



# Young Audiences of Massachusetts *Educational Materials*

Please forward to teachers

7/21/09

## **ABOUT THE PERFORMANCE**

**Characters Educational Theatre:** *Madame Curie*

**Grade levels:** 6-12

In this program, students will meet Madame Curie, the scientist best known for discovering radium and polonium and the recipient of two Nobel prizes. Madame Curie will discuss the long-term significance of her discoveries, her childhood in occupied Poland, and the scientific work she did with her husband Pierre in their laboratory.

## **LEARNING GOALS:**

1. To study the life of Madame Curie in 19th and 20th century Poland and France.
2. To explore the impact of Madame Curie's discoveries on the scientific community.

## **PRE-ACTIVITY SUMMARY:** *Understanding Elements*

Discuss Marie Curie's discovery of radium and polonium. How did she discover these elements? Look at the periodic table of elements. Assign each student an element and ask him/her to find out how it was discovered. Have each student share this information with the class. Compare the different ways in which elements have been discovered throughout the years.

## **POST-ACTIVITY SUMMARY:** *Scientific Discoveries*

Discuss Madame Curie. What did she discover? Explore other scientific discoveries. Divide the class into groups and ask each group to research a scientist and his/her discovery. Have each group share its research with the rest of the class through oral presentations, illustrations, maps, skits, theater, etc.

## **CURRICULUM LINKS:**

Science, English Language Arts, History and Social Sciences, Theater, Women's Studies

# PRE-ACTIVITY: UNDERSTANDING ELEMENTS

**LEARNING GOAL:**

To explore the discovery of the scientific elements

**MATERIALS/PREPARATION:**

Periodic table of elements,  
books about the elements

**TIME:**

2 45-minute sessions

Tips for Teachers:

\* Periodic table:

[www.webelements.com](http://www.webelements.com)

**STEP 1:**

**Discuss** Madame Curie. Why was she famous? Review the chronology of her life (see enclosure). What was her greatest accomplishment? Discuss her discoveries of radium and polonium.

**STEP 2:**

**Discuss** the periodic table of elements. How many elements are there? Ask students to name a few of the common elements and their uses.

**STEP 3:**

**Assign** each student an element. Ask each student to find out how his/her element was discovered.

**STEP 4:**

Have each student present the history of his/her element to the class. Discuss the different ways elements were discovered. Compare an element that was discovered recently with one discovered 100 years ago. How were the discoveries different? Have innovations in scientific technology changed the way in which things are discovered?

**EXTENSIONS:**

- 1) **Discuss** the role of women in science.
- 2) **Have** students review the vocabulary words (page 4).



# POST-ACTIVITY: SCIENTIFIC DISCOVERIES

**LEARNING GOAL:**

To explore important scientific discoveries

**TIME:**

2 45-minute classes

**TIPS FOR THE TEACHER:**

\* Scientific Discoveries:

**Jonas Salk**

polio vaccination

**Louis Pasteur**

pasteurization

**Benjamin Franklin**

electricity

**Alexander Fleming**

penicillin

**Galileo**

Saturn

**STEP 1:**

**Discuss** Madame Curie. What did she discover? Why were her discoveries important to science?

**STEP 2:**

**Discuss** other scientific discoveries. (See **TIPS FOR TEACHERS.**) Divide the class into groups and assign each group one of the scientific discoveries from the list and/or others that students discussed.

**STEP 3:**

**Ask** each group to research the scientist and the discovery.

Students should answer the following questions:

1. When and where did the scientist live?
2. When did s/he make his/her discovery?
3. How did s/he discover it?
4. What affect did the discovery have on the rest of the world?
5. What prior discoveries led to this one?
6. What discoveries later on depended on this one?
7. Did the scientist receive recognition during his/her lifetime?
8. Did the scientist accomplish other things during his/her life?

**STEP 4:**

Have each group present its answers to these questions through oral presentations, illustrations, maps, theater, skits, etc.

**EXTENSIONS:**

- 1) **Ask** students to think of a time when they “discovered” something. List what information helped them reach that conclusion.
- 2) **Ask** students to investigate the effects of radioactive materials on humans. What are some of the symptoms? Did Madame Curie suffer from any of these symptoms?
- 3) **Discuss** how Marie Curie might react to the current controversy over nuclear weapons and the use of nuclear power.



### Significance of Marie Curie's Discoveries

Marie Curie's discoveries challenged four basic truths of the day.

