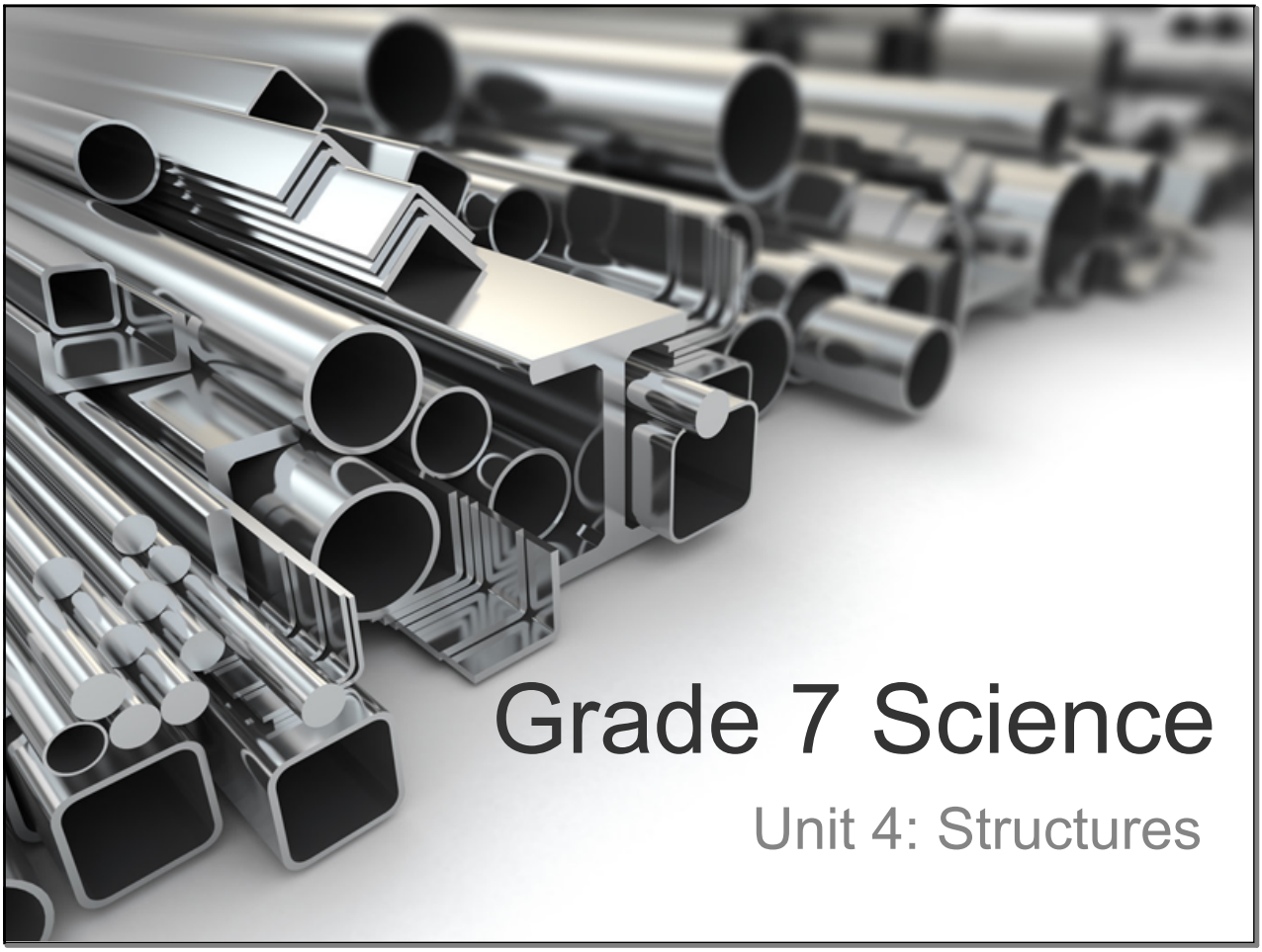


Grade 7 Science

Unit 4: Structures

At the start of the unit we discussed qualifications needed to be an engineer. Why are there so many? Safety

What can be unsafe about a structure?

