

- Explain the trends in electron affinities for the first 5 elements of the second row of the periodic table, in terms of their electronic configurations.
i.e. Discuss the trend in ΔH for the following reaction: $A(g) + e^- \rightarrow A^-(g)$

Marks

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Element	Li	Be	B	C	N
ΔH (in kJ mol^{-1})	-60	+241	-27	-122	+8

The electron configuration of Li is $[\text{He}] 2s^1$ - it has a single unpaired electron in its outer shell. There is space in the $2s$ orbital for another electron so a higher energy orbital does not to be occupied. The nuclear charge of Li holds onto the extra electron sufficiently to compensate for the extra electron – electron repulsion that occurs. Adding an extra electron is favourable and so ΔH is negative.

The electron configuration of Be is $[\text{He}] 2s^2$ - it has a filled $2s$ orbital. Any an extra electron would have to go into the $2p$ orbital. This has a higher energy and occupation of it is energetically unfavourable, despite the higher nuclear charge of Be compared to Li.

The electron configuration of B is $[\text{He}] 2s^2 2p^1$ - it has a single unpaired electron in its $2p$ orbital. The extra electron is being added to the same subshell. The extra proton in the B nucleus means that an electron is favourable compared to the situation in Be. As the extra electron can have a spin parallel with the other $2p$ electron, the additional electron – electron repulsion is minimal.

The electron configuration of C is $[\text{He}] 2s^2 2p^2$. It has 2 unpaired electrons in its $2p$ orbitals. The extra electron is being added to the same subshell. The extra proton in the C nucleus means that an electron is even more favourable compared to the situation in B. As the extra electron can have a spin parallel with the other $2p$ electrons, the additional electron – electron repulsion is minimal.

The electron configuration of N is $[\text{He}] 2s^2 2p^3$ - it has 3 unpaired electrons in its $2p$ orbitals. An additional electron has to pair its spin with one of these electrons and this leads to a large increase in electron – electron repulsion. Because of this, ΔH is positive.

- Briefly explain the following concepts and their electronic origins.

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(a) paramagnetism

Paramagnetism is the property of any substance that is attracted by a magnetic field. It occurs to the presence of unpaired electrons. Paramagnets lose their magnetism when the magnetic field is removed.

(b) polar bond

If the electron density in a covalent bond is not shared equally between the 2 atoms, a polar bond is formed. This occurs when the 2 atoms have different electronegativities.