Action Research Meets Engineering Design
Roller coaster activity description and rubrics

ENGINEERING TASK - Roller Coaster Project

Client Need and Background Information: You will each be trying to satisfy the needs of a client. You will need to come up with your **design** and use a **schematic** to illustrate it, build a **model**, write a **procedure**, and prepare a **presentation** of your recommendation to fit their needs.

Goal: You and your group are to design a high speed, high thrill, and high quality roller coaster for an eccentric multi-millionaire who loves superheroes and fast food. He requests that you work together as a team and build him his favorite roller coaster yet, one that will be featured at King's Island.

Constraints: You will be given:
- 5 tubes (6 feet of flexible pipe insulation) to create this wonder
- 10 marbles
- 1 roll of tape
- 2 pairs of scissors
- 1 clip board

Requirements for the project:

1. Take a client meeting:
- Meet with the client to clearly understand his client's needs
- Provide detailed evidence of the parts of the engineering design process
- Come out of meeting with clear understanding of goal

2. Use the engineering design process:
- Prepare detailed descriptions of what your group did during each part of the design process

3. Prepare and present a schematic:
- Initial design (drawing of coaster)
- Labeled re-design schematic of your finished roller coaster that includes points of gravitational potential energy, potential energy, kinetic energy, friction, and any applications of Newton's Laws.

4. Build a model of your roller coaster:
- Include 5 pictures of your roller coaster displaying your construction and theme
- Name should also be displayed

5. Roller Coaster Data:
A data table that illustrates evidence of the following:
- Five time trials

- Accurately calculated distances
- Accurately calculated times
- Accurately calculated speeds
- Average speed for all 5 time trials

6. Procedure

- Write a step-by-step procedure for how to build the coaster. This procedure must be clear enough so that the client is able to modify or reproduce the coaster.

7. Presentation

- Brief 2- minute presentation of coaster and why it fits the client's needs
- Include pictures of coaster, procedure, EDP, and anything else you think will need to meet the needs of the client (theme music, speed statistics, movie) Think I-MOVIE

ENGINEERING DESIGN PROCESS DOCUMENTATION

Client's Needs

Model Coaster Name: _____ Client: _____

Team Name and Members: _____

Team Leader: _____

Engineering Principles	**0-2 points**	**6-7 points**	**8-9 points**	**10 points**
Ask	No evidence of questions	Evidence of concrete, procedural questions	Questions are directly linked to engineering design process	Questions are directly linked to engineering design process and the client's needs
Imagine	No evidence of schematic designs	Limited and vague sketches;	Sketches reflect understanding of the engineering design process	Sketches reflect understanding of the engineering design process and attention to the client's needs
Plan	No evidence of a plan	Limited and/or lacks attention to details	Reveals an understanding of the feasibility of the engineering design process	Reveals an understanding of the feasibility of the engineering design process and the necessity of meeting the

				client's needs
Create	No evidence of a working model	Has a working model; yet limited in design and operation	Model illustrates a moderate level of sophistication in design and operation	Model illustrates a high level of sophistication in design and operation
Improve	No evidence of a re-design	Minor changes performed on re-design	Changes made to model were informed by structural limitations	Changes made to model were informed by structural limitations and addressed client's needs

Earned Points = ____/50

SCHEMATIC
(Includes initial design and redesign)

Team Name and Members:

_____

Team Leader: _____

Schematic Design	**0-2 points**	**6-7 points**	**8-9 points**	**10 points**
Initial Design	Vague, non-detailed line drawing	Limited details in drawing	Solid roller coaster design, includes possible theme, some energies, etc.	Detailed roller coaster design, theme and name present, energies labeled, Newton's Laws indicated
Re-design	**0-2 points**	**6-7 points**	**8-9 points**	**10 points**
Accuracy of Drawing	Not Accurate	Barely resembles the coaster	Somewhat resembles the coaster	Clearly resembles coaster
Attractive Drawing	Unacceptable	Neat and done in pencil	Done in color, very neat, labels are handwritten	Done in color, labels are typed
Types of Energy Labeled	Not labeled	One type of energy labeled	Two types of energy are labeled	Three or more types of energy are labeled
Newton's Laws Labeled	Not labeled	One of Newton's Laws is labeled	Two of Newton's Laws are labeled	All three Laws are labeled

