

Brief History of the Atom and its' structure

Section 4.1 & 4.2

Earliest Model of the Atom

- An **atom** is the smallest particle of an element that retains its identity in a chemical reaction.
- Philosophers and scientists have proposed many ideas on the structure of atoms.

Democritus

Democritus believed that atoms were indivisible and indestructible.

Democritus's ideas were limited because they didn't explain chemical behavior and they lacked experimental support.

Dalton

By using experimental methods, Dalton transformed Democritus's ideas on atoms into a scientific theory.

Dalton's Atomic Theory

1. All elements are composed of tiny indivisible particles called atoms
2. Atoms of the same element are identical. The atoms of any one element are different from those of any other element.
3. Atoms of different elements can physically mix together or can chemically combine in simple whole-number ratios to form compounds.
4. Chemical reactions occur when atoms are separated, joined, or rearranged. Atoms of one element are never changed into atoms of another element in a chemical reaction.

What are three kinds of subatomic particles?

Three kinds of subatomic particles are electrons, protons, and neutrons.

Discovery of the electron

In 1897, the English physicist J. J. Thomson (1856–1940) discovered the electron. **Electrons** are negatively charged subatomic particles.

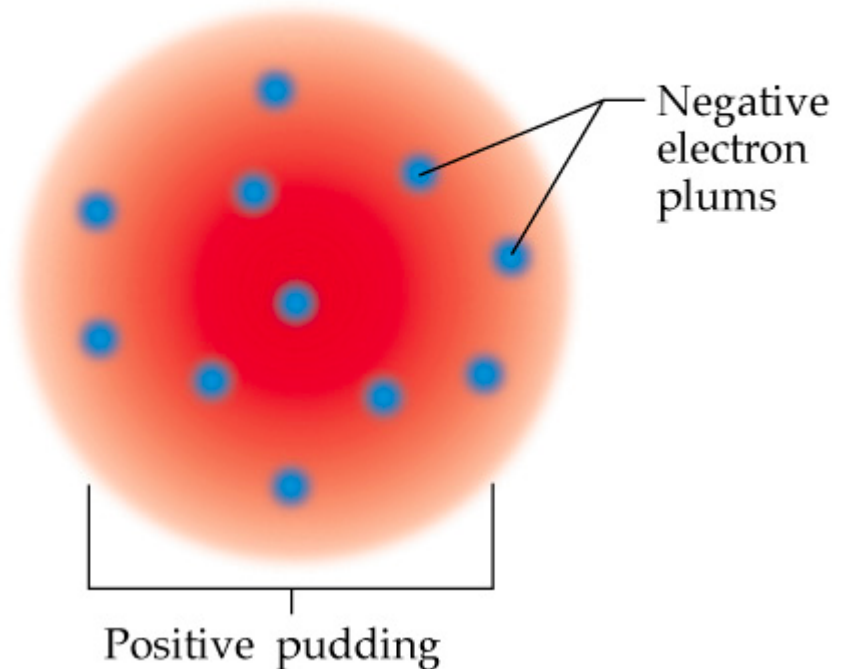
Properties of subatomic particles

Particle	Symbol	Charge	Relative Size (relative to a proton)	Actual Mass
Electron	e^-	-1	1/840	9.11×10^{-28}
Proton	p^+	+1	1	1.67×10^{-24}
Neutron	n^0	0	1	1.67×10^{-24}

How was the structure of an atomic described?

J.J. Thompson and others supposed the atom was filled with positively charged material and the electrons were evenly distributed throughout. (Plum Pudding Model)

Thompson plum pudding model of the atom



However.....

This model of the atom turned out to be short-lived, however, due to the work of Ernest Rutherford (1871–1937).

