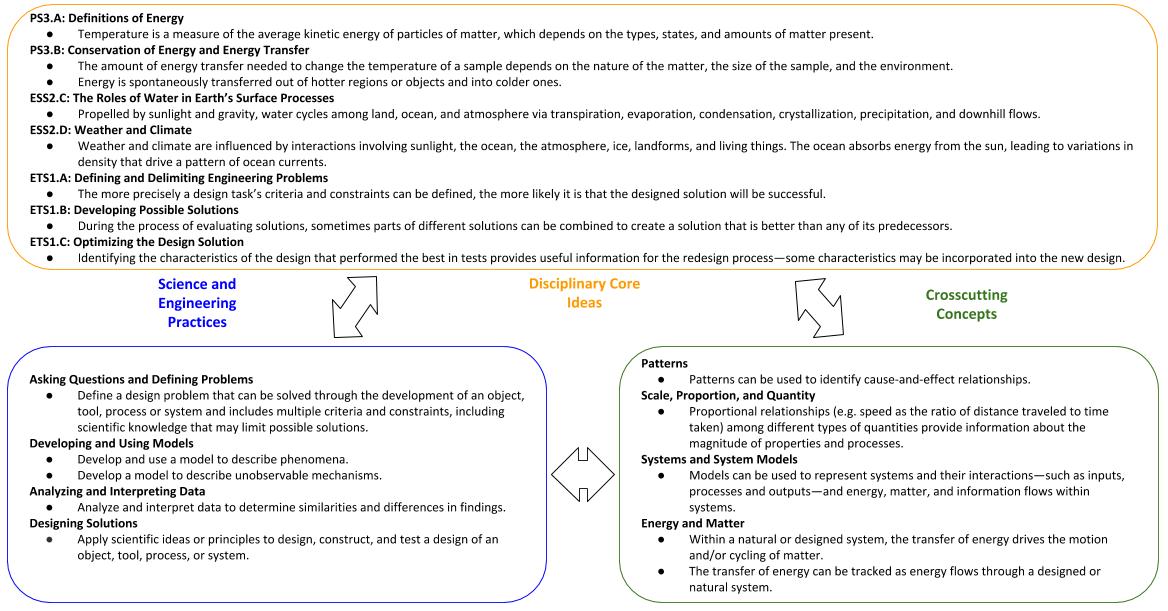
**Unit Essential Question:** *How do people use technology to survive in regions with different climates?*

**Introduction**

In the Lift-Off Task, students observed pictures of places that seem inhospitable! How are people able to live in regions with freezing temperatures or scorching heat? In this project, the students’ task is to help make it possible for people to live in these places. As a group, students select a region with an extremely hot or extremely cold climate. After exploring the causes of such an extreme climate, each group will design a product that makes it more comfortable for people to live in this region, and present it in the format of their choice. These could be a variety of products, from clothing to buildings to heating/cooling devices. After presenting their products, each student will then write a consumer report to review the science behind why the product is needed and how the product works. This can also be in the format of their choice (e.g., written report, flyer, video, blog, etc.)

**3-Dimensional Assessment**

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**\***To maintain the authenticity of the Culminating Project, the SEP of MS-PS3-4 (Planning and Carrying Out Investigations) is instead assessed in Task 4.

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

9 days at end of unit

* Group Project: 4 periods (includes 1 presentation day)
* Individual Project: 5 periods
  + First draft: 3 periods
  + Feedback: 1 period
  + Revision: 1 period

**Materials**

Product Presentation

* Materials to build physical prototype (See Task 5 Materials List)
* Poster Paper
* Color pencils/markers or computer graphics
* Presentation software (e.g., PowerPoint, Prezi, etc.)

Consumer Report

* Blank Paper or Computer Program
* Color pencils/markers or computer graphics

**Instructions for the Culminating Project**

1. Introduce the Culminating Project at the end of the Lift-Off task, including both group and individual components outlined in the Challenge.
2. Read over the Culminating Project Task Card with the students. We recommend only reading the Challenge and Group Project Criteria for Success at this time in order to not overwhelm students with information.

* Review some potential formats for their group presentation (poster presentation, Powerpoint, Prezi, physical demonstration of product, 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.)

1. Remind students as they complete the Project Organizer that they will be planning pieces of their presentation and recording scientific concepts they will likely use for their individual project. However, there is nothing wrong with students going back and changing their ideas over the course of the unit. The students won’t fully design their presentation until the end of the unit, so changes made during the imaginative and creative time is acceptable and to be expected.
2. Make sure the students fill out the Project Organizer after each task as this will help them think about parts of their presentation along the way. This process allows students to both apply and document relevant scientific concepts as they progress through the unit. This will inform both their group and individual projects.

* We recommend that students complete the Project Organizer individually, with the exception of choosing a region after the Lift-Off Task as a group. They might discuss ideas first as a group, but should then respond individually. It is important to allow students time to process concepts on their own and generate their own ideas, which can be used later when it comes to developing their group project.

