Marks 3

- 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: $A(g) + e^- \rightarrow A^-(g)$

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

The electron configuration of Li is [He] $2s^1$ - it has a single unpaired electron in its outer shell. There is space in the 2*s* 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 [He] $2s^2$ - it has a filled 2*s* orbital. Any an extra electron would have to go into the 2*p* 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 [He] $2s^2\ 2p^1$ - it has a single unpaired electron in its 2*p* 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 2*p* electron, the additional electron – electron repulsion is minimal.

The electron configuration of C is [He] $2s^2\ 2p^2$. It has 2 unpaired electrons in its 2*p* 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 2*p* electrons, the additional electron – electron repulsion is minimal.

The electron configuration of N is [He] $2s^2\ 2p^3$ - it has 3 unpaired electrons in its 2*p* 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.