

Transformation 2013

Design Challenge

Planning Form

Design Challenge Title: Skycoaster Project

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School: Manor High School

Subject: Principles of Technology

Abstract: The students will design and build a model of a Skycoaster that is 1 meters tall and will successfully support a 1 kilogram mass when dropped.

MEETING THE NEEDS
OF STEM EDUCATION
THROUGH DESIGN CHALLENGES

Begin with the End in Mind

- Does this design challenge meet the criteria for STEM student needs (21st century skills, TEKS, TAKS)?

Summarize the theme or “big ideas” for this design challenge.

The students will design and build a model of a Skycoaster that is 1 meters tall and will successfully support a 1 kilogram mass when dropped.

Identify the TEKS/SEs that students will learn in the design challenge (two or three).

Principles of Technology I TEKS

- 5B, 5D
- 6A, 6C

Identify key skills students will develop in this design challenge.

- Generate and interpret graphs describing motion.
- Develop and interpret a free-body diagram for force analysis.
- Apply examples of complex technological devices where force must be controlled, measured or applied.
- Evaluate and predict what happens to an object when forces on it are balanced and when forces on it are unbalanced.

Identify the 21st century skills that students will practice in this design challenge (one or two).

www.21stcenturyskills.org

Brainstorming, Problem Solving Skills, Collaboration, Communication

Identify STEM outcomes to be included in this design challenge.

The student will use engineering design processes to design a working model that they must present to their peers.

Craft the Driving Question

- *Have you posed an authentic problem or significant question that engages students and requires STEM knowledge to solve or answer?*

State the essential question or problem statement for the design challenge. The statement should encompass all design challenge content and outcomes, and provide a central focus for student inquiry.

You are working on a design team for an engineering firm that has been hired to construct a safe Amusement Park ride called the “Skycoaster.” Your design team will construct a 1 meter tall working model that safely and successfully supports a 1 kilogram mass when dropped from the structure. Your team must sell the idea to a committee representing Fiesta Texas/Six Flags.

Plan the Assessment

STEP 1: Define the products and artifacts for the design challenge.

Early in the challenge:

- Force Overview
- Force in Mechanical Systems
- Lab 1M1 – Mechanical Stress – Its Cause and Effect
- Graphing – Manual, Calculator, Computer
- Lab 1M2 – Measuring Forces
- Vector Drawings of Lab
- Journal showing research
- Research on Skycoasters and Bungee Jumping.
- Timeline

During the challenge:

- Journal showing research
- Flow chart on how the Skycoaster will work.
- Sketch of the Skycoaster.

End of the challenge:

- Demonstration/Presentation of the design/working model of the device.
- Journal showing research
- Presentation to “sell” their project to Fiesta Texas/Six Flags

Plan the Assessment

STEP 2: State the criteria for exemplary performance for each product.

- *Do the products and criteria align with the standards and outcomes for the design challenge?*

Product: Lab 1M1 – Mechanical Stress – Its Cause and Effect

Criteria: Check for safety, data evaluation, graph construction, data analysis and conclusions

Product: Lab 1M2 – Measuring Forces

Criteria: Check for safety, data evaluation, vector drawings, data analysis and conclusions

Product: Journal

Criteria: Daily ½ page entries, no tear outs, blue/black pen only, complete sentences, record criteria, entries student defined

Product: Design Sketches of Skycoaster

Criteria: Scaled drawing of Front, Side and Top.
Scale, labels, dimensions, pencil, no free hand drawings.

Product: Presentation/Demonstration of Design/Working Model of the Skycoaster.

Criteria: All members of the design team must participate in a 3 minute presentation that can include PPT, Poster or Transparencies or the demonstration of their working model.

Map the Design Challenge

Look at the major product for the design challenge and analyze the tasks necessary to produce a high-quality product. What do students need to know and be able to do to complete the tasks successfully? How and when will they learn the necessary knowledge and skills?

