

Name:

Date:

C2 - Test 6  
BONDING  
Advanced

**GCSE**

**CHEMISTRY**

**AQA - Triple Science**

Mark

Grade

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### Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

### Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

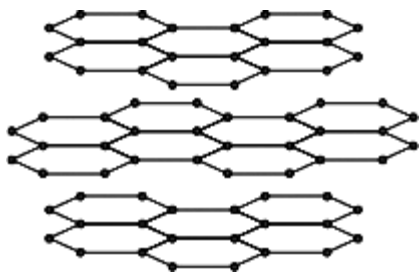
### Information

- The marks for the questions are shown in brackets

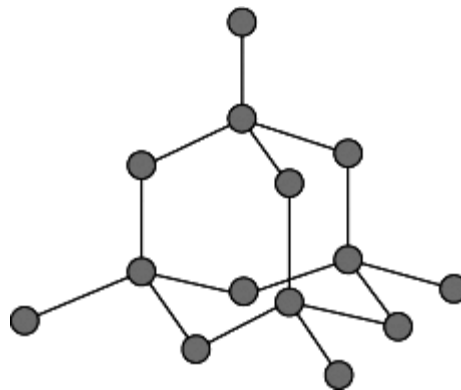
1.

Graphite and diamond are different forms of the element carbon.  
Graphite and diamond have different properties.

The structures of graphite and diamond are shown below.



**Graphite**



**Diamond**

(a) Graphite is softer than diamond.

Explain why.

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(4)

(b) Graphite conducts electricity, but diamond does not.

Explain why.

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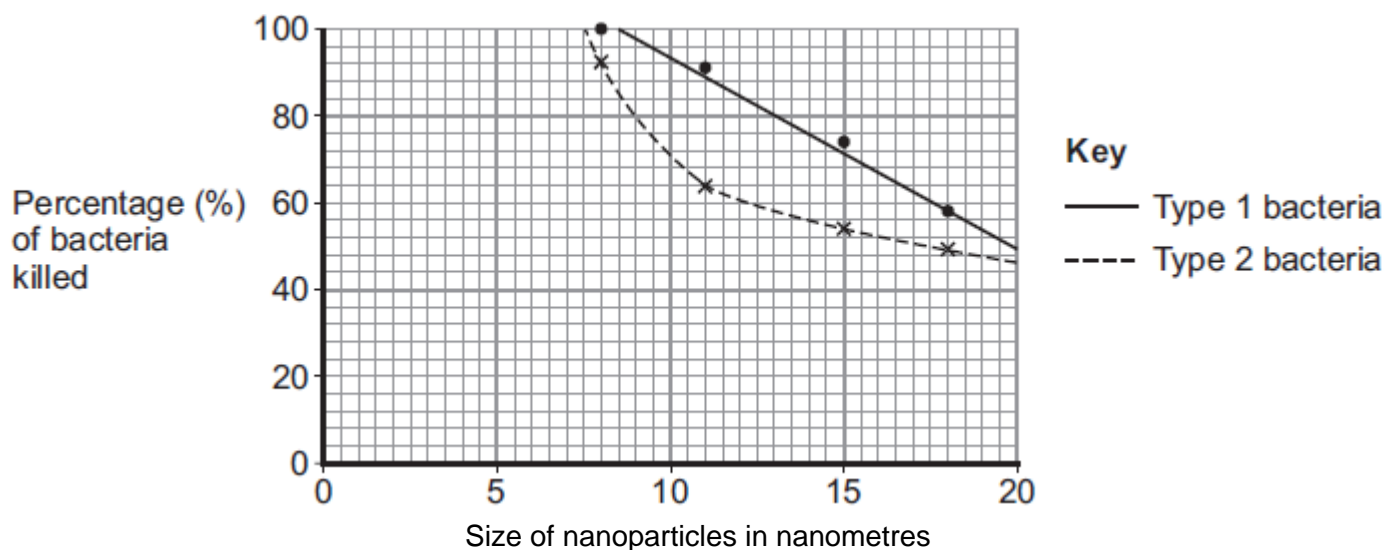
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(3)  
(Total 7 marks)

2.

