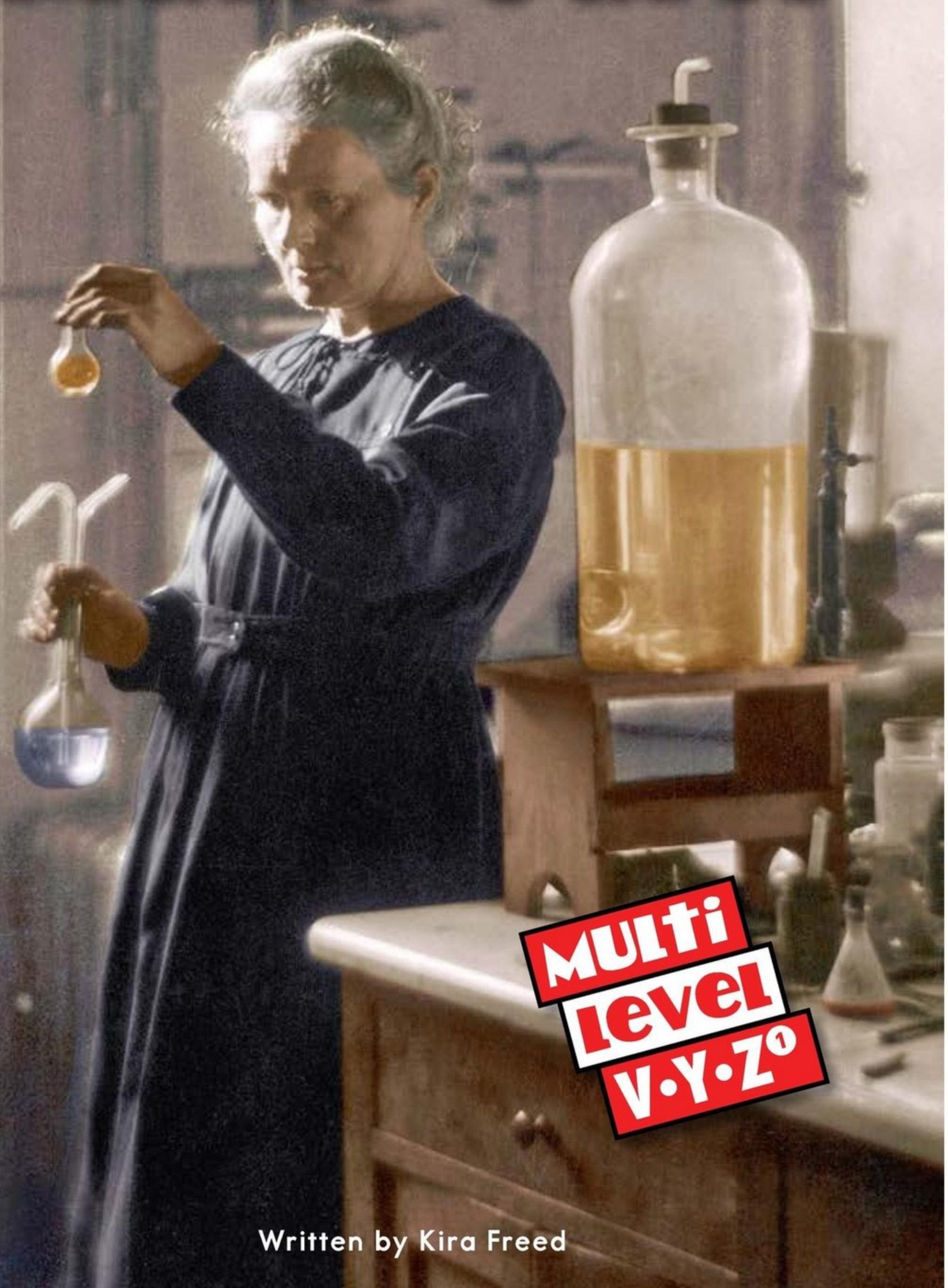


LEVELED BOOK • Y

Marie Curie



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Written by Kira Freed

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Marie Curie



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Focus Question

Who was Marie Curie, and how did she change the world of science?

