



1. This question is about different substances and their structures.

(a) Draw **one** line from each statement to the diagram which shows the structure.

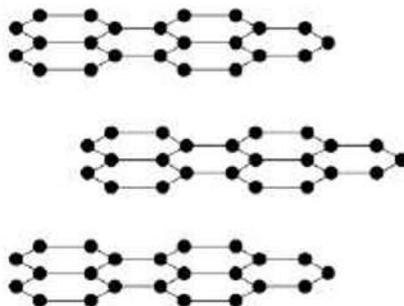
Statement	Structure
The substance is a gas	
The substance is a liquid	
The substance is ionic	
The substance is a solid metal	

(4)



(b) **Figure 1** shows the structure of an element.

**Figure 1**



What is the name of this element?

Tick **one** box.

Carbon

Chloride

Nitrogen

Xenon

(1)

(c) Why does this element conduct electricity?

Tick **one** box.

It has delocalised electrons

It contains hexagonal rings

It has weak forces between the layers

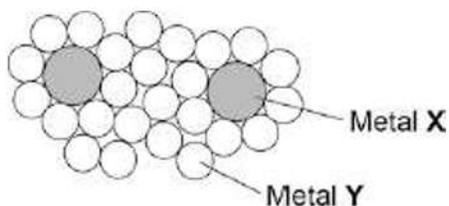
It has ionic bonds

(1)



(d) **Figure 2** shows the structure of an alloy.

**Figure 2**



Explain why this alloy is harder than the pure metal Y.

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(2)

(e) What percentage of the atoms in the alloys are atoms of X?

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(2)

(f) What type of substance is an alloy?

Tick **one** box.

Compound

Element

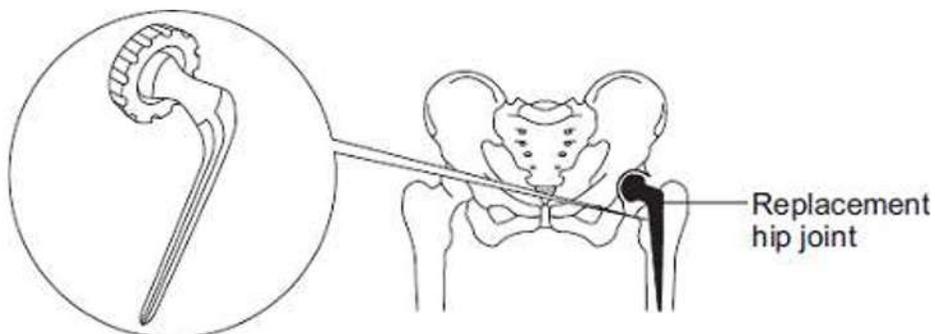
Mixture

(1)

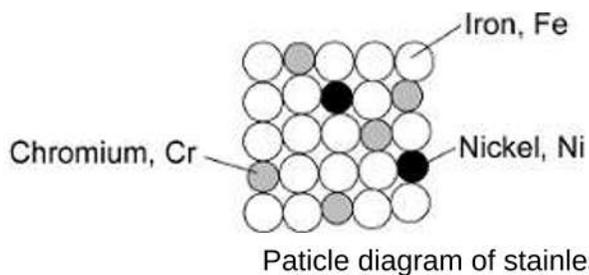
(Total 11 marks)



2. 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.



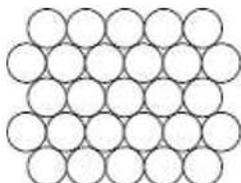
- (a) Use the diagram to complete the percentages of metals in this stainless steel.

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*?

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(1)



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

Suggest why.

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(1)

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

Explain why.

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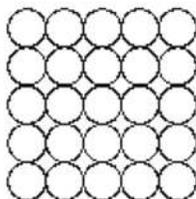
(2)

(Total 6 marks)

3.

Iron is the main structural metal used in the world.

(a) The diagram represents the particles in iron, Fe.



