1. This question is about substances containing carbon atoms.

(a) Diamond is made of carbon atoms.

(i) Diamond is used for tips of drills.

Figure 1 shows a drill.

Figure 1

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Give **one** reason why diamond is used for tips of drills.

_____

_____

(1)

(ii) Diamond nanoparticles can be made.

Use the correct answer from the box to complete the sentence.

hundred	**million**	**thousand**

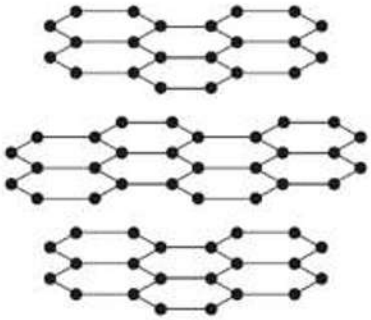
Nanoparticles contain a few _____ atoms.

(1)

(b) Graphite is made of carbon atoms.

Figure 2 shows the structure of graphite.

Figure 2



(i) What type of bonding does graphite have?

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

(1)

(ii) How many carbon atoms does each carbon atom bond to in graphite?

Tick (✓) **one** box.

1 ☐

2 ☐

3 ☐

4 ☐

(1)

(iii) What is a property of graphite?

Tick (✓) **one** box.

Dissolves in water ☐

Has a low melting point ☐

Soft and slippery ☐

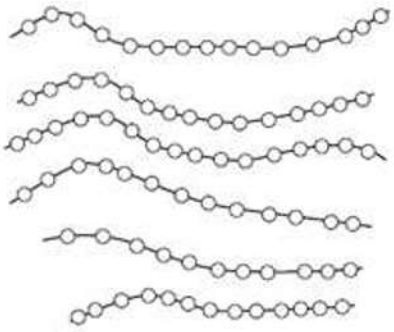
(1)

(c) Poly(ethene) is made of carbon and hydrogen atoms.

Poly(ethene) is a thermosoftening polymer.

Figure 3 shows the structure of a thermosoftening polymer.

Figure 3



(i) Complete the sentence.

Between the polymer chains in a thermosoftening polymer there are no _____ .

(1)

(ii) Use the correct answer from the box to complete the sentence.

condense	**dissolve**	**melt**

Heating would cause a thermosoftening polymer to _____ .

(1)

(iii) Many ethene molecules react together to make poly(ethene).

Different types of poly(ethene) can be made by changing the conditions for the reaction.
Suggest **two** conditions that could be changed.

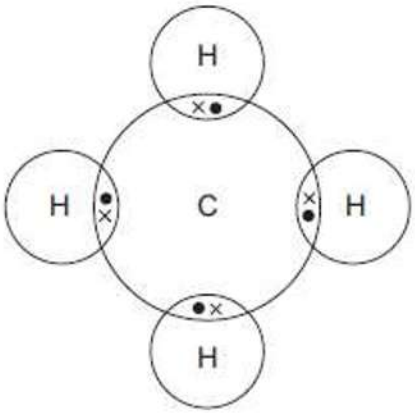
1. _____

2. _____

(2)

(d) **Figure 4** shows how the atoms are bonded in methane.

Figure 4



(i) What is the formula for methane?

Tick (✓) **one** box.

C_4H ☐

CH_4 ☐

C_4H_4 ☐

(1)

(ii) Methane has a low boiling point.

What does methane consist of?

Tick (✓) **one** box.

Charged ions ☐

A giant lattice ☐

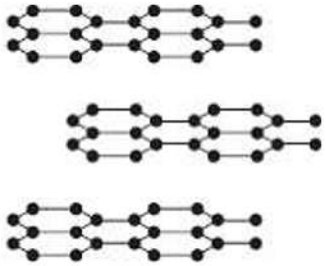
Small molecules ☐

(1)

(Total 11 marks)

2. The diagrams show the structures of diamond and graphite.

Diamond



Graphite

(a) Diamond and graphite both contain the same element.

What is the name of this element? _____

(1)

(b) Use the diagrams above and your knowledge of structure and bonding to explain why:

(i) graphite is very soft

_____

_____

_____

_____

(2)

(ii) diamond is very hard

_____

_____

_____

_____

(2)

(iii) graphite conducts electricity.

