

Foundations of Engineering Unit 2: CO2 Car Dragster

Unit Focus

In this unit, students will apply the 8 step Engineering Design Process to design and create a solution to a complex problem. Students will go through the process in designing a CO2 dragster that will compete in a replicated drag racing event. Students will apply safety protocol as they design, create and test their CO2 dragster to be built for speed. Students will spend a significant amount of time assessing their dragster in a variety of tests and analyzing the data to help them predict the outcome of their design. During this whole process, students will document their work in their engineering report with the final analysis being done at the end and submitted.

Stage 1: Desired Results - Key Understandings

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Standard(s)	Transfer	
 Common Core Mathematics: 9 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	Students will be able to independently use their learning to T1 Develop a product/solution that adheres to key parameters (e.g., cost, timeline, restrictions, available resources and audience). T2 Explore and hone techniques, skills, methods, and processes to create and innovate T3 Leverage connection(s) in other subject areas (including STEM) to make sense of a given problem, product, or solution.	
	Meaning	
	Understanding(s)	Essential Question(s)
	Students will understand that U1 Both the tools I am using and the way I am using them impact the quality of the result, the safety of the shop environment, and the longevity of the equipment. U2 A successful Engineering solution is grounded in attention to detail throughout the design and building process. U3 Technological design involves tradeoffs among competing constraints and requirements. U4 Communicating ideas accurately through the use of word, speech, and technical sketching/drawing improves products and processes. U5 Orthographic projection drawings are considered to be the official "language" of any design industry therefore all design professionals need to be fluent in this language.	Students will keep considering Q1 How do I select the appropriate tool to get the desired result? Q2 How do my behaviors and actions affect the safety of myself and others? Q3 What is the problem I am trying to solve through the design? How do I design this based on the constraints? Q4 How do I make what I designed? When does the design need to be changed? Q5 Why is the ability to read and understand the language of working drawings important for success in the design industry?

Stage 1: Desired Results - Key Understandings

- Describe and use safety laboratory equipment. ENG.06.06
- Describe the process for researching known, relevant information, constraints and limitations. *ENG.02.03*
- Test a prototype. *ENG.02.09*
- Use all tools and equipment safely *ENG.06.03*
- Use the design process to solve problems by creating and refining prototypes. *ENG.02*
- Write technical reports. ENG.05.02

Technology Education (CTE)

 Design, Measurement, and Layout: Interpret technical drawings, rough drawings and sketches, and the use fractional measurement. TE.WT.C

Technology Essential Knowledge and Skills: 12

• Construct charts/tables/graphs from functions and data. EKS.03.04

ITEEA - Standards for Technological Literacy

Technological Literacy: K-12

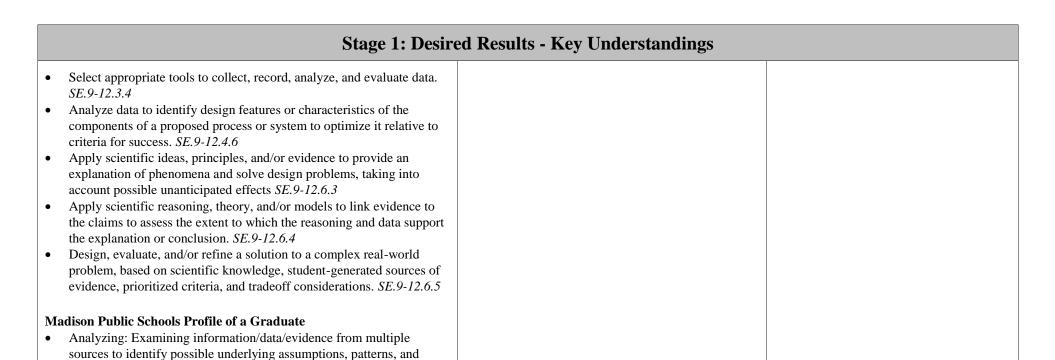
- Students will develop an understanding of engineering design. (9)
- Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. (10)
- Students will develop the abilities to use and maintain technological products and systems. (12)
- Students will develop the abilities to assess the impact of products and systems. (13)

NGSS/NSTA Science & Engineering Practices

NGSS Science & Engineering Practices: 9-12

- Ask questions to clarify and refine a model, an explanation, or an engineering problem. *SE.9-12.1.4*
- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations. SE.9-12.1.8
- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system. *SE.9-12.2.3*
- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts. *SE.9-12.3.3*

Acquisition of Knowledge and Skill		
Knowledge	Skill(s)	
K1 8 step Engineering Design Process and what evidence needs to be collected for an Engineering Report K2 Six principle views (top, bottom, left, right, front & back) of a given object. K3 The different line types are: Object, hidden, center, dimension, extension, cutting planes and section. K4 An orthographic projection is a multi-view drawing used to show all of the features of an object. K5 Statistical functions (Min, max, mean, mode and median) help find patterns within data	Students will be skilled at S1 Hand sketch a 3 dimensional object Orthographically including all of the features. S2 Identify and use appropriate tools to build their design (CO ₂ Car) S3 Develop a design (CO ₂ car) within a given set of specifications. S4 Analyze and interpret data to assess the performance of their solution. S5 Express technical knowledge used in solving a problem in a clear, concise, and coherent manner within an engineering report. S6 Create a full scale working drawing that displays all the pertinent information needed to create a part.	



relationships in order to make inferences. (POG.1.2)

audience and purpose. (POG.2.2)

Design: Engaging in a process to refine a product for an intended