The Secret Inside an Atom

A Story About the Structure of an Atom

One afternoon, Maya and Arjun were sitting in science class.

Mrs. Patel held up a small piece of gold.

"Do you remember what everything around us is made of?" she asked.

"Atoms!" Maya answered.

"Exactly! But have you ever wondered what is **inside an atom**?"

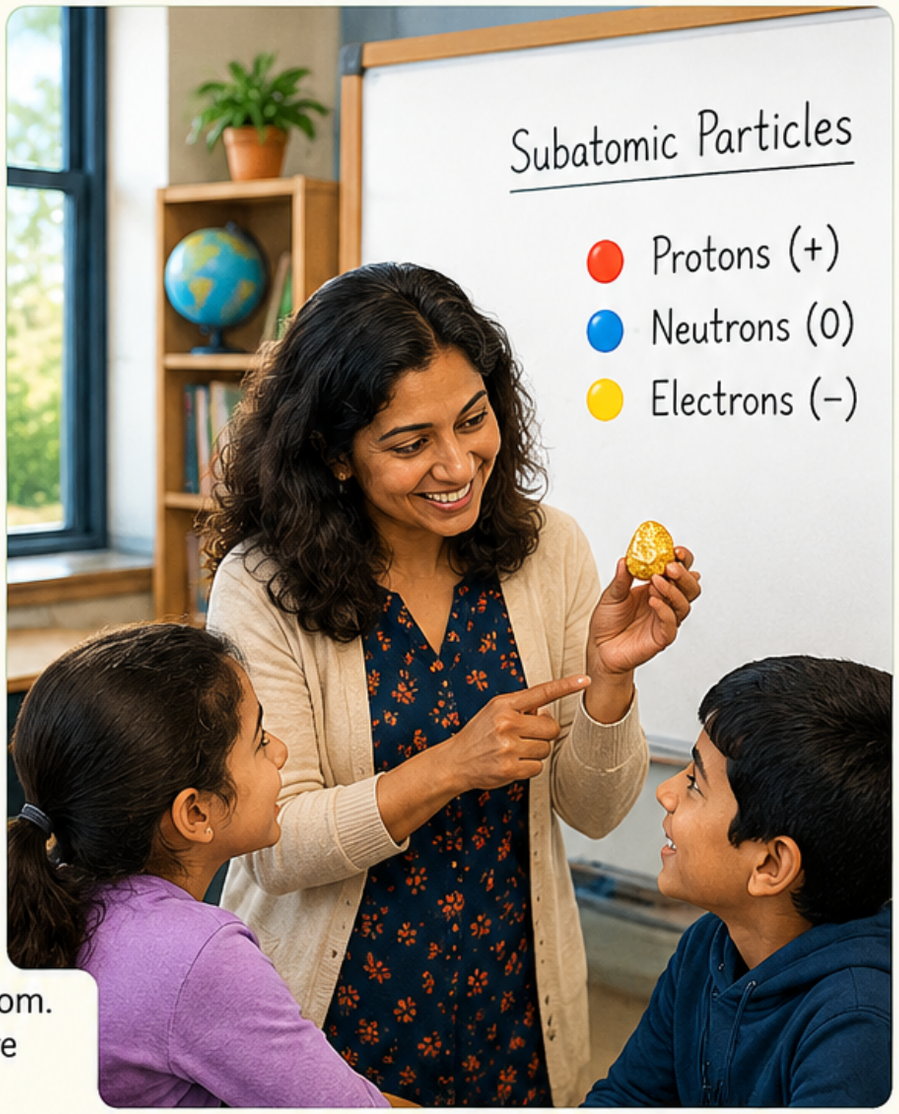
Arjun looked surprised.

"Atoms are already so tiny! Can there be something even smaller inside them?"

"Yes!" Mrs. Patel smiled. "Atoms contain three important particles called **subatomic particles**."

"Subatomic particles?" Maya asked.

"Subatomic means smaller than an atom. The three main subatomic particles are protons, neutrons, and electrons."



She wrote on the board:

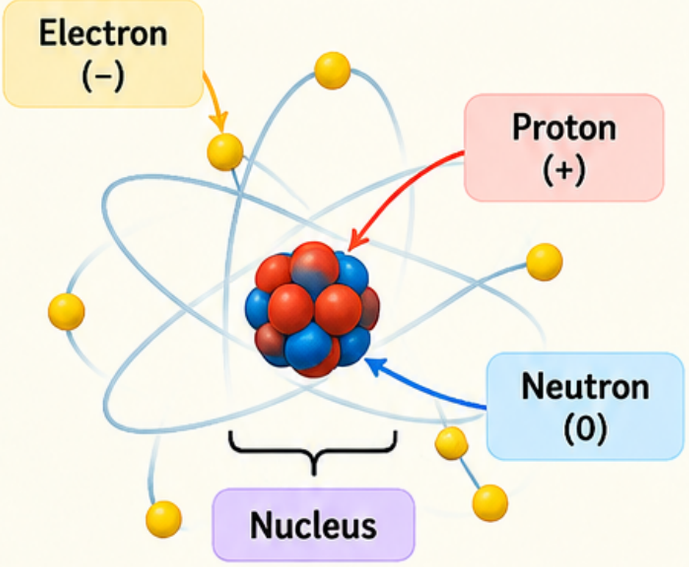
- **Protons (+)** — Positively charged particles.
- **Neutrons (0)** — Particles with no electric charge.
- **Electrons (–)** — Negatively charged particles.

