

# Structure + Bonding Carbon

## Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.2 Bonding Structure + Props Matter
Sub-Topic	Structure + Bonding Carbon
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 50 minutes

Score: /50

Percentage: /100

Grade Boundaries:

**Q1.** Carbon nanotubes are cylindrical fullerenes.

Explain the properties of carbon nanotubes.

Answer in terms of structure and bonding.

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**(Total 6 marks)**

**Q2.** Scientists have recently developed a method to produce large sheets of a substance called graphene.

Graphene is made from carbon and is a single layer of graphite just one atom thick.

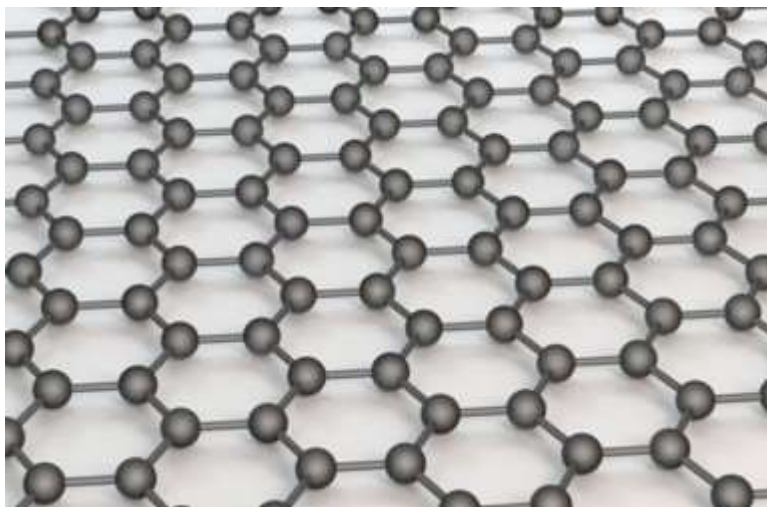
The properties of graphene include:

- it conducts electricity
- it is transparent since it is only one atom thick
- it is strong and durable.



These properties make it suitable to overlay a monitor screen to make it a touchscreen.

The photograph below shows the structure of graphene.



Photographs supplied by iStockphoto/Thinkstock

Use your knowledge of the bonding in graphite and the photograph of the structure to help you to explain, as fully as you can:

- (a) (i) why graphene is strong;

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(3)

- (ii) why graphene conducts electricity.

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(2)

- (b) Suggest why a sheet of graphite which has a large number of carbon layers would

not be suitable for the touchscreen.

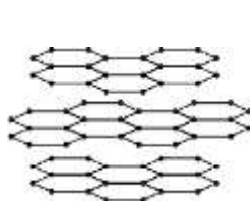
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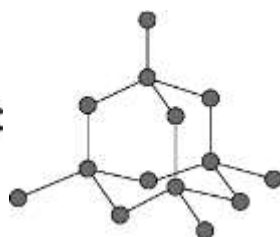
(1)  
(Total 6 marks)

- Q3.** 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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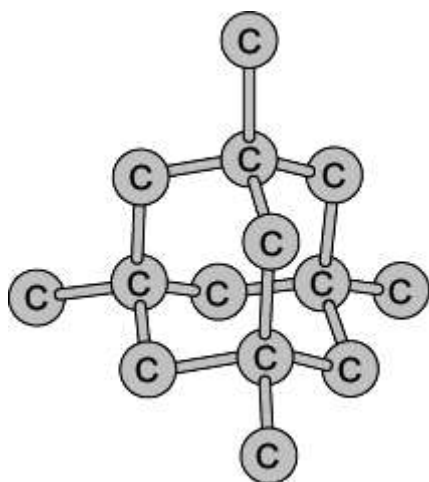
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(3)  
(Total 7 marks)

- Q4.**      Diamonds are used as abrasives.



Model of part of the diamond structure

Diamonds are very hard.  
Explain why.

A good answer will include information on the structure and bonding in diamonds.

