TOPIC 2.2: ATOMIC STRUCTURE

THE ABOUT

CHAPTER ANALYSIS

TIME

- Relatively straight forward chapter
- 2 **key** concepts
- 1 **advanced** concept

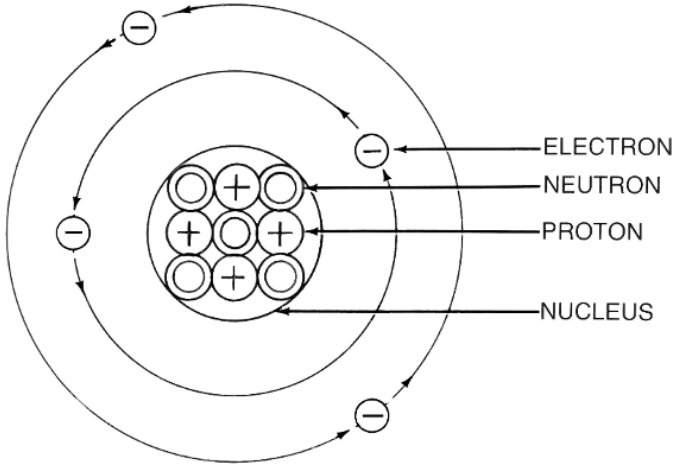
EXAM

- Usually tested in MCQs or Section A
- Tested as add-on to other chapters
  → Chemical Bonding, Periodic Table

WEIGHTAGE

- Light overall weightage
- Constitute to **1.5%** of marks for past 5 year papers

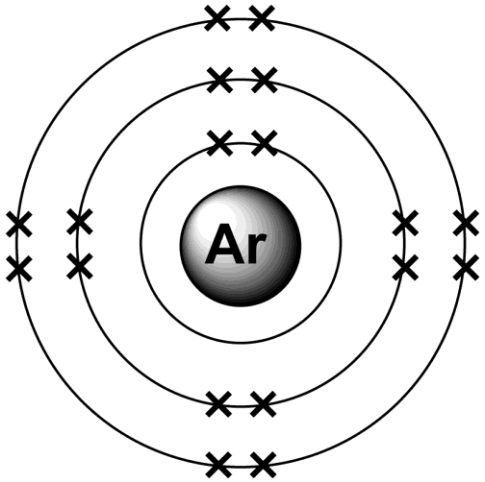
BASICS



Subatomic particle	Charge	Relative mass	Symbol	Location
Proton	+1	1	p	Nucleus
Neutron	0	1	n	Nucleus
Electron	-1	1 / 1836 **(negligible mass)**	e	Electron shell

BASICS

Ar atom:
18- protons
22 - neutrons



First shell: Maximum of **2 electrons**

Second shell: Maximum of **8 electrons**

Third shell: Maximum of **8 electrons**

Must know: ***2,8,8*** *electronic configuration*

*For elements after calcium, the third shell is able to hold a maximum of 18 electrons. → *transition metals*

BASICS

Nucleon number (protons + neutrons) — **40**

Ca — Symbol of element

Proton number / atomic number — **20**

Proton number: The total **number of protons** in an atom (number of electrons as well)
Nucleon number: The total **number of protons and neutrons** in the nucleus of an atom

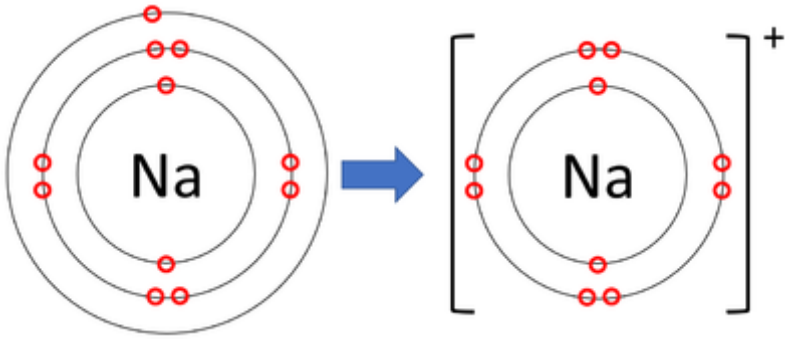
Identity of an element is dependent on its proton number, not its nucleon number.
→ *To review later: Isotopes*

'plus' sign

FORMATION OF POSITIVE IONS

When atoms that lose electrons, there are now more protons than electrons, hence they become positively charged. They would become a **cation**.