"Protons and neutrons are found in the center of the atom, called the nucleus. Electrons are found around the nucleus."

"So an atom has tiny parts inside it!" Maya said.

"Exactly! And scientists worked for many years to discover them."

A Model of an Atom



Science Fact:

Protons, neutrons, and electrons are called subatomic particles. The nucleus contains almost all the mass of an atom.

Science Fables

The Mystery of the Invisible Rays

Mrs. Patel turned off the classroom lights.

Long ago, scientists wanted to understand what atoms were made of.

She showed the children a picture of a glass tube.

“A scientist named William Crookes used a special tube containing gas at very low pressure.”

“What did he do with it?” Arjun asked.

“He connected it to a high-voltage electricity supply.”

Mrs. Patel pointed to the picture.

“Something amazing happened! **Invisible rays** traveled through the tube and made a screen glow.”

“Were those rays made of light?” Maya asked.

“Not exactly. They were called cathode rays.”

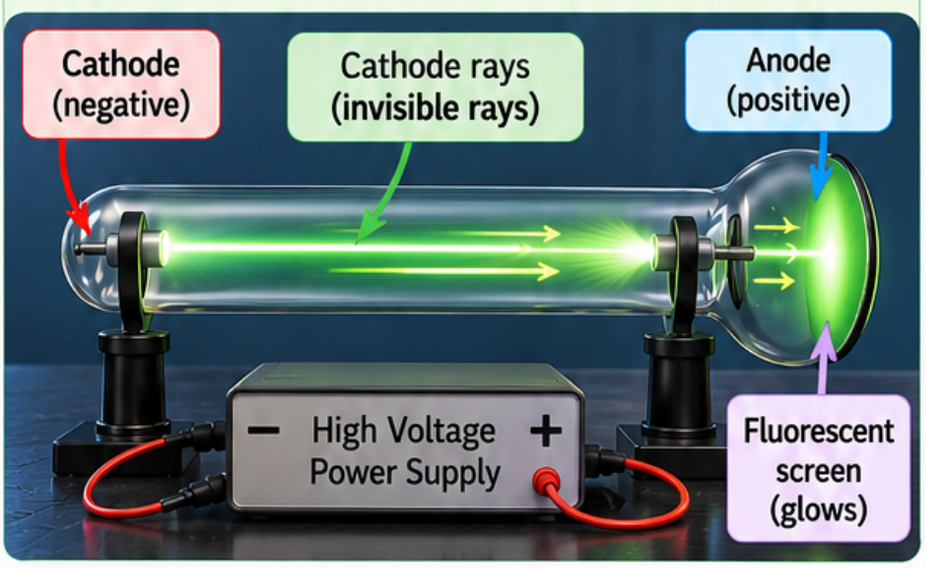
She explained that the rays traveled in straight lines and could even make shadows.

“Later, scientists discovered that these rays were streams of tiny particles called electrons.”

“Wow!” Arjun exclaimed. “So electricity helped scientists discover something inside atoms!”



William Crookes’ Experiment



Science Fact:

Cathode rays travel from the negative cathode toward the positive anode.

Science Fables

The Discovery of Electrons

The next day, Mrs. Patel drew a glass tube on the board.

“A scientist named J. J. Thomson wanted to learn more about cathode rays.”

“What did he discover?” Maya asked.

“He placed electrically charged plates near the rays.”

Mrs. Patel drew a positive plate and a negative plate.

“The rays bent toward the positive plate.”

“Why?” Arjun asked.

“Because opposite electric charges attract each other.”

“So the rays must be negatively charged!” Maya exclaimed.

