



SCIENCE

TERM 1 G9

LECTURE BY: sir teddy b

ATOMS, PARTICLES, PURE SUBSTANCES

1 atoms

Everything around you is made of **matter**, and all matter is made of **tiny particles called atoms**. Scientists discovered more information over time, so the **atomic model kept changing as new evidence was found**.

2 history of the atomic model

2.1 leucippus (5th century bc)

- Father of Atomic Theory
- First person to **suggest** that matter is made of **tiny indivisible particles**
- particles later became known as atoms
- started the idea of atoms

2.2 democritus - atomism

- greek philosopher
- **He believed that:**
 - Everything is made of **atoms**
 - Atoms are **tiny**
 - Atoms are **indivisible**
 - Atoms are **always moving**
 - Atoms **cannot be seen** by the **naked eye**

2.3 john dalton (1803) - solid sphere model

- ❖ **billiard ball model** - atoms looked like billiard balls, shows atoms as **spherical identities**
- ❖ proposed the **five postulates:**
 - a. Matter is made of **atoms**.
 - b. Atoms cannot be **created or destroyed**.
 - c. Atoms cannot be **divided**.
 - d. Atoms of the **same** element are **identical**.
 - e. **Different** elements have **different** atoms.
 - f. Atoms **combine** in simple whole-number ratios to form **compounds**.

2.4 j.j. thomson (1904) - plum pudding

- said it looked like a **chocolate chip cookie**
- discovered the **electron**
- he said:
 - atom is a **positive sphere**
 - **negative electrons** are scattered inside of it
- **Plum pudding model** - the atom is composed of a **positively charged sphere** with **negatively charged electrons distributed** throughout the atom

2.5 ernest rutherford (1911) - nuclear model

- **Gold Foil Experiment** - most of the atom is an **empty space**
- positive charge is concentrated in a **tiny nucleus**
- **electrons move around** the nucleus
- the center of the atom is **dense**



SCIENCE

TERM 1 G9

LECTURE BY: sir teddy b

2.6 niels bohr (1913) - planetary model

- **Planetary Model** - positively charged nucleus **surrounded** by **negative electrons traveling in fixed, circular orbits**
- electrons move **around the nucleus** in fixed **energy levels (electron shells)**
- **Electrons:**
 - stay only in **specific shells**
 - **cannot** stay **between** shells
 - **absorb or release** energy when jumping shells

2.7 james chadwick (1932) - neutron

- ★ discovered the **neutron**
- ★ **Neutron:**
 - have **no charge (neutral) (0)**
 - are **inside the nucleus**
 - add mass
 - keeps the **nucleus stable**
- ★ proved this by bombarding **beryllium with alpha particles**

2.8 quantum mechanical model (modern model)

- scientists discovered that electrons **don't travel in exact paths**
- electrons stay in **orbitals**
 - ◆ **orbitals** are regions where electrons are **most likely to be found**
- supported by the **Davisson-Germer Electron Diffraction Experiment**, which showed that **electrons behave like waves**

3 structure of an atom

NUCLEUS (Center)

Contains:

- Protons (+)
- Neutrons (0)
- Almost all the mass is here.

ELECTRON SHELLS - Surround the nucleus.

Contain:

- Electrons (-)
- Example:
 - Helium = 2
 - Aluminum = 2, 8, 3
 - Chlorine = 2, 8, 7

4 subatomic particles

tiny units of matter and energy that are smaller than an atom

4.2 proton

Symbol: p^+

Charge: +1

Mass: ≈ 1 amu

Location: Nucleus

Importance:

- Determines the **identity of an element**.
- Without changing protons,
- the element **stays the same**.

4.3 neutron

Symbol: n^0

Charge: 0

Mass: ≈ 1 amu

Location: Nucleus

Importance:

- Keeps **nucleus stable**.
- Too many or too few neutrons **can make the atom radioactive**.

4.4 electron

Symbol: e^-

Charge: -1

Mass: Very tiny (about $1/1836$ amu)

Location: Electron shells

Importance:

- **Responsible for:**
 - Electricity
 - Chemical bonding
 - Chemical reactions



SCIENCE

TERM 1 G9

LECTURE BY: sir teddy b

5

rules

5.1 rule #1

Atomic Number = Number of Protons

- Example: Carbon:
- Atomic Number = 6
- Protons = 6

5.2 rule #2

Mass Number = Protons + Neutrons

- **Formula:** Mass Number = $p + n$
- **Formula:** Neutrons = Mass Number - Atomic Number

5.3 rule #3

Neutral Atom

Electrons = Protons

Example:

- Oxygen
- Protons = 8
- Electrons = 8

5

pure substance

- A material with a **fixed chemical composition**.
- Always contains the **same kind of particles**.
- There are **2 types**:

5.2 element

Made of only **one type of atom**.

Examples:

- Oxygen (O)
- Gold (Au)
- Carbon (C)
- Aluminum (Al)

FACT: All atoms of the **same element** have the **same number of protons**.

Protons = Identity

5.3 compound

Made when **two or more** elements **chemically combine**.

Examples:

- **Water (H₂O)**
- **Carbon dioxide (CO₂)**
- **Salt (NaCl)**

Mnemonic: **COMPOUND = COMBINATION**

6

isotopes

Atoms of the same element have:

- Same **number of protons**
- Same **number of electrons**
- Different **number of neutrons**

Some isotopes are:

- **Stable**
- **Radioactive**

Example:

Fluorine-18 - Used in PET Scans to detect cancer because it emits radiation that scanners can detect.

3

MAIA GUALBERTO | MANRESA SCHOOL (only bring back to maia if theres a written star on top of the reviewer. thanks lots!)



7

summary

- Matter is made of atoms.
- Leucippus first suggested tiny indivisible particles.
- Democritus called them atoms.
- Dalton said atoms are solid spheres.
- Thomson discovered electrons.
- Rutherford discovered the nucleus.
- Bohr proposed electron shells.
- Chadwick discovered neutrons.
- The Quantum Model says electrons are found in orbitals, not exact paths.
- An atom has a nucleus (protons + neutrons) and electron shells.
- Protons determine the element.
- Neutrons affect stability.
- Electrons are involved in electricity and bonding.
- Atomic Number = Protons
- Mass Number = Protons + Neutrons
- Electrons = Protons (for neutral atoms)
- Elements contain one kind of atom.
- Compounds are combinations of elements.
- Isotopes have the same protons but different neutrons.