevant to this unit are those that use insulators. For example, igloos use thick layers of ice as insulators to retain any body heat inside. Down jackets similarly act as a fantastic insulator by creating lots of tiny air pockets to trap warm air and retain heat. For more information on extreme climates and human technologies used to survive them, read the teacher versions for each task in this unit.

In this task, students create a concept map, which is a graphical tool that helps to organize and represent knowledge and questions, and is an effective academic language instruction tool. In this task, students will likely add only basic ideas relating to climate and technology. As students learn more about climate and thermal technologies, they will add more complex questions and ideas to this concept map. If your students have not had previous experience making concept maps, please see the instructions in Part B below for strategies on teaching this skill.

**Academic Vocabulary**

* Climate
* Extreme
* Problem
* Criteria
* Constraint

\*Additional academic vocabulary will vary by class

**Time Needed (Based on 45-Minute Periods)**

2 Days

* Introduction, Part A and Part B: 1 period
* Class Concept Map, Project Overview, and Project Organizer: 1 period

**Materials**

* Unit 2, Lift-Off Task Student Version

Part B

* Poster paper and markers
* Post-Its (Optional)

Part C

* Class Poster Paper and markers
* \*See Instructions below for other optional materials to use for the class concept map

Connecting to the Culminating Project

* Culminating Project Handout
* Project Organizer Handout
* Computers or Tablets (for research)

**Instructions**

1. Introduce students to the unit by reading or projecting the Unit Essential Question aloud.
2. Humans are able to survive in a wide variety of climates around the world. Some of these climates are very extreme! In this activity, students think about if they can imagine living in such extreme conditions.
3. First have students make some observations as they compare the photos in their student guides. The photos on the left show buildings and clothing in an extremely hot environment, and the photos on the right show buildings and clothing in an extremely cold environment.

* You can have students do this independently, in pairs, or in groups.

**Part A**

1. In this section of the task, students will generate questions to help them make sense of the phenomenon—humans surviving in extreme climates. Using these self-generated questions throughout the unit will help them get a better understanding of what causes extreme climates and what technologies humans can use to survive within them.
2. Have students complete this section individually in their student guide.

* For students who need more support, encourage them to look back at the pictures, and consider any questions they have.
* Here is a list of some potential questions students might generate: “What is the climate like in the photos on the left? What is the climate like in the photos on the right? Why can’t our bodies survive in extreme temperatures? Why do people live in these areas? Why do people wear black robes in hot weather? How could a house made of house possibly help keep people warm? Why do rocks surround the house in the desert? Why does the desert house have a long eave on one side? Why do puffy jackets help keep you warm? ”

**Part B:**

1. In this part of the task, students create a concept map as a group.

* Remind students to refer to the directions on their student guide to help them make their concept map. First, students should compare each member’s list of questions and record/connect key questions on a piece of poster paper. They will then draft possible answers to the questions, using prior knowledge.
* Remind students that there are no right or wrong questions or predictions, so students feel encouraged to contribute any and all questions and ideas they think of.
* Because this is a collaborative task, it is recommended that you remind students of group work norms and assign group roles, such as Resource Manager, Facilitator, Recorder, and Harmonizer (See “How to Use this Curriculum” for more details).

1. Students will display their posters on a wall and then walk around and look at each group’s ideas. One suggestion for gallery walks is for students to interact with the posters in some way. For example, students are required to initial or leave post-its on three questions that they are also excited about on other posters.

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| Macintosh HD:Users:laurenstoll:Downloads:Sample Concept Map (1).jpg**How to Concept Map**  For students with less experience making concept maps, we have detailed a strategy below for introducing concept mapping using more familiar content. An example is also provided, but this will vary depending on what your students come up with as you make your own model.   1. Write the phenomenon in the middle of the poster, in this case “Humans breathe harder when they exercise.” 2. Ask students to share questions they might ask to make sense of this phenomenon and make a list of these questions on the board. 3. Model the process of reviewing the list and finding similarities amongst the questions.    * Place these key questions on the concept map poster, modeling how to put similar questions near each other on the poster. Circle these to signify that these are questions, not content knowledge. 4. Ask students to look at the key questions and see if any of the questions are connected: Would answering one question lead to one of the other questions? Model making these connections by drawing arrows between the circles. 5. In this Lift-Off task, students will only be drafting possible answers to the questions, not actually gathering and recording learned concepts. However, throughout the unit, they will be adding content they have learned. Model this by recording a student’s prior knowledge to one of the questions, using boxes to signify that these are pieces of content knowledge rather than questions.    * Use connector words to identify the relationships between the content boxes (See image above for an example). 6. Optional: To emphasize crosscutting concepts using a concept map, make a key of different colors for the crosscutting concepts emphasized in this unit. Identify questions that clearly show evidence of the different crosscutting concepts and circle them with the corresponding colors. Explain to students how you made that choice by pointing out the language that hints at that crosscutting concept. \*Note: not all boxes and circles will necessarily have a crosscutting concept. |

**Part C**

1. Construct a whole-class concept map that begins to help students make sense of the phenomenon of humans surviving in extreme climates.

