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Warm-Up | The Historical Development of Atomic Theory

Lesson Objectives

By the end of this lesson, you should be able to:

- Describe early atomic models including Dalton's _____.
- Describe how Thomson's and Millikan's research led to the understanding of the electron in the early atomic model.
- Describe how Rutherford's _____ foil experiment led to Rutherford's _____ model of the atom.

Science Practice: Describe, in writing, how a scientist's creativity resulted in changes in atomic theory.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

	the small, whole numbers that make up the ratio of the masses of the elements found in a compound
	an explanation of the structure of matter in terms of different combinations of very small particles (atoms)

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Lesson Question

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Thinking vs. Doing Science

Democritus: [ ]

- No evidence
- No explanations

Dalton, Proust, others (1800s): science

- Evidence
- Repeated [ ] and observation

Development of Dalton's Theory

Proust's discovery:

- Samples of a [ ] have the same ratio of elements.
- The [ ]: Small, whole numbers make up the ratio of the masses of the elements found in a compound

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Slide 2

Atomic Theory

Law of definite proportions



Dalton's **atomic theory**

These ideas are an explanation of the structure of [ ] in terms of different combinations of very small [ ] (atoms).

Dalton's Work

Formed tin [ ]:

- Total of 100 g tin reacts with 13.5 g oxygen or 27 g oxygen only
- Oxygen consumed in a [ ] ratio.
- Deduction: presence of atoms of tin and atoms of [ ]

Each tin atom can combine with one or two oxygen atoms. The atoms cannot combine in any other ratios.

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Dalton's Atomic Theory

The components of Dalton's atomic theory:

- Atoms are [ ].
  - Atoms are the smallest components of matter and cannot be broken down.
- Elements are composed of identical atoms and these atoms are unique to each element.
  - Atoms of different elements are different.
- Compounds are composed of atoms of two or more elements in [ ] proportions.
  - The ratio of atoms in a compound is fixed for all samples of the compound.
- A chemical reaction is a rearrangement of the atoms into new combinations.
  - The [ ] cannot create or destroy atoms, it can only rearrange them.

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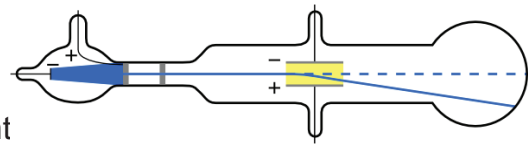
Discovery of the Electron

J.J. Thomson (late 1800s)



- [ ] ray tube experiment
- Stream of particles emitted from [ ] end of tube
- Particles bend toward [ ] electric charge

Particles must be part of an atom, and atoms have subatomic particles.

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The Plum Pudding Model

Thomson's results led to the proposal of a new atomic model, the plum pudding model.

- _____ floating in a sea of positive charges
- Modification of Dalton's model of a solid, indivisible sphere
- Recognition of the existence of electrons and the _____ of the whole atom

Millikan's Oil Drop Experiment

Oil drop experiment:

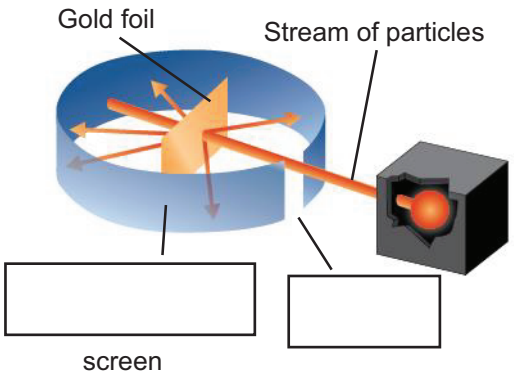
- Measured rate of fall of _____ oil droplets
- Determined the charge on an _____
- Related to Thomson's experiment – _____ of mass-to-charge for an electron

Together, Millikan's and Thomson's results allowed for the determination of the mass and charge of the electron.

Test of the Plum Pudding Model

Ernest Rutherford developed an experiment to test the plum pudding model.

- Tiny, positively charged particles shoot out of a particle gun toward a thin sheet of _____ foil.
- Reflected particles are detected at various _____.



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Discovery of the Nucleus

Results of Rutherford's experiment:

- Most particles pass [ ] through.
- A few particles are [ ] at very large angles.

Conclusions:

- An [ ] is mostly empty space.
- A positive charge is concentrated in a small, central region (nucleus).
- The volume of the [ ] is small, but the mass of the atom is concentrated within this tiny volume.

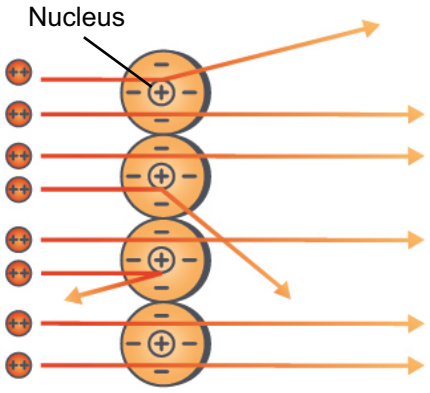

Diagram not drawn to scale

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Summary | The Historical Development of Atomic Theory

Lesson Question

Who or what contributed to the understanding of the atom?

Answer

Slide 2

Dalton's Atomic Theory

Dalton's atomic theory was based on evidence and observation.

- Atoms are _____.
- All atoms of an _____ are identical.
- Atoms of different elements are different.
- Atoms combine in fixed ratios to form compounds.
- Atoms cannot be created or destroyed, only _____.

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Summary | The Historical Development of Atomic Theory

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Contributions of Thomson, Millikan, and Rutherford

Thomson, Millikan, and Rutherford tested and refined Dalton's atomic theory.

- Thomson discovered that atoms contain smaller particles called [ ].
  - Thomson proposed the plum pudding atomic model.
- Millikan's work allowed for the determination of the [ ] on an electron.
- Rutherford's work showed that the plum pudding model is inaccurate.
  - Most of the [ ] of the atom is concentrated in the nucleus.
  - Most of the atom is empty space.

Use this space to write any questions or thoughts about this lesson.

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