Aristotle & Democritus

What idea did Democritus introduce to our understanding of matter?

What was the problem with Aristotle and Democritus' "theories?"

John Dalton

Where did Dalton derive most of the knowledge that he used to come up with his postulates?

Dalton's Postulates

1) All matter is made up of tiny particles called "atoms."

2) Atoms are the smallest component of matter and are indivisible.

3) All atoms of a given element are identical to one another.

4) Compounds are formed by combinations of different elements in whole-number ratios.

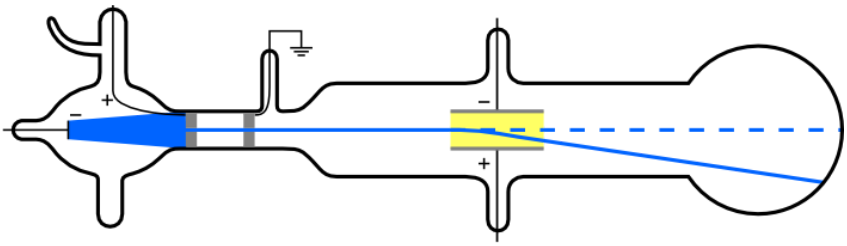
5) Chemical reactions (changes) involve the rearrangement of atoms.

What did **Dalton's atomic model** "look like?"

J.J. Thomson

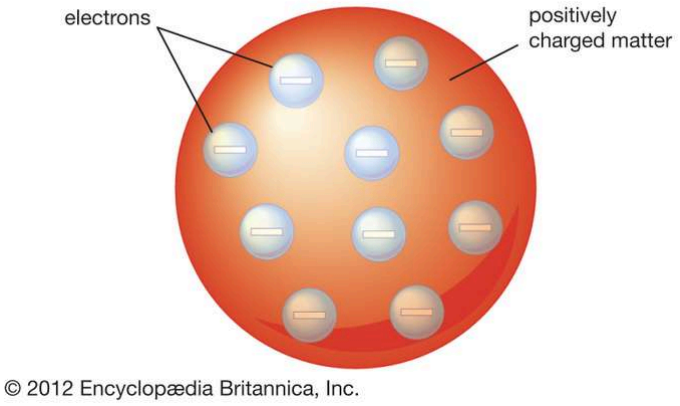
What did Thomson use to study atoms?

What were the major components of Thomson's experimental set-up?



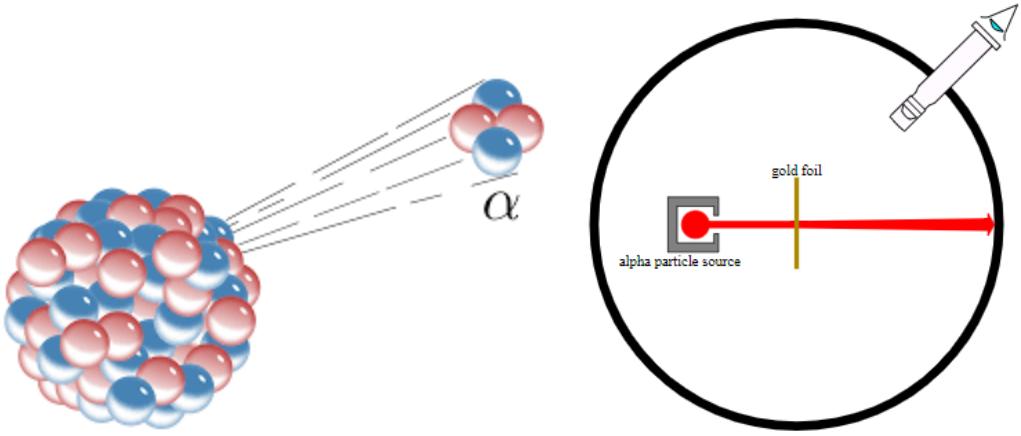
What was the significance of Thomson's experiment? What observations did he and his team make?

What did Thomson's atom "look like?"

