Q. Hey, do you know any good jokes about sodium?

A. Na

The Periodic Table 2

Tracking Trends!

Learning Intention:

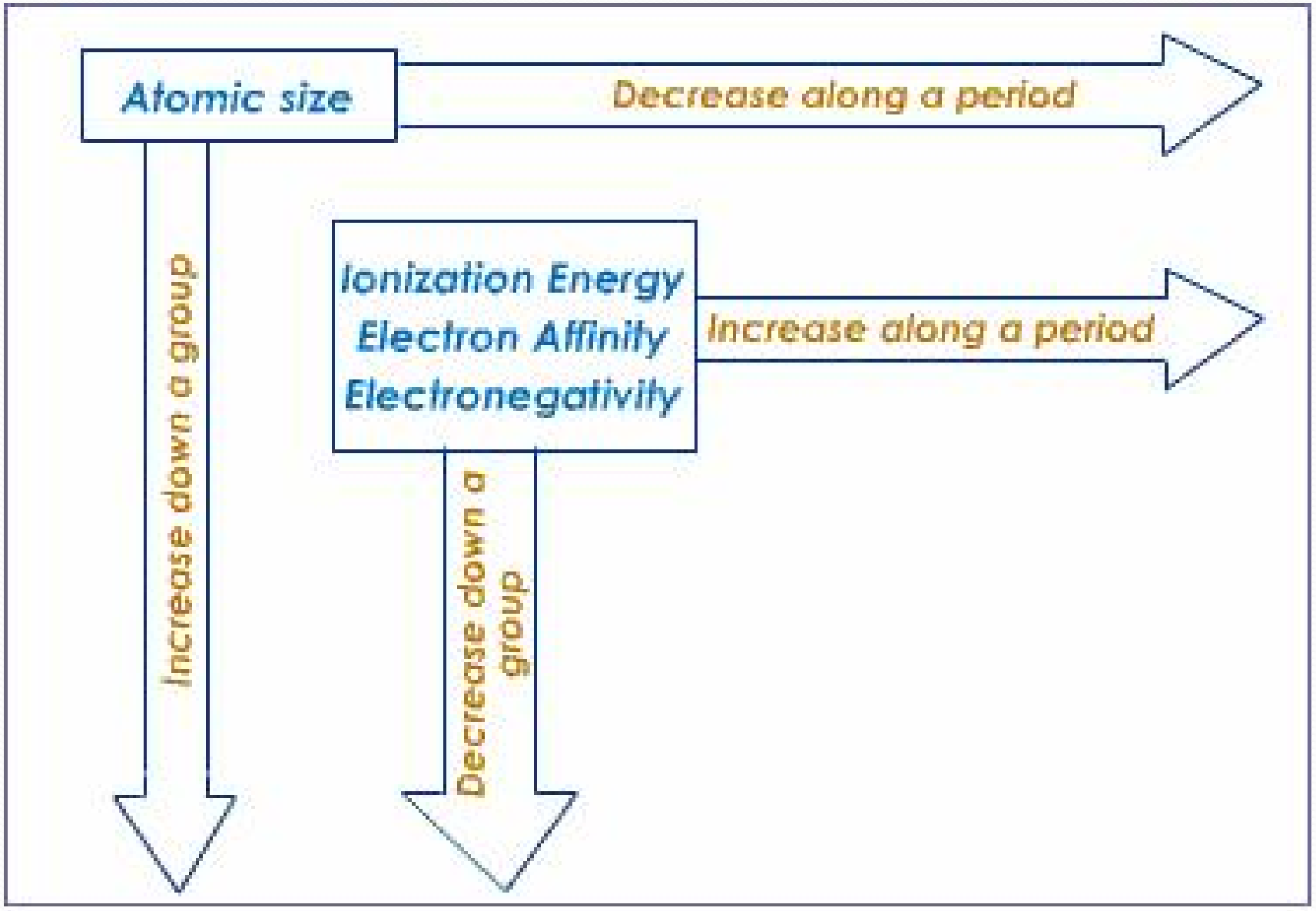
- To explain the trends and patterns in the following atomic properties of the main group elements: atomic number and radius, ionisation energy, electronegativity and types of compounds formed.
- To use electronic configuration and atomic properties to predict the reactivity of the main group