The sodium atom achieves a stable electronic configuration by losing one electron. It becomes a sodium cation with a charge of +1 and is written as Na^+.

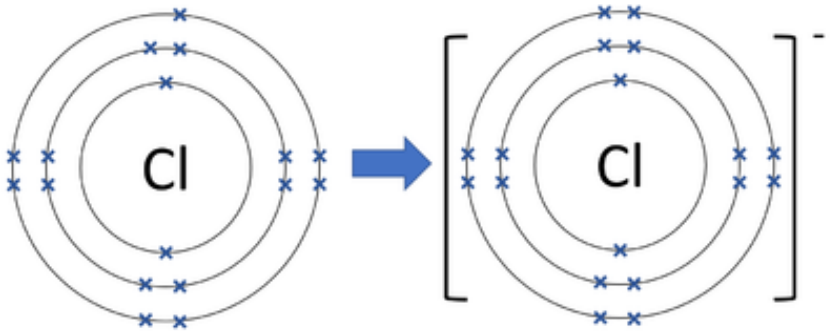


FORMATION OF NEGATIVE IONS

When atoms gain electrons, there are more electrons than protons now, they become negative ions, called an **anion**.

Negative

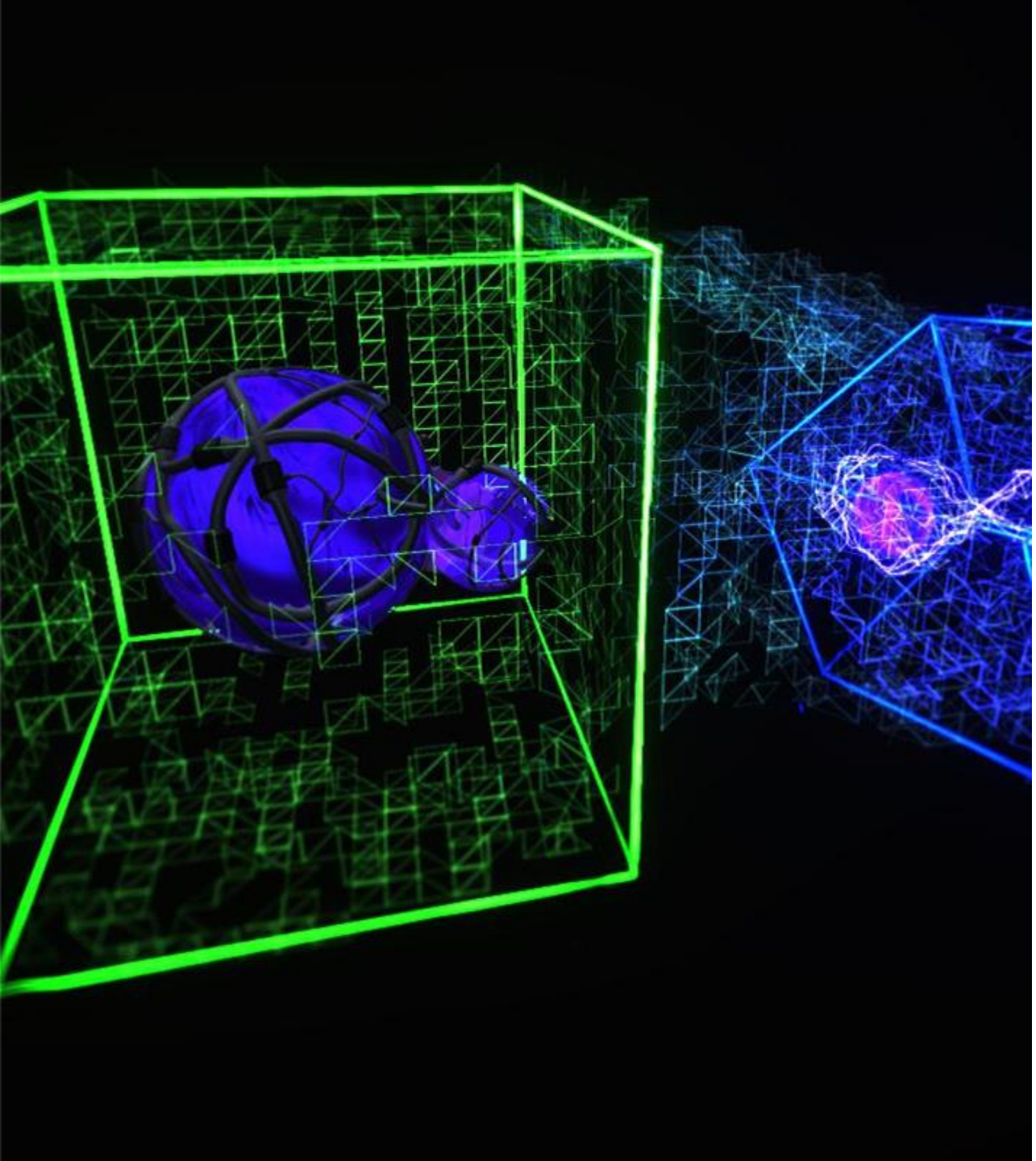
The chlorine atom fully completes its valence shell by gaining one electron. It is now a chlorine anion with a charge of -1 and is also written as Cl^-.