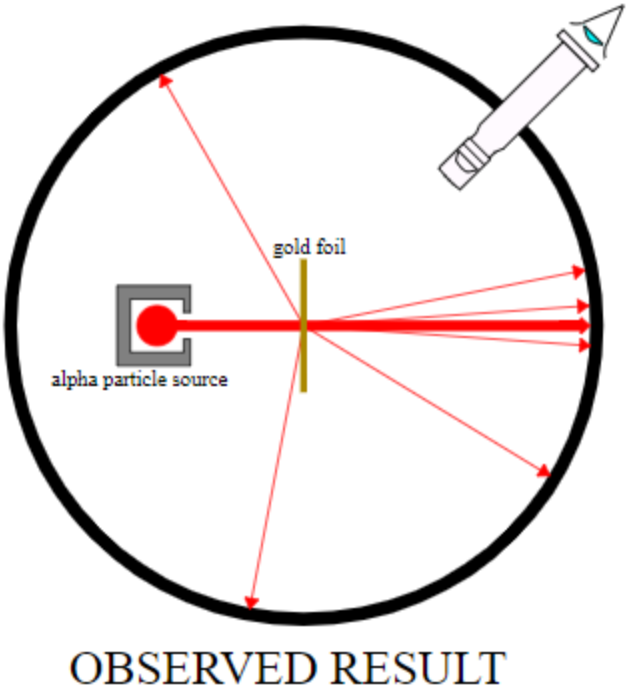


Ernest Rutherford

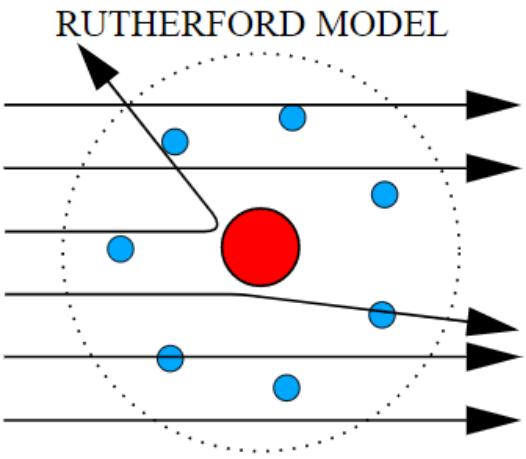
What is an "alpha particle?" Why did Ernest Rutherford shoot alpha particles at gold foil?



What did Rutherford actually see in his experiment?



OBSERVED RESULT



What does the atomic model "look like" after **Rutherford's gold foil experiment**?

What are the subatomic particles that exist in an atom?

After the gold foil experiment, it was determined that there were three subatomic particles:

Protons:

Charge:

Mass:

Location:

Neutrons:

Charge:

Mass:

Location:

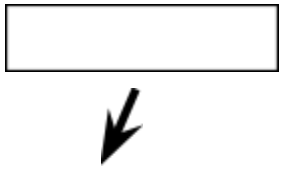
Electrons:

Charge:

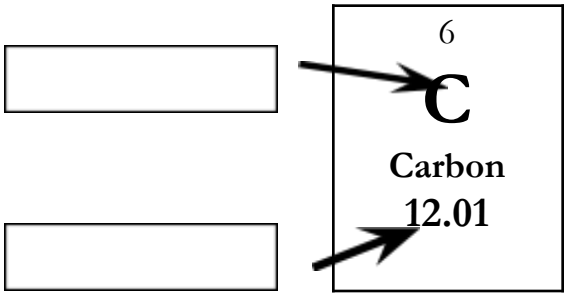
Mass:

Location:

Which of the subatomic particles determines the identity of an element?

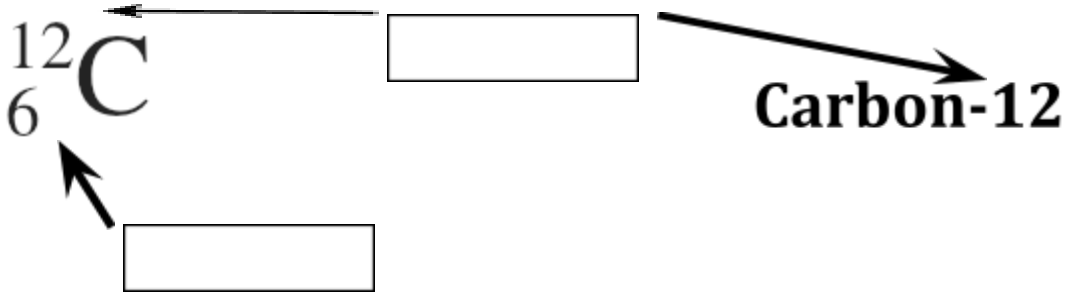


Atomic number:



How do we determine how many neutrons an atom has?