_____

_____

_____

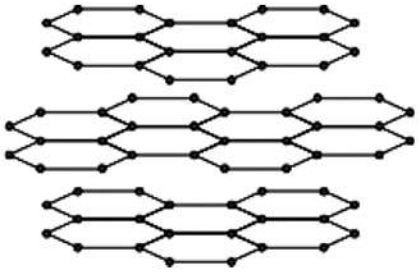
_____

(2)

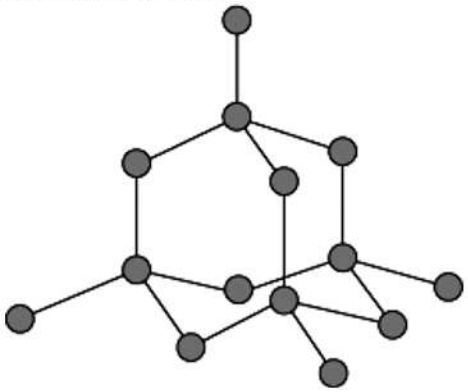
(Total 7 marks)

3. 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.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

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

Explain why.

_____

_____

_____

_____

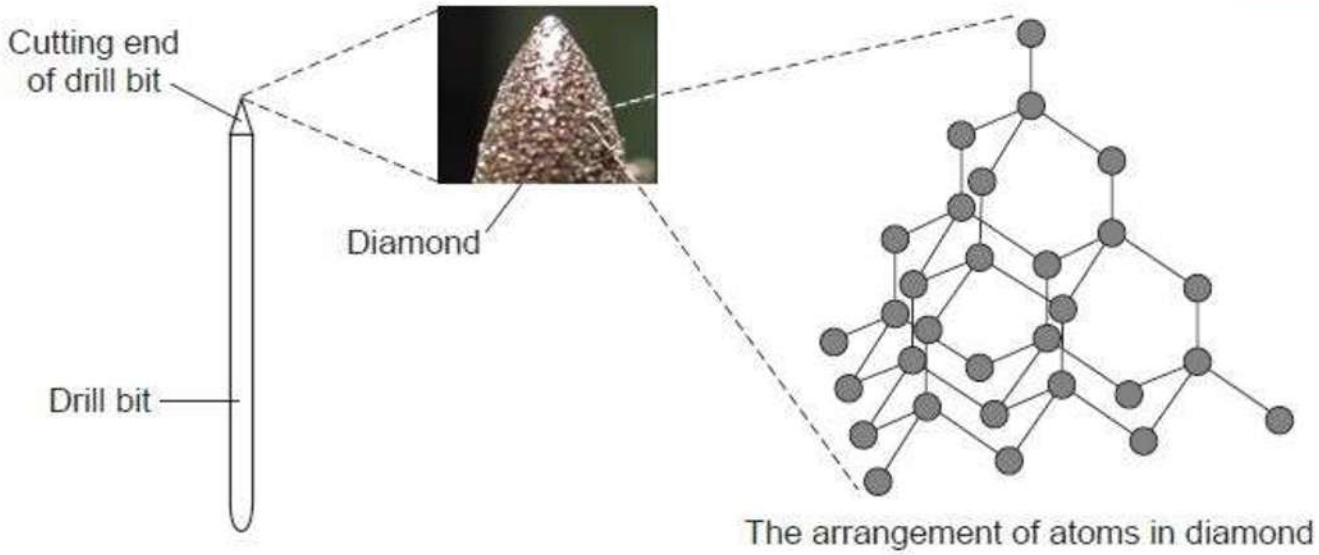
_____

_____

(3)

(Total 7 marks)

4. A drill bit is used to cut holes through materials. The cutting end of this drill bit is covered with very small diamonds.



By Wanderlinse [CC By 2.0], via Flickr

Draw a ring around the correct word in each box.

(a) Diamond is made from [carbon / nitrogen / oxygen] atoms.

(1)

(b) Diamond has a giant structure in which [none / some / all] of the atoms are joined together.

(1)

(c) The atoms in diamond are joined together by [covalent / ionic / metallic] bonds.

(1)

(d) In diamond each atom is joined to

two
three
four

other atoms.

