



Lesson 3.3 – Structural Analysis

Concepts

1. Objects are held together by means of joinery, fasteners, or adhesives.
2. Precision measurement tools and techniques are used to accurately record an object's geometry.
3. Operational conditions, material properties, and manufacturing methods help engineers determine the material makeup of a design.
4. Engineers use reference sources and computer-aided design (CAD) systems to calculate the mass properties of designed objects.
5. There are many mass properties of a product; some of these are volume, surface area, density, and mass.

Performance Objectives

It is expected that students will:

- Describe the differences between joinery, fasteners, and adhesives.
- Identify the types of structural connections that exist in a given object.
- Use dial calipers to precisely measure outside and inside diameter, hole depth, and object thickness.
- Identify a given object's material type.
- Identify material processing methods that are used to manufacture the components of a given commercial product.
- Assign a density value to a material, and apply it to a given solid CAD model.
- Perform computer analysis to determine mass, volume, and surface area of a given object.

Essential Questions

1. What are the differences between joinery, fasteners, and adhesives?
2. What is the difference between an adhesive and a solvent?
3. How does a design's material makeup impact the joinery, fasteners, and adhesive methods used to hold its components together?
4. What factors influence the selection of a material for use in a design?
5. For what reasons might a designer need to know the mass, volume, and surface area of an object?
6. What is the difference between an object's mass and an object's weight?

7. What is the difference between force and stress?

Key Terms

[Adhesive](#)

[Adhesive Bonding](#)

[Analysis](#)

[Competitor](#)

[Compression](#)

[Fastener](#)

[Hypothesis](#)

[Joinery](#)

[Manufacturing Process](#)

[Mass](#)

[Mechanical Fastener](#)

[Non-Renewable Resource](#)

[Part Interaction](#)

[Renewable Resource](#)

[Reverse Engineering](#)

[Snap-Fit](#)

[Stress](#)

[Surface Area](#)

[Teardown](#)

[Tension](#)

[Torsion](#)

[Volume](#)

Instructional Resources

PowerPoint® Presentations

[Wood Fasteners, Joinery, & Adhesives](#)

[Product Disassembly](#)

[Mass Property Analysis](#)

[Metal Fasteners, Joining & Adhesives](#)

[Plastic Fasteners, Welding & Bonding](#)

Word Documents

[Optional Activity 3.3.1a Wood Joinery Identification](#)

[**Optional Activity 3.3.1b Wood Fasteners and Adhesives Classification**](#)

[Optional Activity 3.3.1c Metal Joining Process Identification](#)

[Optional Activity 3.3.1d Metal Fasteners and Adhesive Classification](#)

[Optional Activity 3.3.1e Plastic Welding Procedure Identification](#)

[Optional Activity 3.3.1f Plastic Fasteners & Bonding Classification](#)

[Activity 3.3.2 Product Disassembly](#)

[Activity 3.3.2a Product Disassembly Chart](#)

[Activity 3.3.2b Materials Usages Charts](#)

[Activity 3.3.3 Mass Property Analysis](#)

[Optional Activity 3.3.3a-g Mass Property Analysis Extras](#)

Project 3.3.4 Product Disassembly Display

Lesson 3.3 Key Terms and definitions in Excel

Reference Sources

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Note: Additional resource information is available in the Lesson 3.3 Teacher Notes.