**SCIENCE 10 CHEMISTRY** **Name: _____**

**Date: _____**

**Period ___**

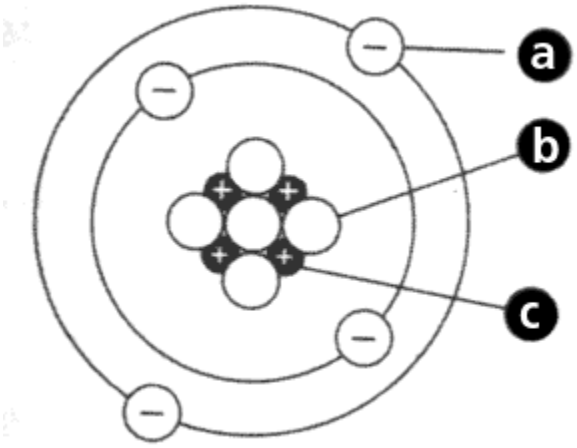
What is the world made of ?

What holds it all together ?

## Elementary Particles

Atoms are made of **subatomic particles**. The three types of subatomic particles are:

- **a) ELECTRONS**
- **b) NEUTRONS**
- **c) PROTONS**




***But what are these particles made of?***

They are made of (or *are*) **elementary particles**.

***What is an elementary particle?***

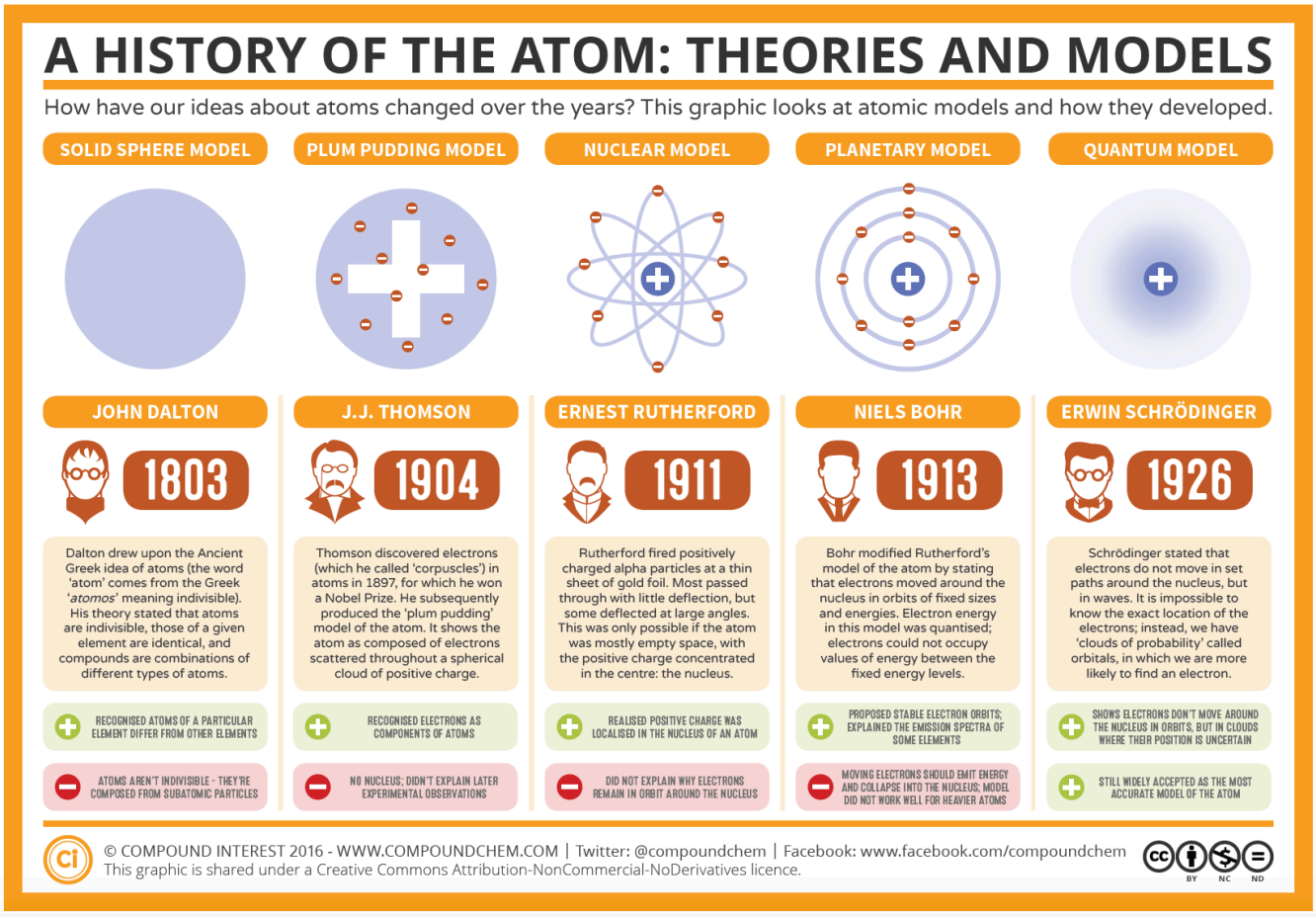
An elementary particle is a particle that is **not made up of any smaller particles.**
Elementary particles are the building blocks of the universe.
All the other particles and matter in the universe are made up of elementary particles.