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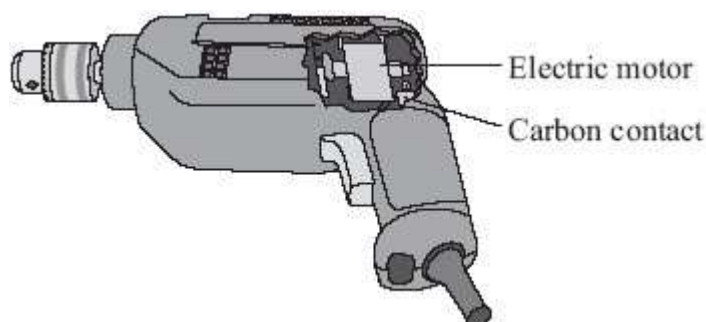
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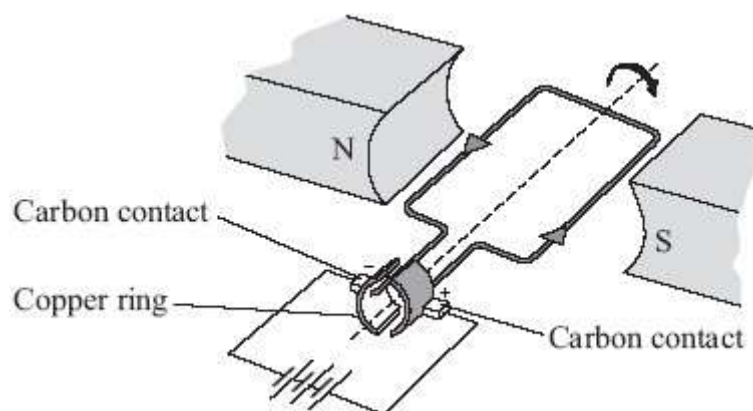
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(3)  
(Total 3 marks)

**Q5.** This drill contains an electric motor.



The diagram below shows the main parts of an electric motor.



The carbon contacts are made of graphite. Springs push the contacts against the copper ring.

The contacts conduct electricity to the copper ring. The copper ring rotates rapidly but does not stick or become worn because the graphite is soft and slippery.

Graphite has properties which are ideal for making the contacts in an electric motor.

Explain, in terms of structure and bonding, why graphite has these properties.

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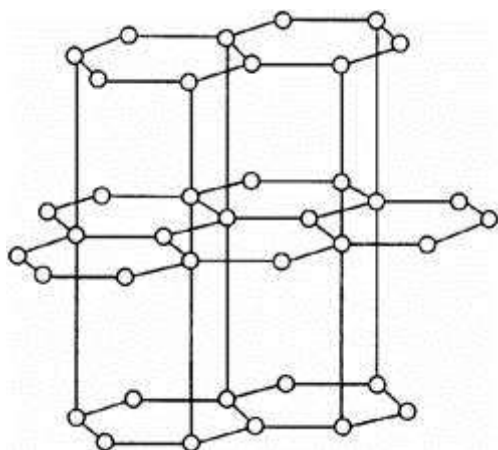
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**(Total 5 marks)**

**Q6.** The diagram represents the structure of graphite.



Use your knowledge and understanding of the structure of graphite to explain why graphite can be used:

- (a) in the 'leads' of pencils;

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- (b) as an electrical conductor.

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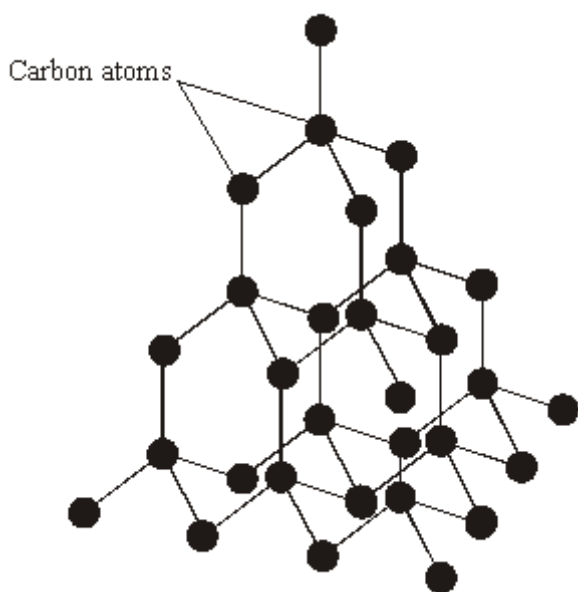
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(Total 5 marks)

