Lesson: **Mechanical Engineering: Automotive Engineering**

Grade Level: 8-9 – Time Required: 40 minutes – Lesson Dependency: None – Subject Areas:

* History
* Design
* Science and Technology

Summary

Automotive engineering is a relatively new subdivision of mechanical engineering that deals with the construction and designing of cars. This lesson gives a brief introduction to automotive engineering. Students will be told what it is and be given a brief history lesson that will show the first car. Students will also be introduced to a couple of careers in automotive engineering and be taught the systems of automobiles and the difference between modern and old mechanisms. Finally, students will understand what self-driving cars are, their pros and cons, and then take part in a debate on whether self-driving cars are worth it or not.

Engineering Connection

Automobiles are not only common but are crucial to modern times. Transportation of goods, people, and services has been around cars and trucks since the early 1900s. This has led to engineers having to come up with solutions involving transportation with cars needed in mind. Additionally, automotive engineering, whether it be the manufacturing or designing of cars, has opened a variety of new career opportunities and paths for those working within the mechanical engineering branch of engineering. These engineers are constantly applying their knowledge and skills due to the constant need for better, more efficient engines and car models.

Learning Objectives

Upon the completion of this lesson, students should be able to:

* Understand what automotive engineering is
* Know the history behind the creation of the first car
* Know the type of systems of the automobile
* Know two careers that require extensive knowledge of automotive engineering
* Know the difference between cars of the past and the cars of today
* Know what self-driving cars are and their pros and cons

### Educational Standards

* [CTE-TECED.68.ROBTEC.01.03](https://www.cpalms.org/Public/PreviewStandard/Preview/14774) - Describe emerging technologies and their implications on the field of robotics.
* [CTE-TECED.68.TSPTEC.01.01](https://www.cpalms.org/Public/PreviewStandard/Preview/14819) - Describe how transporting people and goods involve a combination of individuals and vehicles.
* [CTE-TECED.68.TSPTEC.01.02](https://www.cpalms.org/Public/PreviewStandard/Preview/14820) - Identify subsystems of transportation vehicles, such as structural, propulsion, suspension, guidance, control, and support that must function together for a system to work effectively.
* [CTE-TECED.68.TSPTEC.01.03](https://www.cpalms.org/Public/PreviewStandard/Preview/14821) - Describe subsystems of transportation vehicles, such as structural, propulsion, suspension, guidance, control, and support that must function together for a system to work effectively.
* [CTE-GEN.68.GENRL.26.09](https://www.cpalms.org/Public/PreviewStandard/Preview/13141) - List occupations, job requirements, and job opportunities in engineering technology.

Worksheets and Attachments

* [Automotive Engineering Presentation](https://docs.google.com/presentation/d/1Xahc0u8GP9PyOr2ZHoukUAKFuIK1KVUt3k0adjQ0GWw/edit?usp=sharing)
* [World’s First Car](https://www.youtube.com/watch?v=DL_mJeb6O04) (Video) – Stop the video at 2:50 mark
* [Self-Driving Car Debate Worksheet](https://docs.google.com/document/d/12EMvsi5XG6B4GNkv_YhGVrACZhB-Oxuxr0RbkeWux64/edit?usp=sharing)

Introduction/Motivation

Following the invention of the first gas-powered car by Karl Benz in 1885, the automotive industry was born. The early years of the car were defined by simple autonomous cars with few moving parts and many safety issues. Only the rich could afford the luxury and the creation of cars was primarily done by small, local shops that would soon leave the business shortly after entering it. The 1900s saw the competition of three types of cars, the steam-powered car, the electric car, and the gasoline car. By the end of the 1920s, gasoline cars had become the dominant type of car. Post-World War I, automotive pioneers, such as Henry Ford, would go on to start the mass production of cars and give the wider public the ability to afford and use cars.

The decades that followed saw the establishment of today’s leading car manufactures and the growth of those that had already been established. Thousands of people sought employment in the construction of automobiles, with hundreds of factories being opening across the word. However, manufacturers and engineers alike noticed the many safety issues these vehicles possessed and would soon begin finding ways to solve these issues. The remainder of the 20th century would see an increase in the number of automotive engineers and designers who were now tasked with not only increasing the efficiency of cars, but also the safety of them. Additionally, the aerodynamics of cars was also put into consideration, with the design changes over the decades being a result of this.