Words to Know

anemia
breakthroughs
commission
doctorate
electrometer
element

Nobel Prize
nominated
perseverance
physics
Sorbonne
X-rays

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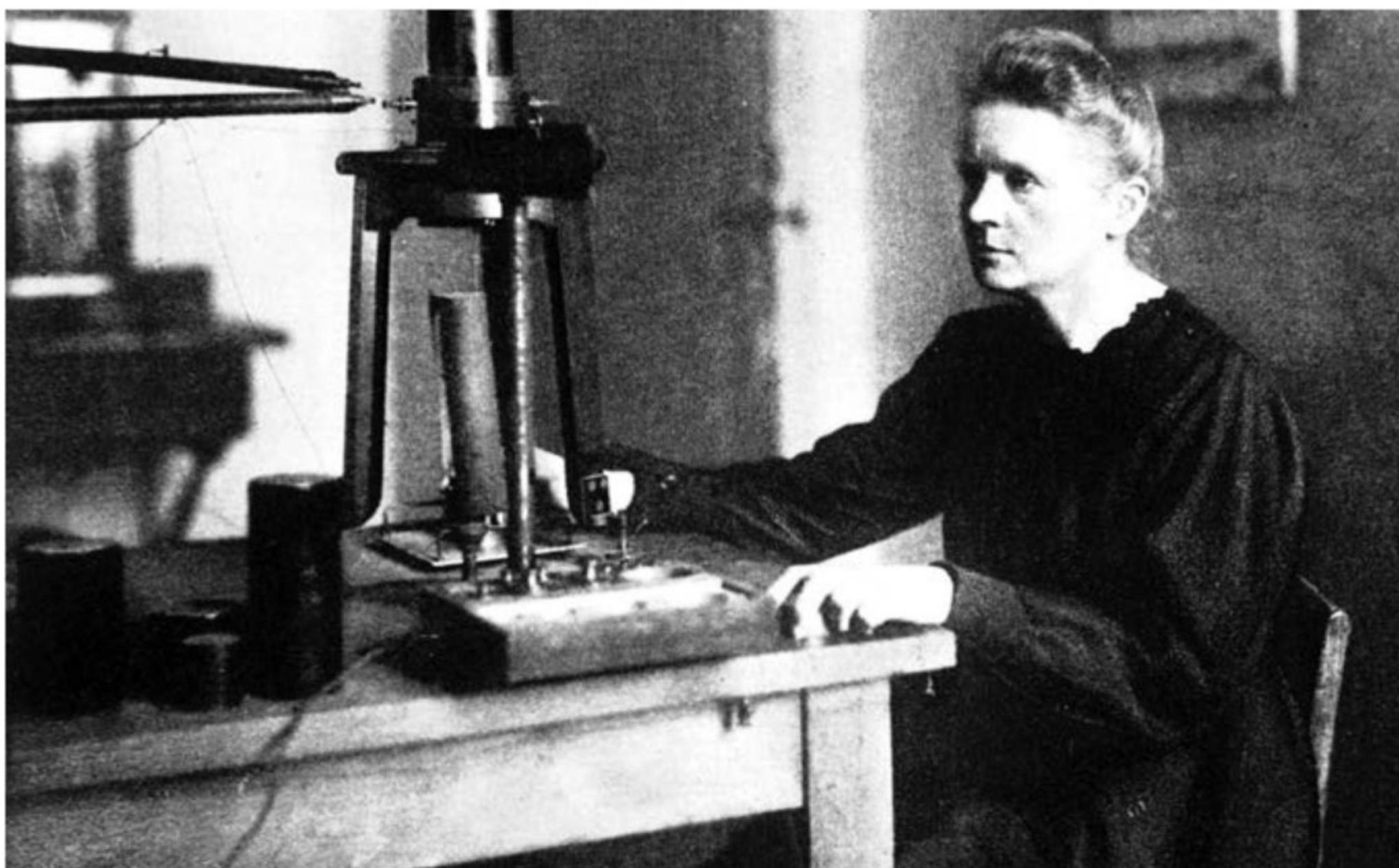
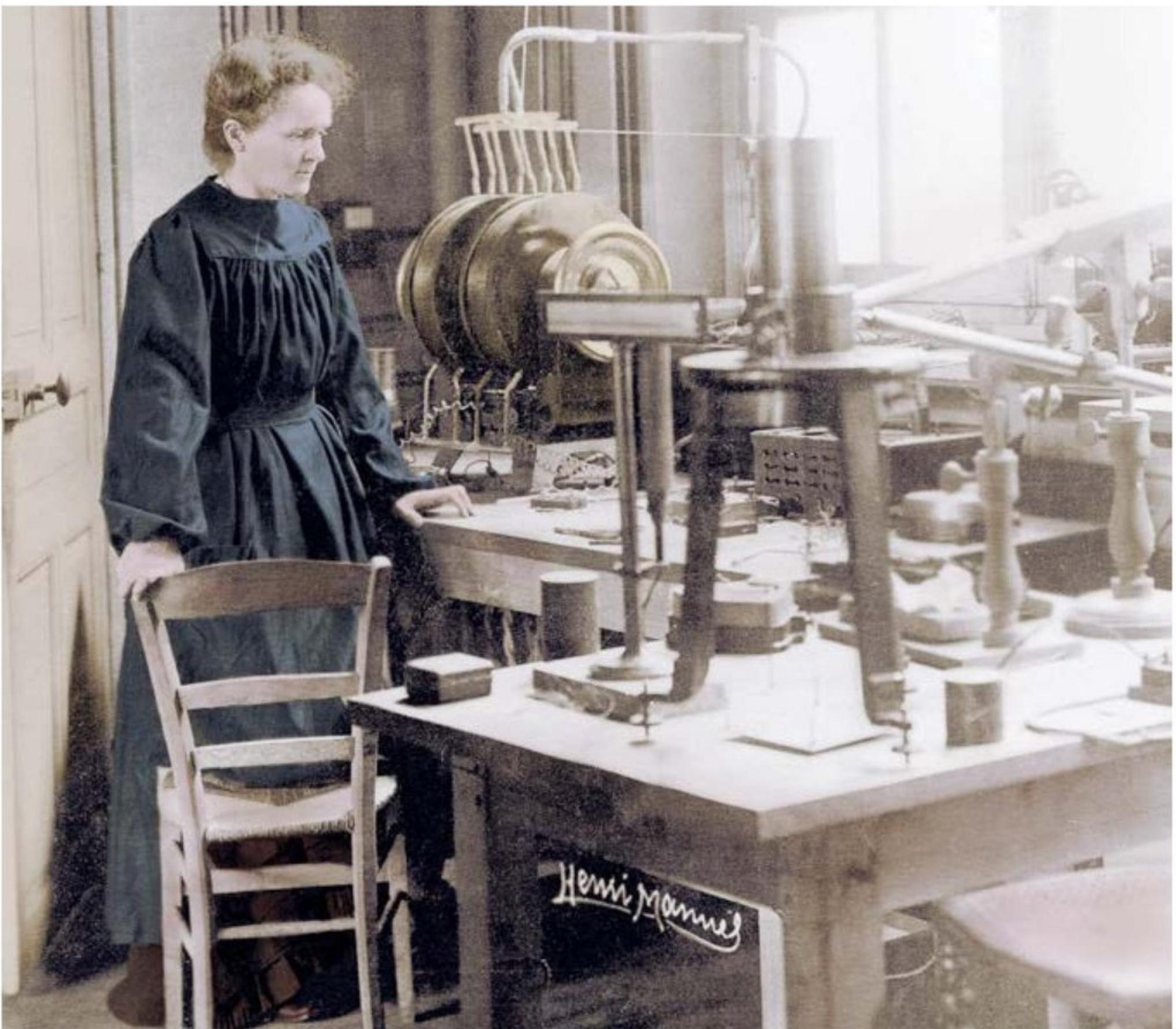


Table of Contents

Trailblazer	4
Early Years	5
Patience and Preparation	6
Paris at Last	7
Two Types of Rays	8
Achievements and Recognition	10
Dark Times and More Acclaim	12
On the Battlefront	13
Later Life	14
Gifts to the World	15
Glossary	16



Marie Curie's laboratory was packed with scientific instruments, some of which were invented by her husband, Pierre, and his brother, Jacques.

