Marks 6

- The electronic energies of the molecular orbitals of diatomics consisting of atoms from H to Ne can be ordered as follows (with energy increasing from left to right):

$$\sigma \ \sigma^* \ \sigma \ \sigma^* \ 2\times\pi \ \sigma \ 2\times\pi^* \ \sigma^*$$

(the '2×' denotes a pair of degenerate orbitals)

Use this ordering of the molecular orbitals to identify the following species.

(i) The lowest molecular weight diatomic ion (homo- or heteronuclear) that has **all** of the following characteristics:

a) a single negative charge,
b) a bond order greater than zero *and*
c) is diamagnetic.

(ii) A diatomic species that has the same electronic configuration as O_2.

(iii) All of the atoms with atomic numbers less than or equal to 10 that cannot form stable, neutral, homonuclear diatomic molecules.

Given that there are three degenerate *p* orbitals in an atom, why are there only two degenerate π orbitals in a diatomic molecule?