Today, the need for those to physically construct vehicles is decreasing due to new developments in the field of robotics. However, the need for automotive engineers continues to grow due to the need for engineers who can oversee the construction progress. There is also a constant need for designers to continuously come up with new ideas on how to save fuel and increase the safety of cars. Automotive engineers of today now have access to computer-aided designing software that can allow for the virtual testing of many design features included in a model. The rise in the need for alternative fuel sources and self-driving has also allowed automotive engineers to work alongside biochemical and robotics engineers respectively.

The purpose of this lesson is to introduce students to the idea of pursuing a career in automotive engineering or equivalent. Students who are interested in cars and the like will be able to learn about something that allows them to use their passion to help others and have a career that can build upon that passion.

(Transition into the presentation slides relating to simple machines by using the script provided in Lesson Background)

Lesson Background and Concepts for Teachers

(The text that follows relates to the [Automotive Engineering Presentation](https://docs.google.com/presentation/d/1Xahc0u8GP9PyOr2ZHoukUAKFuIK1KVUt3k0adjQ0GWw/edit?usp=sharing) of the Mechanical Engineering Unit. Additionally, the script is meant to be an aid to the presenter rather than what they should say verbatim. The goal is for the presenter to put the information in their own words as best they can while still making it easy to understand. Presenters are not recommended to read off the slides.)

**Slide 1 –** Alright, now that your break is over, it’s time to go into our next topic: automotive engineering. Now, who here can tell what is automotive engineering? You don’t have to be right. (allow them to respond and then answer them accordingly) Okay, let’s move on to the next slide.

**Slide 2 –** Automotive engineering, also known as automobile engineering, is a branch of vehicle engineering that combines multiple disciplines, such as mechanical and electrical. It is the designing and construction of automobiles, which are vehicles designed to be used on roads, have four wheels, and use a gas or diesel engine. Cars, trucks, and buses are examples of automobiles. It is a branch that is constantly being improved upon, with new designs being thought up and drawn on an almost daily basis. In modern times, automotive engineering is very important since automobiles are crucial to the transportation of goods, services, and people on land. But it wasn’t always like that.

**Slide 3 –** While steam-powered automobiles had been in existence since the 1860s, it wasn’t until the invention of the gasoline engine in the mid-1870s that the first modern cars would begin to be developed. Karl Benz was a German engineer who is credited with creating the first practical automobile in 1885. He would later receive his patent for it in 1886, dubbing it the “Benz Patent Motorcar.” He would found his company, Benz & Cie., in 1883 which would merge with Daimler-Motoren-Gesellschaft in 1926 to form Mercedes-Benz, three years before his death. Despite the debate on whether he deserved the credit or not, his contributions and company continue to influence the automotive industry to this day.

**Slide 4 –** We have a video here that depicts the world’s first car being used, although it is a replica. (Play the video, the instructor may ask any questions they deem necessary during the playtime. Stop the video at the 2:50) For those who want to watch the full video at a later time, the link to the video is provided at the bottom of the slide, so I’ll give those who want to see a minute to take a picture. Now let’s move on.

**Slide 5 –** Here we have the three systems of an automobile: the electrical system, the fuel system, and the engine system. The electrical system consists of all the electrical components of the car, from the battery to the navigation system. Older models may only have radios and cassette players, while newer models have built-in computers and can connect to the internet. The fuel system consists of everything from the storage of fuel to the processing and transport of it. Fuel is stored in the fuel tank and is connected to the engine. The fuel can either be gasoline, diesel, or a biofuel. Electric cars replace the entire fuel system with a large battery and wiring. Finally, there is the engine system which consists of, you guessed it, the engine! The engine has the most parts of the car, and it is arguably the car’s heart. It is what makes the car move. The system consists of the cooling system, the internal-combustion engine, the battery, ignition, etc. These are the three main systems of modern cars, with there being other smaller features that aren’t big enough to warrant their separate system.

**Slide 6 –** Here are two careers that those who pursue automotive engineering can go into. Note that these are just two out of the many that you can go into, we just don’t have the time to go over them all. The first one is automotive manufacturing, in which those in that career are responsible for the making of cars, trucks, motorcycles, etc. They also oversee the construction of a vehicle or can physically do it themselves. They can even do both! The other is engine manufacturing. Engine manufacturers are responsible for the assembling of machines and engines. They are also responsible for the construction and rebuilding of machines, engine testing, and performing maintenance.

**Slide 7 –** There is a difference between modern mechanics and old mechanics. Every year, newer, more efficient models are released, making older models slowly become obsolete. Additionally, older mechanics possess more safety risks than the newer models, making their continued use a danger to the driver, their passengers, other drivers, and pedestrians. Newer jobs are requiring more skilled workers due to the addition of computers and advanced navigation systems.