Chemistry 403 video: Trends in the Periodic Table

http://www.gpb.org/chemistry-physics/chemistry/403

- Living Periodic Table worksheet
- Living Periodic Table info chart
- Living Periodic Table questions
- Periodic Table trends worksheet

Trends in properties



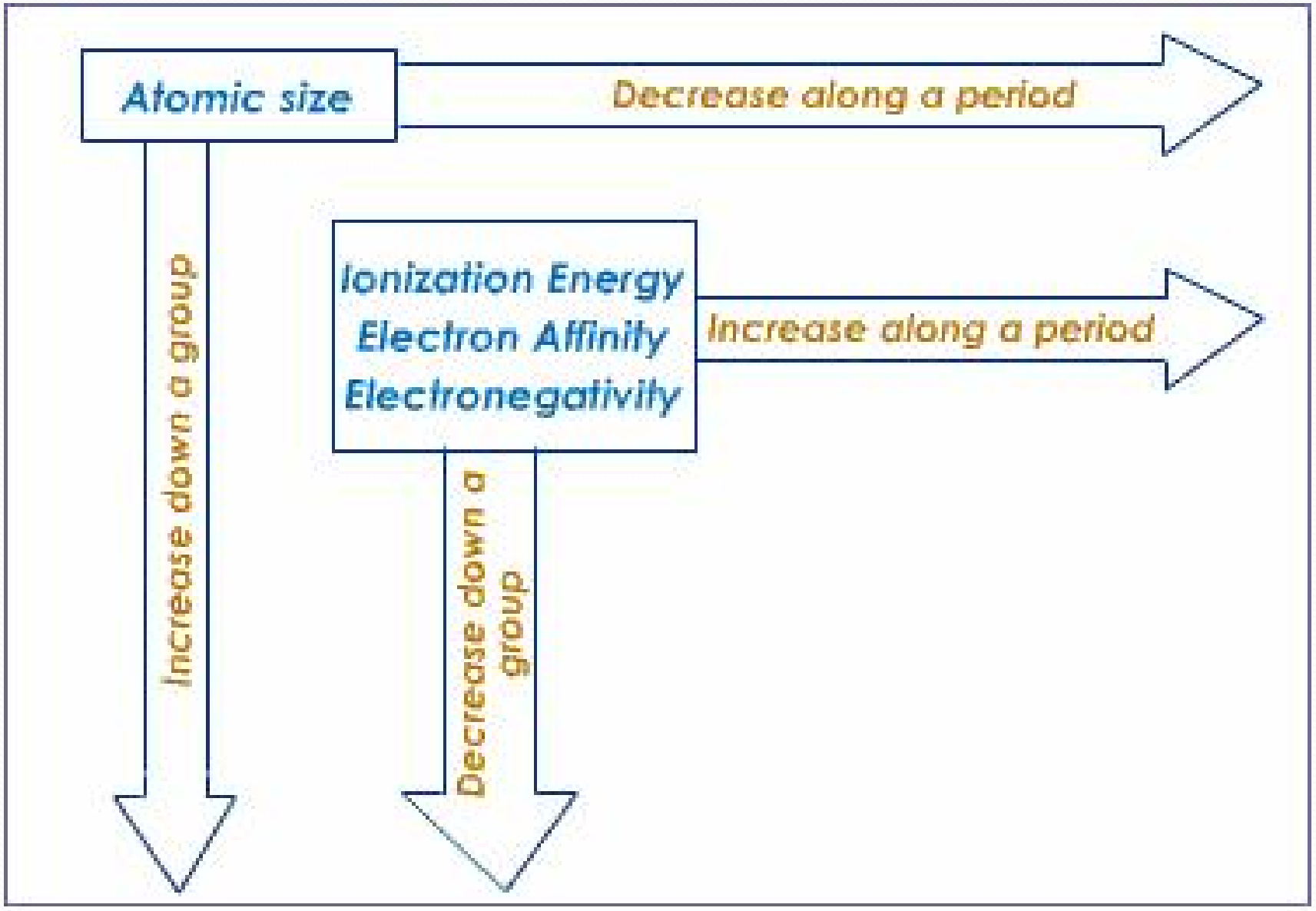
Trends in the properties

- As we move across a period from left to right one more electron is added to the same shell.
  - However, the atomic size decreases.
  - This is because the positive charge of the nucleus also increases and pull the electrons closer.
- As we move down a group the same number of electrons are present in the outer shell
  - However, one more shell has been added so the atom size increases.

Trends in Properties

- Electron Affinity – how much the atoms wants electrons
- Electronegativity – measure of the ability of an atom to attract an electron towards itself
- Ionization Energy – Energy required to kick out an electron.

Trends in properties



Trends in properties

- Let's look at Sodium which has 1 electron in its outermost shell.
- To become "full", Sodium really wants to get rid of its electron in the outermost shell.
- Therefore it has low electron affinity, electronegativity and ionisation energy.

Trends in Properties

- Let's compare with Chlorine, which has 7 electrons in its outermost shell.
- To become "full", Chlorine really needs to take in one extra electron.
- Therefore, it has high electron affinity, high electron negativity and ionisation energy.

Trends in Properties

- Now let us compare Fluorine and Chlorine.
- They both really want that 1 extra electron to be “full”.
- However, Chlorine’s outermost electrons are in the next shell further from the positive nucleus.
- Therefore, Chlorine’s electron pulling power from the positive nucleus (core charge) is less and that is why electron affinity, electronegativity and ionisation energy is less than fluorine.