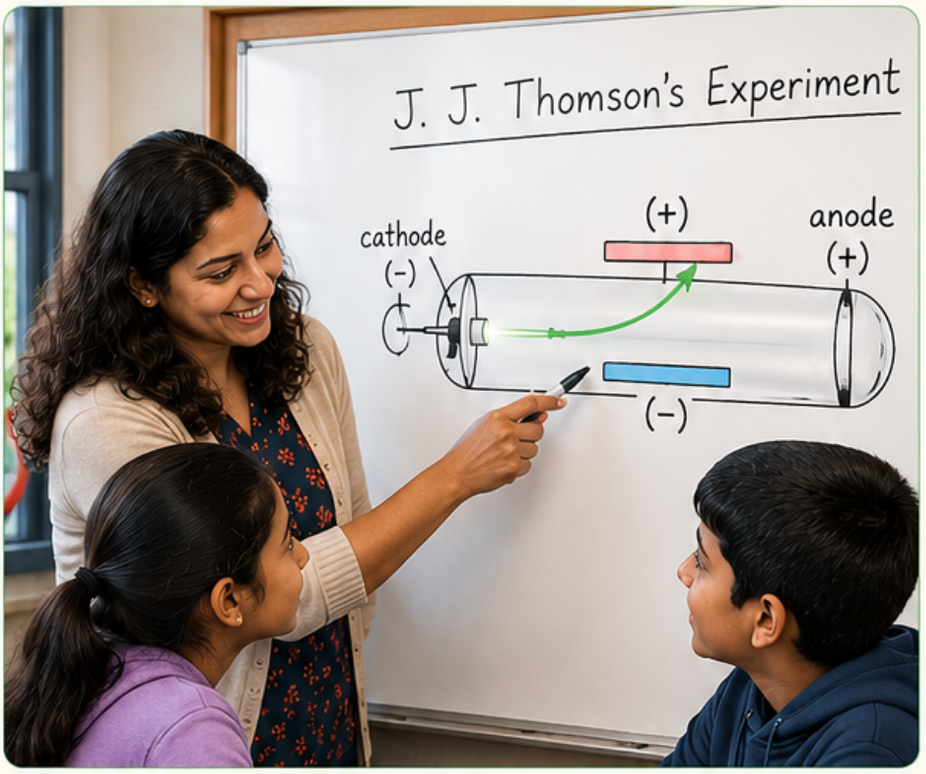
“Exactly! Thomson showed that cathode rays were made of negatively charged subatomic particles called **electrons**.”

Mrs. Patel continued.

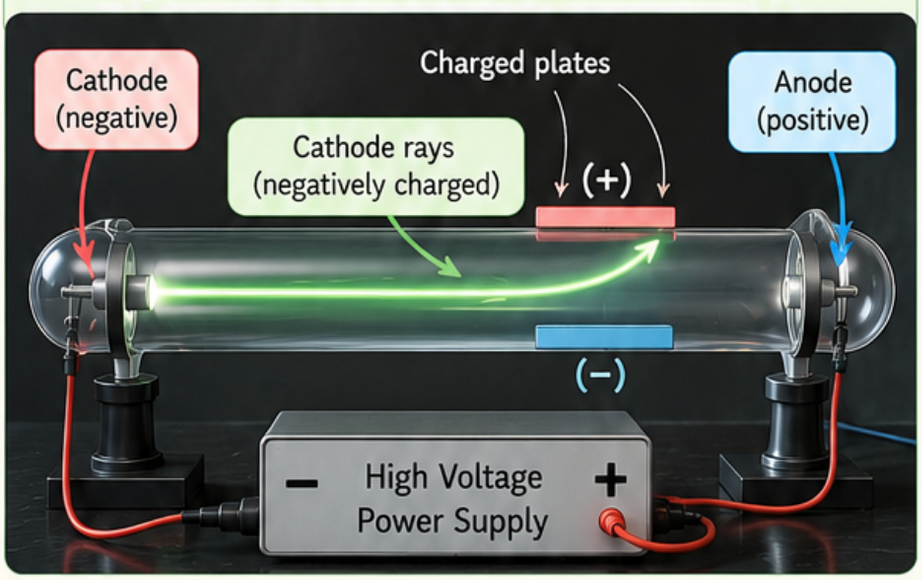
“He also discovered that electrons were much lighter than atoms.”

“So atoms aren’t just one solid piece!” Arjun said.

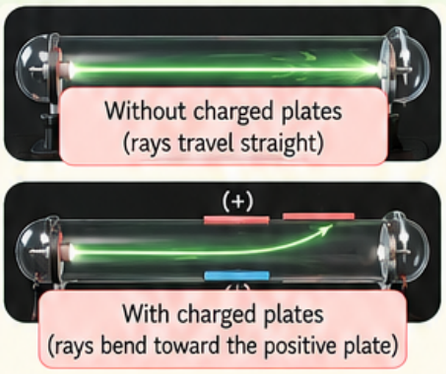
“That’s right! They contain smaller particles.”



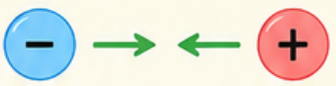
J. J. Thomson’s Experiment



Path of the Rays



Why Do the Rays Bend?



Negative charge (cathode rays)

Positive charge (plate)

Opposite electric charges attract each other.

Science Fact:

Electrons have a negative charge and a very tiny mass.