(1)

(e) Diamond is suitable for the cutting end of a drill bit because it is

hard.
shiny.
soft

(1)

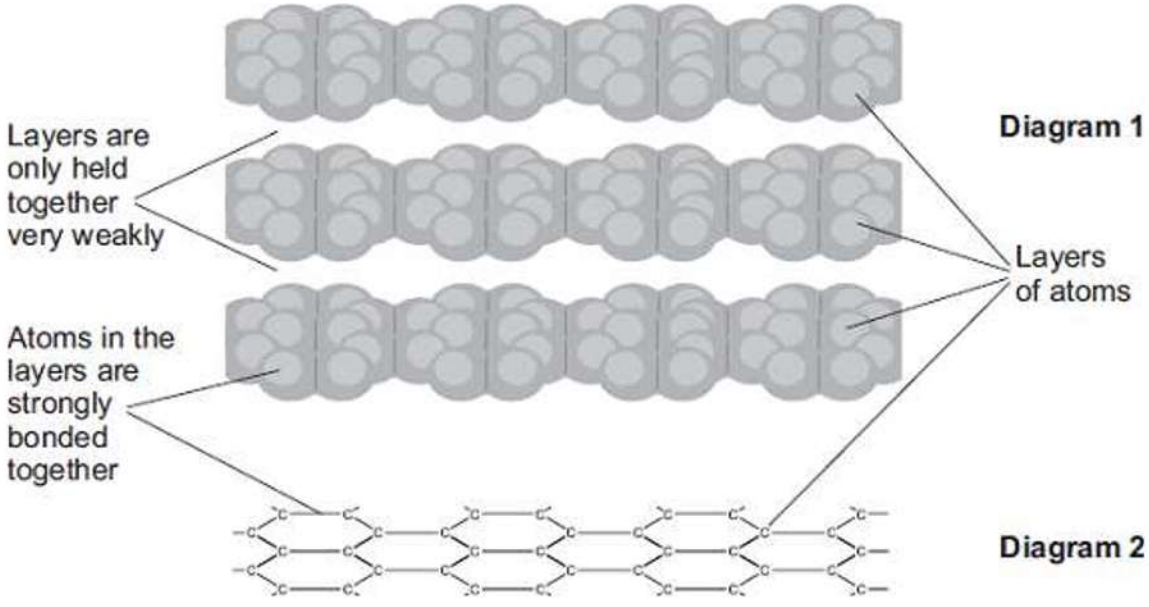
(Total 5 marks)

5. The picture shows a student filling in a multiple choice answer sheet using a pencil.

© Cihan Ta?k?n/iStock

The pencil contains graphite. Graphite rubs off the pencil onto the paper.

Diagrams **1** and **2** show how the atoms are arranged in graphite.



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(a) Use the diagrams to help you explain why graphite can rub off the pencil onto the paper.

_____

_____

_____

_____

(2)

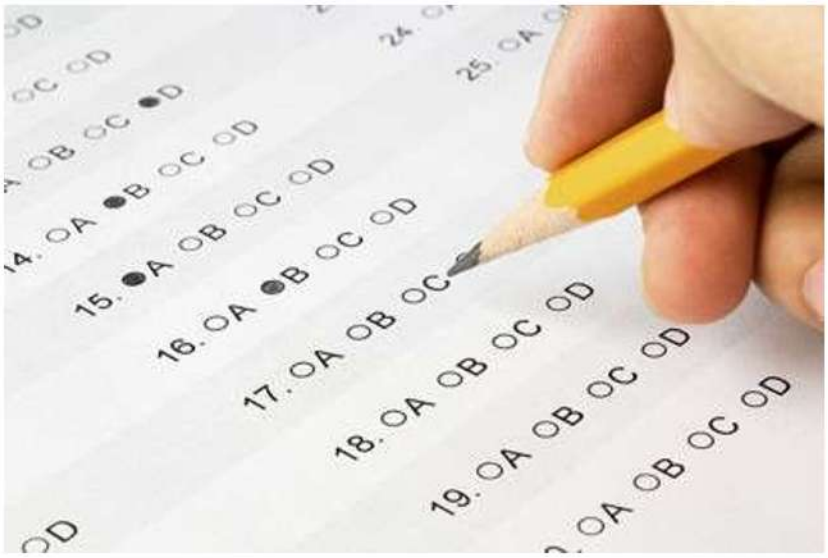
(b) Draw a ring around the type of bond which holds the atoms together in each layer.

covalent **ionic** **metallic**

(1)

(Total 3 marks)

