Lesson Title | Composite Material Testing
Grade Level(s) | 5-8
Timeline | 2 Days

Objectives

Students will build and test composite materials to determine if they increase strength without significantly increasing weight.

Standards

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Crosscutting Concepts: Energy and Matter, Structure and Function

Science and Engineering Practices: Planning and carrying out investigations, Analyzing and interpreting data

Background

Composite materials are all around us. They are used in everything from airplanes to buildings and from swimming pools to race cars.
Materials

Each group needs:
- 5 strips of cardstock (2 inches wide, cut lengthwise)
- Glue
- 1 strip of fiberglass cloth

Whole Class Supplies
- 2 meter sticks or rulers
- Yarn or String
- Milk Jug (Gallon size)
- Pitcher (to pour water into milk jug)
- Towels

Vocabulary

Composite Material: Something made of 2 or more different materials that when combined create something with different characteristics.

Lesson Plan

Day 1: Build Day
- Students in small groups build three test articles
  - Article 1: 2 sheets of cardstock (not glued together) - this is the control, it is not a composite material because there is only one type of material
  - Article 2: 2 sheets of cardstock glued together (composite material)
  - Article 3: 2 sheets of card stock with 1 sheet of fiberglass cloth glued between them. (composite material)
  - Have students write their names on their test articles and allow them to dry overnight
- Hint: Composites work best when given a day to dry
- Hint: The more glue the students use the stronger their composite materials will be
- Testing Apparatus (create this day to be ready to use for testing)
  - Place two rulers or meter sticks between two tables. Leave a 5-8 inch gap between the tables and a 1 inch gap between the rulers
  - Tie string or yarn in a loop through the handle of the milk jug so the jug stays 5-6 inches above the ground when suspended from the rulers
  - Cut the top of the milk jug to make pouring easier
Day 2: Testing Day

- Test #1
  - Weigh testing apparatus (milk jug and string)
  - Weigh: 2 sheets of cardstock without glue and record on the data sheet
  - Loop string around the cardstock and dangle the milk jug between the two rulers
  - Pour water into the milk jug until the test article fails (falls)
  - Hint: Make sure the string is in the middle of the cardstock between the two rulers
  - Reminder: Pour slowly and as soon as it starts to fall, stop pouring. You may need to steady the jug from spinning but do not hold it up
  - Weigh milk jug and water
  - Record results

- Test #2
  - Weigh testing apparatus (milk jug and string)
  - Weigh: 2 sheets of cardstock glued together, record on the data sheet
  - Loop string around the cardstock and dangle the milk jug between the two rulers
  - Pour water into the milk jug until the test article fails (falls)
  - Hint: Make sure the string is in the middle of the cardstock between the two rulers
  - Reminder: Pour slowly and as soon as it starts to fall, stop pouring. You may need to steady the jug from spinning but do not hold it up
  - Weigh milk jug and water
  - Record results

- Test #3
  - Weigh testing apparatus (milk jug and string)
  - Weigh: 2 sheets of cardstock and fiberglass cloth, record on the data sheet
  - Loop string around the cardstock and dangle the milk jug between the two rulers
  - Pour water into the milk jug until the test article fails (falls)
  - Hint: Make sure the string is in the middle of the cardstock between the two rulers
  - Reminder: Pour slowly and as soon as it starts to fall, stop pouring. You may need to steady the jug from spinning but do not hold it up
  - Weigh milk jug and water
  - Record results

- Draw conclusions based on the data.
### Extensions

Test other composite materials
- Student created with more cardstock or fiberglass cloth
- Student created with other materials or different types of glue
- Cardboard

### Resources

Student Data Sheet