Draw a ring around the correct word in the box to complete the sentence.

Iron is described as an element because all the

atoms

compounds

metals

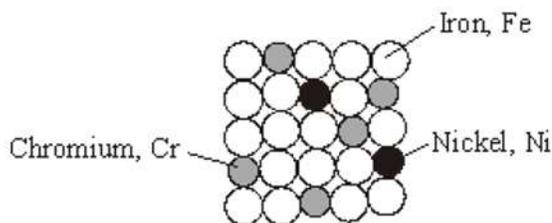
are the same.

(1)



(b) Stainless steel is mostly iron.

The diagram represents the particles in stainless steel.



Use the correct words from the box to complete the sentences about alloys.

metal	mixture	molecule	polymer	smart	structure
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Stainless steel is an alloy because it is a \_\_\_\_\_ of iron, chromium and nickel.

An alloy is made up of more than one type of \_\_\_\_\_.

Stainless steel alloys are harder than iron because the different sized atoms added change the \_\_\_\_\_.

An alloy that can return to its original shape after being deformed is called a \_\_\_\_\_ alloy.

(4)

(c) In the UK, we use about 1.8 billion steel cans every year but only 25% are recycled. Used steel cans are worth about £100 per tonne.

Recycling saves raw materials and reduces waste that would end up in landfill. Producing steel by recycling used cans saves 75% of the energy that would be needed to produce steel from iron ore. This also reduces carbon dioxide emissions.

(i) Give **two** reasons, from the information above, to explain why recycling used steel cans is a good idea.

1. \_\_\_\_\_  
\_\_\_\_\_

2. \_\_\_\_\_  
\_\_\_\_\_

(2)



(ii) Suggest how the local council could increase the percentage of used steel cans that are recycled.

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(1)

(Total 8 marks)

4.

Read this passage about metals.

Metals are crystalline materials. The metal crystals are normally about 20 000 nm (nanometres) in diameter. The atoms inside these crystals are arranged in layers.

A new nanoscience process produces nanocrystalline metals. Nanocrystalline metals are stronger and harder than normal metals.

It is hoped that nanocrystalline metals can be used in hip replacements.



The use of nanocrystalline metals should give people better hip replacements which last longer.

(a) State why metals can be bent and hammered into different shapes.

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(1)



(b) How is the size of the crystals in nanocrystalline metals different from the size of the crystals in normal metals?

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(1)

(c) Hip joints are constantly moving when people walk.

Suggest and explain why the hip replacement made of nanocrystalline metal should last longer than one made of normal metals.

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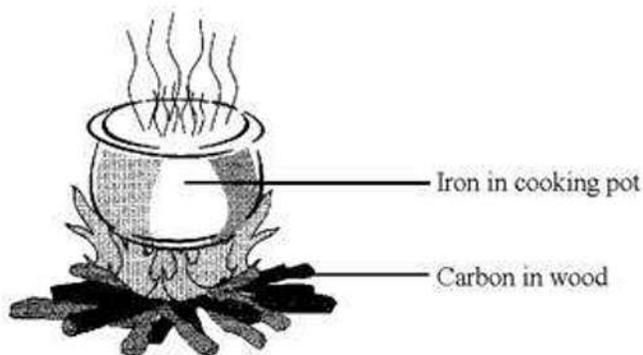
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(2)

(Total 4 marks)

5.

The uses of *elements* depend on their properties.



(a) Carbon and iron are both *elements*. What is an *element*?

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(1)



(b) Complete the sentences by crossing out the words that are wrong. The first one has been done for you.

<del>Non-Metals</del>	Metals	can be hammered into shape.
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Non-Metals	Metals	often have low melting point.
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Non-Metals	Metals	are good conductors of heat.
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(2)

(c) In the box are the names of three metals.

copper    iron    sodium
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Which **one** of these is **not** a good metal for making the cooking pot? Give a reason for your answer.

Metal \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(2)

(Total 5 marks)