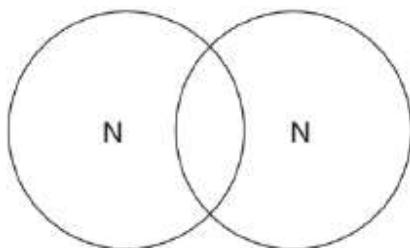


1.

This question is about structure and bonding.

- (a) Complete the dot and cross diagram to show the covalent bonding in a nitrogen molecule,  $\text{N}_2$

Show only the electrons in the outer shell.



(2)

- (b) Explain why nitrogen is a gas at room temperature.

Answer in terms of nitrogen's structure.

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(3)

- (c) Graphite and fullerenes are forms of carbon.

Graphite is soft and is a good conductor of electricity.

Explain why graphite has these properties.

Answer in terms of structure and bonding.

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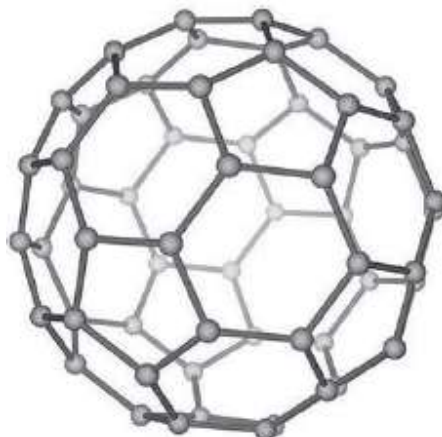
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(4)

- (d) **Figure 1** shows a model of a Buckminsterfullerene molecule.

**Figure 1**



A lubricant is a substance that allows materials to move over each other easily.

Suggest why Buckminsterfullerene is a good lubricant.

Use **Figure 1**.

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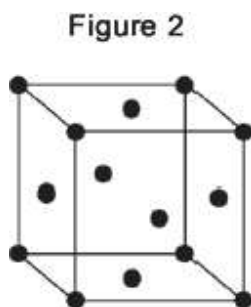
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(2)

Silver can form cubic nanocrystals.

**Figure 2** represents a silver nanocrystal.



- (e) A silver nanocrystal is a cube of side 20 nm

Calculate the surface area to volume ratio of the nanocrystal.

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Surface area to volume ratio = \_\_\_\_\_

(3)

- (f) Silver nanoparticles are sometimes used in socks to prevent foot odour.

Suggest why it is cheaper to use nanoparticles of silver rather than coarse particles of silver.

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(2)

(Total 16 marks)