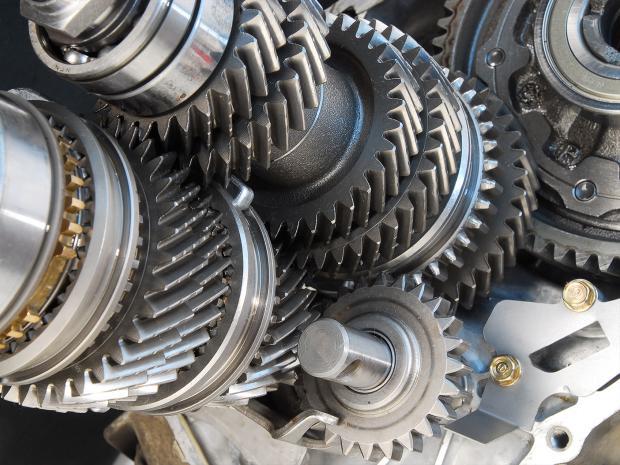
Lesson: **Mechanical Engineering: Intro to Mechanical Engineering**

Grade Level: 8-9 – Time Required: 50 minutes – Lesson Dependency: None – Subject Areas:

* History
* Mechanics
* Science and Technology
* Potential and Kinetic Energy

Summary

Mechanical engineering is one of the oldest and major engineering disciplines. This makes it important to talk about students entering engineering. In this lesson, students will learn what mechanical engineering is and how it is prevalent in our everyday lives. Students will be shown a video depicting the day-in-the-life of an actual mechanical engineer so that they can see what it is like. Four career choices/paths will also be presented to the students so that they may get an introduction to some of the opportunities for earning a mechanical engineering degree presents. Students will be given a brief lesson on what is potential and kinetic energy and participate in an activity involving paper airplanes. Finally, students will be tasked with completing a timeline depicting two contributions historical mechanical engineers have made over the centuries.

Engineering Connection

Since the dawn of civilization, engineering has been present in the lives of ancient peoples and the lives of people today. One of the oldest branches of engineering in mechanical engineering, dating back thousands of years. Since its conception, mechanical engineering has shaped the lives of people. Today, it is commonplace and one of the most popular and important of engineering disciplines due to the sheer number of machines and mechanisms used by people daily. Mechanical engineers are always at work improving the lives of those around them by making new and more efficient machines such as cars, planes, robots, computers, etc. The world today needs them now more than ever.

Learning Objectives

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

* Know what mechanical engineering is
* Understand what it’s like to be a mechanical engineer
* Know what potential and kinetic energy are and their relationship with one another
* Have a simple understanding of aerodynamics
* Know five historical mechanical engineers and two contributions they have made

Educational Standards

[CTE-TECED.68.AERTEC.03.06](https://www.cpalms.org/Public/PreviewStandard/Preview/14366) - Build an aerodynamic vehicle.

[SC.6.P.11.1](https://www.cpalms.org/Public/PreviewStandard/Preview/1767) - Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.

[SS.912.A.1.3](https://www.cpalms.org/Public/PreviewStandard/Preview/3334) - Utilize timelines to identify the time sequence of historical data.

Worksheets and Attachments

* [Intro to Mechanical Engineering Presentation](https://docs.google.com/presentation/d/1DKQNVR8fuE3E7LB9Dl1meCZ_zo7h4i-yufViYYimj8o/edit?usp=sharing)
* [Day at Work: Mechanical Engineer](https://www.youtube.com/watch?v=ocqceS7KlzE)(Video)
* [How to Fold Five Incredible Paper Airplanes | WIRED](https://www.youtube.com/watch?v=JhYZy1ugI3Q)(Video)
* [Mechanical Contributions Timeline Worksheet](https://docs.google.com/document/d/14SHODLVBQBfTo9T_8XjQWNvdN0I--yfSQ2MmiueoE28/edit?usp=sharing)
* [Mechanical Contributions Timeline Answers Worksheet](https://docs.google.com/document/d/1Xj2_DV_2_Qo8W2giGlLjrpwzuO1PL4Q1PlphOpCFzms/edit?usp=sharing)

Introduction/Motivation

As mentioned in the connection, mechanical engineering is one of the oldest engineering disciplines, dating back thousands to tens of thousands of years ago. Simple machines such as the wedge and inclined plane have been in use since prehistoric times, with there being evidence that humanity’s predecessors used them too. Since the birth of civilization in Mesopotamia, mechanical engineering as played an important role in societies, with all requiring it in one way or another. Mechanical engineering was instrumental to the construction of many ancient structures such as the pyramids in Egypt.

Nowadays, mechanical engineering is often viewed as the discipline that focuses on complex machinery and the development of computation devices. However, the same problems that needed solving centuries ago are still being tackled and solved by mechanical engineers. From finding out ways to decrease the time spent on constructing buildings, to the research into developing even faster modes of transportation, the need to solve these issues is constant. With modern technological advances, the discipline has become much broader than before. This allows for more job opportunities and career choices for those who pursue a degree in mechanical engineering.

The purpose of this lesson is to introduce students into the discipline of mechanical engineering and give them an academic advantage over other students. They will be able to have prior knowledge on the subject and be able to grasp more of the information they will be given in their Intro to Engineering Design class. Furthermore, those who have a passion for all things mechanical will be made aware that they can pursue a career with their passion. Students who love to work with cars will be able to use it in automotive design and those who are interested in planes can work in aerospace, all requiring knowledge from mechanical engineering.

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

Lesson Background and Concepts for Teachers

(The test that follows relates to the [Intro to Mechanical Engineering Presentation](https://docs.google.com/presentation/d/1DKQNVR8fuE3E7LB9Dl1meCZ_zo7h4i-yufViYYimj8o/edit?usp=sharing) which is the first lesson in 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 –** Okay everyone, today we are going to talk about mechanical engineering! We go over what is and why it is important.

**Slide 2 –** Okay, who can tell me what they know of mechanical engineering? Do any of you have any prior knowledge? (wait for responses and respond accordingly). Okay, let’s begin.

**Slide 3 –** Mechanical engineering is a branch of engineering that combines engineering physics and mathematical principles with materials science to design, analyze, manufacture, and maintain machines. In other words, it is the branch that deals with anything with moving parts. These moving parts can be car engines and human prosthetics.

**Slide 4 –** Mechanical engineering is important because it is one of the oldest and broadest of the engineering disciplines. Mechanical engineering is present in our everyday lives in the form of cars, planes, the simple machines we use, and even our bodies posses’ aspects of mechanical engineering. Everything that moves or needs to be moved involves mechanical engineering. People who work in the field are known as mechanical engineers. They design develop, build, and test out machines.

**Slide 5 –** Here is a 3-minute video that shows the day in the life of a mechanical engineer. (presenter is free to ask questions at their discretion during the video)

**Slide 6 –** Now we will go into some careers that apply to mechanical engineering. The first and most obvious career is being a mechanical engineer. Mechanical engineers provide efficient solutions to the development of processes and products. They work on all stages of a product, from the research into it to the final commissioning of it. Next is an industrial engineer. They focus on maximizing efficiency and apply their mathematical and mechanical engineering skills to solve problems that relate to the production of products.

**Slide 7 –** After that, there is a career in automotive engineering. They are constantly improving automotive technology, making it more efficient and safer to use. They develop new safety features, car parts, and more fuel-efficient engines. Finally, we have a career as a biotechnology engineer. It is a hybrid of healthcare and engineering, where they are responsible for innovations like the prosthetic limb. They are also responsible for creating new medical devices, software, or similar technologies.

**Slide 8 –** Which of these was the most interesting to you? (respond accordingly) Okay, let’s move on.

**Slide 9 –** Now we will briefly go into kinetic and potential energy. Kinetic energy is the energy of mass in motion, which is the energy an object has when it is moving. Potential energy is the energy that is stored in an object due to its position relative to some zero position. Potential energy is the amount of energy it has stored while stationary. An object possesses gravitational potential energy if it is positioned at a height above (or below) the zero height. Gravitational potential energy is when an object has stored up energy when it is being held above or below something.

**Slide 10 –** Since potential energy is the energy that is waiting, and kinetic energy is energy in motion, what do you think is the relationship between the two? (give tie for students to respond) Potential energy transforms into kinetic when the object is put into motion. Kinetic transforms back into potential when the object is put to rest. This is where the law of the conservation of energy comes into play; the total energy of the system remains constant and only transforms. For example, if you were to hold a ball in your hand, it would have potential energy. When you throw the ball up, the potential energy transforms into kinetic energy as it goes up. When it is the highest it can go, it then becomes gravitational potential energy. When it comes back down, it transforms back into kinetic energy. Hopefully, that makes it easier to understand.

**Slide 11 –** Now we’ll transition into a fun hands-on activity to further explain potential and kinetic energy – paper airplanes! In this activity, you’ll be tasked with creating a paper airplane test it out in front of your peers. When making it, think of different designs, types of paper, height and length, and the force you use on it because it will affect how the plane flies.

**Slide 12 –** In this case, the key is gravitational potential energy. The higher it is thrown, the farther it goes, but the angle must not be too steep.

**Slide 13 –** This paper airplane, dubbed “The Susanne,” flew a record 69.14 meters (266 feet and 10 inches) in 2012. The record has not been broken since.

**Slide 14 –** Here are some other planes that are popular and go far. What would happen if you were to bend the tip of the wings? (wait for responses and respond accordingly)

**Slide 15 –** Here we will provide you with a link to a video that will show you how to create five different types of paper airplanes, including The Susanne. The timestamps are also provided. You will be given 20 minutes to craft and test your paper airplane. You may use the designs in the video or use another of your choice. Your time starts now! (after allotted time meet back with students) Okay, show us what you’ve done (have all students present their airplanes).

