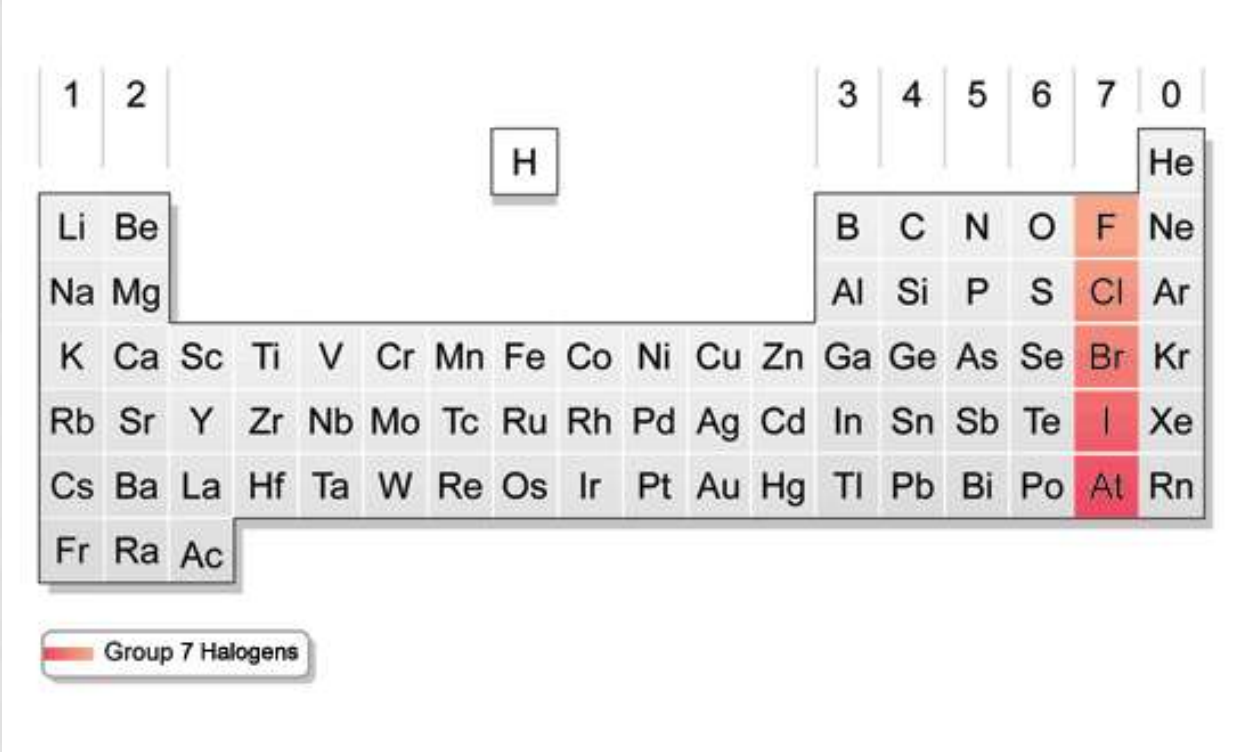
GROUP VII ELEMENTS

BY THUGIANG

WHAT ARE GROUP VII ELEMENTS?