1. Matter consists of irreducible atoms.

*Radioactive elements were shown to be reducing themselves continuously.*

2. There were 92 elements.

*The Curies added 2 more elements.*

3. One element cannot be transformed into another.

*Radioactive elements, in the course of disintegration, change atomic weight and move down the periodic table, becoming entirely new elements.*

4. Matter and energy are different and are subject to different laws.

*The Curies demonstrated that radioactive elements spontaneously give off energy as they disintegrate, which blurred the distinction between matter and energy.*

### CHRONOLOGY

November 7, 1867	Manya Sklodowska was born in Warsaw, Poland.
1891	Marie travels to Paris to study science.
1895	She marries Pierre Curie. Roentgen discovers X-rays.
1898	Marie identifies a new element in an ore sample. She begins work to isolate new elements (radium and polonium).
1902	She isolates one decigram of pure radium and determines the atomic weight of radium (225.93).
1904	Marie Curie wins the Nobel Prize in Physics with Henri Becquerel and her husband.
1906	Pierre is killed in a street accident. The Sorbonne assigns Pierre's teaching position to Marie.
1909	The Pasteur Institute and Sorbonne begin building a lab for Marie.
1911	Marie receives the Nobel Prize in Chemistry.
1914	The lab is completed. Marie institutes mobile X-ray units for field hospitals in the war.
1915	Marie bottles emanations from radium, which cure skin lesions.
1920	She meets Mrs. William Brown Meloney, who raises funds to purchase radium. Marie tours America to accept a gram of radium, then valued at \$100,000. She begins to lose her eyesight.
1921	President Harding presents Marie with a gram of radium.
1929	Marie receives a gram of radium for the Warsaw Radium Institute and meets President Hoover.
1933	She has an unidentified fever, which confuses doctors.
July 4, 1934	Marie dies of pernicious anemia caused by radium exposure.

**RESOURCES:**

Abby, Theodore. Elements and the Periodic Table: What Things Are Made Of. Quincy, IL: Mark Twain Media, 2001.

Borzendowski, Janice. Marie Curie: Mother of Modern Physics. New York: Sterling Publishing Co., 2009.

McClafferty, Carla Killough. Something Out of Nothing: Marie Curie and Radium. New York: Farrar, Straus, and Giroux, 2006.

**VOCABULARY:**

atom	pernicious anemia	radon
atomic weight	polonium	Roentgen device
element	positivism	spectrograph
Nobel Prize	radioactive	uranium

**ABOUT THE PERFORMER:**

A graduate of the Rhode Island School of Design and a former teacher, Marcia Estabrook began performing her characters in 1982. In addition to her Characters Educational Theatre performances, Marcia has been a featured storyteller at the Three Apples and the Big Apple Storytelling Festivals, the John F. Kennedy Library, the Old South Meeting House, the Martin Van Buren Historical Site in Kinderhook, NY, the Deerfield Museum, Old Sturbridge Village, Channel 5's "Tank Away" and Fox 25's "Americana". Marcia has been the keynote speaker at the New England Kindergarten Conference and has also performed and conducted workshops at the CT Storytelling Festival. Marcia appeared in "The Raven and the Dove" and "Town Called a River". She has consulted for the Rhode Island Children's Museum and the National Park Service. Marcia is a member of Solo Together and Historical Entertainments, and is proud to have been twice a nominee for the National Performer of the Year Award from Young Audiences.

**ABOUT YOUNG AUDIENCES:**

Young Audiences of Massachusetts (YAMA) is the oldest, largest and most utilized arts-in-education organization in the state and one of the largest in a national network of 33 chapters. For over 45 years, YA has been serving as a link between teaching artists and the region's school children, providing dance, storytelling, music and theater programs to children in schools, libraries and hospitals in the form of assembly performances, workshops and residencies. The organization's mission is to encourage lifelong engagement with the arts by making them an integral part of every child's education.



# Young Audiences of Massachusetts

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## MASSACHUSETTS CURRICULUM FRAMEWORKS CONNECTIONS

### Characters Educational Theatre: *Madame Curie*

<i>Language Arts 2</i>	...pose questions, listen to the ideas of others, and contribute their own information or ideas in group discussions.
<i>Language Arts 3</i>	...make oral presentations that demonstrate appropriate consideration of audience, purpose, and the information to be conveyed.
<i>Language Arts 9</i>	...identify the basic facts and essential ideas in what they have read, heard, or viewed.
<i>Language Arts 13</i>	...identify, analyze, and apply knowledge of the structure, elements, and meaning of nonfiction material.
<i>History 1</i>	Chronology and Cause...understand the chronological order of historical events and recognize the complexity of historical cause and effect.
<i>History 6</i>	Interdisciplinary Learning: Natural Science, Mathematics, and Technology in History...describe and explain major advances, discoveries, and inventions over time in natural science, mathematics, and technology.
<i>Arts-Theatre 1</i>	Acting...develop acting skills to portray characters who interact in improvised and scripted scenes.
<i>Arts-Theatre 5</i>	Critical Response...describe and analyze their own theatrical work and the work of others using appropriate theater vocabulary.
<i>Arts-Theatre 10</i>	Interdisciplinary Connections...apply knowledge of the arts to the study of English language arts, foreign languages, health, history, and social science, mathematics, and science and technology/engineering.