**Slide 16 –** Now we will give you a timeline to do relating to today’s topic. You must copy the link below and download the worksheet as a word document. You are expected to complete it within 20 minutes, but you may use the 10-minute break period to finish if necessary. The instructions on what to do are in the worksheet. When finished, send your work to the email link provided. Be creative and be sure to include all the necessary information.

**Slide 17 –** (Refer to lesson closure)

Associated Activities

[**Day at Work: Mechanical Engineer**](https://www.youtube.com/watch?v=ocqceS7KlzE)**(Video) –** Students will be shown a video that depicts the day in the life of a mechanical engineer. They will see what he does, how he works, and how he got to his position. The video is very educational despite being three minutes long and may encourage the students to pursue a career in mechanical engineering or become a mechanical engineer.

**Paper Airplane Activity –** The paper airplane activity is a hands-on activity that has students make paper airplanes. This lesson is meant to be a very brief introduction to aerodynamics, as it is prevalent in aerospace engineering, which is closely related to mechanical. Students will use the [How to Fold Five Incredible Paper Airplanes | WIRED](https://www.youtube.com/watch?v=JhYZy1ugI3Q) video to create five different types of paper airplanes that they can use. Students will present their planes after the allotted time nears its end.

[**Mechanical Contributions Timeline Worksheet**](https://docs.google.com/document/d/14SHODLVBQBfTo9T_8XjQWNvdN0I--yfSQ2MmiueoE28/edit?usp=sharing) **–** The timeline is intended to teach students a little history of mechanical engineering without having to lecture. The task is rather simple as the students are only required to find the year in which each of the contributions was made and finish the fun facts. Once the years have been found and the fun facts finished, the student must plot the years and the names of the contributions on the timeline provided. The student has total creative freedom and may handwrite the timeline if they wish. They may also make their timeline and included more information.

Lesson Closure

(After allotted time for the timeline is over, the instructor will address the students) Okay, guys, time’s up but if you need to, you can continue working on the timeline during the 10-minute break. Your timeline must be submitted before the end of the break. As for those who have finished, make sure your work is turned in. You guys can now relax, eat a snack, use the bathroom, browse through your social media, etc. We will meet back in 10 minutes, see you guys then!

Vocabulary/Definitions

***Mechanical engineering –*** *The branch of engineering that deals with the design and production of machinery and moving parts.*

***Potential energy –*** *The energy stored in an object or system while it is stationary or in a similar state.*

***Kinetic energy –*** *The energy of an object while in motion.*

***Law of conservation of energy –*** *the principle that a system that does not have any force that interacts with it from the outside possesses the same amount of energy (it is constant), regardless of the changes in its form.*

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 mechanical 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**

The instructor may add verbal questions relating to the [Day at Work: Mechanical Engineer](https://www.youtube.com/watch?v=ocqceS7KlzE) video at their discretion.

Students will be asked “**Which of these was the most interesting to you?”** on slide 8 regarding the four careers presented in the previous two slides.

On slide 10, students will initially be asked: “what do you think is the relationship between the two?” They will then have some time to answer. After that, the answer will be revealed.

**Lesson Summary Assessment**

Following the completion of the [Mechanical Engineering Presentation](https://docs.google.com/presentation/d/1Qa-7qCbHZcQ9nAlR5SfQ9qmi5zA6U9PtfaReY4UgJ7M/edit?usp=sharing), students will be given an interactive quiz that will feature five questions about mechanical engineering with multiple answer choices and one correct answer:

* What is mechanical engineering? – Engineering that involves moving parts
* Which of these IS a career in mechanical engineering? – Automotive Engineer
* Which of these is NOT a career in mechanical engineering? – Electrician
* An object has kinetic energy when it is… – in motion
* True or False: Mechanical engineering is one of the oldest and broadest of the engineering branches. – True

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**

The [Mechanical Contributions Timeline Worksheet](https://docs.google.com/document/d/14SHODLVBQBfTo9T_8XjQWNvdN0I--yfSQ2MmiueoE28/edit?usp=sharing) may be left as a homework assignment. This is up for the presenter to decide based on student input.

Lesson Extension Activities

Students may be told to measure the distance their paper airplane traveled three times and write it down. They then would be told to send their longest distance. The student with the longest distance may receive a prize at the end, with the two runners-up also receiving prizes too.

Additional Multimedia Support

The organization responsible for producing the day at work video has its own website where they report on various topics: <https://www.wired.com/>

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>

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>

The Best Master’s Degrees Accessed July 10, 2020. (Source of some of the info on careers) <https://www.bestmastersdegrees.com/best-masters-degrees-faq/what-careers-are-available-with-a-mechanical-engineering-degree>

Prospect UK Accessed July 10, 2020 (Source of some of the info on careers) <https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree/mechanical-engineering>

Contributors

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