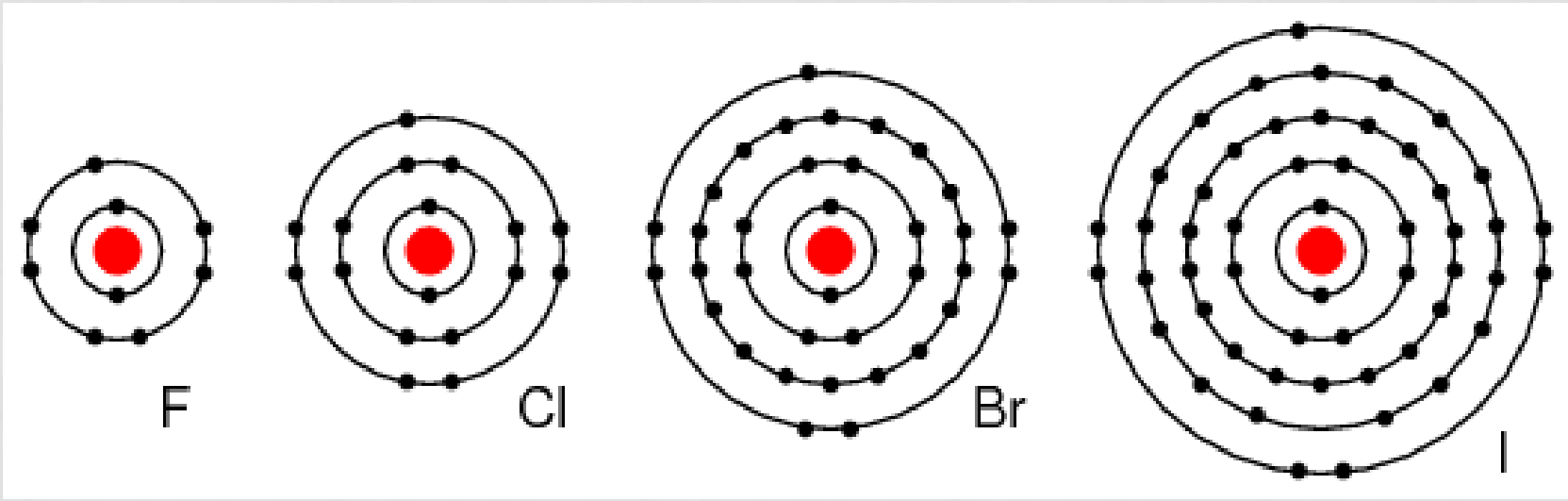


- They are called **halogens.**

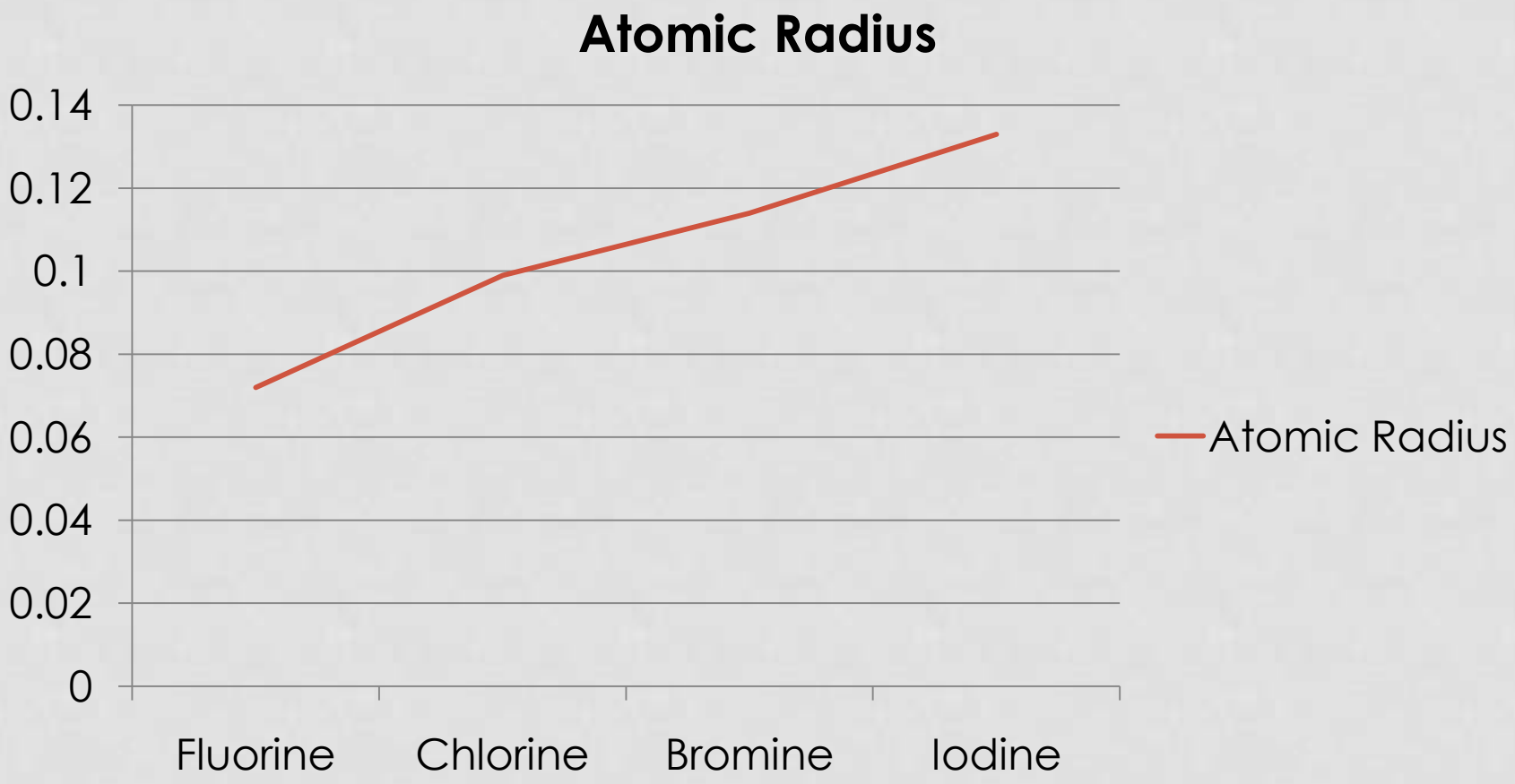
PHYSICAL PROPERTIES

- These elements are **non-metals**.
- At room temperature (25°C), they exist as **diatomic** molecules: F_2, Cl_2, Br_2, and I_2.
- Their atoms have **seven electrons** in the outer principal quantum shell.

