

Materials Science and Technology

Overview of MST Curriculum Content

This page is an overview of the content of the MST curriculum. It includes a description of topics covered and lists examples of labs performed in class. MST is a contextual, hands-on course that integrates science and technology.

Solids

This is the introductory unit in which students are exposed to the importance of Materials Science and Technology. They learn that solids are typically separated into four categories. They also study simple chemistry including chemical bonding, the periodic table, and oxidation-reduction.

Crystal structures, physical properties, and how metals are claimed from their ores are areas of emphasis. The importance of maintaining a student journal and keeping good records is stressed. Examples of experiments include:

- Material Safety Data Sheets (MSDS)
- Identification of Materials
- Formation of Crystals
- Destructive Testing
- Reactivity Series of Metals
- Oxidation/Reduction of Copper

Metals

In this unit, the students are introduced to many of the properties and historical developments of metals. Some of the mechanical properties of metals are investigated along with the effects of heat-treating. Different types of alloys and alloying techniques are emphasized along with the study of phase diagrams. Techniques for testing metals and manufacturing processes are also studied. A major project is the making of sterling silver jewelry using the process of lost wax casting. Examples of experiments include:

- Rolling a Coin
- Drawing a Wire
- Alloying Copper and Zinc
- Cost of a Penny -
- Making a Light Bulb
- Making Tin-Lead Solder
- Annealing Copper
- Powder Metallurgy
- Lost Wax Casting

Ceramics/Glass

In the ceramics unit, the students learn that most ceramics are crystalline solids that have properties related to the ionic or covalent bonds that hold them together. Students also learn that glass has different properties than most ceramics due to the amorphous structure of glass. A variety of processes used to manufacture ceramics are studied including a stained glass project and a Raku pottery project. Examples of experiments include:

- Forming, Firing, and Glazing Clay
- Thermal Shock
- Glass Bending and Blowing
- Glass Batching and Melting
- Dragon Dribble/Dragon Tears
- Coloring Glass
- Stained Glass Project
- Making Raku
- Ceramic Slip Casting

Polymers

What synthetic polymers are and the chemistry involved with them is introduced in this unit. The classification of polymers is included along with how they are altered chemically or with additives. Concerns with recycling are emphasized along with the chemical changes brought about by cross-linking. Historical developments and manufacturing processes are also included. Examples of experiments include:

- Cross-Linking a Polymer (slime)
- Polymer Identification
- Making Nylon 6-10
- Latex Rubber Ball
- Memory in Polymers
- Epoxy Resin Cast
- Polymer Foam Creations

Composites

Types of composites are described and categorized. Strength-to-weight ratios are emphasized including strength measuring, testing, and altering. Wood and concrete are two traditional composites used to introduce many concepts. An emphasis is placed on fiber-reinforced composites including those containing graphite and Kevlar fibers. Examples of experiments include:

- Stressed-Skin Composites
- Plaster of Paris Matrix Composite
- Compression and Tension in a Bending Beam
- Laminated Wood Beams
- Using Portland Cement to Make & Test Concrete
- Hand Lay-Up of a Glass Fiber Reinforced Polymer

This is only a partial listing of the experiments and projects. Many teacher demonstrations are also included in the curriculum. Major themes weave from one unit to the next making it easier for the students to make connections and applications.

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