KEY CONCEPT

Let's delve deeper into the understanding of isotopes, **a common killer question** at 'O' levels.

ISOTOPES
SAME NUMBER OF PROTONS
DIFFERENT NUMBER OF NEUTRONS



Isotopes are atoms of the same element that have the **same amount of protons and electrons** but **different amount of neutrons.**

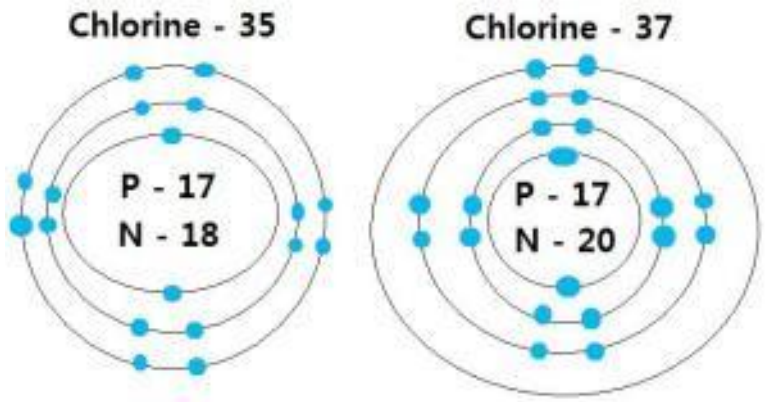
Isotopes of an element have **same chemical properties**, as they have **the same amount of electrons**. Hence, they will undergo the same chemical reactions to form compounds with the same chemical formula. (Recall electronic configuration)

However, isotopes will have **differences in physical properties** as having **different amount of neutrons** means that they have slightly different masses. This would also affect other physical properties like their density.

SAME CHEMICAL PROPERTIES

DIFFERENT PHYSICAL PROPERTIES

Case Study: Chlorine mass: 35.5



Isotopes	Percentage Abundance
^{35}Cl	75%
^{37}Cl	25%

Chlorine mass on the periodic table is 35.5.

Does it mean it has 35.5 proton + neutron?

The answer? No.

Chlorine exists as chlorine-35 and chlorine-37 atoms. There are more chlorine-35 atoms however.

The final **atomic mass** seen on the periodic table is the sum of **atomic mass/percentage abundance of all the isotopes** of chlorine.

Represented by calculation:

35 x 75% + 37 x 25% = *35.5 (average mass)*

 Hence, chlorine's Ar is 35.5.

KEY CONCEPT

things to note

Understanding isotopes

Different number of neutrons

This causes **differences in physical properties** such as density.

Same number of protons/electrons

Isotopes have **similar chemical properties** as atoms would undergo the same chemical reactions to form compounds with same chemical formula.

Atomic mass is an average mass of the element's isotopes

By taking into account the **percentage composition** of the different isotopes and their respective masses, the periodic table displays that calculated **average atomic mass.**

Case study: Chlorine's Ar is 35.5

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