Forces Material Choice Environmental Effects etc.

To help ensure a high level of safety, engineers use something called a "**Factor of Safety**" to help account for anything unexpected.

For example, what are the forces that act on a bridge?

cars people gravity wind waves
trucks etc animals rain bench

← Write answers here

Let's say that an engineer thought of all of these forces, and he designed the bridge to handle all of them at once. Now, let's say that every one of these forces does happen, all at once. Will the bridge hold? Yes

...what happens if a bird flies by and poops on the bridge? ... oops

Factor of Safety

Let's look at how an engineer uses a Factor of Safety.

Example: If a structure must support forces "A" and "B" then the total force it must support is A+B.

However, an engineer may use a factor of safety of 2, so the structure will be designed to hold (A+B)x2

This means that the structure is designed to withstand twice the force. If it was designed to handle exactly the force required, and there was a flaw in the material, it would fail. However, the factor of safety prevents that failure, because the structure is stronger than it needs to be.

Factor of Safety

Here is an example using numbers:

Example: A crane, with a hook having a mass of 50 kg is designed to lift loads of up to 10,000 kg. The engineer in charge used a factor of safety of 1.5. What mass would need to be lifted to actually snap the cable?

Max Mass = 10 000 kg
Factor of Safety = 1.5

Tensile Strength → can hold
10 000 × 1.5 = 15 000 kg
*50 kg hook

∴ It would take a mass of 14950 kg to snap the cable

With ever increasing computer technology, safety can also be monitored by sensors. For example, if an elevator starts to fall too fast, the brakes go on. This is done with an accelerometer, a sensor that detects changes in speed.

Aesthetics

After all of the safety features are settled, the design process can look at two more features:

Aesthetics: *The properties of an object that make it pleasing to the senses.*

Most products, including structures, are in competition, meaning that more than one company makes them. As a consumer we use our senses as part of our decision making process. Therefore, it benefits the designer to make the product aesthetically pleasing.

Ergonomics

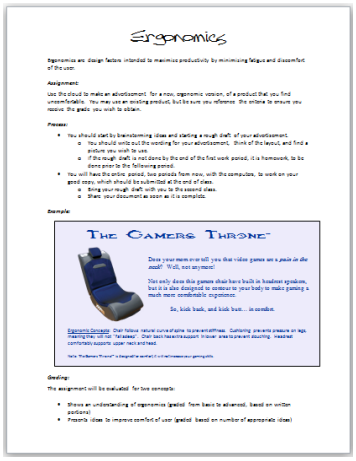
Ergonomics: *Design Factors intended to maximize productivity by minimizing fatigue and discomfort of the user.*

People will not use a product that is not comfortable. However, they also want a product that efficiently completes its purpose. Ergonomic considerations allow the product to balance these two desires, making the product work well, but also not cause any discomfort to the user.

Have a look at the following products:

Ergonomics

Your next assignment in science will be based on the concept of Ergonomics. Let's have a look at the assignment, and discuss the criteria.



Ergonomics

Ergonomics are design factors intended to maximize productivity by minimizing fatigue and discomfort of the user.

Assignment:

Use this sheet to make an advertisement. For a new, ergonomic version, of a product that you find uncomfortable. You may use an existing product, but be sure you reference the online to ensure you receive the goals you wish to obtain.

Process:

- You should start by brainstorming ideas and starting a rough draft of your advertisement.
  - You should write out the wording for your advertisement. Think of the layout, and find a picture you wish to use.
  - If the rough draft is not done by the end of the first work period, it is homework, to be done prior to the following period.
- You will have the entire period, two periods from now, with the computers, to work on your good copy, which should be submitted at the end of class.
  - Bring your rough draft with you to the second class.
  - Share your document as soon as it is complete.

Example:

Grading:

The assignment will be evaluated for two concepts:

- Shows an understanding of ergonomics (grade) from basic to advanced, based on written portions)
- Presents ideas to improve comfort of user (grade) based on number of appropriate ideas)

All of the information for this assignment is posted on the science webpage.

Attachments

- 4-25 Gaming Controllers.jpg
- 4-25 Ergonomics.pdf