

Name:

Date:

C2 - Test 4
BONDING
Intermediate

GCSE

CHEMISTRY

AQA - Triple Science

Mark

Grade

Materials

For this paper you must have:

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

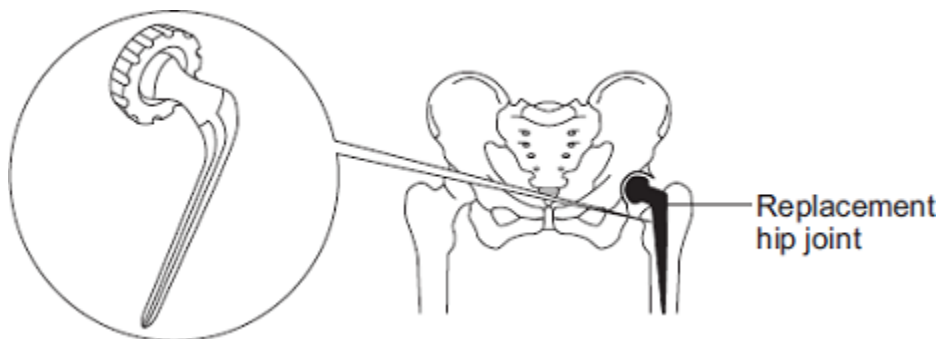
Instructions

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

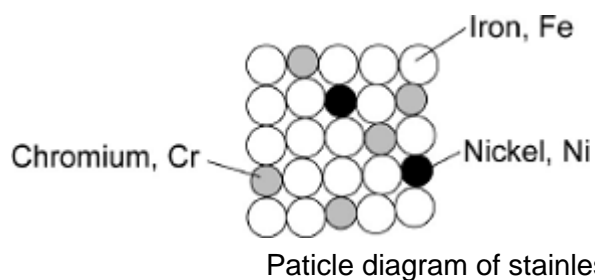
Information

- The marks for the questions are shown in brackets

1. The hip joint sometimes has to be replaced.
Early replacement hip joints were made from stainless steel.



Stainless steel is an alloy of iron, chromium and nickel.
The diagram below represents the particles in stainless steel.



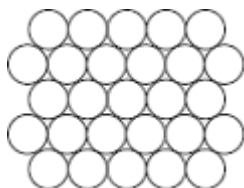
- (a) Use the diagram to complete the percentages of metals in this stainless steel.

The first one has been done for you.

Element	Percentage (%)
Iron, Fe	72
Chromium, Cr	
Nickel, Ni	

(2)

- (b) Pure iron is a soft, metallic *element*.



- (i) Why is iron described as an *element*?

(1)

(ii) Pure iron would **not** be suitable for a replacement hip joint.

Suggest why.

(1)

(iii) The three metals in stainless steel have different sized atoms.
Stainless steel is harder than pure iron.

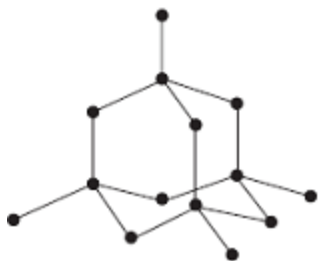
Explain why.

(2)

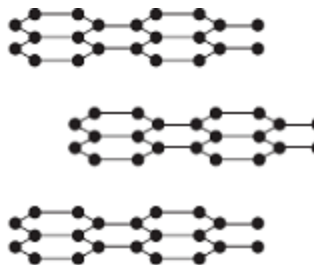
(Total 6 marks)

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.

Read the information

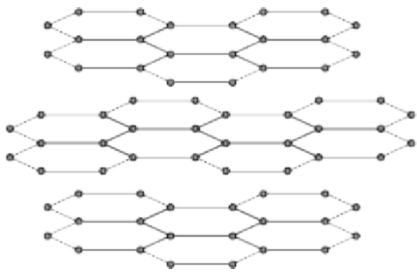
Graphene

Scientists have made a new substance called graphene.
The bonding and structure of graphene are similar to graphite.

Graphene is made of a single layer of the same atoms as graphite.



Graphene



Graphite

Use the information above and your knowledge of graphite to answer the questions.

(a) This part of the question is about graphene.

Choose the correct answer to complete each sentence.

(i)

ionic covalent metallic

The bonds between the atoms in graphene are _____

(1)

(ii)

chromium carbon chlorine

Graphene is made of _____ atoms.

(1)

(iii)

2 3 4

In graphene each atom bonds to _____ other atoms.

(1)

(b) This part of the question is about graphite.

Graphite is used in pencils.


Explain why. Use the diagrams to help you.

(2)
(Total 5 marks)

4. Read the article and then answer the questions.

Nanotennis!

Tennis balls contain air under pressure, which gives them their bounce. Normal tennis balls are changed at regular intervals during tennis matches because they slowly lose some of the air.



'Nanocoated' tennis balls have a 'nanosize' layer of butyl rubber. This layer slows down the escape of air so that the ball does not lose its pressure as quickly.

(a) What is the meaning of *nanosize*?

(1)

(b) Suggest why using 'nanocoated' tennis balls would be good for the environment.

(2)

(Total 3 marks)

5.

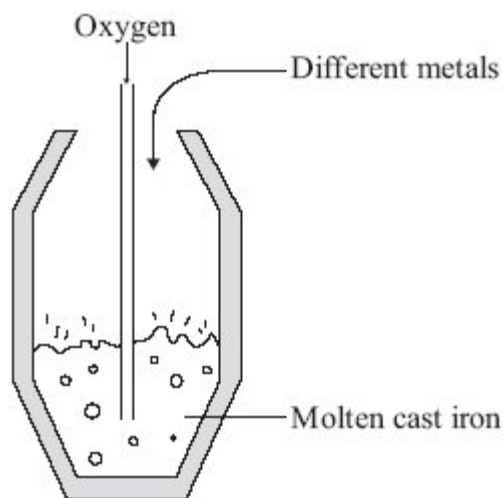
The demand for iron and steel is high.