Trailblazer

At a time when few women were scientists, one woman's research and discoveries changed the world. She left her homeland to study science and math at a leading university. She followed her scientific interests even though the world seemed to block her way at every turn. She became the first female **Nobel Prize** recipient and the only person ever awarded Nobel Prizes in two different scientific fields. This groundbreaking scientist was Marie Curie.



Marie Curie (center) sits for a photograph with her brother and sisters (left to right) Zosia, Hela, Joseph, and Bronya.

Early Years

Marie Curie was born Maria Skłodowska on November 7, 1867, in Warsaw, Poland. She was called Manya as a child. Manya was the youngest of five children. Their father taught math and **physics** at a boys' high school.

When Manya was born, Poland was not an independent country. The area where Manya's family lived was ruled by the Russian Empire, which tried to put an end to Polish patriotism. Loyalty to Poland put people's lives in danger. Manya's father lost his job in 1873 because of his support for Polish independence. In 1876, Manya's oldest sister died. Manya's mother died two years later, when Manya was ten.

Manya was a bright, curious child and an outstanding student. She earned top honors when she graduated from high school at age fifteen in 1883.

Patience and Preparation

Manya and her sister Bronya wanted to continue their studies, but women could not attend the University of Warsaw. They would need to leave Poland but did not have enough money. Instead, the sisters attended Warsaw's "floating university"—free education offered in secret by Polish teachers. Although the classes were no match for the finest European universities, they kept Manya up-to-date on scientific **breakthroughs**.



The Sorbonne was, and still is, one of the finest universities in the world.

Both sisters wanted to attend the **Sorbonne** in Paris, but they had no money for classes. They struck a deal: Manya would earn money for Bronya's education, and Bronya would return the favor after earning her degree. Manya worked as a tutor and governess for five years. In her free time, she studied literature, sociology, physics, chemistry, and math. Through this work, she knew that math and physics were the right path for her. After helping her sister pay for her schooling, it was Manya's turn to attend.

Paris at Last

Manya moved to Paris in 1891 and enrolled at the Sorbonne. She took the name Marie—the French version of Maria—at that time. Two years later, she graduated first in her class with a master's degree in physics. The following year, she earned a second master's, in math.

Before completing her math degree, Marie received a **commission** to study the magnetic properties of steel. She needed a laboratory for her research. In early 1894, another scientist introduced her to Pierre Curie, a physics professor who had done groundbreaking research on magnetism. Pierre arranged for Marie to use some lab space where he worked.



Pierre Curie and Marie Skłodowska Curie as they appeared soon after they married.

Over time, Marie and Pierre's relationship deepened into love. They married in July 1895 and had a daughter, Irene, two years later. Marie continued to be dedicated to her work. After completing her research, she decided to pursue a **doctorate** at the Sorbonne.

Two Types of Rays

Marie needed a topic for her doctoral research. Two important discoveries had recently been made in the world of physics. In late 1895, Wilhelm Roentgen, a German physicist, discovered **X-rays**. Early the following year, French physicist Henri Becquerel discovered that the chemical **element** uranium emitted weaker rays. Marie decided to study uranium rays.

Marie wanted to study the effect of uranium rays on air. Using a device known as an **electrometer**, she measured barely noticeable electric currents in air that had been blasted with uranium rays. Marie verified Becquerel's observations that uranium in any form emitted electricity and that more uranium emitted more intense rays. In addition, she proposed—and later proved—that the rays were a property of uranium's structure. They were not a product of its physical or chemical state.

