

Model of Matter - Atoms and Molecules

Size of an Atom

- An atom cannot be seen with the naked eye

Structure of an atom

- An atom contains three types of sub-atomic particles
 - Proton (+)
 - Neutron (Neutral)
 - Electron (-)
- Protons and Neutrons are found in the nucleus of the atom while electrons move around the nucleus in electron shells

Models of an Atom

- Atoms are represented using various scientific models
- One example is the planetary model
- The nucleus is made up of protons and neutrons, thus it is positively charged
- A neutron is a particle with no charge
- A proton is a positively charged particle
- An electron is a negatively charged particle, it moves around the nucleus at high speeds
- In the planetary model, electrons move around the nucleus in an atom like how the planets move around the sun in the solar system
- Based on the model, the atom is mostly made of empty space
- Within this space, the electrons move about the nucleus
- The pathways taken by the electrons are represented by blue lines in planetary models

Charge of an atom

Type of sub-atomic particle	Relative charge	Relative mass	Position in an atom
Proton	+1	1	Within the nucleus
Neutron	0	1	Within the nucleus
Electron	-1	0	Outside of the nucleus

- In an atom, the number of protons = number of electrons
- + & - charges in an atom are balanced
- Atom is electrically neutral
- Neutrons do not contribute to the overall charge because they don't have a charge

- Unlike the number of electrons, the number of neutrons in an atom is not always equal to the number of protons in the atom.
- Some types of atoms have different numbers of neutrons

Type of atom	Number of protons	Number of electrons	Number of neutrons
carbon	6	6	6, 7 or 8
nitrogen	7	7	7 or 8
uranium	92	92	143 or 146

- The mass of an atom is mainly contributed by the mass of its nucleus, the number of protons and neutrons in the nucleus
- Electrons have mass but they are very much lighter than protons and neutrons, thus the mass of electrons in an atom is considered negligible and do not add up to the mass of an atom

How can the number of protons in an atom be used to identify an element

- The periodic table of elements can be used to find the number of protons in an element
- The number over the chemical symbol of an element in the periodic table is known as the proton number
 - This is the number of protons in the nucleus of an atom
- Elements are arranged in the periodic table in order of increasing number of atoms in their atoms
- No 2 elements can have the same number of protons in their atoms
- The number of protons in atoms differentiates 1 element from one another as they have unique atomic structures

Type of element	Number of sub-atomic particles
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	Proton	Electron	Neutron
Hydrogen	1	1	0
Helium	2	2	2
Lithium	3	3	4

- Hydrogen, helium and lithium have different numbers of protons in their atoms, thus they have different physical and chemical properties

How do we represent the simplest units of elements and some compounds?

- At atom can combine with one or more atoms of the same element or different elements to form molecules
- A molecule is made up of two or more atoms that are chemically combined
- The chemical formula is another way to represent molecules
 - It identifies each constituent element in a molecule by its chemical symbol and indicates the number of atoms of the element
- A molecule of an element consists of only one type of atoms that are chemically combined
- A molecule of a compound consists of two or more types of atoms that are chemically combined

What are some applications of atomic technologies and the possible issues that can arise from them?

- Scientists constantly seek to find out more about atoms as they try to create new materials from them
- The knowledge of atoms has been used for medical purposes and to provide nuclear energy
- In the field of medicine, the properties of atoms are applied in radioactive therapy to cure diseases as well in medical imaging which includes magnetic imaging (MRI) and X-ray
- Energy from atoms is used in nuclear power plants and atomic bombs
- Accidents at nuclear power plants can result in the loss of lives and environmental pollution