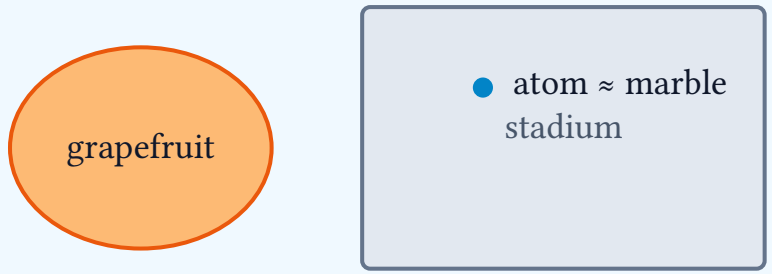
Science 10

Unit A: Energy and matter in chemical change

Atomic models and evidence

The size of an atom

- If you expanded a grapefruit to stadium size, atoms would be marble-sized.
- Atoms are far too small for classroom microscopes: how do we know their structure?



If a grapefruit were an atom, a stadium models its relative size

Two experiments on atomic structure

- Cathode rays bend toward a positive plate, evidence that atoms contain negatively charged electrons.
- Most alpha particles passed through the gold foil.
- A few deflected sharply, which is evidence of a tiny, dense, positive nucleus.
- For carbon-12, atomic number 6 means 6 protons; mass number 12 means 6 protons plus 6 neutrons.

Key terms

proton

Positively charged particle in an atomic nucleus.

neutron

Uncharged particle in an atomic nucleus.

electron

Negatively charged particle found outside an atomic nucleus.

nucleus

Dense central region of an atom containing protons and neutrons.

Key terms

atomic number

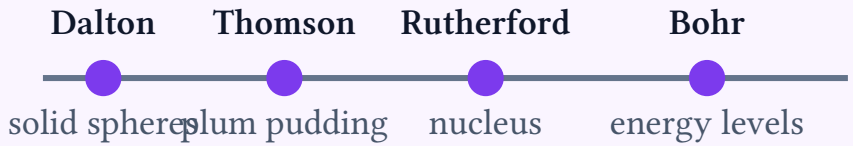
Number of protons in an atom's nucleus.

mass number

Total number of protons and neutrons in a particular atom.

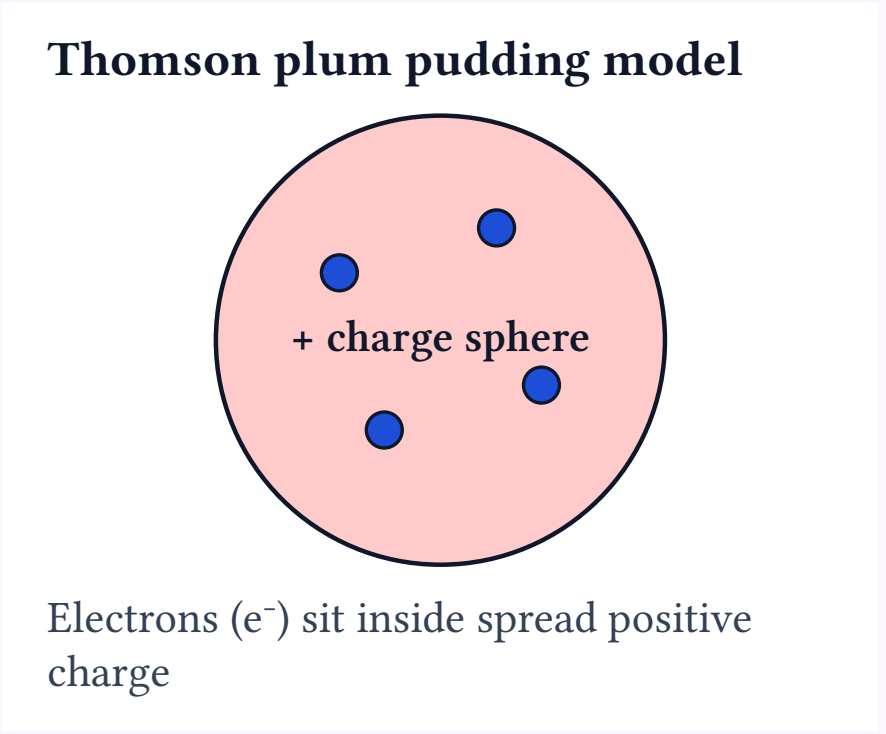
Dalton’s solid sphere model

- Dalton pictured each element’s atoms as solid spheres that stayed whole.
- That picture explains why a compound always combines elements in the same proportion.
- It leaves electric charge unexplained.