**Slide 8 –** I am sure most, if not all of you know what self-driving cars are. Yet, in case there is someone who doesn’t know, I will explain what they are. A self-driving car is a vehicle that drives itself without needing a physical driver. This is done by using a variety of sensors and a lot of coding. The concept of a self-driving car has been around since the late 1930s, with people controlling cars remotely by using radio antennas and remote controls. With today’s technology, economically viable self-driving cars are close at hand.

**Slide 9 –** There are pros and cons to self-driving cars that shed light on why we want them but why have taken so long to come up with them. First, let’s talk about the pros.

* Self-driving cars can reduce the number of crashes, which will save money.
* The reduced number of crashes will also save lives, as 90% of all road fatalities are a result of human error.
* Those incapable of driving due to age or disability will be able to have a greater degree of mobility.
* There is the possibility of quicker commute times.
* Finally, environmentally friendly self-driving cars will improve air quality and reduce pollution.

Next are the cons of self-driving cars.

* There are increased chances of congestion due to the higher number of cars on the road.
* They are at risk of criminal activity through hacking/software crashes and glitches
* May not consider every scenario due to programming limitations.
* Loss of jobs for those who operate transport vehicles like taxi drivers and bus drivers.
* May be too expensive to make or afford.

Now that you all know the pros and cons, I think it’s time we have a debate!

**Slide 10 –** Do you believe that self-driving cars are worth it? For this debate, you all will be separated into separate groups to debate each other in. You will also be given a simple worksheet. In that worksheet, you will have the pros and cons listed for you to refer to during your debate. You will need to then choose what side you’ll be on and give a 2-3 sentence explanation as to why. There will also be a section for you to take notes in, however, that is only optional. You will use this worksheet to aid in your debate and to show that you participated. Once the debate time is over, you will turn in the worksheet and take a poll that will let us see the percentage of the group that chose to side or go against self-driving cars. Let’s begin! (Separate the students into small groups and remind them to work on the worksheet and participate. As a moderator, you will be making sure the students are actively debating each other and ensuring everyone is respectful in doing so.)

Associated Activities

[**World’s First Car**](https://www.youtube.com/watch?v=DL_mJeb6O04)**(Video) –** Students will be shown the first 2 minutes and 50 seconds of the video to have them see how the first car operated. Questions may be asked by the students after the video, and the instructor should respond accordingly.

**Self-Driving Car Debate –** Students will be put into small groups to debate on whether self-driving cars are worth it. Each group will be moderated by an instructor to ensure the students remain on topic and are respectful to one another. They will be asked: “Do you think that self-driving cars are worth having or are they not worth it at all?” The students will then be given 20 minutes to pick a side and debate each other on the topic. At the very end, a poll will be taken to see how many students were in favor of self-driving cars.

[**Self-Driving Car Debate Worksheet**](https://docs.google.com/document/d/12EMvsi5XG6B4GNkv_YhGVrACZhB-Oxuxr0RbkeWux64/edit?usp=sharing) **–** Students will be given a worksheet before going over the pros and cons of self-driving cars. They will use this worksheet as both a reference sheet and as a way for them to demonstrate what side they chose and why. Students will need to state what side they chose and why. Students will be given space to take notes on during the debate, however, these will be optional. Students will turn in the sheets to their instructor after the debate time is over.

Lesson Closure

(The lesson will end after the debate is over and then be followed immediately by the next lesson in the unit) Alright, now that the debate is over, you all must finish up your worksheets and have them submitted in the next few minutes. Once everyone, or almost everyone, has submitted their work, we will move on to the next topic after this one. I hope that you all had fun with the debate and will remember what we discussed today, especially those who are interested in this topic.

(Once work is turned in, move on to the next lesson)

Vocabulary/Definitions

***Automotive Engineering –*** *A branch of vehicle engineering that incorporates other major disciplines such as mechanical, electrical, and safety engineering.*

***Automotive –*** *The design, sale, operation, or manufacturing of automobiles. Examples can be the manufacturing of automotive parts or selling cars.*

***Automobile –*** *A vehicle designed to be used on roads and usually having four wheels and a gasoline or diesel engine. Examples are cars, trucks, and buses.*

***Combustion –*** *The act or process of burning; gas and diesel cars use internal-combustion engines.*

***Ignition –*** *When referring to an inter-combustion engine, it is the process that ignites the fuel in the cylinder.*

***Cylinder –*** *A cylindrical chamber in which a piston slides to move or compress a fluid.*

Assessment

**Pre-Lesson Assessment**

The pre-lesson assessment is a verbal assessment in which the presenter asks students if they have any prior knowledge about automotive engineering and to explain what it is to the best of their ability. Additionally, the students will be asked how much they know about the different parts of a car. Based on the students’ responses, the presenter can either further simplify the lesson or speak to them at a higher grade-level.

