Inquiry Project Design Plan

Teacher/Designer Names: Mallon School: School 21	
Name of Project: Rollercoaster	**Grade Level: 6**
Est Launch Date: 9/18/23	**Est Duration (in weeks): 3/4**
Disciplines Involved: Math/Science	
Problem Statement: By developing a model to describe unobservable mechanisms, we can help others understand.	

STAGE 1: DESIRED RESULTS

Big Idea: Design

Enduring Understandings:

- Energy occurs in our world that is both visible and unobservable
- Energy is measurable
- We can help others understand difficult concepts by designing models

Essential Question(s):
(MEANT TO BE SHARED WITH STUDENTS)

- How can energy transform in our world?
    - How can you transform potential energy to do work?
    - How can you design a ship to carry cargo?

Established Goals (Standards, Performance Indicators, Learning Goals):
*choose relevant standards to unit/project plan timing and learning goals; do not need to use all disciplines below.
** unpack into SWK and SWBAT under identified standards as this will lead to aligned assessment design
Develop and/or use a model to generate data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales.

Science Standards (list if using, unpack under each standard into SWK and SWBAT)**:**

SWK:
- Become a roller coaster engineer and build a roller coaster track including turns, loops, or hills.
- Use scientific principles to test and modify their design to meet the criteria defined.
- Evaluate, model, test, and improve solutions that depend on energy transformations.

SWBAT:
- PE MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
- PE MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- PE MS-ETS1-4 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.

Mathematics Standards (list if using, unpack under each standard into SWK and SWBAT)**:**

SWK:
- Apply multiple skills from the unit to solve real-world problems related to agriculture.
- Problems involve calculating the area of polygons, calculating the surface area of rectangular prisms with whole-number edge lengths, finding factors and multiples, and interpreting, writing, and evaluating algebraic expressions.

SWBAT:
- SMP 1 Make sense of problems and persevere in solving them.
- SMP 3 Construct viable arguments and critique the reasoning of others.
- SMP 6 Attend to precision.

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Technology Standards:

- 4-6.NSD.3 Determine potential solutions to solve hardware and software problems using common troubleshooting strategies.

Other (Art, SEL, etc):

Links to Standards/Reference Frameworks:
NYS NextGen ELA and Math, NGSS, NGSS by DCI Nat'l C3 SS Framework, NYS K-8 SS Standards, ISTE, Social Justice Standards, CASEL SEL Framework, NYS CS and Digital Fluency

Teaching/Learning Goal Notes for Stage 1:
Energy Padlet

STAGE 2: EVIDENCE & ASSESSMENTS:

Performance Task Narrative

Goal: *Provide a statement of the task. Establish the goal, problem, challenge, or obstacle in the task.*
Students use an iterative process to improve their prototypes from Part 1.
Students will choose appropriate models and strategies to plan for and solve the problems in order to show energy transform. They will learn about forms and types of energy and how energy can be transformed and transferred.

Role: *Define the role of the students in the task. State the job of the students for the task.*
Students evaluate solutions for a toy that relies on potential energy and then build and test the toy. Engineers, Designers, Drone Operators, Mathematicians, Scientists

Audience: *Identify the target audience within the context of the scenario.*
Younger students in the school would be the audience.

Situation: *Set the context of the scenario. Define the narrative.*
We are going to be toy designers and design a toy that uses energy after learning about different and forms of energy. You will build and test your toys and present your toys to younger students.

Product(s): *Clarify what the students will create and why they will create it.*

- Students design a simple post driver tool and simulate its use to understand how mass, height, and gravity influence energy.
- Students develop and investigate models to determine changes in kinetic energy and potential energy.
- Students evaluate solutions for a toy that transforms potential energy into kinetic energy and then build and test the toy.
- Name toy and short demo of how to use the toy

Criteria for Success): *Provide students with a clear picture of success. Identify specific standards for success such as rubrics, checklists, quizzes, etc.*

- ❏ Hands on Rubics for each lesson to assess process
- ❏ 4 Expert, 3 Practitioner, 2 Apprentice, 1 Novice, Around the room
- ❏ ABCD cards
- ❏ Self-assessments
- ❏ Group check-ins, Peer critiques, Charette
- ❏ Thumbs up, White boards, Exit tickets, Padlet, Emojis

Other Evidence/Assessments:
Lesson Quizzes and Summative Unit Assessment

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STAGE 3: THE LEARNING PLAN:

Learning Activities

(potential layout below. Can be daily, divided by periods, or even using the Engineering Design Process to divide into stages such as Ask, Imagine, Plan, Create, Improve)

Week 1

Learning Goals: In Lesson 1, students analyze graphs to determine the relationship among an object's speed, mass, and kinetic energy. They also explore how potential energy can be stored due to an object's position or condition.

Learning Events:
Students observe the motion of a rollback can and relate their observations to the energy of the can.
Students design a simple post driver tool and simulate its use to understand how mass, height, and gravity influence the amount of potential energy transformed as a tool drives a post into the ground on the moon and on Mars.

Formative Assessments:
Check for understanding – 4 Expert, 3 Practitioner, 2 Apprentice, 1 Novice, Around the room, ABCD cards, Self-assessments, Group check-ins, Peer critiques, Charette, Thumbs up, White boards, Exit tickets, Padlet, Emojis, Rubrics
Lesson Quiz 1: Introduction to Energy

Notes/Resources:

Hands-On Lab Scoring Rubric

Points	Criteria
	Follows lab procedures carefully and fully
	Identifies relationships between the kinetic energy input and potential energy stored within the can
	Provides evidence for phenomena
	Supports conclusions and explanations with valid and reliable evidence

Week 2

Learning Goals: In Lesson 2, student track how energy is transformed in a system and how it can be transferred in or out of a system. Students also learn that energy is conserved.

Learning Events:

Students collect evidence to construct an argument about the effect of mass and speed on energy transfer.
Students develop and investigate models to determine changes in kinetic energy and potential energy.

Formative Assessments:

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Lesson Quiz 2: Changes in Energy

Notes/Resources:

Hands-On Lab Scoring Rubric

Points	Criteria
	Identifies relationships
	Records observations clearly and completely
	Organizes data clearly in tables

Week 3

Learning Goals: In Lesson 3, students apply an engineering design process to design and optimize a toy that relies on potential energy.

Learning Events:
Students evaluate solutions for a toy that transforms potential energy into kinetic energy and then build and test the toy.

Formative Assessments:

Lesson Quiz 3: Engineer It: Transforming Energy

Notes/Resources:

Hands-On Lab Scoring Rubric

Points	Criteria
	Supports conclusions and explanations with valid and reliable evidence
	Works well with others: shares responsibility, participates in group decision making, listens carefully and respectfully to others, communicates ideas clearly, supports own point of view with reasons or evidence
	Participates in discussions: listens carefully and respectfully to others, stays on task during discussion, shares ideas, supports own point of view with reasons or evidence

Week 4

Learning Goals:

Learning Events:

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Formative Assessments:

Unit 1 Test A