ELECTRON ARRANGEMENTS



ATOMIC RADIUS

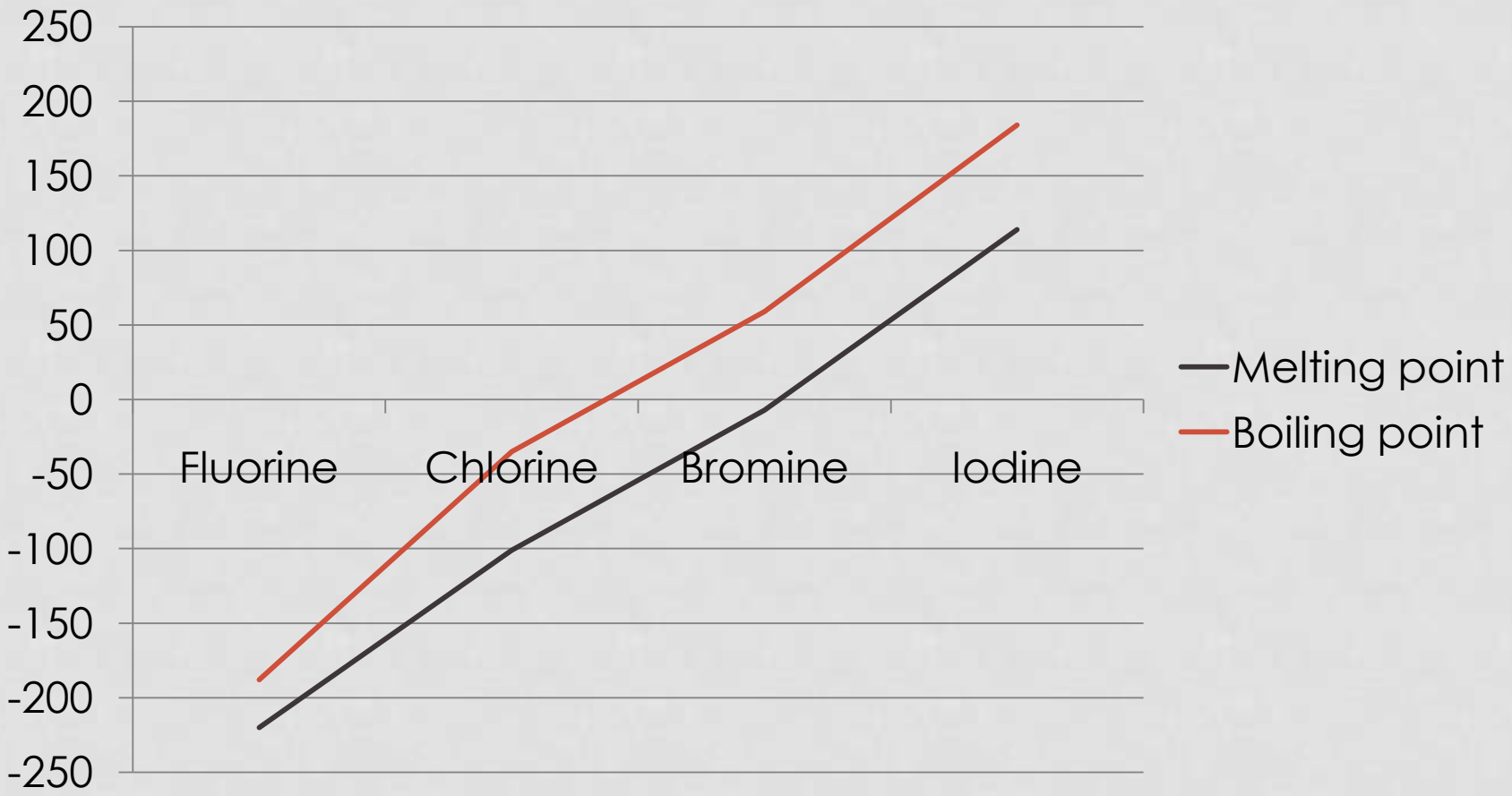


WHY?

- Causeeee…

- The number of layers of electrons around the nucleus.
- The more layers, the bigger the atomic radius.

MELTING AND BOILING POINTS



MELTING AND BOILING POINTS

- The boiling points show us the **volatility** (how easy can they evaporate) of the halogens.
- They are relatively **low** cause they have **simple** molecular structure and **weak** van der Waals' forces between their diatomic molecules.
- These forces **increase** as the no. of electrons **increase** with increasing atomic number (the greater number no. of electrons, the greater the opportunities for dipoles arising within molecules).
- => the **larger** the molecules, the **stronger** the van der Waals' forces.

COLOUR

Fluorine

Pale yellow

Chlorine

Green/ Yellow

COLOUR

Bromine

Orange/ Brown

Iodine

Grey/ Black

REACTIONS

- The halogen atoms require just **one** more electron to achieve a complete outer shell => they can react with **metallic elements** by gaining an electron to become **ions** with a 1- charge.
- For example:
  - $Cl_2(g) + Ca(s) \rightarrow CaCl_2(s)$
- Each halogen atom tends to gain one electron
  - => halogens are **oxidising agents**, their oxidation no. is reduced from 0 to -1 in the compound formed.