Magnesium oxide nanoparticles can kill bacteria.

The figure below shows the percentage of bacteria killed by different sized nanoparticles.



(a) (i) Give **two** conclusions that can be made from the figure above.

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(2)

(ii) Points are plotted for only some sizes of nanoparticles.

Would collecting and plotting data for more sizes of nanoparticles improve the conclusions?

Give a reason for your answer.

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(1)

(b) Magnesium oxide contains magnesium ions ( $Mg^{2+}$ ) and oxide ions ( $O^{2-}$ ).

Describe, as fully as you can, what happens when magnesium atoms react with oxygen atoms to produce magnesium oxide.

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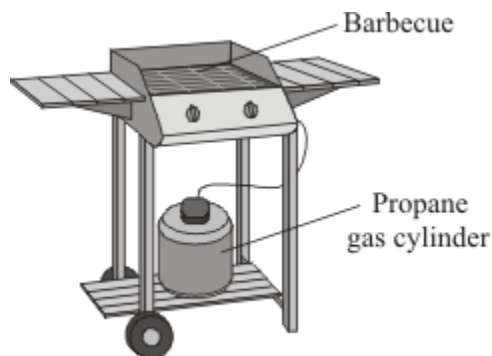
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(4)

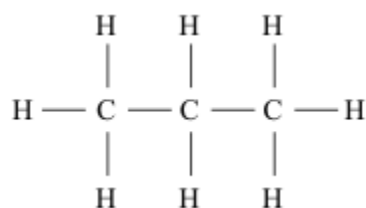
(Total 7 marks)

3.

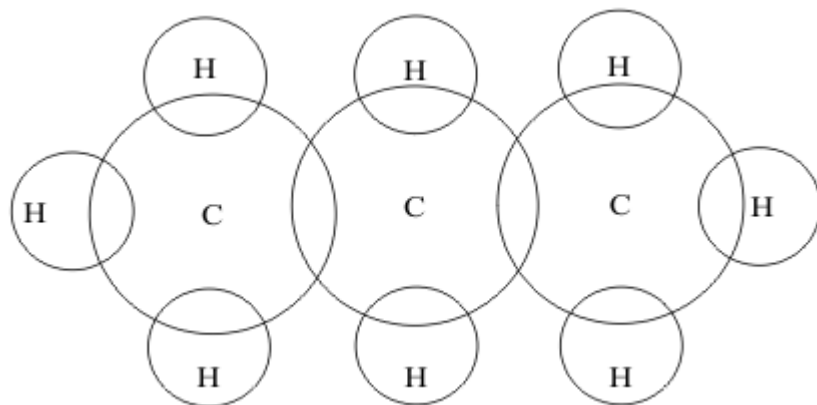
This barbecue burns propane gas.



The structure of propane is shown below.



