2.1 Periodicity

**Periodicity** is the repeating pattern of physical or chemical properties going across the periods.

**Classification of elements in s, p, d blocks**
Elements are classified as s, p or d block, according to which orbitals the highest energy electrons are in.

- **Period 2** = Li, Be, B, C, N, O, F, Ne
- **Period 3** = Na, Mg, Al, Si, P, S, Cl, Ar

**Atomic radius**
Atomic radii decrease from left to right across a period, because the increased number of protons create more positive charge attraction for electrons which are in the same shell with similar shielding.

Exactly the same trend in period 2

**1st Ionisation Energy**
There is a general trend across to increase. This is due to increasing number of protons as the electrons are being added to the same shell.

There is a small drop between Mg + Al. Mg has its outer electrons in the 3s sub shell, whereas Al is starting to fill the 3p subshell. Al’s electron is slightly easier to remove because the 3p electrons are higher in energy.

There is a small drop between phosphorous and sulfur. Sulfur’s outer electron is being paired up with another electron in the same 3p orbital. When the second electron is added to an orbital there is a slight repulsion between the two negatively charged electrons which makes the second electron easier to remove.

**Melting and boiling points**
For Na, Mg, Al- Metallic bonding: strong bonding – gets stronger the more electrons there are in the outer shell that are released to the sea of electrons. A smaller sized ion with a greater positive charge also makes the bonding stronger. Higher energy is needed to break bonds.

Si is Macromolecular: many strong covalent bonds between atoms, high energy needed to break covalent bonds – very high mp + bp

Cl₂(g), S₈(s), P₄(S₅)²- simple molecular: weak van der waals between molecules, so little energy is needed to break them – low mp + bp

S₈ has a higher mp than P₄ because it has more electrons (S₈ =128)(P₄=60) so has stronger v der w between molecules

Ar is monoatomic weak van der waals between atoms

Similar trend in period 2

Li, Be metallic bonding (high mp)
B, C macromolecular (very high mp)
N₂, O₂ molecular (gases! Low mp as small v der w)
Ne monoatomic gas (very low mp)