Thomson’s plum pudding model

- Thomson’s cathode-ray experiments showed that atoms contain electrons, which are negatively charged.
- He placed those electrons inside a sphere of positive charge, the picture nicknamed plum pudding.
- That picture failed to explain why some alpha particles bounce back from thin gold foil.

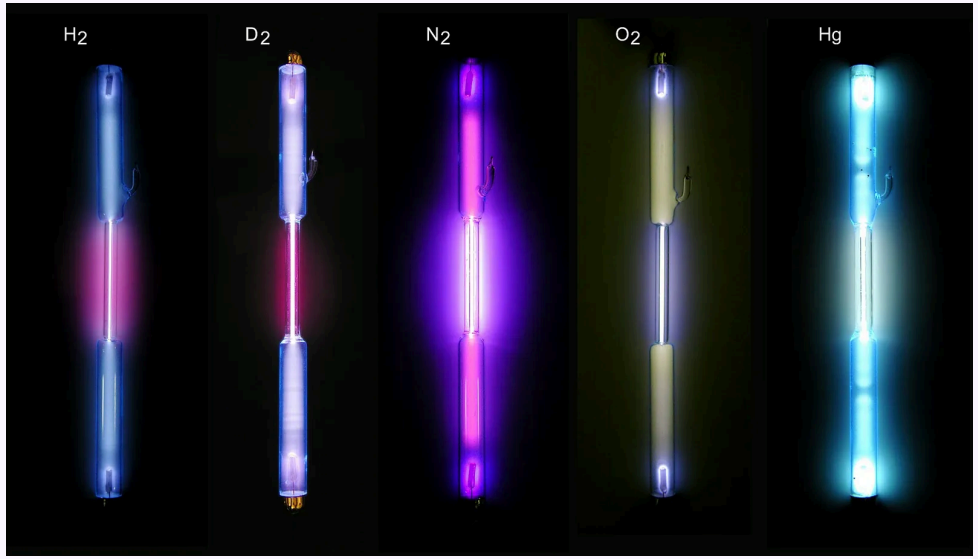


Rutherford’s nuclear model

- Most alpha particles passed straight through the foil, so the atom is mostly empty space.
- The few that bounced require a tiny region that is both dense and positively charged.
- Electrons sit outside that nucleus. The foil results replaced the spread-out positive charge.

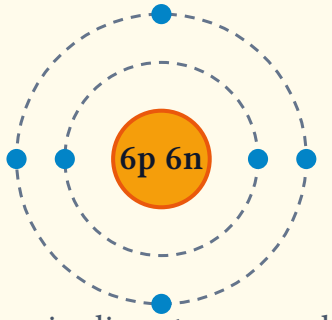
Bohr's energy level model

- Bohr allowed electrons only certain energies, a limited set of orbits.
- Those allowed energies explain the bright-line spectrum of hydrogen.
- A later model describes an electron as a cloud of probability. In this course you name that cloud. Calculating it comes in later courses.



Subatomic inventory

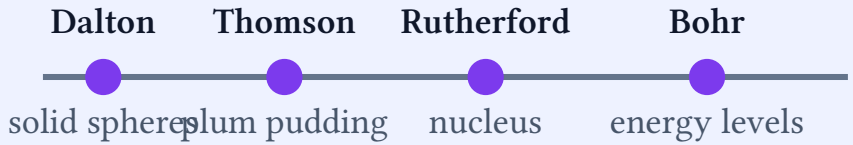
- A neutral carbon-12 atom has 6 protons, 6 neutrons in the common isotope, and 6 electrons.
- Atomic number is the proton count. Mass number is protons plus neutrons.



rade 10 model: electrons in discrete energy levels (2 + 4 for carbo

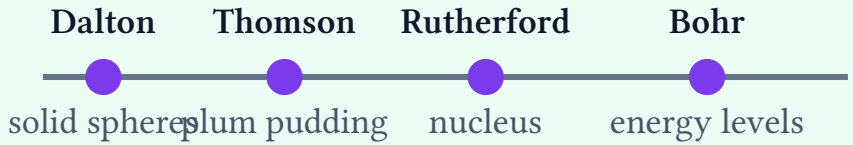
Careers using atomic structure

- Chemical engineering, cosmetology, and food processing use atomic evidence in different jobs.
- In Alberta that evidence shows up in oil-sands analysis, water treatment, medical tests, and farming.



Timeline sort

- Put the models in historical order, from the solid sphere to allowed energy levels.
- For each model, name one observation that the older model failed to explain.



Atomic evidence retrieval check

- Match cathode-ray deflection to the particle Thomson added to the atomic model.
- Match rare large alpha-particle deflections to Rutherford's nuclear revision.
- For carbon-12, determine proton, neutron, and electron counts in a neutral atom.

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