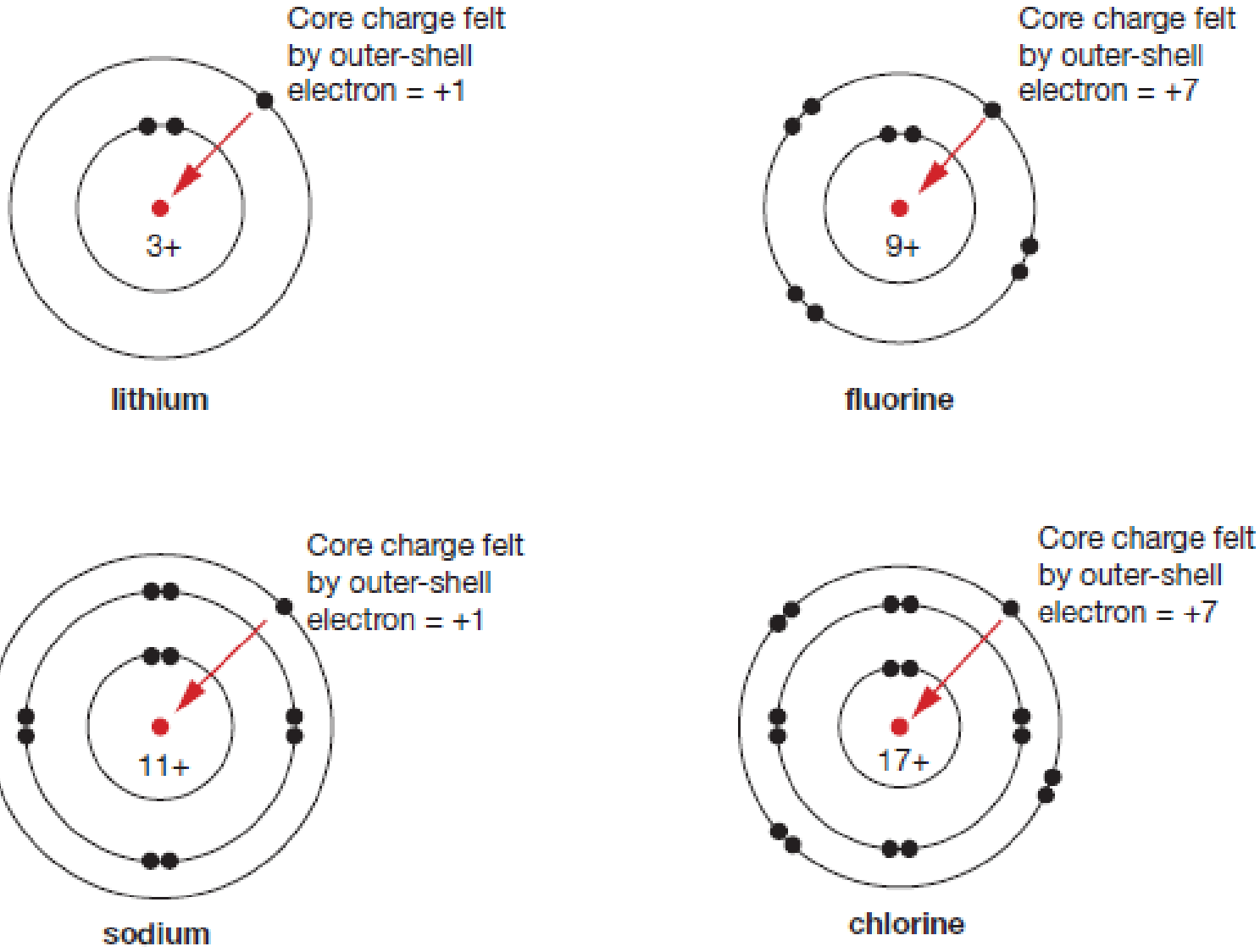


Figure 3.9

Electron shell diagrams of lithium, sodium, fluorine and chlorine. For simplicity, the electrons have been represented in shells rather than subshells.

