Teacher Name: Sheri Kekina Grade Level Teaching: 6th Grade School: He'eia Elementary

Proposed Start Date: April 2, 2019 End Date: April 17, 2019 Duration of Project/Activity: 2 ½ Weeks

Performance Task Creator

Main Benchmarks

to Assess the Depth of Knowledge Required by the Performance Expectations (PEs), Disciplinary Core Ideas (DCIs) of the NGSS:
[Clarification: You can list the key PEs, DCIs, and Crosscutting Concepts that students will come away with when completing this project/activity.]

DOE HCPS:
SC.6.7.1
Describe examples of how forces affect an object's motion.

NGSS:

- 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

Real-World Problem/Challenge:

(A problem that the community or world is currently facing that requires skills and content embedded in the benchmarks to solve.) [Clarification: This can be a real-world need that students can address. The challenge should be doable for the grade level to work on.]

Real-World Problem/Challenge:

Ever wonder why Disney decided to build a Disneyland Hotel (Aulani) and not extend it to a Disneyland Theme Park too? Well just think about the possibilities of Hawaii opening its very first Disneyland location on one of the outer islands. Disneyland is recruiting fresh new engineers to help them in building a fresh new roller coaster that would become Hawaii's first thrilling ride at Disneyland's newest theme park location.

Real-World Role:

(Something that students might actually be or do.) [Clarification: Consider giving them real-world roles such as "budding engineers," "inventors," "innovators," "engineering team."]

Real-world roller coaster engineer address:

- Just like real-world roller coaster engineers, students will recognize the constraints placed on their designs and the design of real roller coasters by the fundamental laws of physics.
- Students will learn that their ability to understand and work within these constraints is paramount to the success of their roller coasters.

What do students need to know or be able to do in order to accomplish this?

[Clarifications: (a) You can briefly outline the key activities by the EDP stages (i.e. "ASK: Students will interview the school principal to ask him/her about how s/he feels about recycling on campus."); (b) You can add time frames for each stage of the EDP if you'd like; (c) Note in the activities how they will develop deeper understandings of content, concepts, and skills/practices (science/engineering); (d) List resources needed, including guest speakers, field trips, books, videos, etc.), and supplies/materials (tools, consumables, etc.).]

Students will need:

the natural environment that may limit possible solutions. (MS-ETSI-1) • Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETSI-2) • Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETSI-3) • Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETSI-4)	**Real-World Product:** (A product that is similar to what would be found in the real-world, eg. Ennvironmental impact statement, essay, public service announcement, a worksheet.) [Clarification: What will students create or develop (process, procedures, protocol, etc.) as a result of using the EDP? Describe briefly here, what the end-product will be that students can showcase at the end of the year.] Task: 1. The He'eia Elementary 6th Grade Engineering Teams will be taking on the task of competing for a bid to build a roller coaster for Disney Theme Parks. Your task is to design and build a durable paper roller coaster model using the templates provided in the (www.paperrollercoaster.com) kit. Your team also needs to be able to explain the physics behind it. 2. The roller coaster must include at two curves, loops, hills, and one additional ride element of your team's own design to allow a marble to successfully complete the track 3/3 times own its own from start to finish. The roller coaster should apply the following science concepts: distance, time, speed, velocity, acceleration, gravity, centripetal acceleration/force, and potential/kinetic energy. 3. You and your team will be expected	**Real-World Audience:** (Ideally beyond the walls of the school, and audience that is authentically a part of the challenge.) [Clarification: This could be the school principal/admin, faculty, staff, students at the school; families, greater community, island/state, other places, world. Make it as realistic as possible, where the audience is the "client" or "customer" or "end user" of your design.] Real-World Audiences: • Disney Theme Parks • People all over the world who would come to go to the theme park to ride the roller coaster • This project would bring Hawaii's economy lots of jobs and revenue	• Students need basic prior knowledge about forces, particularly gravity and friction, as well as some familiarity with kinetic and potential energy. • They should also know Newton's second law of motion and understand basic concepts of motion, such as position, velocity and acceleration.

to keep an engineering design notebook journal that will show you cycling through the engineering design process [(1) Ask, (2) Imagine, (3) Plan, (4) Create, (5) Improve].

4. You will then present with your team your roller coaster prototype to the amusement park manager for Disney (teacher) and a panel of roller coaster enthusiasts (fellow students) and explain the design and build of the roller coaster and why it is the most fun and exciting of all the designs that will be presented.

Transfer Skills:
(How will the <u>science and engineering practices (EDP)</u> be used in real life?)
[Clarification: Refer to the science and engineering practices (SEPs) of the NGSS for the selected standards you chose above. This is the blue box in the NGSS document.]

<u>Transfer Skills for Real Life:</u>

- to ask questions (for science) and define problems (for engineering)
- to develop and use models
- to plan and carry out investigations
- to analyze and interpret data

Real-World Process/<u>the Engineering Design Process</u>:
(The process mirrors what would take place in the real world.)
[Clarification: You can briefly discuss how this project/activity will address all five stages of the EDP.]

<u>Real-World Process/the Engineering Design Process applied to the real world:</u>

- Meet with the client and determine problem statement and requirements/specifications
- Plan and design as an engineering team for your prototype by keeping documentation of the process in an engineering design notebook journal using the engineering design process [(1) Ask, (2) Imagine, (3) Plan, (4) Create, (5) Improve].
- Present your desgined prototype to the client/company by pitching your design

Real-World Scenario/Problem Statement:
(Put it together and set up a scenario that is engaging for students.)
[Clarification: Create a scenario that puts them in the real-world role (i.e. engineering team, innovators, citizen scientists and engineers). Use the template that the UH STEM Pre-Academy gave you at Session #3 to craft this problem statement to engage students and make this assignment a project that will have real outcomes.]

• to use mathematics and computational thinking • to construct explanations (for science) and design solutions (for engineering) • to engage in arguments based from evidenceto obtain, evaluate, and communicate information	Scenario: Ever wonder why Disney decided to build a Disneyland Hotel (Aulani) and not extend it to a Disneyland Theme Park too? Well just think about the possibilities of Hawaii opening its very first Disneyland location on one of the outer islands. Disneyland is recruiting fresh new engineers to help them in building a fresh new roller coaster that would become Hawaii's first thrilling ride at Disneyland's newest theme park location. Problem Statement: He'eia Elementary 6th Grade Engineer Teams need to design and build a durable free-standing roller coaster that includes at least two curves, loops, hills, and one additional ride element of your team's own design to allow a marble to successfully complete the track 3/3 times own its own from start to finish. The roller coaster should apply the following science concepts: distance, time, speed, velocity, acceleration, gravity, centripetal acceleration/force, and potential/kinetic energy.	

Materials:

- Windward Academy CTE Paper Roller Coaster Kits
  - Scissors
  - Tape
  - Ruler or straight edge
  - Magazine or Catalog (used as a cushion - it helps to score the templates when tracing)
  - Ball point pen
  - Cardboard or Foam board (used as a base for the roller coaster)
- Paper Roller Coaster Project Overview Sheet
- Paper Roller Coaster Project Overview Sheet
- Roller Coaster Design Challenge Engineering Notebook
- Calculating Average Speed of a Rolling Marble Lab
  - Completed Roller Coasters
  - Meter Sticks
  - String
  - Stop Watches