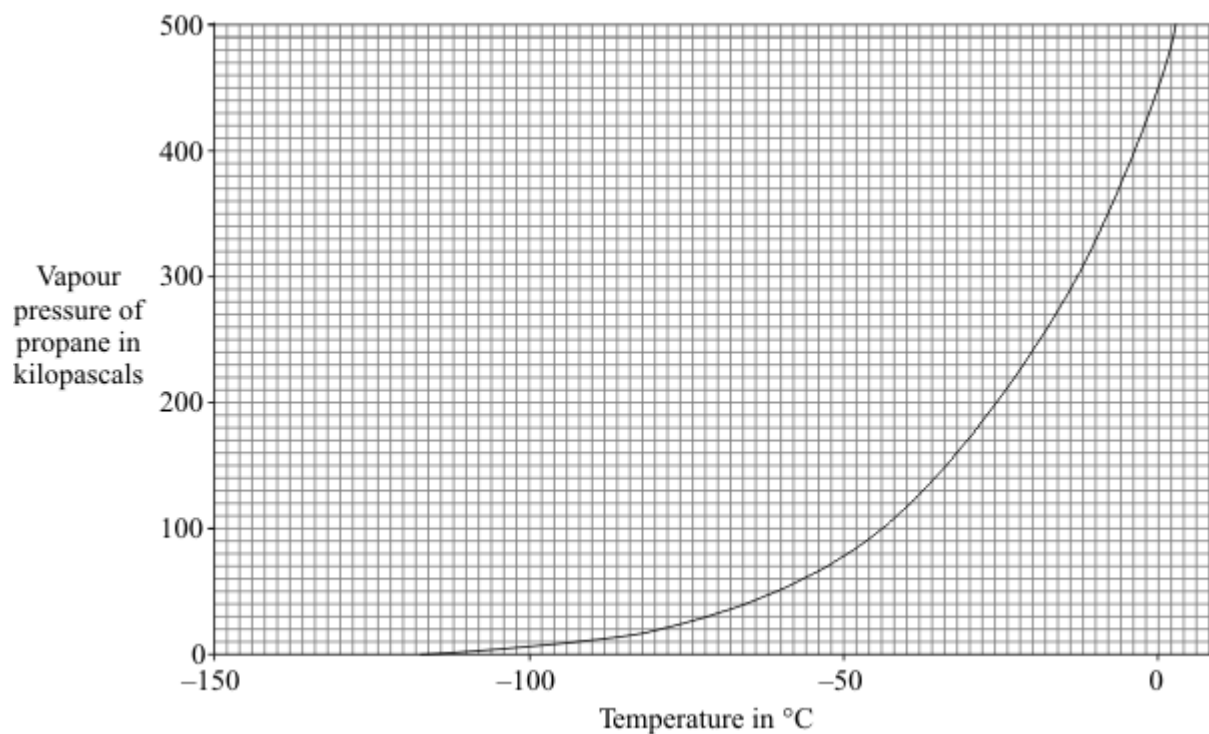
- (a) Complete the diagram to show how the outer energy level (shell) electrons of hydrogen and carbon are arranged in a molecule of propane.



(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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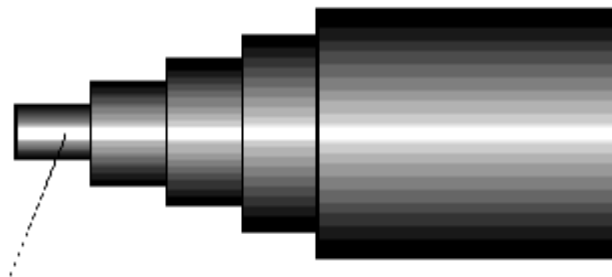
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(2)

(Total 6 marks)

4.

The drawing shows a high quality wire used to make electrical connections on a hi-fi system.



Multi-strand "OFC" copper  
to maintain high signal purity

(a) Copper is used because it is a very good conductor of electricity. Copper is a typical metal.

(i) Describe the structure and bonding in a metal. You may wish to draw a diagram to help you to answer this question.

*To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

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**(3)**

(ii) Explain, by reference to your answer to part (a)(i), why copper conducts electricity.

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**(1)**

(iii) Explain, by reference to your answer to part (a)(i), why copper can be drawn into wires.

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**(1)**

(b) The copper used to make this wire is “OFC” copper. This stands for ‘oxygen free copper’.

(i) It is thought that when molten copper is cooled and solidified it can take in some oxygen from the air. This may slightly decrease the conductivity of the copper.

Suggest why the conductivity might be decreased.

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(2)

(ii) To make it oxygen free, the copper is heated in an atmosphere of hydrogen.

Explain how this will remove the oxygen.

