# BONDING & STRUCTURE Core (SL & HL)

1. (a) Select the substance with the highest boiling point in each of the following pairs. Explain your reasoning.

(i) Ethane ($C_2H_6$) and butane ($C_4H_{10}$)

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(ii) Ethanol ($CH_3CH_2OH$) and methoxymethane ($CH_3OCH_3$)

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(b) Boron trifluoride ($BF_3$) and nitrogen trifluoride ($NF_3$) are both covalent molecules.

(i) Draw Lewis (electron dot) structures to represent boron trifluoride and nitrogen trifluoride.

[2]

(ii) State the shape and bond angles in boron trifluoride and nitrogen trifluoride.

[2]

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(iii) Predict and explain whether $BF_3$ and $NF_3$ have polar **bonds**. State and explain whether they are polar **molecules**.

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2. (a) Refractory tiles for furnaces may be made from magnesium oxide.

(i) Describe the bonding in magnesium oxide.

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(ii) Describe the structure of magnesium oxide and explain why it has a very high melting point.

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(b) Magnesium has typical metallic properties. Outline why metals, like magnesium, can conduct electricity and are malleable.

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(c) Explain why magnesium has a higher melting point than sodium.

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3. (a) Sodium carbonate is a white solid. The carbonate ion ($CO_3^{2-}$) is a compound ion.

(i) Write the formula for sodium carbonate.

[1]

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(ii) Draw a Lewis (electron dot) structure to represent a carbonate ion. Draw a second **resonance structure** for the carbonate ion.

[2]

(iii) The bonds between the carbon and oxygen atoms in the carbonate ion are covalent. Describe the attraction in a covalent bond.

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(iv) Explain why sodium carbonate does not conduct electricity when solid but does conduct when dissolved in water.

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4. Elemental carbon has several allotropic forms, including diamond and graphite. Explain, in terms of bonding and structure, why carbon (diamond) is a very hard substance and does not conduct electricity, but carbon (graphite) is soft and can conduct electricity.

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Total Marks 32 (48 minutes)