Southwest Center for Microsystems Education (SCME)
University of New Mexico

A Comparison of Scale: Macro, Micro, Nano Learning Module

This Learning Module contains six (6) units:
Knowledge Probe (KP) or Pre-test
A Comparison of Scale Primary Knowledge (PK)
Inquiry Activity: Cut-to-Size
The Scale of Biomolecules Activity
Scale Activity: Zoom In / Zoom Out
A Comparison of Scale Assessment

A Learning Module Map is included as a suggested outline on how to use this learning module.

In order to grasp many of the concepts associated with micro and nano-size devices, one needs to understand scale and the size of objects associated with different scales. This learning module introduces various concepts associated with scale, and a comparison of the macro, micro and nano-scales. Activities provide the opportunity to further explore the macro, micro and nano scales and their associations with micro and nanotechnology.

Target audiences: High School, Community College, University

Made possible through grants from the National Science Foundation Department of Undergraduate Education #0830384, 0902411, and 1205138.
Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and creators, and do not necessarily reflect the views of the National Science Foundation.

Learning Module Map for Comparison of Scale: Macro, Micro, Nano

In order to grasp many of the concepts associated with micro and nano-size devices, one needs to understand scale and the size of objects associated with different scales. This learning module introduces various concepts associated with scale, and a comparison of the macro, micro and nano-scales. Activities provide the opportunity to further explore the macro, micro and nano scales and their associations with micro and nanotechnology.

Learning Module units (6):

- Knowledge Probe (KP) or Pre-test
- Comparison of Scale Primary Knowledge (PK)
- Inquiry Activity: Cut-To-Size
- The Scale of Biomolecules Activity
- Scale Activity: Zoom In / Zoom Out
- Comparison of Scale Assessment

Following is a suggested map on the implementation of this learning module.

IMPORTANT STEPS	KEY POINTS	REASONS
Knowledge Probe	This is a 12 question assessment of the macro, micro, and nanoscales.	This knowledge probes helps to determine the participants' current knowledge of scale prior to completing this learning module. This information can be used to assess the effectiveness of this module.
Inquiry Activity: Present the Inquiry Activity "Cut To Size".	Introduce this activity with the PowerPoint presentation "macro-micro-nano". Have the participants read through then complete the activity.	This inquiry activity is designed to stimulate excited about scale at two extremes: the size of the universe vs. the size of an atom.

Unit Presentation: Present the PowerPoint present - A Comparison of Scale: Macro, Micro, Nano	Participants should read the PK either before or after the PowerPoint presentation. A PowerPoint presentation can be downloaded from scme-nm.org and presented to all participants.	This PK discusses the three scales (macro, micro, nano) and the importance of these scales to micro and nano technologies.
Activity – The Scale of Biomolecules	This activity relates scale to biomolecules and how biomolecules are used in MEMS. An understanding of biomolecules would be helpful, but not necessary.	This activity provides students with a connection between fabricated MEMS devices and the biomolecular world. It provides a better visual as to how small this technology has become and the challenges it faces.
Activity – Zoom In / Zoom out: Complete the "Scale Activity – Zoom In / Zoom Out".	This activity is a capstone project for this Learning Module. Students should work in teams of 2 to 3.	In addition to providing further exploration into the various scales, this activity allows the participants the opportunity to demonstrate what they have learned about the various scales.
Assessment: Complete Assessment for this learning module.	Give the participants the assessment for this learning module.	Participants are evaluated on what they have learned about scale and how it applies to micro and nanotechnologies.

Adapted from Graupp, P. & Wrona, R. (2006) The TWI Workbook: Essential Skills for Supervisors. New York, NY. Productivity Press.

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program through Grants. For more learning modules related to microtechnology, visit the SCME website (http://scme-nm.org).