- Do the products and tasks give all students the opportunity to demonstrate what they have

Skycoaster			
Knowledge and Skills Needed <i>Elaborate on the knowledge and skills (TEKS student expectations) required to accomplish each step of the task.</i>	Already Learned	Taught before the project	Taught during the project
1. Terminology	X	X	X
2. Measuring skills	X		
3. Graphing skills - manual	X		
4. Graphing skills - calculator	X		
5. Graphing skills - computer			X
6. Analysis of graphs	X		X
7. How to write up a lab.	X	X	X
8. Dimensional Analysis		X	
9.			
10.			

What PBL tools will you use? (check appropriate box)

- | | |
|--|--|
| <input checked="" type="checkbox"/> Know/need to know lists
<input checked="" type="checkbox"/> Daily goal sheets
<input checked="" type="checkbox"/> Journals
<input type="checkbox"/> Briefs
<input checked="" type="checkbox"/> Task lists
<input type="checkbox"/> Problem logs
<input type="checkbox"/> Project flow charts | <input checked="" type="checkbox"/> critical thinking
<input checked="" type="checkbox"/> problem solving
<input type="checkbox"/> _____
<input type="checkbox"/> _____
<input type="checkbox"/> _____
<input type="checkbox"/> _____
<input type="checkbox"/> _____ |
|--|--|

<p>Title: Skycoaster Project</p>	
<p>TEKS: Principles of Technology I</p> <ul style="list-style-type: none"> • 5B, 5D • 6A, 6C 	
<p style="text-align: center;">Engage Activity (Time:)</p> <p>Identify/focus on instructional task, connect between past & present learning experiences, lay groundwork for activities (ex. Ask a question, define a problem, show a surprising event, act out a problematic situation)</p>	<p>Students will pick up a stretching device (bungee cords, rubber bands, exercise bands, stretch dolls, etc.) and describe how it works to the class. Identify key concepts during this ‘Show and Tell.’</p> <p>Introduce design challenge to students:</p> <p>You are working on a design team for an engineering firm that has been hired to construct a safe Amusement Park ride called the “Skycoaster.” Your design team will construct a 1 meter tall working model that safely and successfully supports a 1 kilogram mass when dropped from the structure. Your team must sell the idea to a committee representing Fiesta Texas/Six Flags.</p>
<p style="text-align: center;">Exploration Activity (Time:)</p> <p>Students get involved with phenomena and materials, students work in teams to explore through inquiry</p>	<p>Students complete lab activities addressing the following:</p> <ul style="list-style-type: none"> • Mechanical Stress – Its Cause and Effect • Measuring Forces
<p style="text-align: center;">Explanation (Time:)</p> <p>Students discuss observations, ideas, questions and hypotheses with peers, facilitators, groups. Learners apply labels to their experiences – thus developing common language, clarification/explanation of key concepts (ex. Writing, drawing, video/tape recordings)</p>	<ul style="list-style-type: none"> • Engage students in a discussion on how the labs would apply to the Skycoaster Project • Show a Video Clip on how a Skycoaster works • Working in teams, students begin brainstorming on how to design their project • Demonstration on various materials that could be used as support ropes for the project • Clarification on how to draw out their designs • Research with a engineer about their project

<p style="text-align: center;">Elaboration (Time:)</p> <p>Expand on concepts learned, make connections to other related concepts, apply understandings to the world. (ex. Extend & apply knowledge) Leads to more inquiry and new understandings.</p>	<ul style="list-style-type: none"> • Student teams produce a Mechanical Drawing of their design • Student teams build a scale model of their teams “Skycoaster” • Student teams create a Media Presentation with PPT/Poster/Transparency/Video Clip
<p style="text-align: center;">Evaluation (Time:)</p> <p>Ongoing diagnostic process to determine if the learner has attained understanding of concepts & knowledge (ex. Rubrics, teacher observation with checklist, student interviews, portfolios, project products, problem-based learning products, assessments) Leads to opportunities for enrichment through further inquiry and investigation.</p>	<ul style="list-style-type: none"> • All members of the group give a 3 -minute oral presentation of their design using their PPT/Poster/Transparency/Video Clip • Demonstrate a working model of the design • Analyze how the group worked together • Problem-solving Challenges
<p>Materials/Equipment: Equipment for Lab activities, Engineering Graph Paper, materials for the project</p>	
<p>Resources: http://en.wikipedia.org/wiki/Skycoaster</p>	