

Exercises 9

Exercise 9.1

Draw a molecular orbital energy-level diagram and evaluate the bond order expected for each of the following diatomic species: a) Li_2 , b) Li_2^+ , c) Li_2^-

State whether each molecule or ion will be paramagnetic or diamagnetic. If it is paramagnetic, give the number of unpaired electrons.

Exercise 9.2

a) Draw the molecular orbital energy-level diagram for N_2 and label the energy levels according to the type of orbitals from which they are made, whether they are σ - or π -orbitals, and whether they are bonding or antibonding.

b) The orbital structure of the heteronuclear diatomic ion NO^+ is similar to that of N_2 . How will the fact that the electronegativity of N differs from that of O affect the molecular orbital energy-level diagram of NO^+ compared with that of N_2 ? Use this information to draw the energy-level diagram for NO^+ .

c) In the highest occupied molecular orbital, will the electrons have a higher probability of being at N or at O? Why?

Exercise 9.3

Write the valence-shell electron configurations and bond orders of a) O_2^{2-} , b) N_2^- , c) C_2^-

Exercise 9.4

Give the valence-shell electron configurations and bond orders for NO and NO^+ . Use that information to predict which species has stronger bonds.

Exercise 9.5

Calculate the bond orders and use them to predict which species of each of the following pairs has the stronger bond: a) C_2 or C_2^- , B) N_2 or N_2^-

Exercise 9.6

Based on their valence-shell electron configurations, which of the following species would you expect to have the least electron affinity: a) Be_2 , b) F_2 , c) B_2^+ , d) C_2^+