**Q7.** 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.

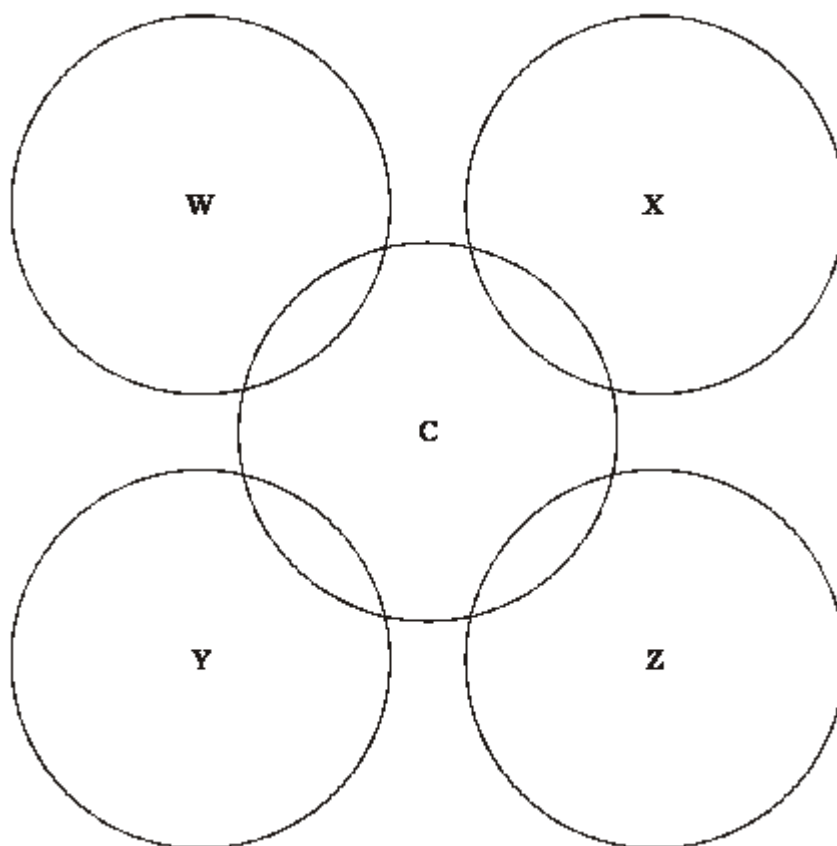
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- (b) The diagram below shows the outer electron shells of five carbon atoms in the giant lattice of diamond.

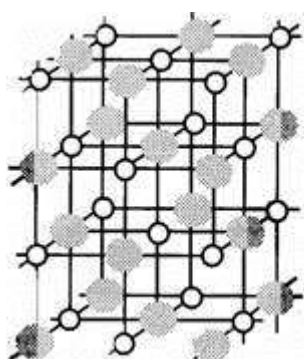
Carbon atom **C** forms bonds with each of the carbon atoms **W**, **X**, **Y** and **Z**.

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)

**Q8.** 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)

- Q9.** (a) Copper is a metal.  
Explain how it conducts electricity.

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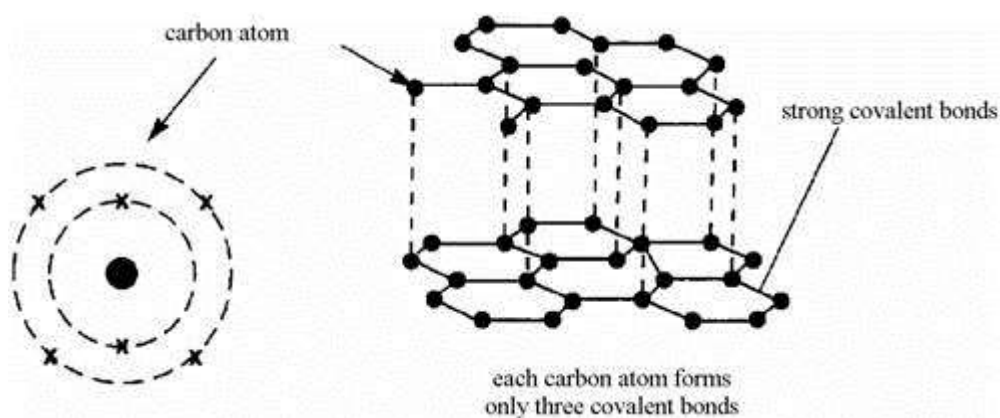
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- (b) Graphite is a non-metal.



Use the information to explain why graphite conducts electricity.

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(3)  
(Total 5 marks)