

Empedocles (500 B.C)

All matter is made up of **water, earth, air & fire**

Democritus (300 B.C)

Solid Sphere Model

Atoms are **indivisible, indestructible, in motion & differs in shapes and sizes**

John Dalton (Early 1800s)

Billiard Ball Model / Solid Sphere Model

Atoms can't be **destroyed, subdivided** or **created**

Atoms of the same element have **identical properties**; Atoms from different elements have **different properties**

During chemical reactions, atoms can be **rearranged, separated** or **created**

Atoms are combined in **simple whole number ratios**

J.J Thompson (Late 1800s)

Plum Pudding Model

Discovered that **electrons** are stuck in a **positively charged matter**

Conducted the **cathode-ray experiment**; Beta particles were attracted to the positively charged magnets

Ernest Rutherford (1911)

Nuclear Model / Rutherford's Model

Dense, tiny positively charge in the centre of an atom

Several **spaces** in an atom

Most of the **mass** is in the nucleus

Max Planck

Proposed that particles can emit a certain amount of **electromagnetic radiation**

Electrons need to obtain the amount of energy before emitting it

Analogy: Similar to a bank machine...you can only receive multiple of \$20.00, although other amounts exit (e.g. \$32.00)

Niels Bohr (1913)

Planetary Model / Bohr's Model

Electrons emit photons (small amount) of light that jumps up or down to other shells and doesn't spiral into the nucleus while emitting photons

Werner Heisenberg's Uncertainty Principle

It's impossible to know both the **position** (location) & the **momentum** (speed) of a particle at any given moment

Erwin Schrodinger (1926)

Quantum Mechanical Model

Mathematically predicted the **regions of space** where electrons can be found



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De Broglie

Quantum Mechanical Model

Electrons behave like **waves & particles**

Conundrum #1

Electrons in motions should emit energy of a **continuous electromagnetic spectrum** (rainbow). This loss of energy would cause electrons to spiral into the nucleus, destroying the atom. This wasn't demonstrated in **Rutherford's Model**, so scientists were skeptical

Electrons in motion doesn't emit a **continous electromagnetic spectrum**, but a **line spectrum** (series of separate lines of different colours of light emitted by atoms of a specific element as they lose quanta) instead. Additionally, once Niels Bohr proved how electrons move from shell to shell when quanta is emitted scientists understood why electrons emitting energy wouldn't crush the atom.



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