Teaching Quantitative Skills in the Geosciences
resources for undergraduate students and faculty

Some Examples of Teaching Numeracy

Each of these PowerPoint modules is part of the Spreadsheets Across the Curriculum project. **Len Vacher** *(University of South Florida and the National Numeracy Network)* graciously provided these files to be used by participants of the 2006 workshop.

PLEASE NOTE: If you have problems viewing the PowerPoint files, try saving them to your computer (right-click on the title and then select "save as") and opening them in PowerPoint. The spreadsheets featured in the files can be modified as you wish from within the PowerPoint application (just double click on the image of the spreadsheet and it will open in Excel).

Earthquake Magnitude: How is Earthquake size measured? (PowerPoint 508kB Jun19 06)
by Laura Wetzel – Eckerd College, St. Petersburg, Florida

This module discusses different ways to measure earthquakes and walks students through making their own spreadsheet to calculate important values such as the amount of energy produced by a given magnitude and the relative size of each magnitude.

Quantitative Concepts and Skills used in this module

- Scientific notation
- Ratios
- Logarithms
- Graphs, linear
- Graphs, semilogarithmic

Understanding Radioactivity in Geology: The Basics of Decay (PowerPoint 505kB Jun19 06)
by C E Stringer, University of South Florida - Tampa

This module uses the activity of popping a bag of popcorn to talk about probability and the spontaneity of radioactive decay. The module includes the use of spreadsheets to understand the mathematics behind radioactive decay and the use of exponential growth and decay.

Quantitative Concepts and Skills used in this module

- Exponential function
- Graphs, exponential
- Graphs, trendline
- Probability

What Time did the Potato Die? (PowerPoint 401kB Jun19 06)
by Rebecca Sunderman, Evergreen State College, Olympia WA

This module has students determine time of "death" of a potato using forensic evidence (the "body" temperature through time). Students recreate a spreadsheet that helps them understand the mathematical relationship of temperature to time.

Quantitative Concepts and Skills used in this module

- Unit conversions
- Trendlines
- Logarithms
- Graphs, linear
- Graphs, semilogarithmic

The Mole in Chemistry (PowerPoint 1.6MB Jun19 06)

by Rachel Wang – Spokane Falls Community College

This module has students determine the number of moles of everyday items (like water). It makes use of spreadsheets, exponential functions and scientific notation.

Quantitative Concepts and Skills used in this module

- Unit conversions
- Scentific Notation
- Significant figures

Modeling with Exponential Functions: How is the Water? (PowerPoint 147kB Jun19 06)

by Vauhn Foster-Grahler – Evergreen State College

This module walks students through the use of mathematical modeling (specifically the change in concentration of bacteria in water). Students generate their own spreadsheet to calculate the growth of bacteria and has them determine the most appropriate model for their data.

Quantitative Concepts and Skills used in this module

- Data Analysis
- Mathematical Modeling
- Logarithmic Re-expression
- Solving Logarithmic Equations
- Reading and interpreting graphs

Simple vs. Compound Interest (PowerPoint 420kB Jun19 06)

by Gary Franchy – Davenport University

This module walks students through calculation and graphing of simple and compound interest. Students use a spreadsheet to complete the assignment.

Quantitative Concepts and Skills used in this module

- Arithmetic Growth
- Geometric Growth
- Forward Modeling
- Function, linear
- Function, exponential
- Graph, XY (scatter)

What are the characteristics of an equilibrium reaction? (PowerPoint 375kB Jun19 06)

by Cheryl Coolidge, Colby-Sawyer College, New London, NH

This module teaches students about chemical equilibrium. Students are walked through using Excel for data reduction and graphical analysis.

Quantitative Concepts and Skills used in this module

- XY Scatter graphs
- Rate
- Percent change
- Exponential decay
- Geometric progressions

Density of Rocks, A: How Large is a Ton of Rocks? (PowerPoint 396kB Jun23 06)

by Len Vacher – University of South Florida, Tampa, Florida

Students build spreadsheets to calculate the edge length of cubes and the diameter of spheres of various rocks weighing a ton. Rocks are ice, vein quartz, gabbro, granite, and porous arkose. Calculations start with list of mineral densities.

Quantitative Concepts and Skills used in this module

- Unit conversion

- Volumes of cubes and spheres
- Weighted average
- Forward modeling using trial and error
- SUMPRODUCT function

Westward Ho! How Far is Yonder Mountain? (PowerPoint 120kB Jun23 06)

by Len Vacher – University of South Florida, Tampa, Florida

Students build a spreadsheet to calculate the distance to and relief of a mountain peak given two vertical-angle sightings to the peak. The angles are sighted during successive days between which the wagon train heads straight for the peak. Manipulation of the spreadsheet allows consideration of the effect of slight errors in the angle measurements.

Quantitative Concepts and Skills used in this module

- Trigonometry, tangent
- Algebra, combining equations
- Algebra, solving equations
- Error propagation

Archimedes and Pi – How Can You Compute Pi? (PowerPoint 228kB Jun23 06)

by Eric Gaze – Alfred University, Alfred, NY

Students build a spreadsheet to calculate the perimeter of regular polygons inscribed within a circle. The spreadsheet is set up recursively, so that students start with a hexagon and finish with a polygon with more than a half-million sides.

Quantitative Concepts and Skills used in this module

- Estimation
- Limits
- Ratios and proportions
- Pythagorean Theorem
- Geometric reasoning
- Logic, IF function

The Manning Equation (PowerPoint 96kB Jun23 06)

by Paul Butler –The Evergreen State College, Olympia WA

How can you calculate the size of a culvert you need to carry a specific discharge? Students build a spreadsheet to invert the Manning Equation.

Quantitative Concepts and Skills used in this module

- Forward modeling
- Inverse problem
- Algebra, rearranging equations
- Iterative solutions
- Power function
- Graphs, XY scatter plot

Artificial River Rapids (PowerPoint 1.1MB Jun23 06)

by Lisa Foster –University of South Florida-Tampa

How deep does the water have to be in an artificial whitewater kayak course to allow an eskimo roll? Students build a spreadsheet to calculate the hydraulic jump associated with the transition from supercritical to subcritical flow.

Quantitative Concepts and Skills used in this module

- Forward modeling
- Algebra, rearranging equations