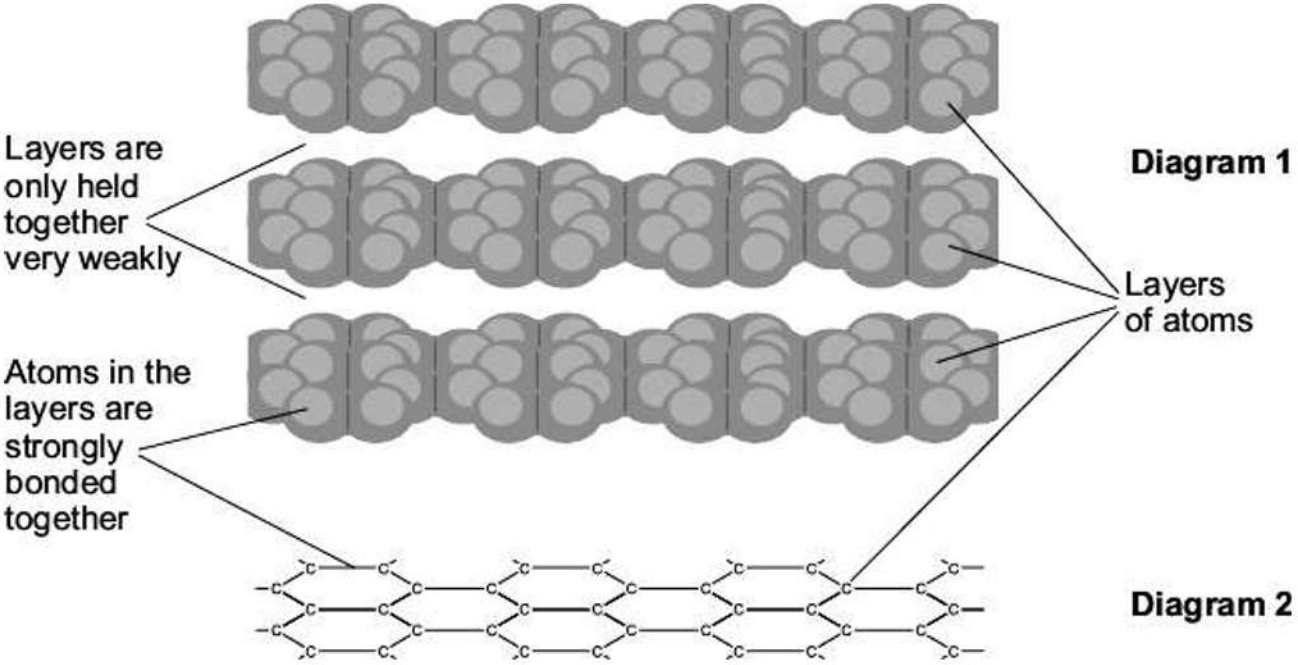
6. The picture shows a student using a pencil to complete a multiple choice answer sheet.



By albertogp123 [CC BY 2.0] , via Flickr

The pencil contains graphite. Graphite rubs off the pencil onto the paper.

Diagrams 1 and **2** show how the atoms are arranged in graphite.



(a) Use **Diagram 2** and your Data Sheet to help you to name the element from which graphite is made.

_____

(1)

(b) Use **Diagram 1** to help you explain why graphite can rub off the pencil onto the paper.

_____

_____

_____

_____

(2)

(c) Draw a ring around the type of bond which holds the atoms together in each layer.

covalent **ionic** **metallic**

(1)

(Total 4 marks)

7. 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.

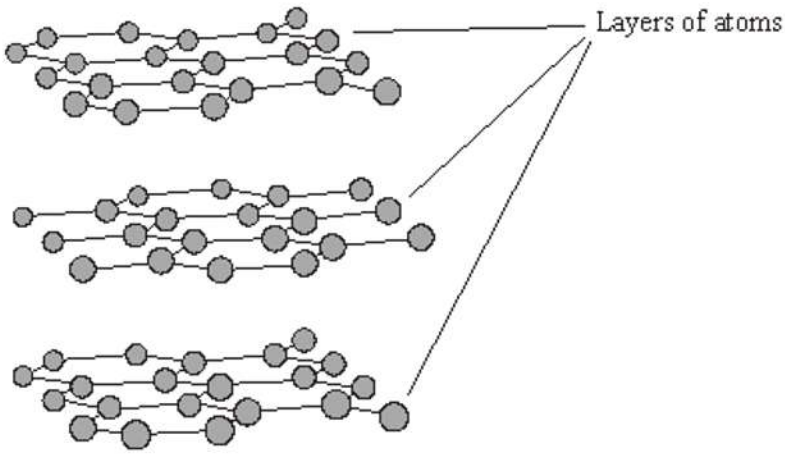
(a) Give **one** reason why a lubricant is used when metal parts rub against each other.

_____

_____

(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.

