Arrangement Of The Electrons

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Summary

- The formation of emission line spectra indicates the presence of energy levels in atoms. An emission line spectrum consists of coloured lines against a dark background.
- The instruments used ot examine spectra are called spectrometers and spectroscopes
- When salts are heated, different colours are emitted depending on the metal present in the salt.
- Bohr proposed that electrons revolve around the nucleus in fixed paths called orbits or energy levels.
- Bohr proposed that the energy of an electron in an energy level is quantised, i.e. fixed at a definite amount.
- When an atom absorbs energy, electrons jump from a lower energy level to a higher energy level.
- Energy is lost when an electron falls from a higher energy level to a lower energy level.
- Since only definite amounts of energy are emitted, this implies that electrons can occupy only definite energy levels.
- An absorption spectrum is produced when white light is passed through a gaseous sample of an element.
- An absorption spectrum consists of dark lines against a coloured background.
- Heisenberg's uncertainty principle states that it is impossible to measure at the same time both the momentum, and the position of an electron.
- An orbital is a region in space within which there is a high probability of finding an electron
- s orbitals are spherical. p orbitals are dumbell-shaped
- A sublevel is a subdivision of a main energy level and consists of one or more orbitals of the same energy

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1 Atomic Absorption Spectrometry

You need to be able to explain atomic absorption spectrometry and give some uses

2 Sublevels

Before, bohr, electrons go in shells
$n = 1$, 2 electrons $n = 2$, 8 electrons .... (this was there in junior cert)
IN leaving cert you have a amore complicated verison of this
Wnen dicovered emsision line spectrums, supported above, however when studied spectrums, what looked like a single line of colored light, it was actually many close together.
The main energy levels are divided into sublevels.
The numner of sublevels is equal to n, ie. $n = 1$ has 1 sublevel,
sublevels named: s, p, d, f, you will not use f
$s = 2, p = 6, d = 10$ (how many each sublevel can be called).
If $n = 1$, it has 1 sublevel, and it is named s. It is called $1s$ and can hold 2 electrons $n = 2$, it has 2 sublevels, $2s$ and $2p$. as $n = 3$, it has 3 sublevels, $3s, 3p, 3d$, $n = 4$, 4 sublevels, $4s, 4p, 3d, 4f$
Electron occupy lowest available energy level first. $3d$ is higher then $4s$, and would be filled beforehand.
There are some exceptions!
If a sublevel is exactly half full, it will be extra stable.
Remember the two exceptions,

- Chromium (Cr) = 1s2, 2s2, 2p6, 3s2, 3p6, 4s1, 3d5
- Copper (Cu) = 1s2, 2s2, 2p6, 3s2, 3p6, 4s1, 3d10

These two elements don't fill 4s, rather making it more stable.

2.1 Example

Write the electron config for boron,
Diagram page 19, fig. 3.17 - 4s is lower in energy than 3d. Sublevel h
$B = 1s^2, 2s^2, 2p^1,$

2.2 Example 2

Nitrogen = 1sˆ2, 2sˆ2, 2pˆ3 Neon = 1sˆ2, 2sˆ2, 2pˆ6 Aliminum = 1sˆ2, 2sˆ2, 2pˆ6, 3sˆ2, 3pˆ1 Potassium (19) = 1s2, 2s2, 2p6, 3s2, 2p6, 4s1 Copper (29) = 1s2, 2s2, 2p6, 3s2, 3p6 ,4s1, 3d10

3 The wave nature of the electron

Louis de Broglei suggested all moving particles hab a wave motion. (know he put forward the idea)
This idea that a particle behaves like a wave is the particle wave duality.
This problem was done mathematically by werner heisenberg, heisenberg uncertainty principle
"It is imposable to know both the momentum and position of an electron".
Consider a beam of light begin used to detect the position of an electron. Light is energy, thus measuring adds energy to the electron. After the beam hits the electron, the position is known, but then it's speed is immediately changed by the energy from the light.
Heisenberg said that the bohr model of the atom was incomplete.

3.1 Limitations of Bohr's theory

- Only worked to explain the emision spectrum of hydrogen, but for more then 1 electron, it couldn't describe it perfectly
- It didn't take into account the wavelike motion of the electron
- When the Heisenberg's Uncertainty Principle, can only refer to the probability of finding an electron
- Bohr's theory could not explain the splitting of certain lines in the emission spectra and didn't taking into account sublevels.

4 Orbitals

DEFINITION **Orbital.**

A region of space within which there is a high probability of finding an electron.

Remember: Orbitals are not the same as an orbit, as it is talking about probabilities of finding an electron
The first orbital is s, it holds 2 electron.
The S orbitals sphere gets bigger as you move out.
A p sublevel is a dumbell shape, and there is 3 types of p orbitals, px, py, pz (each holds 2) alogn each axis
PUT DIAGRAM HERE
CHECK EXAM QUESTIONS!

4.1 Example

How the line spectrum proves energy levels exist.

- In the ground state the electron occupies the lowest available energy level
- THe electron can jump to the a higher level if it receives energy.
- The excited state is unstable
- The electron falls back to a lower level, releasing energy as photons

$$E_2 - E_1 = hf$$