REACTIONS

- They also react with non-metals, forming **covalent** bonds.
- For example:
  - $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
- The halogens get **less reactive** going down Group VII. This correspond to the trend in electronegativity going down the group.
  - Electronegativity is a measure of the tendency of an atom to **attract** a bonding pair of electrons.
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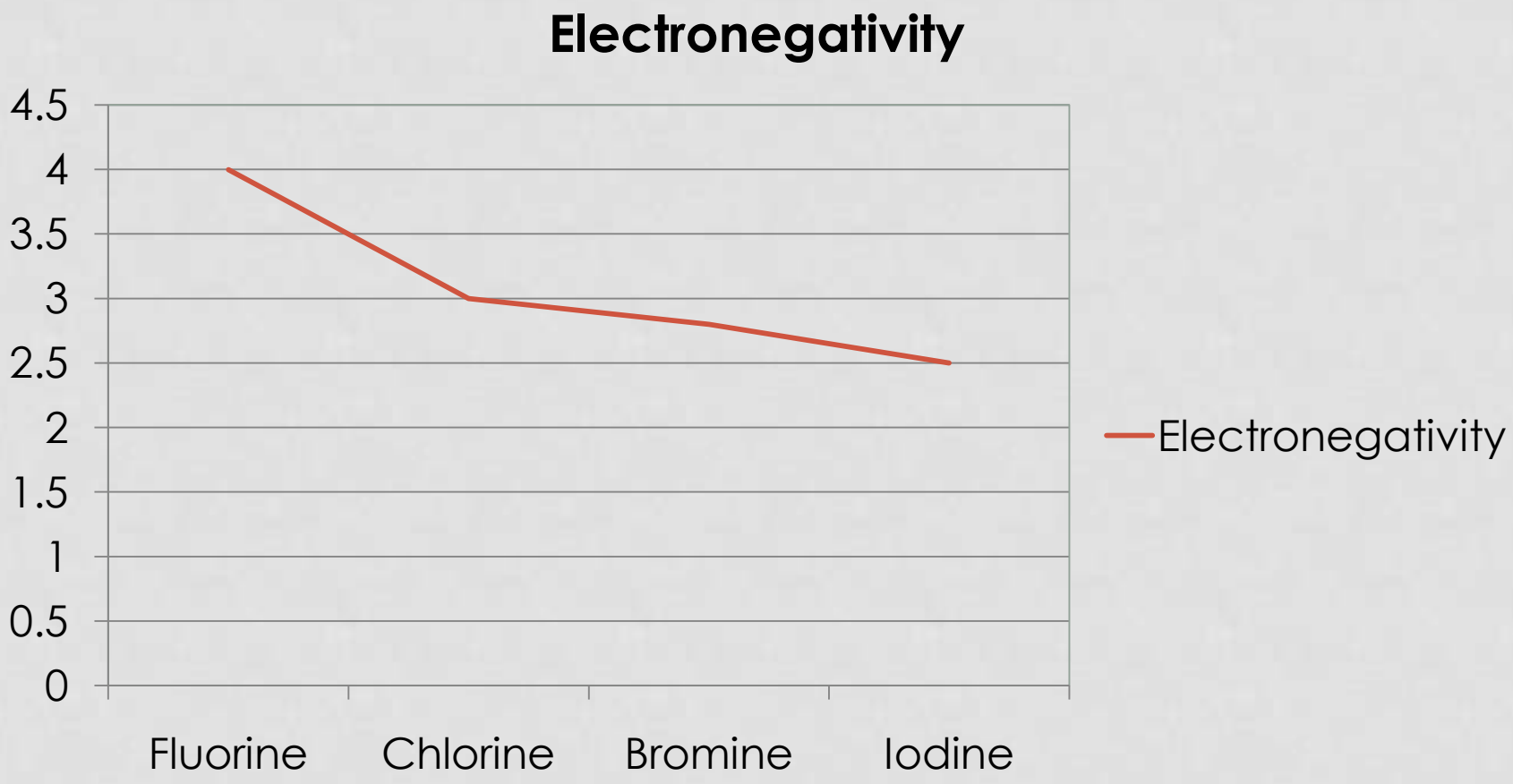
ELECTRONEGATIVITY



WHY?

- Causeeeeee…
- The electrons are not as near to the nucleus as the number of electrons increase. Therefore, the nucleus and the electrons are not as attracted to each other as much. An increase in shielding is observed so the ability to attract electrons decrease. Which means electronegativity decrease down the group.

DISPLACEMENT REACTIONS

- A **more reactive** halogen can **displace** a **less reactive** halogen from a halide solution of the less reactive halogen.
- For example:
  - $Cl_2(aq) + 2NaBr(aq) \rightarrow 2NaCl(aq) + Br_2(aq)$
  - Ionic equation:
  - $Cl_2(aq) + 2Br^-(aq) \rightarrow 2Cl^-(aq) + Br_2(aq)$
- Halogens dissolve well in cyclohexane.

HALOGENS AND CYCLOHEXANE

REACTION WITH HYDROGEN

- Halogens form **hydrogen halides** with hydrogen gas.

Equation for reaction	Description of reaction
$H_2(g) + F_2(g) \rightarrow 2HF(g)$	Reacts explosively even in cool, dark conditions
$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$	Reacts explosively in sunlight
$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$	Reacts slowly on heating
$H_2(g) + I_2(g) \leftrightarrows 2HI(g)$	Forms an equilibrium mixture on heating

WHYYYY? T_T

- Because e e e e e. . . . .

Hydrogen-halogen bond	Bond energy / kJ/mol
H-F	562
H-Cl	431
H-Br	366
H-I	299

- => HF is most thermally stable; HI is the least thermally stable.

THE END

YAYYYY!!!