

**Structure and bonding**

1. This label was on a container of graphite lubricant.

**Super G  
Graphite Lubricant**

**Super G** forms a thin anti-friction film on metal surfaces. It provides good lubrication when metal parts rub against each other.

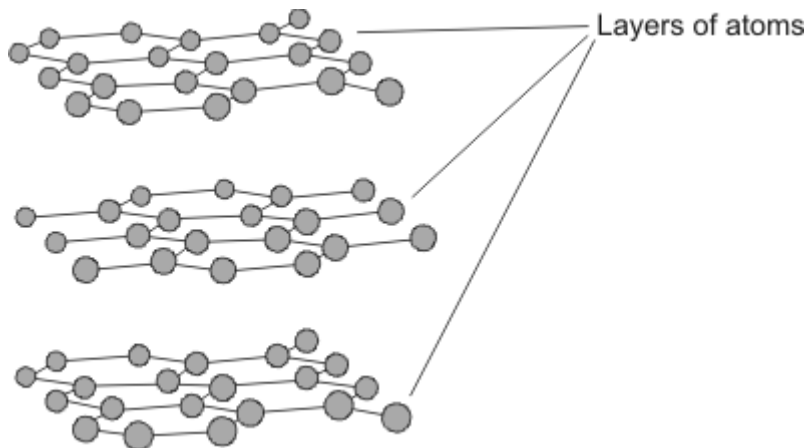
(a) Give **one** reason why a lubricant is used when metal parts rub against each other.

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(1)

(b) The diagram shows the arrangement of atoms in graphite.



(i) Draw a ring around the type of atoms in graphite.

**aluminium                  carbon                  silicon**

(1)

(ii) Graphite is a good lubricant because it is slippery. Use the diagram to explain why graphite is slippery.

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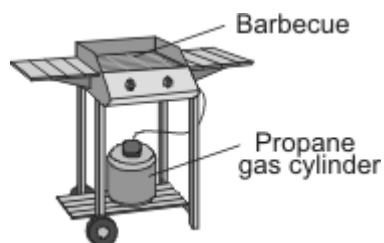
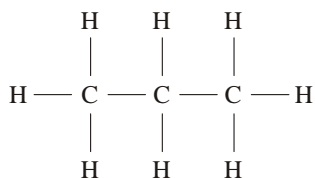
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(2)

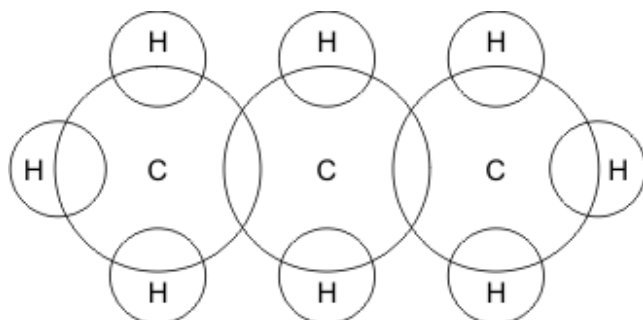
**(Total 4 marks)**

2. This barbecue burns propane gas.

The structure of propane is shown below.

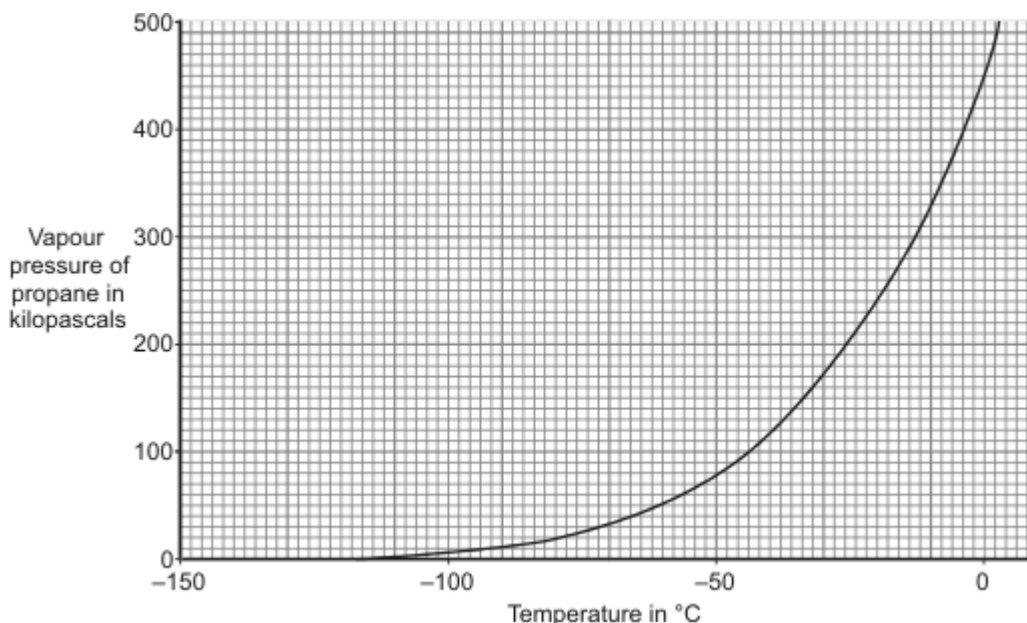


(a) Complete the diagram to show how the outer energy level (shell) electrons of hydrogen and carbon are arranged in a molecule of propane.



