Chemistry

Higher level

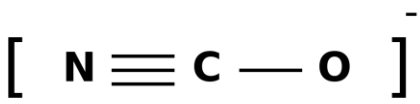
Paper 1B

Practice paper

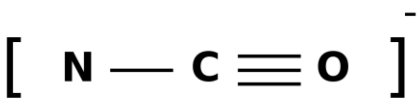
Topic: Chemical Bonding & Structure (Topic 4 & 14)

1. The cyanate ion, NCO^-, has several possible resonance structures. Two are shown below.

Structure A



Structure B



(a) Calculate the formal charge for every atom in both structures A and B. **[3]**

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(b) Using the formal charge data, deduce which structure is the more stable. Explain your reasoning in terms of electronegativity. **[2]**

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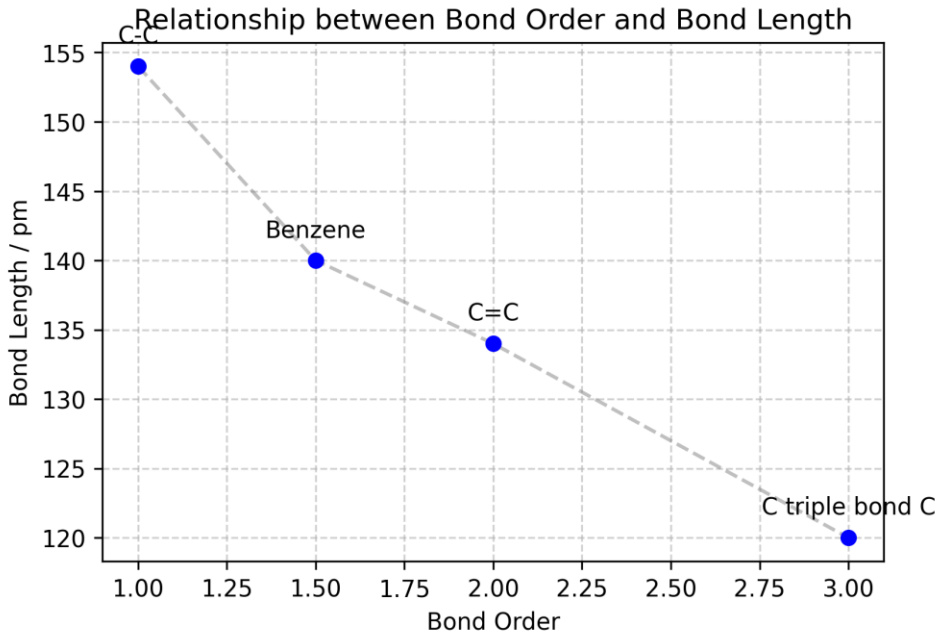
2. The relationship between bond order and bond length for various Carbon-Carbon bonds is shown below.



(a) Explain why a triple bond is shorter than a single bond in terms of atomic orbital overlap and nuclear attraction. **[2]**

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(b) A molecule of Benzene (C_6H_6) has a C-C bond length of 140 pm. Use the graph to deduce the bond order of Benzene. **[1]**

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3. Apply VSEPR theory and hybridization models to the molecules BrF_5 and XeF_2.

(a) For each molecule, deduce the number of bonding electron domains and lone pairs on the central atom. **[2]**

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(b) State the molecular geometry and hybridization of the central atom for both species. **[2]**

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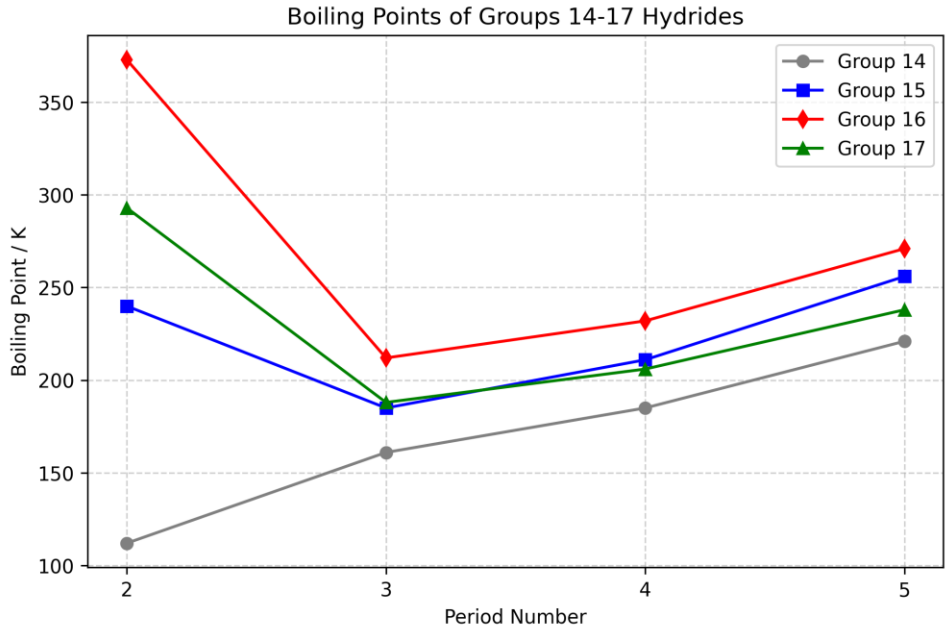
4. The graph below displays the boiling points of Groups 14, 15, 16, and 17 hydrides.



(a) Explain the anomalous boiling points of H_2O, HF, and NH_3 in terms of intermolecular forces. **[3]**

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(b) Compare the boiling point of CH_4 with H_2O. Account for the difference using bonding principles. **[2]**

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