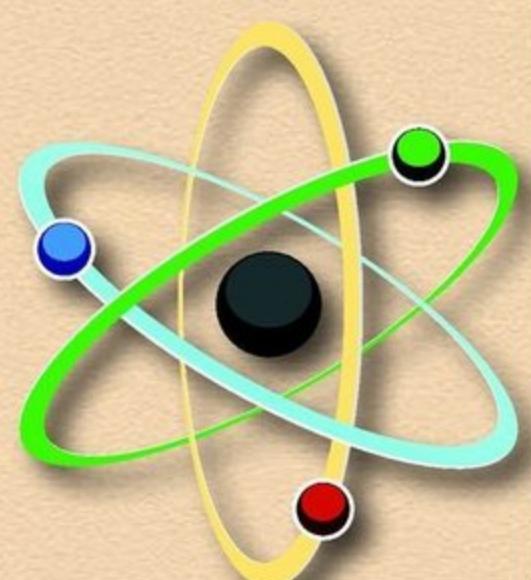
Marie then wondered whether uranium was the only element that made air conduct electricity better. She tested every known element and discovered that thorium also emitted rays. She coined the word *radioactivity* to refer to the emission of rays from an atom's nucleus, or center.

Marie continued to test various materials to see which ones emitted rays. When she tested a mineral called pitchblende, which contains uranium, she found that it gave off more rays than its uranium could account for. She concluded that pitchblende must contain a second radioactive element—one that was unknown to the scientific community.

Up to this point, Pierre Curie had been involved in his own research. In 1898, as Marie's work progressed, he set aside his research to help her. The search for a new element fascinated both of them. After a great deal of research, they discovered two new elements: polonium (named for Marie's homeland) and radium (from the Latin word for "ray"). In addition, Pierre demonstrated that radium's radioactivity could harm living flesh. His discovery opened the doors to treatments for cancer and other illnesses.