The information must be provided to us in one of two ways…



Mass number:

*To find the number of **neutrons** for any element, subtract the **atomic number** (number of protons) from the mass number (number of protons and neutrons).

How many **protons** and **neutrons** would the following elements have?

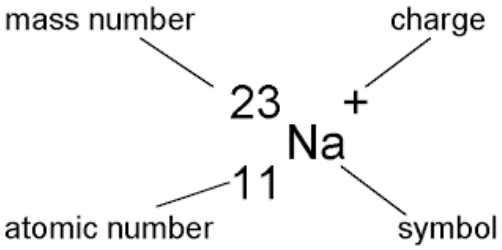
Helium-4 Protons: Neutrons:	$^{190}_{76}Os$ Protons: Neutrons:	**Radon-222** Protons: Neutrons:
$^{35}_{17}Cl$ Protons: Neutrons:	**Tungsten-184** Protons: Neutrons:	$^{232}_{90}Th$ Protons: Neutrons:

How do we determine the number of subatomic particles (including electrons) a **neutral** atom has?

Palladium-106	$^{209}_{83}Bi$

What is the difference between an **atom** and an **ion**?

Where do we find information about ions in a nuclide symbol?



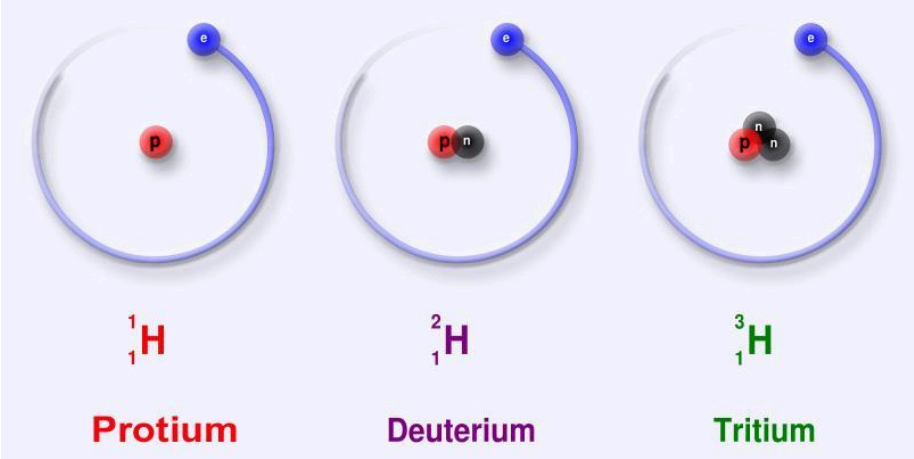
Practice: Identify the number of subatomic particles contained within each atom or ion.

$^{9}_{4}Be^{2+}$	$^{19}_{9}F$	$^{36}_{17}Cl^{1-}$
Protons:	Protons:	Protons:
Neutrons:	Neutrons:	Neutrons:
Electrons:	Electrons:	Electrons:

What does the <u>atomic mass</u> of an element mean?

Isotopes:

For example, there are three stable **isotopes** of the element hydrogen:



% abundance = 99.98%	% abundance = 0.02%	% abundance = trace

The masses of these isotopes are given in **atomic mass units (amu)**. An **amu** is defined as 1/12 of the mass of a carbon-12 atom.

The **percent abuandances** of each isotope is the natural occurance of the particular isotope in nature.

The **average atomic mass** of an element is a weighted average of the atomic masses of the individual isotopes based on their percent abundances.

Example: How would we determine the average atomic mass of silver (Ag) given the following information?

Isotope	Exact Mass	Percent Abundance
Silver-107	106.905 amu	51.85%
Silver-109	108.905 amu	48.15%

Practice: Determine the average atomic mass of the following element.