REVIEW pg 46

Trends in properties

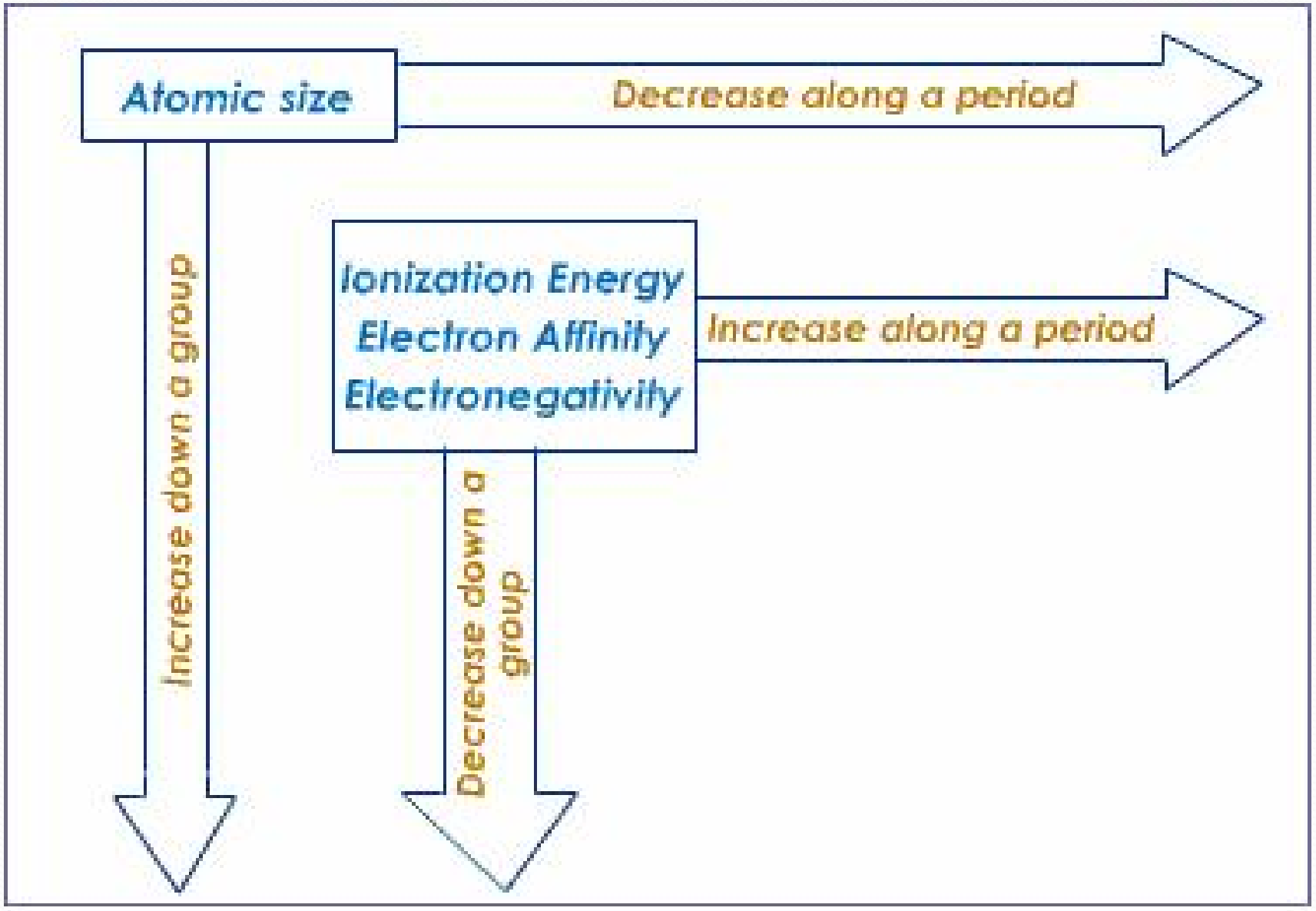


Table 3.1 Trends within the periodic table

Trend	Explanation
Atomic radius increases down a group	Electrons occupy most of the volume of an atom. Potassium, electronic configuration of $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$, is much larger than lithium, electronic configuration $1s^2 2s^1$.
Atomic radius decreases across a period	The size of atoms decreases. The increasing positive charge of the nucleus pulls the outer-shell electrons closer, causing the volume of an atom to reduce (Figure 3.9).
First ionisation energy decreases down a group	As the atoms become larger, their outer electrons are further from the nucleus. The energy required to extract the outermost electron from an atom (the first ionisation energy) decreases.
First ionisation energy increases across a period	As the strength of attraction between the outer electrons and the nucleus increases, the energy required to remove the outermost electron from an atom increases.
Electronegativity decreases down a group	As the outer electrons become more distant, electrons are more weakly attracted to an atom (Figure 3.8).
Electronegativity increases across a period	The electron-attracting ability of atoms increases as the pull on the outer electrons increases (Figure 3.7).

Chemical reactivity

- Why do you think group 1 and group 17 elements are the most reactive?
  - Because they are the elements closest to get “full” shell.