Science Fables

The Discovery of Positive Particles

"Now we know about electrons," Maya said. "But what about positive charges?"

Mrs. Patel smiled.

"Another scientist, Eugen Goldstein, studied a special glass tube with tiny holes in the cathode."

"What did he see?" Arjun asked.

"He observed another type of ray traveling in the opposite direction from cathode rays."

"These were called **canal rays**, or **anode rays**."

"Were they negatively charged too?" Maya asked.

"No. They were positively charged!"

Mrs. Patel explained that canal rays contained positive ions.

"Later, scientists identified the proton, a positively charged subatomic particle found in the nucleus."

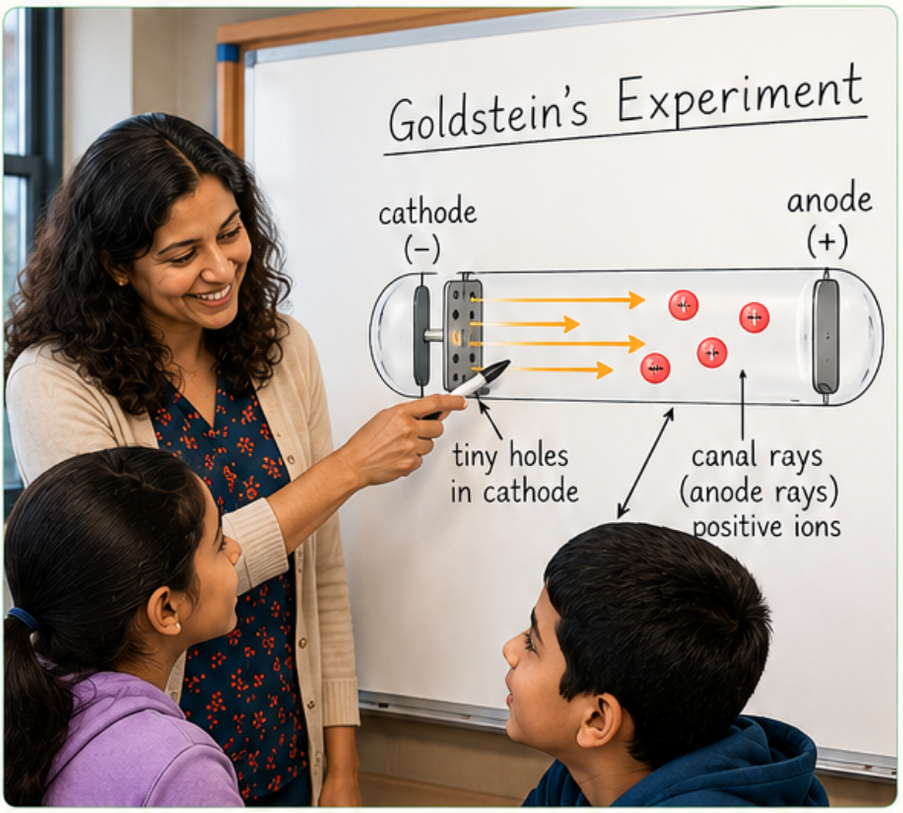
She wrote:

Proton = Positive charge (+)

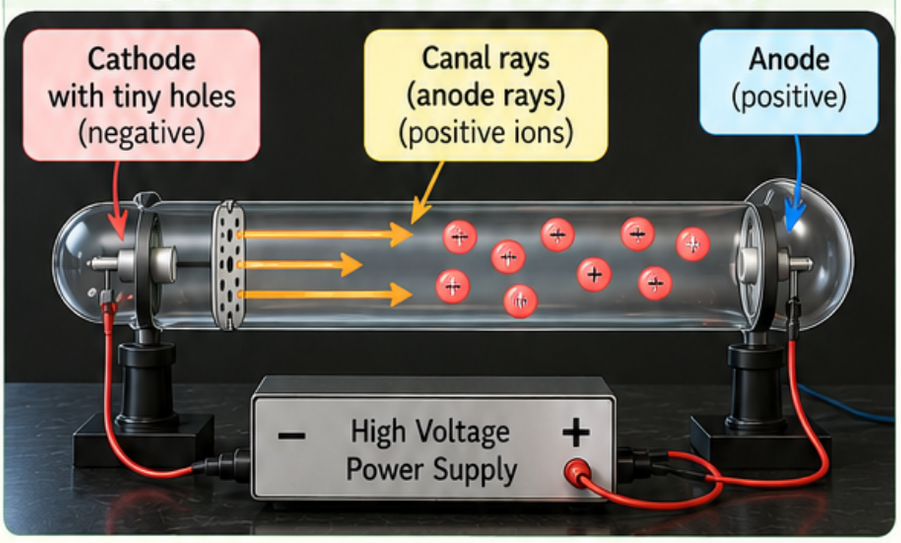
"Protons are much heavier than electrons."