Earned Points = ____/50

ENGINEERING DESIGN PROCESS DOCUMENTATION
Model of Roller Coaster

Model Coaster Name: _____ Client: _____

Team Name and Members:
_____

Team Leader: _____

Key Features	**0-2 points**	**6-7 points**	**8-9 points**	**10 points**
Coaster Model	Model of coaster is incomplete	Model is completed but construction appears shaky	Model is completed and held up through testing	Model is completed on time and exhibits strong construction
Definite Theme on Coaster	No theme	Theme present but has little follow through.	Theme is present throughout ride	Theme is well done throughout the ride
Would Attract Visitors	Not Attract	Minimal attraction	Moderate attraction	Strong attraction
Track Openness (tunnels)	Mostly a closed track	25% open	50% open	>75% open
Engineering	Nothing unique	1 unique feature	2 unique features	3 unique features
Vertical Loops	1 loop	2 loops	3 loops	4 loops

Earned Points = ____/60

ENGINEERING DESIGN PROCESS DOCUMENTATION
Model of Roller Coaster – Testing (Data Tables)

Team Name and Members:
_____

Team Leader: _____

Key Features	**0-2 points**	**6-7 points**	**8-9 points**	**10 points**
Construction of Table *rows *columns *labels	Not constructed accurately	Some elements present	Most elements present	All elements present
Math is accurate and answers are labeled correctly	3 or more mistakes in computation or labeling	2 mistakes in computation and labeling	1 mistake in computation and labeling	No mistakes in computation and labeling
Completion *5 speed trials *Accuracy *times *speed *average speed	3 or more things not complete	2 things not complete	1 thing not complete	Everything complete

Earned Points = ____/30

ENGINEERING DESIGN PROCESS DOCUMENTATION
Model of Roller Coaster – Procedure

Team Name and Members:
_____

Team Leader: _____

	0-20 points	**60-70 points**	**80-90 points**	**100 points**
Procedure format and clarity	Procedure is written in paragraph format	Procedure is written in numbered format but has 2 or more unclear steps or missing steps	Procedure is written in numbered format, but has 1 unclear step or missing step	Procedure is written in numbered format and is clear and complete

Earned Points = ____/100

ENGINEERING DESIGN PROCESS DOCUMENTATION
Presentation to Client

Team Name and Members:
_____

Team Leader: _____

	0-2 points	**6-7 points**	**8-9 points**	**10 points**
Picture of Coaster	1-2 pictures of coaster are present	3 pictures of coaster are present	4 pictures of coaster are present	5 pictures of coaster are present in *PowerPoint* or *I-Movie* format
Procedure	Procedure is not present	Procedure is present, but not formatted correctly and has 2 or more spelling errors	Procedure is present, in list format, with interesting font, color, background and has 1 spelling error	Procedure is present, with interesting font, color, background, and no spelling errors in *Power Point* or *I-Movie* format
Presentation follows Engineering Design Process	Engineering design process in not included	Engineering Design Process is present, but not used during presentation	Presentation follows Engineering Design Process, goal is clearly present	Presentation follows EDP, goal is clearly present and is included in *Power Point* or *I-Movie* format
Creativity	Presentation is just a few people talking	Presentation has all members participating	Presentation has interesting visual and auditory effects; All members participate	Presentation is done in *Power Point or I-Movie* with well-executed visual and auditory effects
Overall Presentation Skills	Poorly prepared; Evidence of little to no practice	Presentation is read and shows a little evidence of practice	Presentation is well-practiced, people know when to speak and do so	Presentation works well with *Power Point* and *I-Movie*., fluent,

			fluently	engaging

Earned points = ____/50