Isotope	Exact Mass	Percent Abundance
#1	23.985042 amu	78.99%
#2	24.985837 amu	10.00%
#3	25.982593 amu	11.01%

Example: Given the following information, determine the percent abundances of the isotopes of nitrogen, N.

Isotope	Exact Mass	Percent Abundance
Nitrogen-14	14.003074 amu	???
Nitrogen-15	15.000108 amu	???

Practice: Determine the percent abundances of the isotopes of the following element.

Isotope	Exact Mass	Percent Abundance
Copper-63	62.9296 amu	???

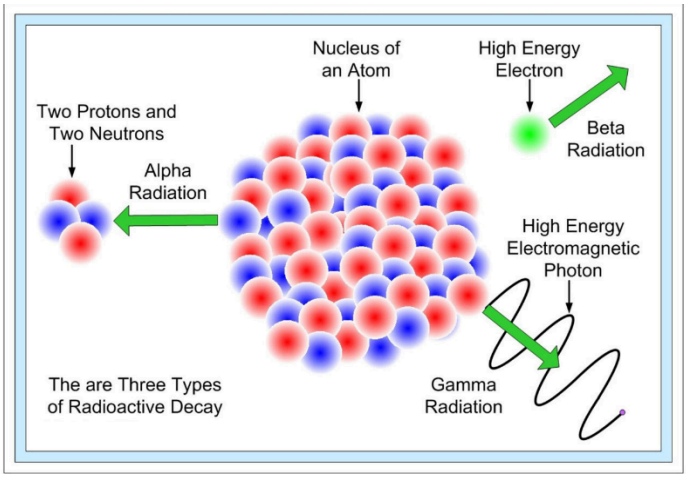
Copper-65	64.9278 amu	???

Practice: Of the following groups of isotopes, which one do you think has the highest percent abundance in nature?

tin-118 and tin-120	**potassium-39 and potassium-41**	**mercury-200 and mercury-202**
barium-136, barium-137, barium-138	**krypton-82, krypton-84, krypton-86**	**chromium-50, chromium-52, chromium-53**

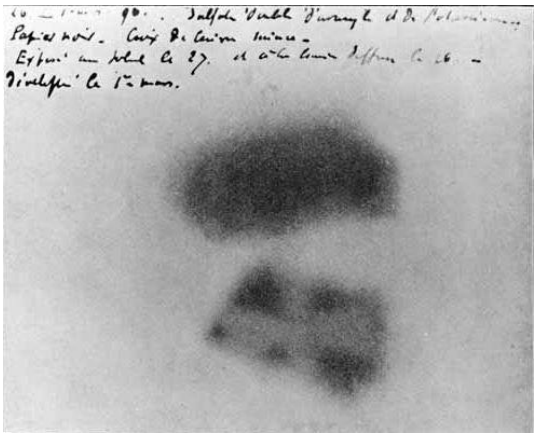
Radioactivity

What is **radioactivity**?



Who discovered radioactivity? How was it discovered?

Henri Becquerel:

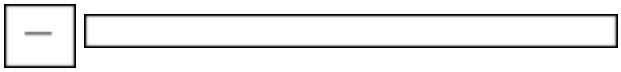


Marie Curie:

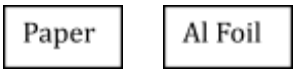
What were the three types of radiation that were classified by Ernest Rutherford?

1)
2)
3)

Practice: Using the diagram below, draw a picture representing how the three different types of radiation would be affected by charges and by differing materials.



How is radiation **useful** and **relevant** to everyday life?



Example: How can we determine the missing information in the following nuclear equation?

Uranium-238 □ Thorium-234 + ???

Example: Complete the following nuclear equation.

Carbon-14 □ Nitrogen-14 + ???

Example: Complete the following nuclear equation.

Radium-226 □ ??? + alpha particle

Practice: Complete the following nuclear equation.

Cobalt-60 □ ??? + beta particle

Americium-241 □ Neptunium-237 + ???

Radon-222 □ ??? (after alpha emission)

*Why didn't we complete any examples using gamma radiation?