"So electrons are negative, and protons are positive!" Arjun said.

"Exactly!"



Goldstein's Experiment



Comparison of Rays

Cathode Rays
(negative, electrons)

travel from cathode (–) to anode (+)

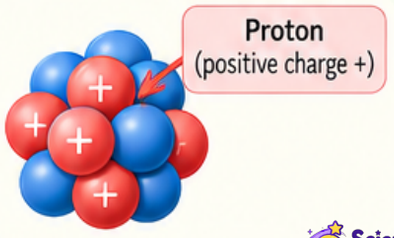
Canal Rays (anode rays)
(positive ions)

travel from anode (+) to cathode (–) through holes

Science Fact:

Â proton has a positive charge and a mass about 1,836 times that of an electron.

Proton in the Nucleus



Science Fables

The Plum Pudding Model

Mrs. Patel drew a large circle filled with tiny dots.

“This was one of the first models scientists made to explain atoms.”

“Why does it look like a watermelon?” Arjun laughed.

“That’s a good comparison!” Mrs. Patel said.

“J. J. Thomson imagined that an atom was a positively charged sphere with negatively charged electrons embedded inside it.”

“Like seeds inside a watermelon?” Maya asked.

“Exactly!”

Mrs. Patel pointed to the drawing.

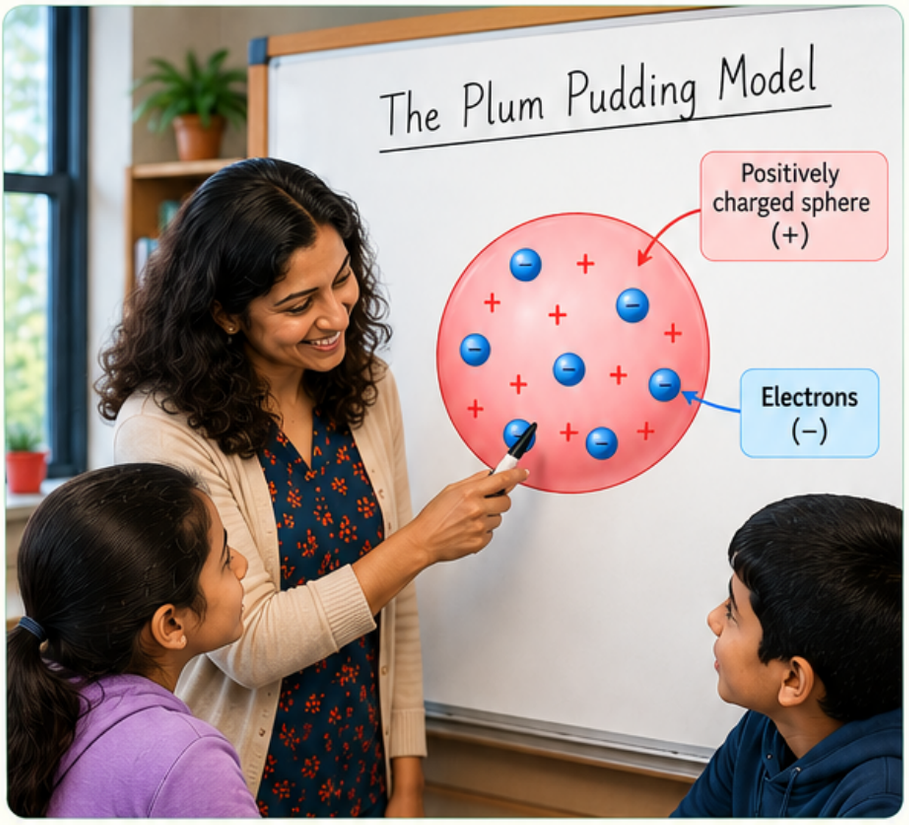
“The positive and negative charges balanced each other, making the atom electrically neutral.”

“So scientists thought electrons were stuck inside a positive ball?” Arjun asked.

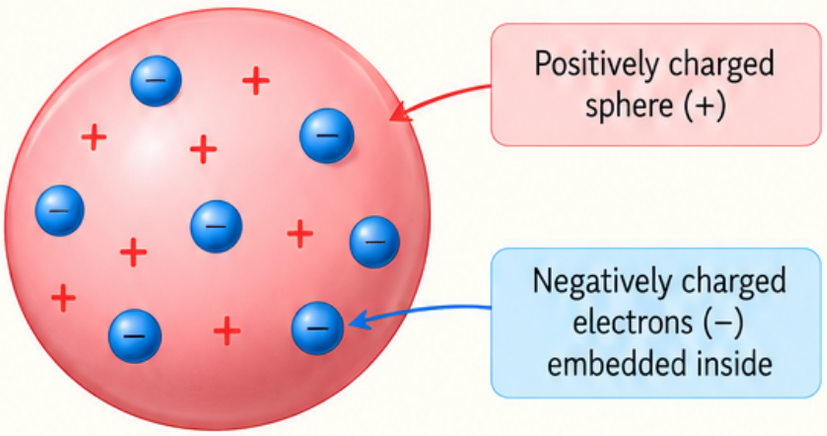
“Yes! This was called the **plum pudding model**.”