1. The table below summarizes how the Project Organizer guides the students through developing different components of their product presentation (group product) and consumer report (individual product).

|  |  |  |
| --- | --- | --- |
| **Task** | **Project Organizer** | **Group and Individual Culminating Project** |
| **Lift Off**  Extreme Conditions | * Choose a region as a group. * Define the problem, identify the criteria for a successful solution, and identify the constraints of solving this problem. | * Group: A description of why it is difficult to live in this region * Individual: A definition of the problem the product addresses, including criteria and constraints |
| **Task 1**  Climate, Part 1 – Heating the Earth | * Research the region you selected.   + Where is it located on Earth?   + How can its location explain the typical temperature in a region?   + Draw a Sun-Earth model to show and explain a major cause of your region’s climate. | * Group: A description of the region’s climate and causes of this climate * Individual: A detailed description of the region’s climate, including models that show how unequal heating and rotation of Earth play a role |
| **Task 2**  Climate, Part 2 – Oceans and Atmosphere | * Construct a model to explain how atmospheric and oceanic circulation affect the climate in your region. | * Group: A description of the region’s climate and causes of this climate * Individual: A detailed description of the region’s climate, including models that show how patterns of atmospheric and oceanic circulation play a role |
| **Task 3**  A Water Molecule’s Journey | * What are some ways that water is a part of your region’s climate? * Using words or a model, describe the processes that create the water conditions in your region. | * Group: A description of the region’s climate and causes of this climate * Individual: A detailed description of the region’s climate, including models that show how the water cycle plays a role |
| **Task 4**  Thermal Energy Transfer | * Will your product need to help people stay warm or cool down? * Would this require increasing or decreasing the kinetic energy of the particles? Explain. * Based on your explorations, how might you be able to make this possible? What factors should your product consider? | * Group: An explanation of how the device works, including descriptions of temperature, thermal energy transfer, and kinetic energy of particles * Individual: A description of the original prototype, including the proportional relationships from Task 4 investigations that inspired the design |
| **Task 5**  Extreme Living Solutions | * Draw a labeled diagram of your final product. Show how thermal energy transfer is either minimized or maximized. * Explain how it works. * Describe how you combined best characteristics from different designs to create a product that best meets your criteria and constraints. Cite the data that supported your decisions. | * Group: An explanation of how the device works, including descriptions of temperature, thermal energy transfer, and kinetic energy of particles * Individual: A labeled diagram of the product that uses a model and written description to explain how it works to minimize or maximize thermal energy transfer |

1. After all the learning tasks and the Project Organizer are completed, students can start to design their product presentation in the format of their choice. The Project Organizers and Group Project Criteria for Success should be used as reference to remind students to include all the components of their presentation.

* As always, we recommend the use of group roles for Culminating Project work time (See “How to Use This Curriculum” for details). We recommend changing the roles every work day.
  + Below is a list of some possible products students may design, but keep in mind that it is likely students will come up with a variety of other ideas:
    1. For extreme cold: houses with double-paned windows, concrete walls inside of houses with large windows to absorb and retain heat from the sun, building insulation in walls, insulated gloves, hot water bottles, quilts or clothing with pattern of insulation pockets, thick curtains, thermos, radiator foil, solar ovens, etc.
    2. For extreme heat: houses with double-paned windows, wind towers, white washed houses, cooling domes, water trenches beneath huts for evaporative cooling, small windows, dugouts, reflective clothing, loose-fitting clothing, water-wicking clothing, ice chest, insulated cups, etc.

1. Once student groups have presented their products (either through class-wide presentations or a gallery walk), students are ready to begin their individual project. Each student will create a consumer report that explains the science behind why their product is needed and how the product works. This can be in the format of their choice (e.g., written report, flyer, video, blog, etc.) but must meet all the criteria in the student handout. Because of the variety in format options, no template is provided for this individual project.
2. Conduct a peer review of the consumer reports after students have completed a first draft.

* Copy the Consumer Report Peer Review Feedback form found in the Student Instructions. Another option is to use the Student 3-Dimensional Individual Project Rubric.
* Assign each student a partner, preferably a partner from a different group.
* Students switch drafts and assess them using the peer review feedback form.
  + Remind each student to give one positive comment and one constructive comment for each section on the checklist.
  + Allow students time to present their feedback to their partner, so their partner may ask clarifying questions if needed.

1. After receiving feedback, allow students time to complete a final draft based on the feedback they received.

**Assessment**

The Project Organizer can be formatively assessed using:

* *Criteria of your choice.* We recommend using the 3-Dimensional Assessment matrix from the Unit Overview to inform your criteria.

The Group Culminating Project will be summatively assessed using:

* The *Group Project Criteria for Success* Checklist

The Individual Culminating Project will be summatively assessed using:

* The *3-Dimensional Individual Project Rubric*.
* Keep in mind that the Proficient level indicates that the student has successfully demonstrated understanding of the criteria. Because we are in the early stages of NGSS adoption, it may take multiple opportunities throughout the course of the year for students to reach Proficient.
* If you wish to give students a numeric score, you could take the average score of all of their rubrics or add up rubric scores to give students a summation out of the total. Because of the note above, this scoring may not correlate to traditional grading systems.
* While we recommend scoring all of the project criteria with the rubrics for each student, we understand the burden of that level of scoring.
  + One option is to select the rubrics that you wish to focus on for this project and use those to assess each student’s individual project.
  + Another option is to review the Proficient level of each of the project’s rubrics and use the descriptions to generally analyze all student work for trends.