**Post-Intro Assessment**

Have students ask any questions about the lesson after each slide (if needed) to ensure they are paying attention and retaining the information that is told to them.

Students may be presented with verbal questions related to the [World’s First Car](https://www.youtube.com/watch?v=DL_mJeb6O04) video at the instructor’s discretion on slide 4.

**Lesson Summary Assessment**

Following the completion of the Mechanical Engineering Unit, students will be given an interactive quiz that will feature five questions about automotive engineering with multiple answer choices and one correct answer:

* When was the first automobile made? – 1885
* Who made the first automobile? – Karl Benz
* Which of the following is NOT a part of the fuel system? – Exhaust Pipe
* True or False: The modern automobile has 6 systems. – False
* Which of the following is NOT a system found in modern cars? – Aquaponic System

The “lesson summary assessment” will be this final quiz, which has 20 questions. The reasoning behind this was to avoid giving the students an exam after each lesson under the unit this lesson is a part of. The quiz itself is kept short so that students are not discouraged or intimidated by it. Additionally, students will be explained why the correct answer is correct and why the other answer choices are wrong after each question. This will allow the students to learn more and retain the information better. The quiz itself is also very interactive and visually appealing, which will keep the students engaged. Finally, each question is worth a certain amount of points, with students gaining points every time they get a question right. In the end, the top three students will receive a prize. The prize will provide the student with the incentive they need to do well on the quiz, but the quiz itself will be revealed at the end.

**Homework**

Students will be asked to create a quick biography of Karl Benz detailing his place of birth, date of birth, who his parents were, where he lived, when he died, his early life, career, and the time before his death.

Lesson Extension Activities

Students may be told to watch the remainder of the [World’s First Car](https://www.youtube.com/watch?v=DL_mJeb6O04) video in their free time as it goes into the history of car design and safety. The teacher(s) may ask them questions related to the video as part of the homework assigned to make sure they watched the video.

[Electric Bottle Car](https://www.instructables.com/id/Electric-Bottle-Car/) Activity: The teacher(s) may replace the homework assignment with Instructables’ Electric Bottle Car as a project. It is an intensive hands-on activity that students can do at home with adult supervision. The result is a bottle car that propels itself using a battery and electric turbine which spins the propeller. It is recommended that the teacher(s) make sure to consider whether each student has the physical and financial means to do the project at home.

Additional Multimedia Support

<https://www.instructables.com/living/> Instructable living provides many tutorials on how to improve one’s life through hands-on projects. It is also useful for finding projects that can aid in other lessons about engineering.

References

Dictionary.com. Lexico Publishing Group, LLC. Accessed July 28, 2020. (Source of most vocabulary definitions, most of which were done in my own words) <http://www.dictionary.com>

CPALMS Standards Accessed July 28, 2020 (Source of educational standards) <https://www.cpalms.org/Public/search/Standard>

Encyclopedia Britannica Accessed July 28, 2020 (Source for most information on automotive engineering and Karl Benz) <https://www.britannica.com/>

Teach Engineering Lesson: Triangles & Trusses Accessed July 20, 2020. (I based the structure of my lesson on this source, but no information was taken or needed from it) <https://www.teachengineering.org/lessons/view/cub_trusses_lesson01>

Budget Direct Driverless cars pros and cons Accessed July 19, 2020 (Used for my pros and cons for self-driving cars) <https://www.budgetdirect.com.au/blog/driverless-cars-pros-and-cons.html>

Contributors

Jorge Diaz, Alex Garrido, Victoria Velazquez, Justin Barroso, Abiel Vasallo, Reuben Latorre, and Kyle Kamiya.

Supporting Program

SYIP 2020 Summer Internship Program partnered with Hialeah Gardens Senior High School.

Acknowledgments

I would like to acknowledge the author(s) of Lesson: Triangles & Trusses. I based the structure of my lesson on the article. I would also like to acknowledge Hialeah Gardens Senior High School for allowing me to write this lesson and conduct the research on it.