



INTRO TO THE NANOSCALE

Can steel burn? What is a nanometer?

Does size really matter?

Students learn that size **does** matter. They will investigate how changes in the shape or size of an object affect its surface area to volume ratio (SA/V), which can change dramatically in the nanoscale. They will apply this knowledge to design an exploding liquid geyser.

By incorporating everyday materials into science lessons, the Materials World Modules (MWM) program at Northwestern University has found the solution to getting students excited about learning science while helping teachers meet national and state education standards.

The modules are easy to organize and inexpensive to use. They can be incorporated into any science class because of the breadth of subjects covered in the Activity and Design Project sections. Each module is a supplemental science unit that takes 1-3 weeks of class time (approximately 10 hours) to complete.

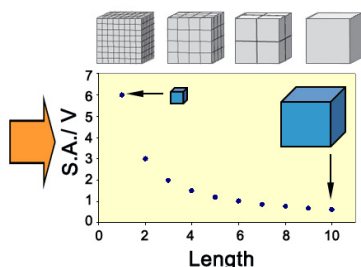
Module At-a-Glance:

Activities

- Size Dependent Properties
- Powers of 10 and Scale
- Surface Area and Volume
- Playing the Nano Concept Card Game "Nanocos"

Design Project

- Designing a Liquid Geyser



MWM will give students an opportunity to understand the world around them in a way they have never experienced before. The modules promote an awareness of the roles science and technology play in society and guide students to take increased control of their work.

Width of human hair (0.0001 m)	Head of a pin (0.001 m)	Width of fingernail (0.01 m)	Diameter of CD (0.1 m)
1	10x	100x	1000x
Carbon nanotube (1 nm)	Antibody IgM (12 nm)	HIV virus (100 nm)	S. Aureus bacteria (600 nm)
		GULLIVER'S TRAVELS	

MWM is designed to improve STEM education

Science • Technology • Engineering • Math

Interdisciplinary

Integrates science & non-science subjects

Flexible

Can adapt to your teaching style, students' ability and class time

Hands-on

Contains activities that lead up to inquiry-centered design projects

Cutting-edge

Examines issues on the forefront of technological research

Materials World Modules

An Inquiry & Design Based STEM Education Program

Northwestern University ■ www.materialsworldmodules.org

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Connects
to Your
Curriculum

Chemistry

- Chemical Reactions ■ Food Chemistry ■ Hydrogen Bonding Polarity ■ Surface Chemistry/Catalysis

Biology & Life Sciences

- Size and Bone Strength ■ Size and Skin Coverage ■ Microscopy ■ Allometry ■ Size and Metabolic Rate ■ Size and Thermoregulation

Mathematics

- Dimension ■ 2-D and 3-D Geometric Shapes ■ Scale ■ Estimation/Approximation ■ Powers of Ten ■ Logarithm and Exponents ■ Ratios and Proportions ■ Length, Area, and Volume Measurement ■ Surface Area to Volume Ratio ■ Graphical Analysis

Physics & Physical Sciences

- Color ■ Capillary Forces ■ Energy Transfer ■ Quantum Effects ■ Size and Forces/Strength ■ Size and Dominant Forces ■ Size and Surface Tension ■ Size and Terminal Speed ■ Size and Thermal Radiation ■ Types of Microscopes ■ Astronomical Objects

Language Arts

- Writing a Report ■ Public Speaking ■ Giants and Tiny Creatures in Fantasy Stories ■ Large and Small Scale Creatures/Devices in Science Fiction Stories ■ Numbers and Magnitude in Literature