_____

_____

_____

_____

_____

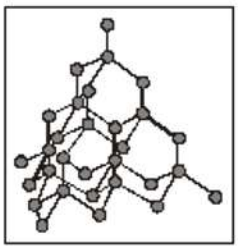
(2)

(Total 4 marks)

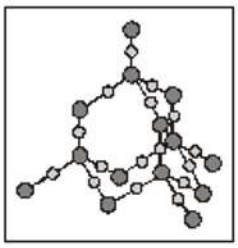
8. This question is about giant structures. Diamond, graphite and silicon dioxide all have giant structures.

(a) The diagrams show the structures of these three substances.

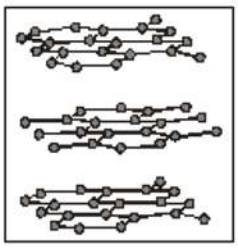
Draw a line from each structure to its name.



Silicon dioxide



Graphite



Diamond

(2)

(b) Complete the sentences using words from the box.

covalent	**four**	**hard**	**ionic**
shiny	**soft**	**three**	**two**

(i) Diamond, graphite and silicon dioxide have high melting points because all the atoms in their structures are joined by strong _____ bonds.

(1)

(ii) In diamond each atom is joined to _____ other atoms.

(1)

(iii) Diamond can be used to make cutting tools because it has a rigid structure which makes it very _____

(1)

(iv) In graphite each atom is joined to _____ other atoms.

(1)

(v) Graphite can be used to make pencils because it has a structure which makes it _____

(1)

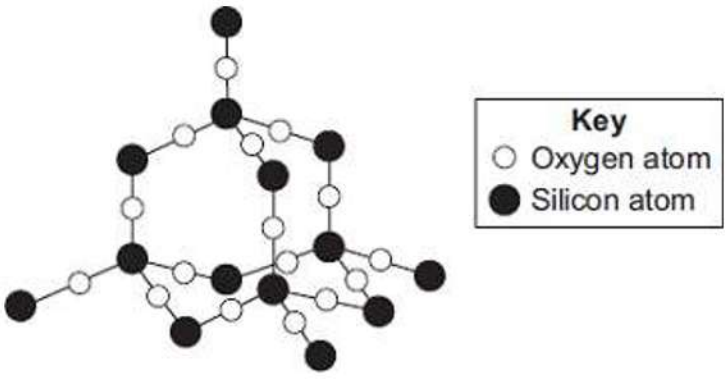
(c) When a diamond is heated to a high temperature and then placed in pure oxygen it burns. Carbon dioxide is the only product.

Name the element in diamond. _____

(1)

(Total 8 marks)

9. The diagram shows a small part of the structure of silicon dioxide.



(a) Use the diagram above to answer the question.

Draw a ring around the correct answer to complete each sentence.

In silicon dioxide, each silicon atom is bonded with | two | three | four | oxygen atoms.

The bonds in silicon dioxide are | ionic. | covalent. | metallic.

(2)

(b)

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Silicon dioxide is used as the inside layer of furnaces.

Suggest why.

_____

_____

(1)

(c) Nanowires can be made from silicon dioxide.

Draw a ring around the correct answer to complete the sentence.

The word ‘nano’ means the wires are very

brittle.
thick.
thin.

(1)

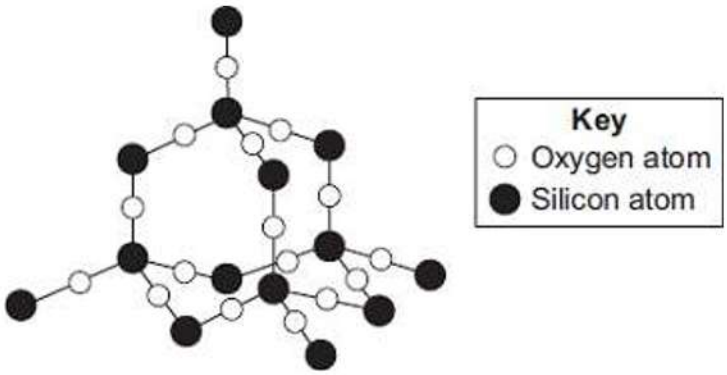
(Total 4 marks)

10. Silicon dioxide is used as a lining for furnaces.

Furnaces can be used to melt iron for recycling.

© Oleksiy Mark/iStock

The diagram shows a small part of the structure of silicon dioxide.



Explain why silicon dioxide is a suitable material for lining furnaces.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)