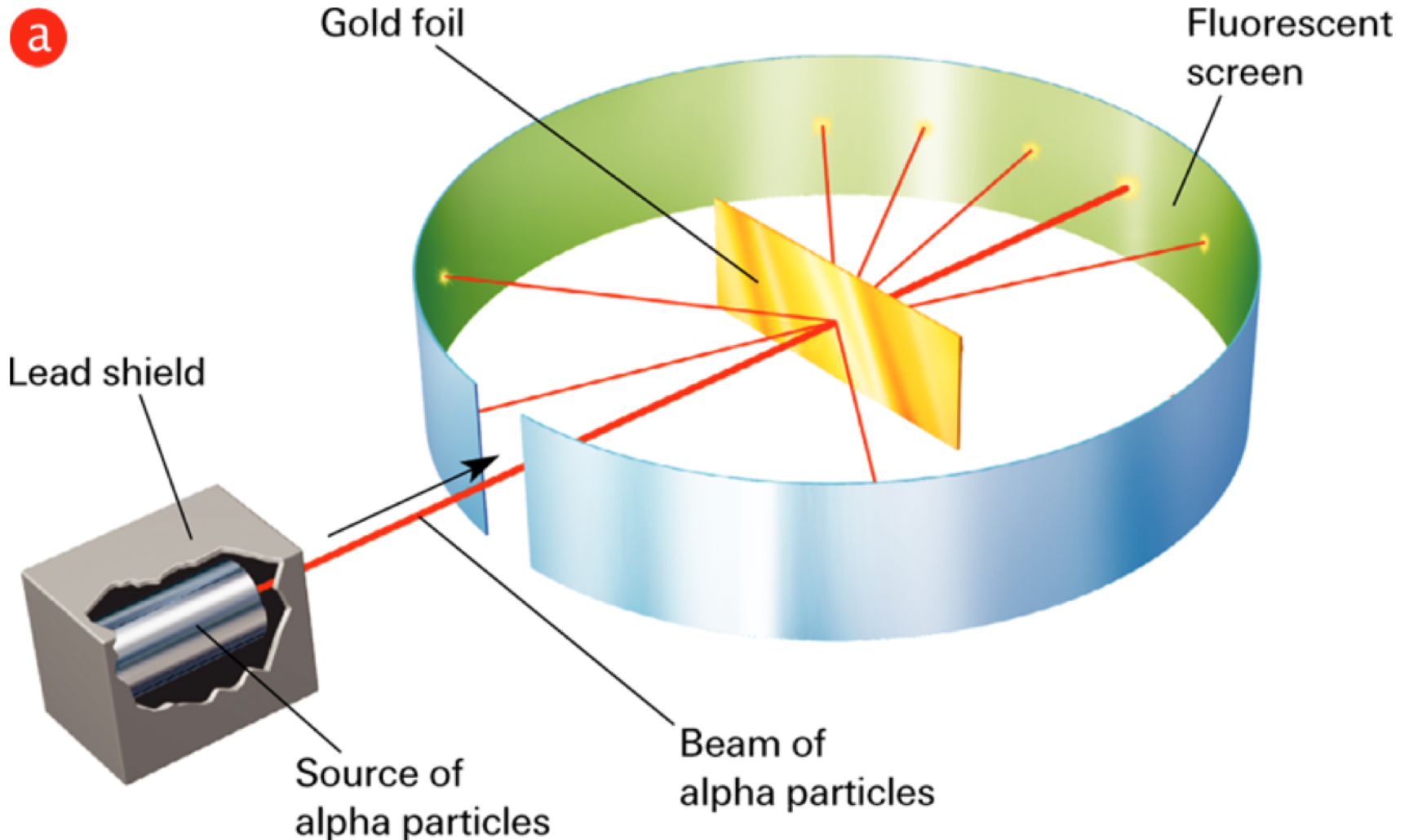
Rutherford's Gold-Foil Experiment

In 1911, Rutherford and his coworkers at the University of Manchester, England, directed a narrow beam of alpha particles at a very thin sheet of gold foil.

The experiment

Rutherford and his coworkers aimed a beam of alpha particles at a sheet of gold foil surrounded by a fluorescent screen.