- Explain why the reactivity of metals increases down a group, whereas, the reactivity of non-metals decreases down a group.
  - For metals, it is because the electrons are further from nucleus and thus is easier to kick out.
  - For non metals, its reactivity is dependent on its ability to attract electrons.
  - As we go down the group in non-metals, the space to put in the extra electrons are further from the nucleus and thus it is more difficult to attract.

Noble Gases

- Which group and elements are given this name?
  - Group 18, Helium, Neon, Argon, Krypton, Xenon.
- Why are they given this name?
  - Because they are arrogant nobles and do not react with other elements.

Noble Gases

- List the uses of 4 of the noble gases:
  - Helium
    - For floating balloons
    - Making fun of Sheldon Cooper for comedic effect.
  - Neon
    - Used in neon signs
  - Argon
    - Used in some light bulbs
  - Krypton
    - Also used in light bulbs, and perhaps to kill Superman
  - Xenon
    - For car headlights

Forming compounds.

- Now consider Sodium which has 1 electron to give out, what would be its ideal partner that can take in this electron?
  - Hint: what element really wants to take in that 1 extra electron?

Review pg 50

Success Criteria:

- ☐ I can explain the trends and patterns in the following atomic properties of the main group elements: atomic number and radius, ionisation energy, electronegativity and types of compounds formed.
- ☐ I can use electronic configuration and atomic properties to predict the reactivity of the main group