Iowa State University Engineering Ambassadors

Short presentation descriptions for available presentations

All presentations include a review of the Engineering Design Process, which is similar to the Scientific Method, and an activity that will occupy the majority of the time of the presentation. Activities will be performed in groups and usually include a challenge to design the best product (ex: the Structural Engineering activity challenge is to hold the largest weight at the top of the structure). All activity materials will be provided, and EA presentations are completely free.

Structural Engineering (4^{th} – 7^{th})

Structural Engineering is about engineering buildings across the world. We discuss what factors we need to consider when designing a building and some situations in which the right assumptions weren't made and a building failed. We will teach students about forces and moments at a very basic level and relate it to forces that act on a building like snow, wind, and people. We will close the presentation by walking through the engineering and construction process of buildings. The activity will challenge students to construct their own structure made from spaghetti noodles and marshmallows that can hold a specific "snow" or "wind" load that we will apply to it.

Flight (5^{th}-8^{th})

Flight introduces the basic ideas and principles behind airplane flight and design. We will discuss the basic idea of how airplanes stay in the air, how airplanes control flight, and how airplanes are designed. This presentation will also introduce Newton's first law of motion and relate this idea to flight. We will also bring up materials engineering topics to teach the students how materials need to be considered when designing planes. Along with this, we will introduce basic forces that act on an airplane. At the end of the presentation, we will have a fun and interactive project where the students will use the topics, they learned from the presentation to design and build paper airplanes.

Electricity (4th – 5th grade)

Electricity is about the idea of how we as engineers use the energy from electricity to power everything in our lives. We talk about where electricity comes from in an atomic state and show it in real world examples, such as showing batteries and electron flow. We also discuss the idea of conductors and inductors and how it changes the amount of electricity that can flow through the object. We do make comments to make sure children understand the power and how dangerous electricity can be throughout the presentation to make them aware that this isn't a toy to mess around with.

Biomedical Engineering (5th-8th)

Biomedical Engineering introduces a basic understanding of how BME's can grow artificial organs. We also introduce the idea that engineers can use biology to complete complex chemical reactions. We then talk about the different fields of engineering and how they relate/have applications in biomedical engineering. We end with an introduction to biomedical devices and use that to lead into an activity of creating a stethoscope from a rubber tube, funnels, and balloons. The activity encourages them to come up with a way to create the stethoscope given only the materials so that they can work through the engineering design process to find the best solution.

Robotics (5th-7th)

Robotics is influencing many aspects of work practices at home as well as industrial level. They are being used at home for cleaning purposes and at the same time we are sending robots in space and underwater to help humans in research and experiments. They are one of the many important factors contributing in technology development. This presentation introduces middle schoolers to robotics. It explains what is a robot, their different types, and their working. We discuss their benefits and how they are going to shape the future research and technology.

Biomimicry (6th-12th)

The natural world is a vast and amazing subject. Most things in the natural world can be equated to engineering projects. The one connection would be to relate birds to planes. To do this we would have to take various attributes from the birds and connect them to the plane. For example, how the bird's bone structure relates to the plane structure, how the bird's beak relates to the nose of the plane, how the bird's shape influences the plane's fuselage, and the bird's wings relates to the shape and size of the plane's wings. This presentation can be presented to Middle Schoolers and High Schoolers.

Simple Machines (4th-6th grade)

The simple machines presentation explores levers, wheel and axel components, and pulleys in an effort to explain how engineers can use these everyday machines to make tasks easier. We discuss how simple machines are often overlooked in day-to-day activities such as bicycles or hammers. Then we focus our discussion on pulleys and how engineers use pulleys to decrease the amount of force or effort is required to move a weight such as an elevator. We then finish by introducing the idea that engineers often put multiple machines together to create a system in order to make our lives easier. We use interesting topics such as rock climbing to engage the students and keep them engaged throughout the presentation. At the end of the presentation, the students become the engineer and design a pulley system in order to carry a weight with a lesser force, using the engineering design process.

Ziplines (4^{th}-8^{th})

Ziplines includes an introduction to some engineering/science topics, gets students thinking about logistics, and relates both of those ideas to engineering. First, the logistics of a zipline are considered: what materials to use, what can make an appropriate base, how to keep passengers safe, and how to evaluate environmental factors (wind, rain, etc.) After that, the science topics discussed are kinetic and potential energy; they are explained in the context of ziplines as the kinetic energy of the moving passenger, and the gravitational (height) and spring (elastic brake) potential energy present in the system. The last section is an overview on how engineers can tackle the design and construction of a zipline, what kinds of engineers are likely to work on such a project, and an introduction to the activity. The activity is making a zipline, which is just a bit of fishing line set up as a wire on which the student groups can test the zipline carriages they made out of the given materials.

Wind Energy (6^{th}-8^{th})

Wind energy introduces the possibilities of wind as a form of sustainable, renewable energy. We work through the mechanical and kinetic energy in a wind turbine system, and how those forms of energy are translated into electrical energy. We talk about the parts of a wind turbine and the different disciplines of engineering involved. We also discuss the impact of using renewable energy vs. nonrenewable energy on our world. We encourage them to think about how the various forms of energy production have different aesthetic benefits/downfalls. Our activity gets them to work with the engineering design process to use limited materials to try to make a functional pinwheel/windmill without any examples, and then showing them an example and comparing the two. There are many solutions to engineering problems; creativity is encouraged!

Roller Coasters (4^{th}-8^{th})

Roller Coasters relates a fun outdoor activity to kinetic and potential energy. In this presentation, we go over the essential parts of a rollercoaster. Then, we discuss what makes a rollercoaster fun- is it speed? Or height? Or maybe a loopity-loop? Students will learn about both kinetic and potential energy and how we measure it. A rollercoaster rider gains potential energy when they are at the top of the track, and uses kinetic energy as they fly down the other side. We will talk about the many disciplines of engineers that design rollercoasters from the wheels to the entire structure.

Boats and Buoyancy (4^{th}-8^{th})

Buoyancy is a super important for engineers to understand making boats. In this presentation we dive into the concept of buoyancy and explain the science behind it. We then talk about how engineers use that concept to make boats as well as what other engineers are involved in making boats. The age range for this group is 6^{th}-8^{th} due to the semi-technical discussion of buoyancy. For the activity we have groups make their own boats out of given materials and have a competition's to see who can hold the most marbles.

Cars (6^{th} -9^{th} grade)

In this presentation we will explore the concept of speed and acceleration and how these two concepts apply to everyday life. Cars are fascinating and using this everyday machine we can bring these concepts in a vivid way to the kids. We will cover the evolution and the design process of cars in a simple language that 6^{th} to 9^{th} grades kids can understand with getting into the details and at the same time bring our message home. Our ultimate goal is to clarify some of the myths about engineering and help them understand that engineering is about making everyday life easy and they can become engineers too.