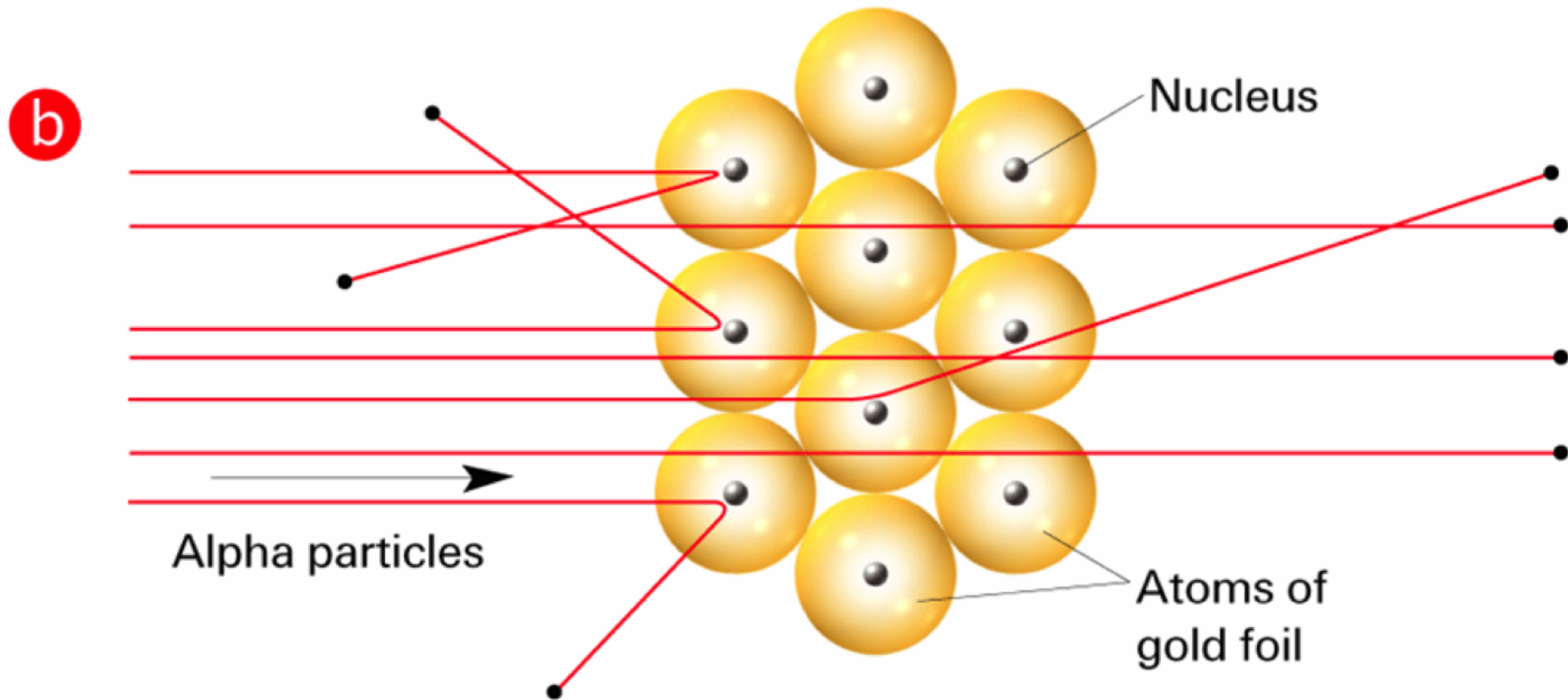
The experiment



The experiment-results

Most of the particles passed through the foil with no deflection at all. A few particles were greatly deflected

The experiment-results



Conclusion

1. Most of the alpha particles pass through the gold foil because the atom is mostly empty space.
2. The mass and positive charge are concentrated in a small region of the atom.
3. Rutherford called this region the nucleus.
Particles that approach the nucleus closely are greatly deflected

Review of Atomic Structure

Video: [Click Here](#)

The Nucleus

The nucleus is the tiny central core of an atom and is composed of protons and neutrons

The electrons are distributed around the nucleus and occupy almost all the volume of the atom.

Atomic Structure Check In

1. The ancient Greek philosopher credited with suggesting all matter is made of indivisible atoms is

a. Plato.

b. Aristotle.

c. Democritus.

Socrates

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 - a. teaching that all matter is composed of tiny particles called atoms.
 - b. theorizing that all atoms of the same element are identical.
 - c. using experimental methods to establish a scientific theory.
 - d. not relating atoms to chemical change.

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Atomic Structure Check In

3. Which of the following is NOT an example of a subatomic particle?

- a. proton
- b. molecule
- c. electron
- d. neutron

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b.molecule

c.electron

d.neutron

Atomic Structure Check In

4. The nucleus of an atom consists of

a.electrons only.

b.protons only.

c.protons and neutrons.

d.electrons and neutrons.

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b.neutrons.

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