“Was that model correct?” Maya asked.

“Not completely. Another scientist would soon make an amazing discovery.”



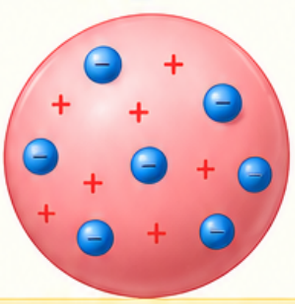
J. J. Thomson’s Plum Pudding Model



Like a Watermelon!



Watermelon
(seeds inside)



Plum pudding model
(electrons inside a positive sphere)

Science Fact:

Thomson’s model showed that atoms contain electrons, but it did not include a nucleus.

Science Fables

The Amazing Gold Foil Experiment

Mrs. Patel held up a picture of a very thin sheet of gold.

“A scientist named Ernest Rutherford wanted to test how atoms were arranged.”

“He used gold?” Arjun asked.

“Yes! He directed tiny, positively charged particles called **alpha particles** toward thin gold foil.”

“What happened?” Maya asked.

“Most of the particles passed straight through the foil.”

“That’s surprising!” Arjun said.

“But some particles changed direction, and a very small number bounced backward!”

Maya looked confused.

“How could that happen?”

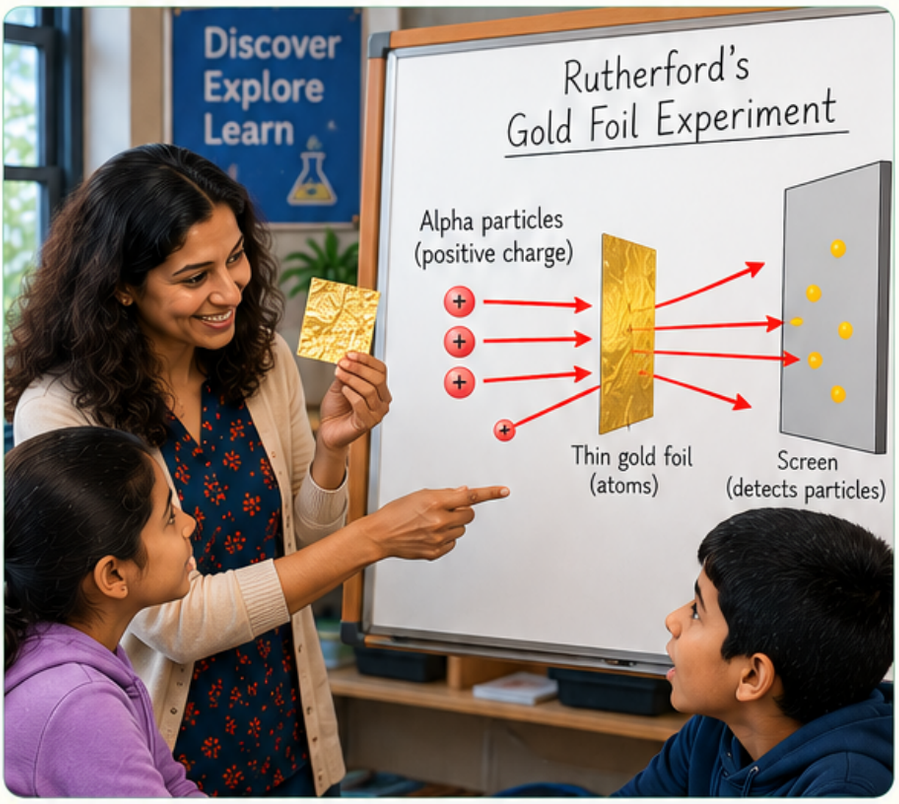
“Rutherford realized that atoms must be mostly empty space.”

Mrs. Patel drew a tiny dot in the middle of a large circle.