* Start with the phenomenon in the middle.
* Then ask students to share out the questions that were most common across all the posters in the classroom. As you record questions on the poster, organize them based on connections you see. Draw circles around each question (as you add to the concept map throughout the unit, you’ll also be adding concepts learned, which can be written in boxes to distinguish them from the questions).
* Ask students to identify any connections they see between the questions and record these as lines between the questions.
  + Recommended: Give pairs of students think time to come up with 1-2 connections to add to the class concept map and call on pairs using equity sticks. This encourages more equitable participation in this class-wide activity.
* The purpose of this concept map is to facilitate generation of student questions, promote language development, and support understanding of the science content throughout the unit. Allowing students to ask their own questions and use their own words to make meaning of the concepts will not only help them make deep connections about science content but will also help their oral and written language development.
* This whole class concept map will be revisited at the end of each task, asking students questions like: Are there any new questions you have about the phenomenon? Are there any connections you want to add or change? What is your reason for that addition/revision? Are there more connections we can make between the questions/ideas already on the map? Do you want to add any new ideas/concepts to the map?

1. Because this concept map will be added to and revised throughout the unit, here are some practical options for implementation.

* If you have access to white board paper, we encourage you to use these for class posters since it will allow you and your students to make revisions throughout the unit.
* Another option is to use smaller pieces of paper for each class and project using a document camera; this will save space as opposed to doing large class posters.
* We highly recommend students keep their own version of this concept map in their notebooks, adding questions and concepts as they go through the unit.

1. Once the draft concept map is complete, introduce students to the crosscutting concepts for this unit. We recommend posting posters of each crosscutting concept in your classroom (See beginning of teacher guide for templates).

* The crosscutting concepts for this unit are: Scale, Proportion, and Quantity; Systems and System Models; and Energy and Matter. Assign a color for each crosscutting concept that can be used throughout the unit.
* Have students analyze the class concept map for as many examples of the crosscutting concepts as they can find. Depending on the questions they have, they may be able to find an example of each of the crosscutting concepts or perhaps just some.
* We recommend modeling this process by picking a question, identifying the crosscutting concept, and tracing the circle in the corresponding color. Explain the key words that helped you identify the crosscutting concept in this question. Some identifying words that students might look for are:
  + **Scale, Proportion, and Quantity**: These could be phrases such as, “is proportional to”, “compared to”, “has a ratio of”, “is bigger/smaller than”, “is longer/shorter than”, etc.
  + **Systems and Systems Models**: These could be phrases such as, “is a part of” “connects to,” “interacts with,” “is made up of,” “works together with,” etc.
  + **Energy and Matter**: These could be phrases such as, “energy is transferred/flows,” “is conserved,” “is important for,” “is needed,” etc.

**Connecting to the Culminating Project**

1. Hand out the Culminating Project Task Card and read the Challenge and Group Project Criteria for Success aloud as a class.
   * Review some potential formats for their group presentation (poster presentation, Powerpoint, Prezi, physical demonstration, etc.)
   * Take questions for clarification.
   * Optional: As a class, brainstorm a list of some possible products that might make living in extreme conditions more comfortable. The purpose of this exercise is to emphasize that there is a large range of products (e.g., clothing items, types of homes, heating/cooling devices, etc.)
2. Pass out their Project Organizer and explain that they will complete a section of this after each task in class. After students research and decide on a region as a group, they should independently complete the rest of the Lift-Off Task section of the Project Organizer in class. Revisions can be done for homework, depending upon student’s needs and/or class scheduling.

* Students have been tasked to design a product that makes it more comfortable for people to live in a region with an extreme climate. The student prompt is as follows: Research a few different regions with an extreme climate (too hot or too cold). As a group, choose one of these regions to focus on for your culminating project and describe the extreme climate there. Then individually,
  + Define the **problem**: Why is it difficult to live in this region?
  + Identify the **criteria** for a successful solution: How will you know your product has solved the problem?
  + Identify the **constraints** of solving this problem: What might make it hard to solve this problem?

**Reflection**

1. At the end of the task, ask students to reflect on what they have learned over the course of this task by answering the following three questions in their student guide:
   * At the beginning of this task, you made a list of all the questions you have about humans surviving in extreme climates. Look back at your list: after learning from your peers, how can you add to your list? What kinds of things did you initially leave out? Use the class concept map to help you.
   * In this unit, we will be focusing on three crosscutting concepts: **Scale, Proportion, and Quantity**: Proportional relationships among different quantities tell us about the magnitude of processes; **Systems and System Models**:Models can be used to represent systems and their interactions; and **Energy and Matter**: The transfer of energy drives the motion or cycling of matter, and it can be tracked as it flows through a system. Looking at your class concept map, give one example of how a crosscutting concept came up in today’s task.
   * Now that you understand what project you’ll be working on over the course of this unit, what else do you need to know? What additional questions do you have?
2. There are no right answers but encourage students to look back at their initial lists and their class concept map. They should not change their initial responses, but rather use this reflection space to add to their questions and ideas based on what they have learned through this task. By generating more of their own questions, students continue to engage in sense-making of the phenomenon and the gathering of knowledge and skills for their final project.