(a) Iron that is extracted from its oxide by carbon reduction in a blast furnace is called cast iron. Cast iron contains about 4% carbon. This carbon makes cast iron very brittle.

Carbon steels can be made by the following processes.

- Blowing oxygen into molten cast iron to remove most of the carbon.
- Adding a calculated amount of carbon.

Sometimes different metals may also be added to the molten carbon steels.



(i) Suggest how blowing oxygen into molten cast iron removes most of the carbon.

(2)

(ii) Why are different metals sometimes added to molten carbon steels?

(1)

(b) The percentage of iron and steel recycled in the UK has been increasing.

Year	%iron and steel recycled
1998	25
2000	35
2002	42
2004	46
2006	57

The UK government has set targets for the percentage of iron and steel to be recycled. In 2006 the target was exceeded.

Suggest **two** reasons why the UK government wants to encourage recycling of iron and steel.

1. _____

2. _____

(2)

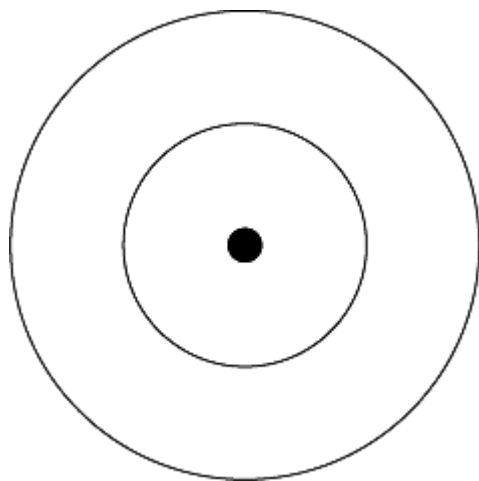
(Total 5 marks)

7. Pure carbon can exist in two forms, diamond and graphite.

(a) Complete the diagram to show the electronic structure of a carbon atom.

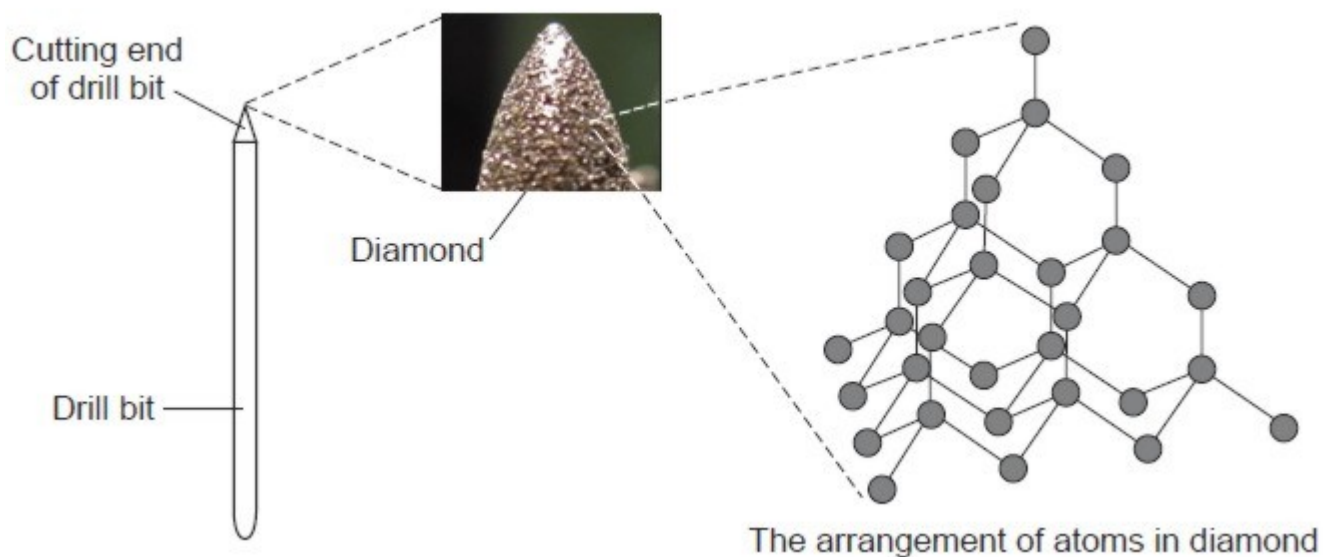
A carbon atom has 6 electrons.

Show the electrons as crosses (x).



(1)

(b) 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

(i) What property of diamond makes it suitable for use on the cutting end of a drill bit?

(1)

- (ii) Explain, as fully as you can, why diamond has this property. Use your knowledge of the structure and bonding of diamond and the information shown opposite to help you to answer this question.

(3)

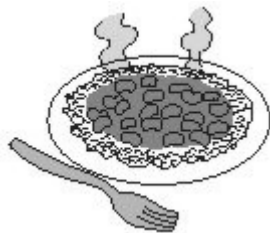
- (c) Explain why graphite is a good conductor of electricity and why diamond does **not** conduct electricity.

(3)

(Total 8 marks)

8.

- (a) A tin of red kidney beans contains calcium chloride as a firming agent.



Calcium chloride is an ionic compound which contains calcium ions (Ca^{2+}) and chloride ions (Cl^-).