(1)

(b) The graph shows how the vapour pressure of propane changes with temperature. The vapour pressure of a liquid is the pressure of the vapour above the liquid.



(i) Describe, as fully as you can, how the vapour pressure of propane changes with temperature.

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(2)

- (ii) The boiling point of a liquid is the temperature at which its vapour pressure is equal to the air pressure above the liquid.

Use the graph to find the boiling point of propane when the air pressure is 100 kilopascals.

Boiling point ..... °C

(1)

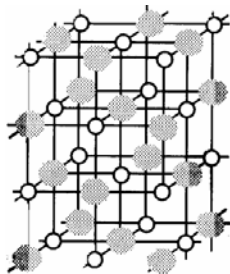
- (c) Explain, in terms of molecules, why propane has a low boiling point.

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(2)

(Total 6 marks)

3. The diagrams show the giant structures of sodium chloride and diamond.



sodium chloride (melting point 801°C)

diamond (melting point 4800°C)

- (a) The equation shows how sodium chloride could be formed.

Balance the equation.



(1)

- (b) By reference to the detailed structure of sodium chloride explain fully why:

- (i) sodium chloride has a quite high melting point,

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(1)

- (ii) solid sodium chloride melts when it is heated strongly,

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(2)

- (iii) molten sodium chloride will conduct electricity.

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(1)

- (c) By reference to the detailed structure of diamond, explain why the melting point of diamond, is higher than that of sodium chloride.

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(2)  
(Total 7 marks)

4. (a) Copper is a metal. Explain how it conducts electricity.

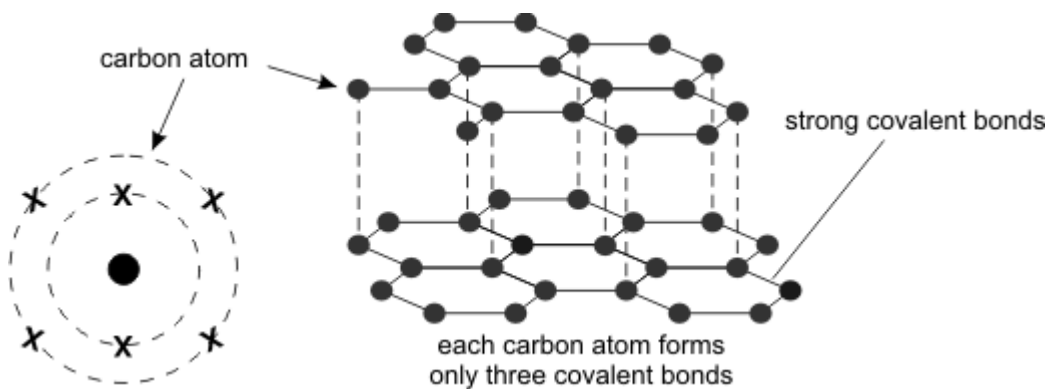
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(2)

- (b) Graphite is a non-metal.



Use the information to explain why graphite conducts electricity.

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(3)  
(Total 5 marks)

5. Read the article about the use of nanoparticles in sun creams.

**Sun creams**

Many sun creams use nanoparticles. These sun creams are very good at absorbing radiation, especially ultraviolet radiation. Owing to the particle size, the sun creams spread more easily, cover better and save money because you use less. The new sun creams are also transparent, unlike traditional sun creams which are white. The use of nanoparticles is so successful that they are now used in more than 300 sun cream products.

Some sun creams contain nanoparticles of titanium oxide. Normal-sized particles of titanium oxide are safe to put on the skin.

It is thought that nanoparticles can pass through the skin and travel around the body more easily than normal-sized particles. It is also thought that nanoparticles might be toxic to some types of cell, such as skin, bone, brain and liver cells.

(a) Explain why nanoparticles pass through the skin and travel around the body more easily than normal-sized particles of titanium oxide.

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(2)

(b) Explain why sun creams containing nanoparticles should be tested further.

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(1)

(c) Suggest why some companies that make sun creams might not want to do more tests.

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(2)

(Total 5 marks)