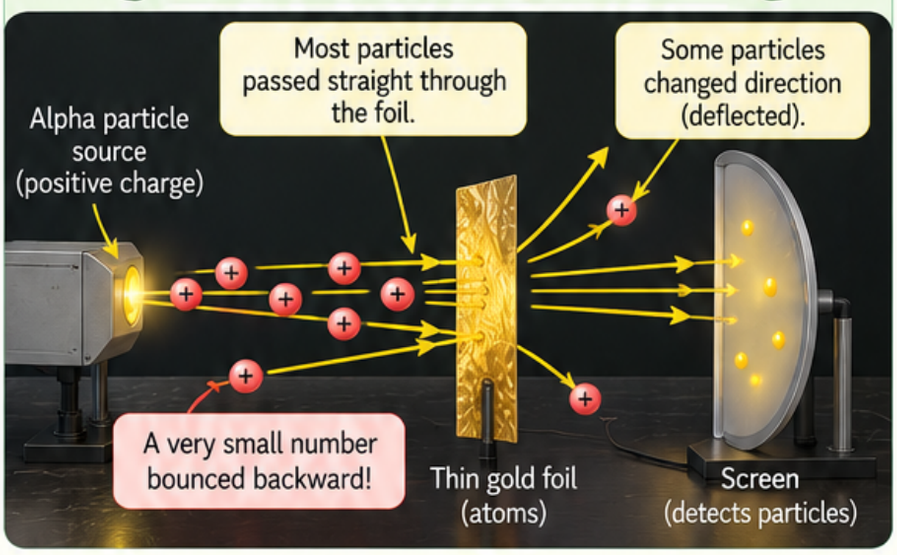
“He discovered that almost all the mass and positive charge of an atom are concentrated in a very small center called the **nucleus**.”

“So the nucleus is tiny, but very important!” Maya said.

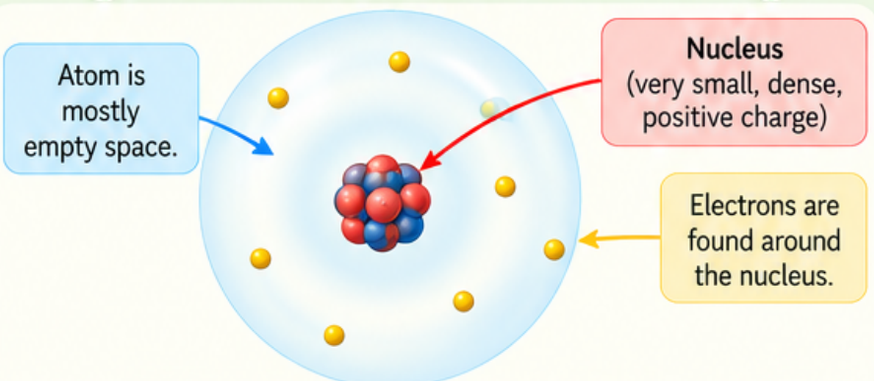
“Exactly!”



Results of the Experiment



Rutherford’s Model of the Atom



Science Fact: Rutherford’s experiment showed that atoms are mostly empty space and have a small, dense, positively charged nucleus.

Science Fables

Building an Atom

Mrs. Patel placed three colored balls on the table.

A red ball, a blue ball, and a yellow ball.

“Let’s build a simple model of an atom!”

She pointed to the red ball.

“This represents a proton. It has a positive charge.”

Then she picked up the blue ball.

“This represents a neutron. It has no electric charge.”

She placed both balls together.

“Protons and neutrons are found in the nucleus.”

“What about the yellow ball?” Arjun asked.

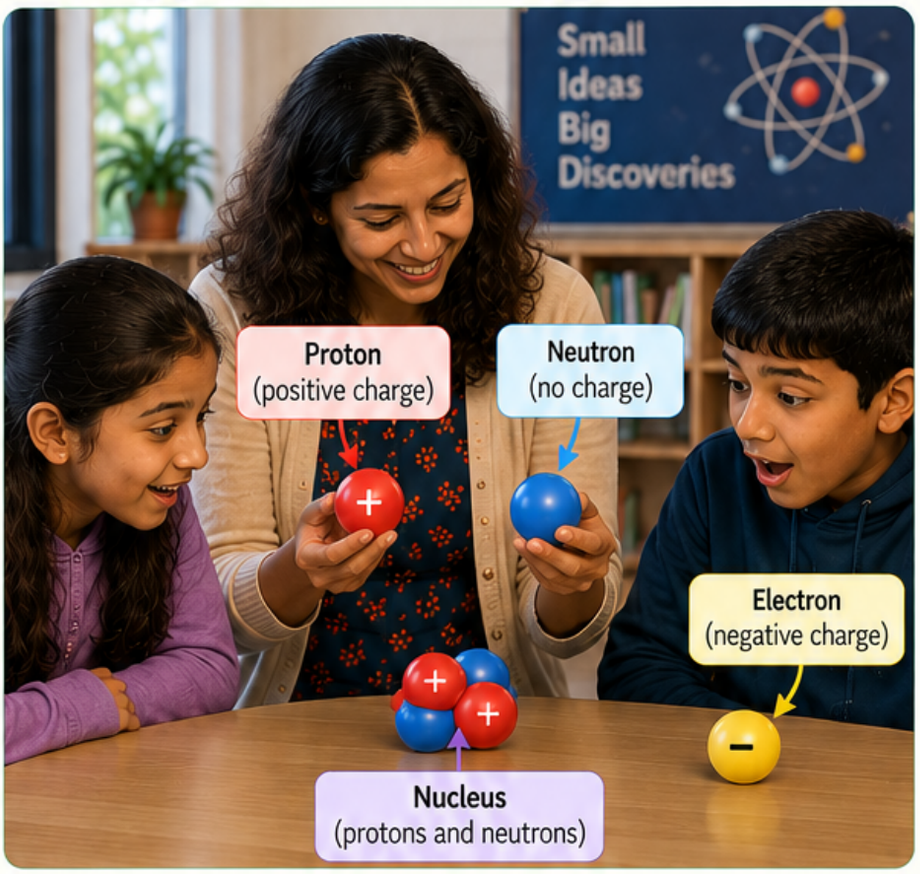
“That represents an electron. It has a negative charge and is found around the nucleus.”

