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 run. 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:

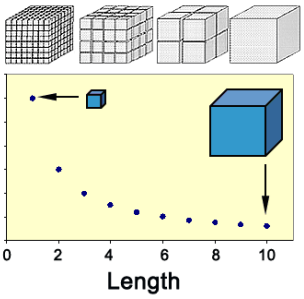
Activities

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

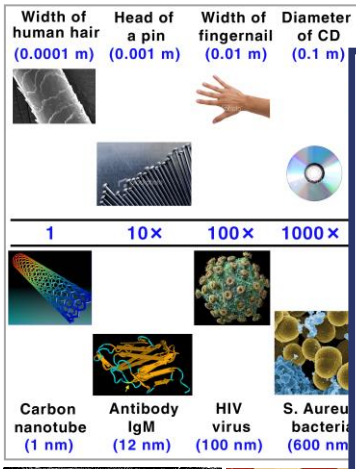
Design Project

- Designing a Liquid Geyser

*Nanocos card game is available separately.



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.



MWM is designed to improve STEM education

Science ▪ Technology ▪ Engineering ▪ Math

Interdisciplinary
Integrates science & non-science subjects

Flexible
Modify to your teaching style, students' ability and class time

Hands-on
Contains activities that lead up to inquiry-centered design projects

Cutting-edge
Introduces issues on the forefront of technological research

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

Materials World Modules

An Inquiry & Design Based STEM Education Program

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