Gold Seal Lesson:

Copernicus Education Gateway

Author(s) *Michael Lucky Voiselle*			*Lesson Title:* *I CANNOT SEE AN ATOM*			
Grade Span			*ICLE Application Model*			
K-4	*5-8*	*9-12* *X*	*A*	*B*	*C* *X*	*D*

Instructional Focus:

Reading Students read a variety of grade level materials, applying strategies appropriate to various situations
Writing Students write for a variety of purposes and audiences with sophistication and complexity appropriate to the grade level.
Basic Concepts and Knowledge Students develop an understanding of scientific concepts using facts, theories, principles, and models.
Unifying Concepts and Processes Students recognize patterns and processes, making connections in terms of systems and subsystems that explain the interrelationships of the natural and designed world.
Science as Inquiry Students demonstrate knowledge and skills necessary to perform scientific inquiry.

Performance Task

Your group of 4 students will use the methods pioneered by Ernest Rutherford in the early 1900's and still used by particle physicists in their super colliding accelerators today. You will learn how to identify the characteristics of particles that you cannot see.

Your group should look up the Laws of Reflection to determine what it means and how particles behave when being deflected. Record in your science journal.

On your table is a 30centimeter square board hiding a shape underneath near the center. Your teacher has placed a flat shape cut from three/quarter inch shelving board. Your group is to determine the shape by rolling marbles underneath and watch how they bounce back. Develop with your group who will roll and who will keep track of the deflection. Record all group comments, observations, problems, and how your group solved them in your science journal. Your team will have 10 minutes to determine a shape. Place a piece of paper on top of the board for sketching the paths of the marbles. Then analyze this information to determine the object's actual shape. Neatly draw a picture of this shape in your journal.

After 10 minutes each group is to rotate around the room to identify another shape by rolling marbles again. Repeat this process until you have attempted 4 different shapes.

Each student is to write a summary of the experiment thus far. Include all the observations, diagrams, comments, and problems above and respond to the following 5 questions. The summary must be well-organized and free from spelling and grammatical errors.

1. Can you tell the size of the object as well as the shape?
2. How could you find out whether the shape has features that are smaller than your marble?
3. Without looking, how can you be sure of your conclusions?
4. Include a drawing of your 4 shapes to the dimensions you believe they are.
5. Compare your drawings to other groups in the class and record your observations and comments.

Your group is to research the development of the concept of the atom. You will need to include the following people in your next write-up: Democritus and Aristotle, two Greek philosophers; John Dalton; Ernest Rutherford; Hans Geiger; Ernest Marsden; and Neils Bohr. You are to include colorful drawings of the different atomic model concepts such as the Cloud Model, Bohr Model, and the Rutherford Model as they evolved. What are the major problems that scientists face when they study tiny unseen particles? This paper should also be well-written and free from spelling and grammatical

errors. You may use any resources available to you including textbooks, the Internet, encyclopedias, textbooks, and other people.

ICLE Essential Skills

Apply in writing the rules and conventions of grammar, usage, punctuation, paragraphing and spelling. (ela1)
Gather information from a variety of sources, including electronic sources, and summarize, analyze, and evaluate its use for a report. (ela3)
Use writing as a tool for learning in formats such as learning logs, laboratory reports, note-taking, journals and portfolios. (ela40)
Present information in well-organized fashion that will be clear to the target audience. (ela11)
Know and apply the principles of scientific inquiry. *(Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.) (Not Ranked s*114)
Plan and apply real or hypothetical models and constructions to facilitate investigation and learning and the solution to practical problems. *(Not Ranked s115)*
Make observations using senses and instruments. Inferences and interpretations are arrived at based on observations. Classify observable properties and organize observations in a meaningful and logical way. (s5)
Know the three most prominent models of the atom: The Rutherford, Bohr, and Cloud models. Examine how each theorizes the way in which electrons orbit about the nucleus. (s107)

Scoring Guide:

RATE CRITERIA: 3=Excellent, 2=Satisfactory, 1=Unsatisfactory, 0=Does not attempt or does not understand

CRITERIA	**SCORE**
Experimental procedure and group cooperation	_____
Drawings reflected many marble trials and a close resemblance to the actual shapes and neatly done	_____
Student demonstrated an understanding for the Law of Reflection	_____
All questions were addressed in the first write-up, well-written and free from spelling and grammatical errors	_____
Comments on comparing their shape to other group shapes were included in the write-up	_____
All scientists and their contributions to the concept of the model of the atom were addressed	_____
Student included neat and colorful drawings of the atom as it evolved	_____
Student demonstrates an understanding for the problems that particle physicists face working with unseen items	_____
Second write-up was well-written and free from spelling and grammatical errors	_____

Keywords

English Language Arts	Mathematics	Science
Reading **Research**	**Algebra**	**Earth Science**
Writing **Grammar** **Spelling** **Journal** **Technical Writing**	**Geometry**	**Life Science**
Communications	**Statistics**	**Chemistry** **Atomic Structure** **Scientific Research**
Literature	**Calculus**	**Physics** **Atomic Theory** **Scientific Process**
Other	**Trigonometry**	**Other** **Modeling** **History of Science**
	Other	

Picture, Chart, or Graph next page: