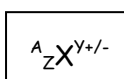


# HANDOUT

|         |                 |             |               |
|---------|-----------------|-------------|---------------|
| Module: | Chemistry SL/HL | Topic:      | Atomic theory |
| Tutor:  | Dr. Liakatas    | Date given: |               |

|                 | Proton         | Neutron        | Electron                 |
|-----------------|----------------|----------------|--------------------------|
| Relative mass   | 1              | 1              | 1/1840                   |
| Relative charge | +1             | 0              | -1                       |
| Found           | In the nucleus | In the nucleus | In shells around nucleus |



A = mass number = protons + neutrons

Z = atomic number = protons

Y = charge = electrons lost (+) or gained (-)

If Y=0 → electrons = protons = Z

If Y≠0 → electrons = Z+Y (-) or Z-Y (+)

Example:  ${}^{27}_{13}\text{Al}^{3+}$  → 13 protons, 14 neutrons, 10 electrons

**Isotopes** = atoms of the same element with *same protons* but *different neutrons*  
 = same Z but different A  
 Isotopes have *same chemical* but *different physical* properties.

**Relative (natural) abundance** = percentage proportion of each isotope of the element

**Relative atomic mass** = weighed average of the mass number of all isotopes

Example: Chlorine contains 75%  ${}^{35}\text{Cl}$  and 25% of  ${}^{37}\text{Cl}$

Relative atomic mass =  $(0.75 \times 35) + (0.25 \times 37) = 35.5$

Light **absorbed** → electron in atom gains energy → moves to higher energy level

Light **emitted** → electron in atom loses energy → falls to lower energy level

Light **spectrum** = separation of light to the frequencies it contains (e.g. using a prism)

**Continuous spectrum** = all frequencies present (rainbow) - (e.g. white light)

**Line spectrum** = specific bright lines on dark background - (e.g. emission spectrum)

▶ Lines of a line spectrum correspond to electron transitions between energy levels

▶ Energy levels converge to high energies → emission lines converge to high frequencies

**Frequency regions:** **Ultraviolet** = high frequencies = transitions to **first** energy level

**Visible** = middle frequencies = transitions to **second** energy level

**Infrared** = low frequencies = transitions to **third** energy level

**Electronic structure** of an atom = number of electrons in each energy level (shell)

1<sup>st</sup> energy level → holds up to 2 electrons

2<sup>nd</sup> energy level → holds up to 8 electrons

3<sup>rd</sup> energy levels → holds up to 8 electrons

Example:  ${}_{15}\text{P}$   
 Electronic structure is 2,8,5

**Valence electrons** = electrons in the highest (outermost) energy level (shell)