

Chemistry
Higher level
Paper 2

Practice paper

Topic: Chemical Bonding & Structure (Topic 4 & 14)

1. Sulfur forms a variety of compounds, some of which expand its octet.

(a) Draw the Lewis structures for SF₄ and SF₆.

[2]

(b) State the number of electron domains and the molecular geometry for both species. [2]

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2. The chlorate ion, ClO₄⁻, can be drawn with different numbers of double bonds.

(a) Calculate the formal charge of Chlorine in a structure where all Cl-O bonds are single bonds.

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(b) Determine the formal charge of Chlorine if three Cl=O bonds are used. Deduce which structure is more stable.

[2]

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3. Analyze the bonding in ethene (C₂H₄) and ethyne (C₂H₂).

(a) Identify the hybridization of the Carbon atoms in both molecules.

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(b) Describe the overlap of orbitals required to form a pi (π) bond.

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(c) Explain why ethene is more reactive towards electrophiles than ethane.

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4. Benzene is often represented as a resonance hybrid.

(a) State three pieces of experimental evidence that support the delocalized model over the localized Kekule structure.

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(b) Describe the bonding in Benzene in terms of sigma and delocalized pi systems. **[3]**

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5. Consider the species NO_3^- , NO_2^+ , and NO_2^- .

(a) Determine the molecular geometry and hybridization of the Nitrogen atom in each species. **[3]**

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(b) Arrange them in order of increasing bond angle. Justify your answer. **[3]**

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6. Sigma bonds are generally stronger than pi bonds.

(a) Explain, in terms of orbital overlap, why sigma bonds are stronger. **[2]**

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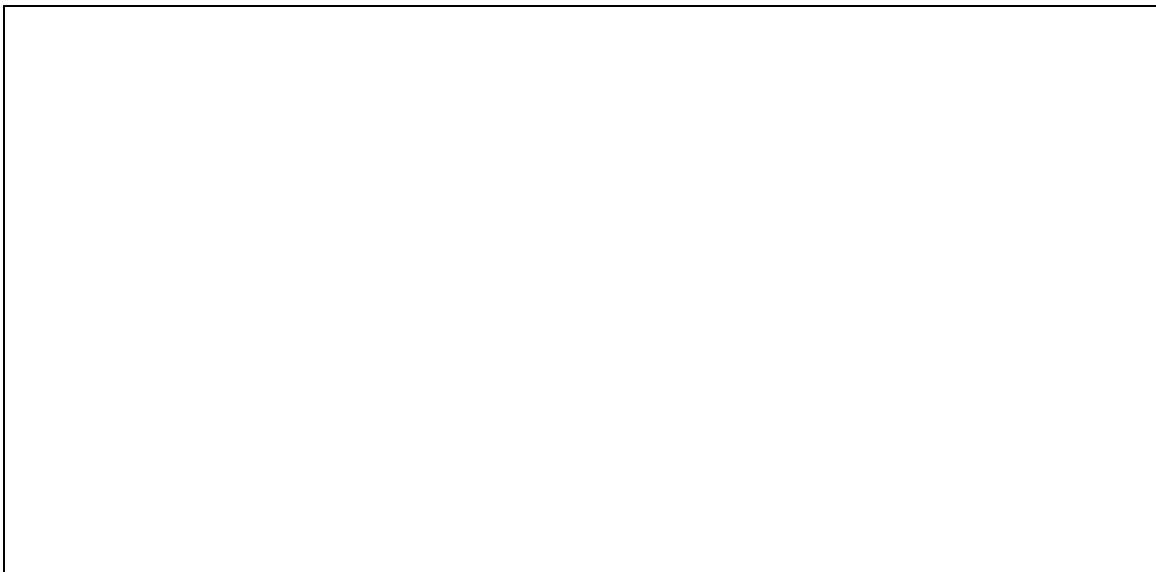
(b) Why are multiple bonds (sigma + pi) always shorter than single bonds (sigma only)?

[2]

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7. Draw the Lewis structures and identify the shapes of XeF_2 and ICl_4^- .

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8. Explain the hybridization process that allows Carbon to form four equivalent bonds in CH_4 .

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9. Compare the boiling points of propan-1-ol and propanone. Explain the difference in terms of intermolecular forces and their relative strengths.

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10. Discuss the polarity of trans-1,2-dichloroethene and cis-1,2-dichloroethene.

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