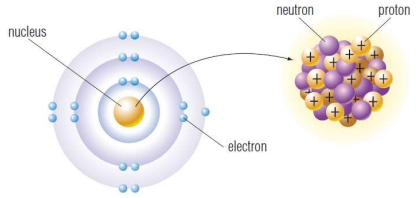
SNC1D CHEMISTRY

ATOMS, ELEMENTS, & COMPOUNDS

- Atoms & Elements (P.175; P.178-185)

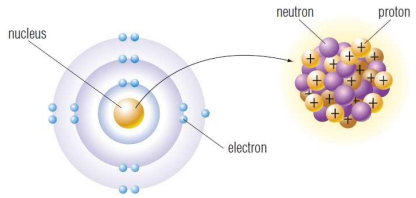
The Atom

*All elements are composed of atoms, and one atom is the smallest unit of any element. Although there are more than 100 different elements, each with its own kind of atoms, the atoms themselves are made of different kinds of smaller particles, called **subatomic particles**. Three subatomic particles are protons, neutrons, and electrons, and they have different properties.*



The Atom

*A **proton** is positively charged. A **neutron** has no charge and is similar in mass to a proton. Both protons and neutrons are found in the **nucleus**. An electron is negatively charged and has much less mass compared to a proton and a neutron. **Electrons** orbit the nucleus, much like planets orbit the Sun. The number of protons and electrons in an atom are equal so the atom is neutral (+ve and –ve charges cancel each other).*



The Atom

*When electrons are energized by heat, electricity, or light, they use this extra energy to jump out to a higher orbit (**excited state**). However, the excited electrons are very unstable & tend to fall back into their normal, more stable orbits (**ground state**). When the electrons drop back to their normal orbits, their extra energy is given off in the form of visible light.*

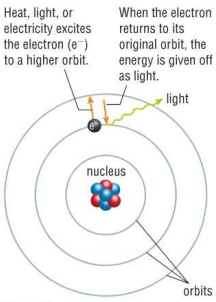
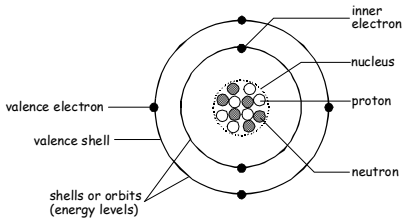


Figure 11 The Bohr–Rutherford model of the atom

The Atom

ATOMIC STRUCTURE

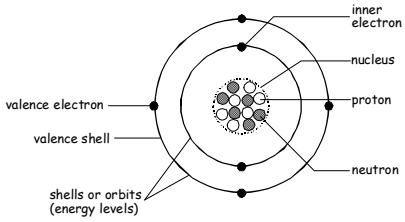
- 3 subatomic particles ☞ electrons, protons, and neutrons
- atoms are neutral (#p = #e)



The Atom

PLANETARY MODEL (BOHR-RUTHERFORD)

- electrons "circle" the nucleus in different energy levels (orbits)
  - 1st orbit ☞ 2 e's max
  - 2nd and 3rd orbit ☞ 8 e's max
- electrons can move from one orbit to another



The Atom

The following table summarizes the properties of these subatomic particles.

ATOMIC STRUCTURE

Particle	Symbol	Relative Mass	Electric Charge	Location	Able to Move?
proton	p^+	1	+	nucleus	no
neutron	n^0	1	neutral	nucleus	no
electron	e^-	1/2000	–	outside nucleus	yes

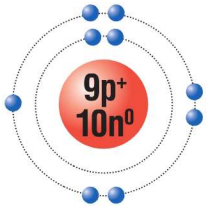
NOTE!

Relative mass *compares the mass of an object to the mass of another object.*

The Atom

BOHR-RUTHERFORD (B-R) DIAGRAM

- circle in centre represents nucleus
- number of protons and neutrons are written in the circle
- electrons are shown in circular orbits



NOTE!

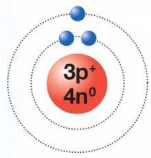
Electrons are typically only paired up after the 4th electron in each orbit.

The Atom

PRACTICE

1. The diagram to the right is a Bohr-Rutherford model of the element lithium.
   (a) How many protons, neutrons, and electrons are there?

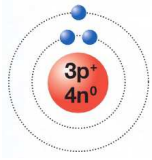
   (a) there are 3 protons, 4 neutrons, and 3 electrons



The Atom

PRACTICE

1. The diagram to the right is a Bohr-Rutherford model of the element lithium.
   (b) What is the overall charge of the atom?

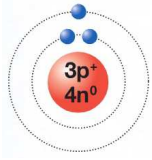


(b) zero – it is neutral ($3^+ + 3^- = 0$)

The Atom

PRACTICE

1. The diagram to the right is a Bohr-Rutherford model of the element lithium.
   (c) Draw a similar diagram of an atom that has four protons, five neutrons, and four electrons. Be sure to label each particle with its name and whether it is positive (+), negative (–), or neutral (0).



The Elements

Approximately 90 elements occur naturally on Earth, and in recent years, chemists have made more than 25 new elements. Gold, copper, and oxygen are common examples of elements. Based on their properties, all the elements can be divided into three classes: metals, non-metals, and metalloids.

The Elements – Metals

*Most of the elements are **metals**.*

- *Most are shiny and silver or grey in colour (except gold and copper).*
- *They are good conductors of electricity and heat.*
- *Except for mercury, they are solids at room temperature.*
- *Most are malleable and ductile.*
- *Most react with acids.*


The Elements – Non-Metals

*Only 17 elements are **non-metals**. They are grouped together mainly because they do not resemble metals.*

- *11 are gases, 5 are solids and 1 is a liquid (bromine).*
- *Most solid non-metals are dull but some are brightly coloured (sulphur).*
- *The solid non-metals are brittle.*
- *They are usually poor conductors of electricity and heat.*


The Elements – Metalloids

*The remaining elements are **metalloids**.*

- *They have properties in between those of metals and non-metals.*
- *They are all solids at room temperature.*
- *They conduct electricity but not very well, and so are called semiconductors.*
- *Most are shiny and grey, but unlike a metal, are brittle.*



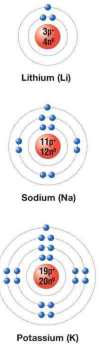
boron *silicon* *germanium*

The Elements

PRACTICE

2. Why do different elements have different properties?

different atomic structures (i.e. # of p's and n's) = different properties



The Elements

PRACTICE

3. How are all these elements organized?

by atomic number

The Elements

PRACTICE

4. What makes mercury different from other metals?

it is a liquid at room temperature

Activity: Flame Test (1DCHEM-ASG2)

INSTRUCTIONS

A. Read the activity "1DCHEM - ASG2 (Flame Test)".
B. Follow the instructions given (i.e. method 1 to 8).
C. Answer the questions given (i.e. conclusion and analysis 1).
D. Submit a formal lab report.

✔ Check Your Learning

WIKI (CHEMISTRY)

✎.... 1DCHEM - WS5 (The Elements)