



INTERACTIVE i-MWM

What is the first and foremost property that increases in importance at the nanoscale?

As an object size gets smaller and smaller, the surface area-to-volume ratio (SAV) becomes larger. The beginning of an understanding of the nanoscale is both getting a sense of how small it is and realizing that some intriguing properties arise when an object gets so small that surface behavior is dominant. i-MWM provides an interactive format to support mastery of non-intuitive, difficult core nano concepts.

By adopting an interactive mobile platform, i-MWM combines hands-on scientific inquiry and engineering design projects with web-based multimedia tools (e.g. interactive animations, simulations, modeling and data analysis tools, games, and tutorials) to accelerate and deepen student understanding of complex spatial, time- and size-dependent phenomena that underlie emerging technologies.

Module At-a-Glance:

Activities (Gr 6-8/9-12)

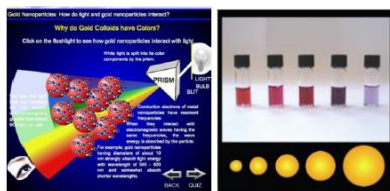
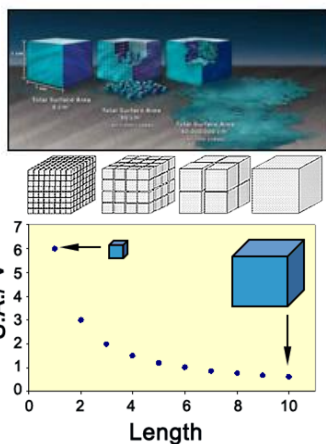
- Measurement & Tools
- Size and Scale
- Surface Area-to-Volume Ratio
- Size-Dependent Properties

Design Projects

- Geyser Design

- Linked core nano STEM concepts with traditional disciplinary subjects
- Aligned with NGSS and engaged in science and engineering design practices
- Connected to relevant nano crosscutting concepts to enhance learning across subjects
- Seamless integration with classroom activities
- Increased flexibility and broad access
- Rapid assessment feedback
- Cyber platform for community collaboration

SAV Tutorial



Interactive Gold Colloid Animation

CUBE BUILDING ANIMATION
Choose a building method and view instructions by clicking respective instructions button on the right.

COMPUTATIONAL ANIMATION OF NANOMATERIALS USING A CUBE BUILDING ILLUSTRATION

DESIGN PROJECT: "CO₂ GEYSER" COLA REACTING TO SAND

i-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

Chemistry

- Chemical Reactions ■ Food Chemistry ■ Hydrogen Bonding ■ Polarity ■ Surface Chemistry/ Catalysis ■ Structure and Properties of Matter ■ Biochemical Reactions ■ Oxidation & Reduction ■ Natural & Synthetic Dye Molecules ■ Intermolecular Forces & Chemical Bonding ■ Energy Bonds/ Levels ■ Separation of Mixtures ■ Electrochemical Cells

Biology & Life Sciences

- Size & Bones Strength ■ Size & Skin Coverage ■ Microscopy ■ Allometry ■ Size & Metabolic Rate ■ Size & Thermoregulation ■ Photosynthesis ■ Food Chain/ Web ■ Absorption & Diffusion ■ Cellular Structure ■ Energy Flow in the Ecosystem

Mathematics

- Measuring ■ Graphing (Making & Interpreting) ■ Computing ■ Averages ■ Rates ■ Dimension ■ Scale ■ Estimation ■ Power of Ten ■ Logarithm and Exponents ■ Ratios & Proportions ■ Length, Area & Volume Measurement ■ Surface Area to Volume Ratio ■ Graphical Analysis

Physics & Physical Sciences

- Property of Matter ■ Potential Energy, Kinetic Energy & Work ■ Electromagnetic Spectrum & Absorption Spectra ■ Light Energy, Heat Energy & Energy Transformations ■ Charged Particles, Electricity ■ Circuits, Current, Voltage & Electric Power ■ Color ■ Capillary Forces ■ Energy Transfer ■ Quantum Effects ■ Size & Forces/ Strength ■ Size & Dominant Forces ■ Size & Surface Tension ■ Size & Terminal Speed ■ Size & Thermal Radiation ■ Types of Microscope ■ Astronomical Objects

Geology & Earth Science

- Metals & Minerals ■ Use of Natural Resources ■ Renewable Energy ■ Environmental Pollution Issues

Environmental Science

- Global Warming ■ Alternative Energy ■ Fossil Fuels ■ Cellular Structure ■ Energy Flow in the Ecosystem

Engineering Education

- Designing ■ Building Prototypes ■ Communications ■ Optimization

Language Arts

- Fantasy Stories ■ Sci-fi Stories ■ Literature

Materials World Modules

An Inquiry- & Design-Based STEM Education Program

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