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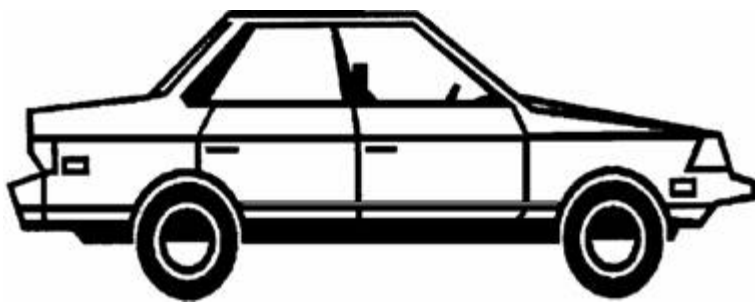
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(1)

(Total 8 marks)

5.

Iron is used (as steel) to make the body panels for cars.



The iron panels have to be bendable so that they can be pressed into the shape required, but must also be strong. The panels must also be able to conduct electricity because they form part of the electrical circuits of the car.



(a) Iron is a typical metal. Describe the structure and bonding in a metal such as iron. You may use a diagram if you wish.

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**(4)**

(b) Explain how the structure and bonding of iron:

(i) allows the body panels to conduct electricity;

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**(2)**

(ii) allows the body panels to be bent into shape;

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**(1)**

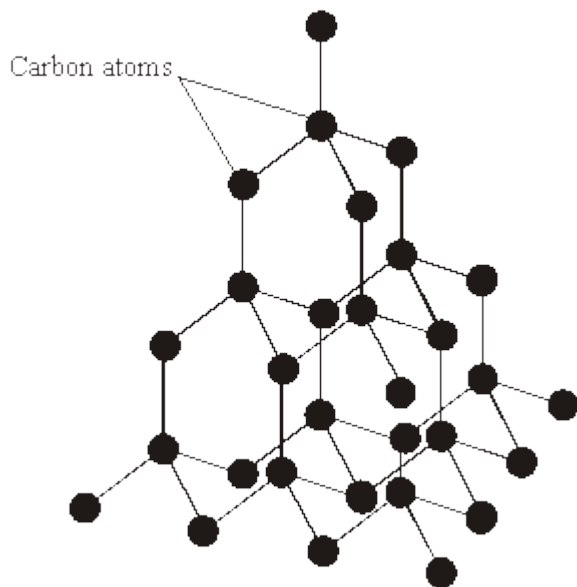
(iii) gives the body panels strength.

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**(1)**

**(Total 8 marks)**

**6.** The diagram shows the structure of diamond.



- (a) *To gain full marks for this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Explain, as fully as you can, why diamond has a high melting point.

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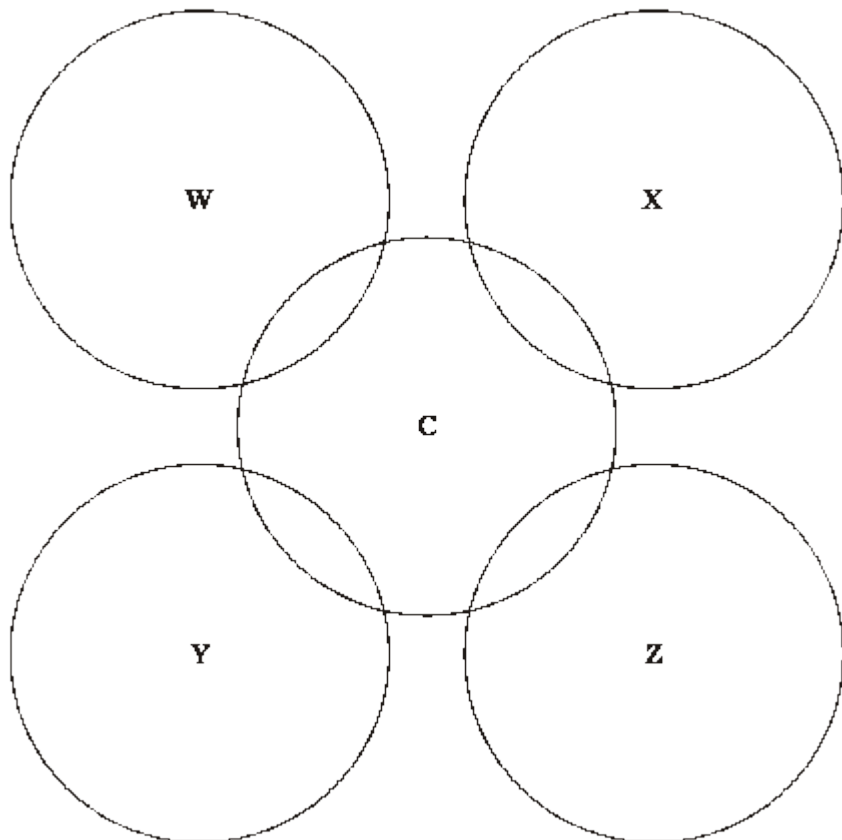
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**(3)**