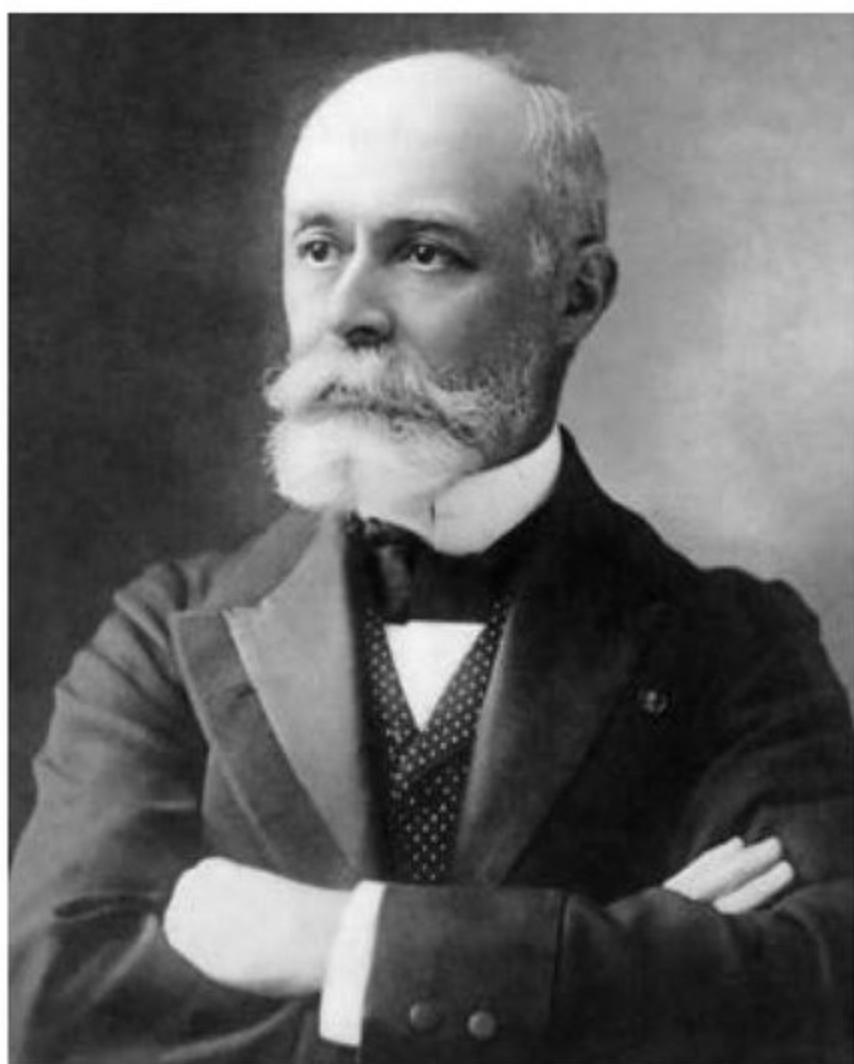
The Birth of Atomic Physics

Marie's discovery about rays being a property of uranium's atomic structure sparked a far-reaching shift in scientific understanding that became the foundation of atomic physics. Scientists at the time thought that atoms could not be broken down into smaller units. Someone else discovered electrons at about the same time, but it was Marie who discovered that atoms store an immense amount of energy.



Achievements and Recognition

Marie earned her Doctor of Science in June 1903. She was the first woman in France to be awarded a doctorate. She was also the first woman in all of Europe to be awarded a doctorate in science.



Henri Becquerel

Despite Marie's leading role in the groundbreaking physics research she and Pierre conducted, she was almost ignored for the Nobel Prize, one of the world's most respected awards, because she was a woman. At first, only Pierre Curie and Henri Becquerel were **nominated** for the

1903 Nobel Prize in Physics. A mathematician on the committee who was a champion of female scientists let Pierre know. Pierre responded that it would be a terrible injustice for Marie not to be included.

Health Concerns

Marie and Pierre were often ill while doing their research. It wasn't clear whether the cause was working too hard or radiation. Marie did not accept the idea that radiation was to blame, but today we know that exposure to radiation can cause illness and death.



Marie and Pierre worked closely together for many years.

Marie's name was then added to the list of nominees. She and Pierre won together, along with Becquerel, in December 1903. The award, which recognized their pioneering work on radiation, was the first Nobel Prize awarded to a woman.

The Curies instantly became famous around the world. Pierre received a promotion to professor at the Sorbonne, and Marie received a salary and became chief of laboratory. She was excited by the attention and new responsibilities. In addition to her research and a teaching position, she enjoyed explaining her discoveries to the public.

The Curies had a second daughter, Eve, in 1904. Around the same time, the Sorbonne gave the Curies a new laboratory to work in.



The Curies finally moved to a laboratory with more space in 1904.

Dark Times and More Acclaim

The Curies were riding high on their successes when tragedy struck. In 1906, Pierre was run over by a horse-drawn wagon and killed instantly. News of his death spread around the world. Marie was completely numb with shock but eventually found the will to go on. She was offered Pierre's teaching position as Professor of General Physics at the Sorbonne. She was the first woman to become a Sorbonne professor.

Marie was awarded a second Nobel Prize, this time in chemistry, in 1911. She won the award for her work in radioactivity and her discovery of radium and polonium. Marie was the first scientist to be awarded two Nobel Prizes. To this day, she is the only person to be awarded prizes in two different areas of science.

Timeline of Marie Curie's Life

1867	Born in Warsaw, Poland, November 7	1903	Earns doctorate in physics; awarded Nobel Prize in Physics
1883	Graduates high school	1904	Daughter Eve is born
1891	Moves to Paris	1906	Pierre dies; becomes Sorbonne's first female professor
1893	Earns master's degree in physics	1911	Awarded Nobel Prize in Chemistry
1894	Earns master's degree in math	1914	Uses portable X-ray machines in World War I
1895	Marries Pierre Curie	1918	World War I ends; opens Radium Institute
1897	Studies Becquerel rays; daughter Irene is born	1934	Dies on July 4
1898	Discovers polonium and radium		

On the Battlefront

World War I broke out in late July 1914, and Germany invaded France just a few days later. Most of Marie's staff left to fight in the war, and resources for scientific research were lacking. Marie looked for ways to put her science to work to help the war effort. She made portable X-ray machines available in the field for treating wounded soldiers. Throwing herself into her new project, Marie convinced wealthy people to donate their cars. She set up twenty mobile X-ray stations and two hundred fixed stations. She also learned how to use X-ray equipment and taught herself to drive so she could operate the portable X-ray machines herself.



