# *What's Smaller Than a Pygmy Shrew?*

## Purpose
To introduce students to the concept of atoms and their components, to highlight atoms' roles as the building blocks of matter, and to help students develop visual images of subatomic particles, atoms, molecules, and cells and their relative sizes.

## Background
This activity uses a short illustrative narrative (a fancy name for a picture book), What's Smaller Than a Pygmy Shrew? by Robert E. Wells, to help students begin to develop mental images of the size, scale, and structure of the atomic world. Its clear illustration and direct, engaging narrative is well suited to middle school students. Its picture book format shouldn't mislead you or your students into thinking it's an "easy" book. The contents of this book are very appropriate for middle school students. There are a number of activities that proceed the actual reading of the text. These pre-reading activities are meant to help expose previous misconceptions and identify what students may already know.

The book begins with a pygmy shrew and explores increasingly smaller and smaller objects. The illustrations are drawn to scale as completely as possible and give the reader strong visual images of the pygmy shrew, a ladybug, protozoa, molecules, atoms, nuclei, protons, neutrons, quarks, and electrons.



## Expected Outcomes
By the end of this activity, students should be able to identify the components of an atom (namely electrons, protons, neutrons, and quarks) and their location in the atom. Students should be able to rank subatomic particles, atoms, molecules, and cells in order of relative size. Students should be able to correct previous misconceptions of atoms.

## Materials
One or more copies of *What's Smaller Than a Pygmy Shrew?*
Copies of Vocabulary Guide, Ranking Objects by Relative Size, and Student Assessment worksheets (one of each per student)
Pencils
Markers or colored pencils (optional)

## Procedure

1. Each student should receive a copy of the Vocabulary Guide for What's Smaller Than a Pygmy Shrew? This guide lists the most important vocabulary in the text. Much or most of the vocabulary may be unclear and/or unfamiliar to students. Give students enough time to look at each word. Students should put an X in the first column if they have never heard of the word or an X in the second column if they have heard the word but are unable to give a definition. If students do know (or think

they know) the definitions, they should write those definitions in the third column. It is very important for students to understand that this activity is meant to help prepare them for the vocabulary and is not graded for "correctness". At this point it is acceptable for students to know few or none of the definitions of these words. At the end of the unit, however, students will be expected to know these definitions.

2. Once students have had enough time to try to define these words, students should share their definitions with each other and the whole class. Students should be encouraged to draw pictures to help explain their definitions. A chalkboard, overhead transparency, or large paper should be available for students to record their ideas and their diagrams. The teacher should allow all ideas to be presented, contrasted, and compared. At this point, it is not yet necessary for students to have a completely correct definition of each word. The purpose of this pre-reading activity is to expose previous knowledge and misconceptions.

3. Now that students have had some time exchange ideas and draw diagrams, students should complete the Ranking Objects by Relative Size sheet. Students, in pairs or small groups, should rank the objects on the list from smallest to largest. Again, this is pre-reading strategy that will help expose misconceptions and elicit previous knowledge.

4. Students should gather together to read the book. The teacher showing and reading a single copy works well. If multiple copies are available, students could read the text in small groups. Make sure students have sufficient time to see each illustration.

5. After having read the book, students should now return to the Ranking Objects by Relative Size sheet. In their pairs or groups, students should be given some time to rearrange the listed objects so that they are ranked accurately. Discuss the sheet with the entire class and clarify misconceptions or errors.

6. Now students should be able return to the Vocabulary Guide and to define words they were unable to define, to correct wrong definitions, and to clarify or to embellish earlier definitions. This may take some time. Students might work with other students, use the discussion notes and drawings on the chalkboard, transparency, or large paper, or reread the text in order to put together their new definitions. A whole class discussion of these definitions should follow individual work time.

7. Students should complete the Student Assessment sheet. This could be used as an in-class or take-home assessment.



**Possible Extension**

An excellent extension of this activity would use the use of the Eames' *Power of Ten* book and or/video or the IMAX video, *Cosmic Voyage.* Both explore scale in the universe, moving from the subatomic level to the ends of the known universe. In both

videos, the viewer moves toward and away from objects by a scale factor of 10. The *Powers of 10* website (powersof10.com) also provides students an opportunity to move from image to image. In addition to providing strong visual images and a feel for relative scale, these videos offer a great way to show students how to use scientific notation.