- (b) The diagram below shows the outer electron shells of five carbon atoms in the giant lattice of diamond.

Carbon atom C forms bonds with each of the carbon atoms W, X, Y and Z.

Draw the positions of all the electrons in the outer shells of each of carbon atoms C, W, X, Y and Z.

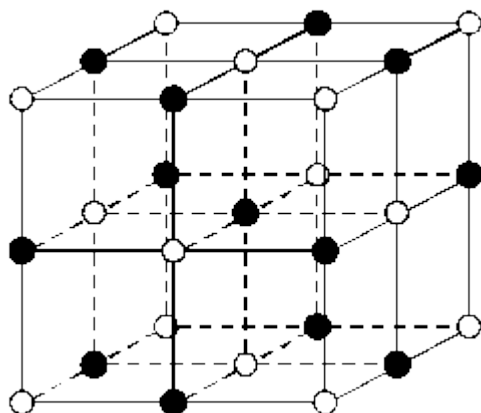


(3)

(Total 6 marks)

7.

- (a) The diagram shows part of the ionic lattice of a sodium chloride crystal.



- (i) Complete the spaces in the table to give information about **both** of the ions in this lattice.

Name of ion	Charge
_____	_____
_____	_____

(2)

- (ii) When it is solid, sodium chloride will not conduct electricity. However, molten sodium chloride will conduct electricity. Explain this difference.

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(2)

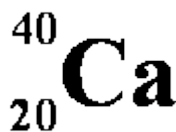
- (iii) Complete the sentence.

Sodium chloride conducts electricity when it is molten and when it is

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(1)

- (b) The symbol for a calcium atom can be shown like this:



- (i) What is the mass number of this atom?

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(1)

- (ii) What information is given by the mass number?

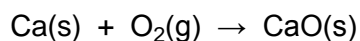
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(1)

(c) Calcium burns in oxygen with a brick-red flame. The product is a white solid. It is calcium oxide and its formula is CaO.

(i) Balance the chemical equation for the reaction.



(1)

(ii) Describe, in terms of electrons, what happens to a calcium atom when it becomes a calcium ion.

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(2)

(Total 10 marks)

8.

This question is about sodium chloride and iodine.

(a) Describe the structure and bonding in sodium chloride.

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(4)

(b) When sodium chloride solution is electrolysed, one product is chlorine.

Name the **two** other products from the electrolysis of sodium chloride solution.

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(2)

- (c) Many people do not have enough iodine in their diet.

Sodium chloride is added to many types of food. Some scientists recommend that sodium chloride should have a compound of iodine added.

Give **one** ethical reason why a compound of iodine should **not** be added to sodium chloride used in food.

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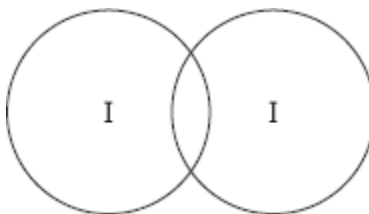
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(1)

- (d) The bonding in iodine is similar to the bonding in chlorine.

- (i) Complete the diagram below to show the bonding in iodine.

Show the outer electrons only.



(2)

- (ii) Explain why iodine has a low melting point.

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(3)

- (iii) Explain, in terms of particles, why liquid iodine does not conduct electricity.

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(2)

(Total 14 marks)