“So protons and neutrons are in the middle, and electrons are outside!” Maya said.

“Correct!”

Mrs. Patel explained that protons and neutrons are much heavier than electrons.

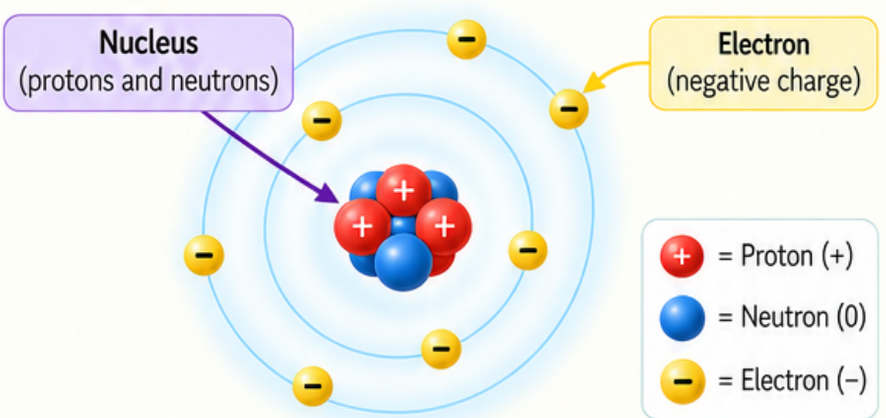
“Now I understand!” Arjun smiled. “Atoms are tiny, but they have their own structure!”



Subatomic Particles

Proton	Neutron	Electron
Prositive charge (+)	No electric charge (0)	Negative charge (–)
Found in nucleus	Found in nucleus	Found around nucleus
Heavy	Heavy (similar mass to proton)	Very light

A Simple Model of an Atom



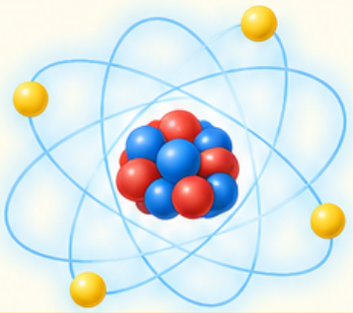
Science Fact: A neutral atom has the same number of protons and electrons.

Science Fables

Science Element: Remember!

What Are Subatomic Particles?

Subatomic particles are particles smaller than an atom. The three main subatomic particles that make up atoms are protons, neutrons, and electrons.



Subatomic Particles

Subatomic particle	Charge	Location	Approximate mass
Proton	+1	Nucleus	1 amu
Neutron	0	Nucleus	1 amu
Electron	–1	Around nucleus	Nearly 0 amu

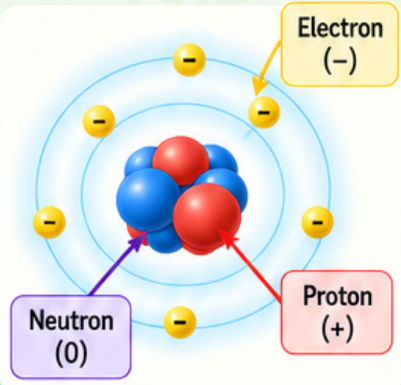
Important Discoveries

Scientist	Contribution
William Crookes	Studied cathode rays
J. J. Thomson	Discovered electrons and proposed the plum pudding model
Eugen Goldstein	Observed positive canal rays
Ernest Rutherford	Discovered the small, dense atomic nucleus and later identified the proton
James Chadwick	Discovered the neutron

Key Ideas

- Atoms are made of three main subatomic particles: protons, neutrons, and electrons.
- Protons have a positive charge, neutrons have no charge, and electrons have a negative charge.
- The nucleus is very small and dense.
- Most of an atom is empty space.
- Protons and neutrons account for nearly all an atom's mass.
- Electrons occupy regions around the nucleus.
- An atom is electrically neutral when its protons and electrons are equal in number.

A Closer Look at an Atom



Remember:

Atoms may be incredibly small, but understanding their subatomic particles helps us understand the structure of everything around us!

Science Fables