

Mini Car Design Challenge

Using the Design Process, you and a partner will design, document, model, and produce a toy car with interchangeable parts. The design must consist of three parts: body (2), chassis, and wheels (4). Each partner will design their own body for the car but partners must work together to design a single chassis and set of wheels.

Time Frame: 4-6 weeks

Stage 1 - Desired Results

<u>Big Idea(s)</u>
<ol style="list-style-type: none">1. Effective use of the engineering design process to solve problems.2. Documentation of the process used to solve the problem.3. Use of appropriate tools to take accurate and precise measurements.4. Developing a design from conception to prototype.5. Use of appropriate modeling software.6. Using tolerance to create interchangeable parts.7. Statistical and graphical analysis of data.

PA Core Standards / Next Generation Science Standards

<u>T & E Education</u>	<u>Science Education</u>	<u>Mathematics Education</u>	<u>Computer Science</u>	<u>CEW</u>
<ul style="list-style-type: none">• 3.1.10.D• 3.2.10.D• 3.6.10.B• 3.7.10.D	<ul style="list-style-type: none">• HS-ETS1-2• HS-ETS1-4	<ul style="list-style-type: none">• CC.2.1.HS.F.3• CC.2.1.HS.F.5• CC.2.2.HS.D.10• CC.2.2.HS.C.6• CC.2.4.HS.B.2• CC.2.4.HS.B.3		<ul style="list-style-type: none">• 13.3.11.C• 13.3.11.E

Essential Questions

- How can the engineering design process help you to create a better design?
- How can an engineer communicate an idea and the process of how they came up with that idea?
- What dimensions on a technical drawing require tolerance notation?
- What tools should be used to take accurate and precise measurements?
- How can accurate technical drawing aid in the creation of models and prototypes?
- How can statistical and graphical analysis be used to describe the relationship between two variables?

Students Will Know

- Content specific vocab
 - Reverse engineering
 - Tolerance
 - Interoperability

Students Will Be Doing

- Functional and interoperability analysis
- Documenting their use of the design process
- Using precision measurement tools (dial caliper)

<ul style="list-style-type: none"> ○ Functional analysis ○ Annotation ● Steps of design process ● Process and purpose of reverse engineering ● Process to create technical drawings and models of a design ● Appropriate and safe use of tools and machines 	<ul style="list-style-type: none"> ● Creating annotated technical drawings and 3D models of designs for rapid prototyping ● Testing and recording data to evaluate prototype performance ● Performing statistical and graphical analysis of data ● Using tools and machines to assemble prototype
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Stage 2 - Evidence of Understanding

Assessments (Formative and Summative):	Performance Task(s)
<ul style="list-style-type: none"> ● Informal Formative Assessments throughout activity ● Formal assessments: <ul style="list-style-type: none"> ○ Project rubric 	<ul style="list-style-type: none"> ● Documentation of engineering design process in engineer's notebook ● Functional and interoperability analysis of existing parts ● Creation of technical drawings ● Creation of 3D models ● Construction of prototype ● Testing and evaluation of prototype

Stage 3 - Lesson Learning Targets

<p>Learning Activities:</p> <p>Learning targets are written from the students perspective. I can...</p> <p>These should lead up to answering the Essential Question(s).</p>
<ul style="list-style-type: none"> ● Identify steps of the engineering design process and the tasks involved with each step. ● Describe the importance of the design process in creating an effective solution. ● Use appropriate tools/devices to take and record accurate and precise measurements. ● Describe an object through dimensional annotation. ● Create appropriate and accurate technical drawings. ● Describe the concept of tolerance as it relates to interoperability of parts. ● Interpret data through statistical and graphical analysis. ● Create a graphical model to describe the relationship between two variables.

RESOURCES / LINKS

Activities	Presentations	Assessments
<ul style="list-style-type: none"> ● Mini Car Design Challenge 	<ul style="list-style-type: none"> ● Mini Car Presentation 	<ul style="list-style-type: none"> ● Mini Car Design Challenge Rubric