**ATOMIC MODEL History**

For many years scientists thought that the atom was the smallest particle possible.
We explored the development of the ATOMIC MODEL in Science 8 !!!

Scientists have subsequently learned that the atom was made up of even smaller particles.
When we study the atom we learned about the basic particles of the atom including the **electron, proton, and neutron** that we labeled on the diagram, above.
Today, scientists have found even smaller particles that make up the proton and the neutron.

**History of Atomic Chemistry: Crash Course Chemistry # 37.**
**https://youtu.be/thnDxFdkzZs**
10 minute video




More Information on each of these proposed models here:
**https://www.compoundchem.com/2016/10/13/atomicmodels/**

Of course there are MANY more scientists that contributed to what we know about the model of the atom, over the centuries.

# Elementary Particles - Quarks, Bosons, Leptons

### Types of Elementary particles

There are two main categories of elementary particles:

- **FERMIONS**
- **BOSONS**

## Fermions

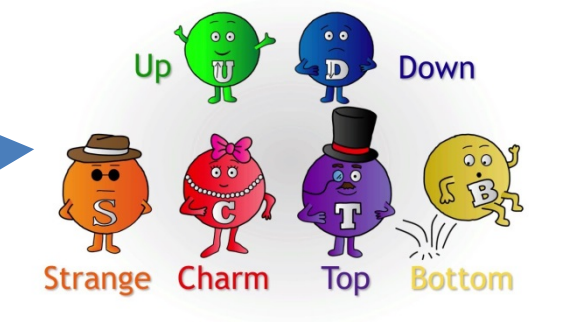
Fermions are the **MATTER** particles.

All matter is made up fermions. Fermions are divided into two types of particles:

- **QUARKS**
- **LEPTONS**

**Quarks** - the basic building blocks for **protons, and neutrons.**

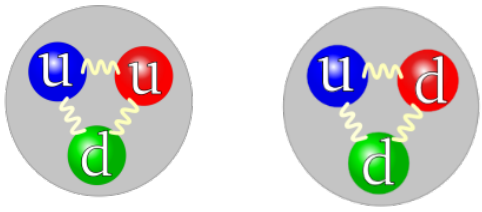
- There are six types of quarks and they have pretty interesting names
- The different types of quarks are called " **flavours** " by physicists.




*Note: A proton is made up of* **three** *quarks*

**Proton:** A proton is made up of three quarks including two "up" quarks and one "down" quark.

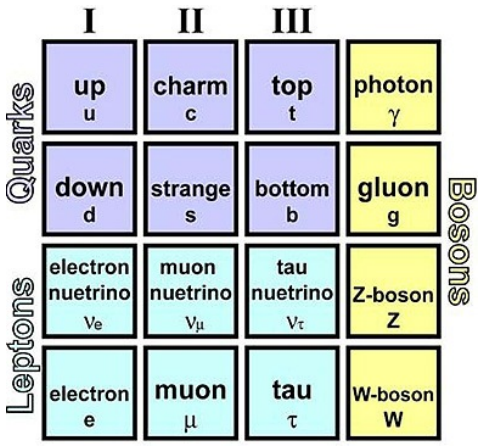
**Neutron:** A neutron is made up of three quarks including two "down" quarks and one "up" quark.




**Leptons -** One type of lepton that you have probably heard of is the **electron.**
Electrons are important building blocks for atoms.
Other types of leptons include the **Muon** and the **tau.**

## Bosons

Bosons are **FORCE** -carrying particles. This means that they are made up of tiny bundles of **ENERGY.**




**Photon** - **LIGHT** is made up of a type of boson called a photon.

**Gluons** – Gluons are a type of boson that act as the force-carrier between quarks in creating one of the fundamental forces of nature, the **STRONG FORCE.**

## Four Fundamental Forces:

All interactions in the universe (YES THE UNIVERSE) are thought to arise from four different forces

### Strong

- The strongest of the forces
- Holds the **NUCLEUS OF AN ATOM** together
- Uses **GLUONS** to hold protons and neutrons together


### Weak

- The second strongest force (only weak when compared to the **STRONG** force)
- Responsible for **RADIOACTIVITY** in some elements

### Electromagnetism

- Electricity and magnetism are interconnected
- Static electricity, like a balloon sticking to a wall, or magnetism, like magnets attracting or repelling each other are both the result of a *single* force
- Positively charged **PROTONS** attract negatively charged **ELECTRONS**
- Holds the **ATOM** together

### Gravity

- The **WEAKEST** of the fundamental forces
- Holds you to the **EARTH**, and the Earth to the sun (etc.)
- Very easy to overpower