Marie Curie (center) traveled by ship to New York to tour the United States with her daughters Irene and Eve in 1921.

Later Life

After World War I ended, Marie worked tirelessly and successfully to turn the Sorbonne's Radium Institute into a world-class center for research on radioactivity.

Marie's daughter Irene and her husband were awarded the Nobel Prize in Chemistry in 1935. Sadly, Marie didn't live long enough to celebrate that achievement. We now know that radioactive substances are very dangerous, but that was not known during Marie's life. She died at age sixty-six on July 4, 1934, from a type of **anemia** that is often caused by long-term radiation exposure. Marie was buried next to Pierre. In 1995, their remains were moved to the Panthéon in Paris, where France's most brilliant citizens are buried. Marie was the first and only woman to be buried there for her own achievements.

Gifts to the World

Marie Curie's work caused a revolution in scientific understanding about the nature of atoms and opened up new frontiers in medicine. It also led to the discovery of radiocarbon dating, a way to determine the age of ancient life forms. Marie

showed that careful, purposeful scientific investigation can yield extraordinary breakthroughs.

As amazing as Marie Curie's scientific contributions were, her legacy went beyond them. Even as she faced one obstacle after another, she stayed clear about her purpose and gave the world an inspiring

model. In her words: "Life is not easy for any of us. But what of that? We must have **perseverance** and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained."



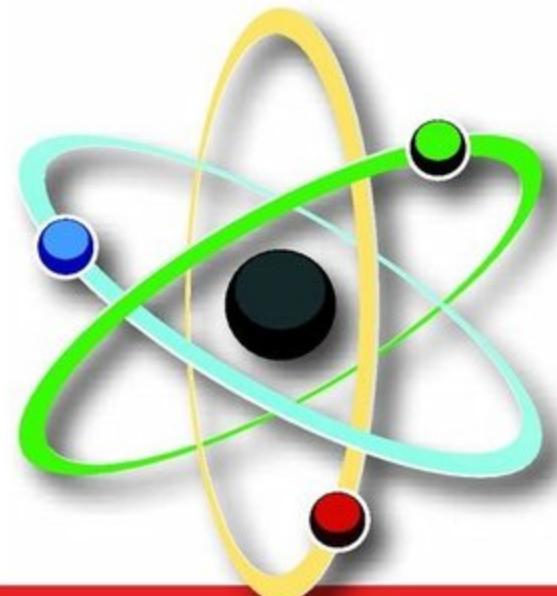
Glossary

anemia (<i>n.</i>)	a condition in which there are too few red blood cells (p. 14)
breakthroughs (<i>n.</i>)	important events or advances in knowledge (p. 6)
commission (<i>n.</i>)	a task or project that someone requests or authorizes (p. 7)
doctorate (<i>n.</i>)	the highest degree a university can award; a Ph.D. (p. 7)
electrometer (<i>n.</i>)	a device used to detect and measure differences in electric currents (p. 8)
element (<i>n.</i>)	a substance that cannot be broken down into simpler substances and is made up of only one kind of atom (p. 8)
Nobel Prize (<i>n.</i>)	one of six prizes awarded each year for work in chemistry, economics, literature, medicine, or physics, or for advancing the cause of world peace (p. 4)
ominated (<i>v.</i>)	named as a candidate for a job, award, or position (p. 10)
perseverance (<i>n.</i>)	the quality of staying determined and committed despite challenge or delay (p. 15)
physics (<i>n.</i>)	the scientific study of matter, motion, and energy (p. 5)
Sorbonne (<i>n.</i>)	a university in Paris, France, famous for its high academic standards (p. 6)
X-rays (<i>n.</i>)	invisible energy that can go through many solid substances (p. 8)

Marie Curie

A Reading A-Z Level Y Leveled Book

Word Count: 1,545



Connections

Writing

How would our world be different without the work of Marie Curie? Write an essay highlighting her achievements and their impact on our world today.

Social Studies

Research another woman who has won a Nobel Prize in science. Create a poster for your class, including biographical information about the scientist and her impact on science.

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