Access Tuition

GCSE Chemistry

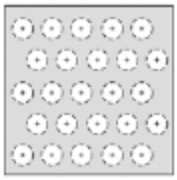
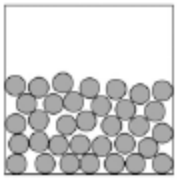
Metallic Bonding

Question Paper

Time available: 38 minutes
Marks available: 34 marks

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

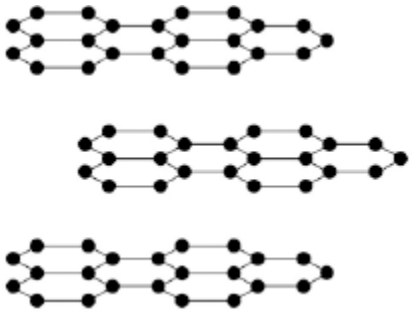
(a) Draw **one** line from each statement to the diagram which shows the structure.

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 ☐

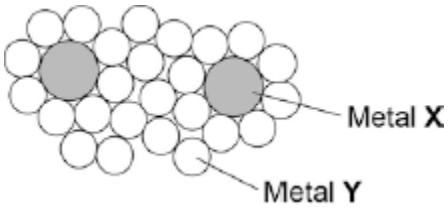
It has weak forces between the layers ☐

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**.

_____

_____

_____

_____

(2)

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

_____

_____

_____

_____

(2)

(f) What type of substance is an alloy?

Tick **one** box.

Compound ☐

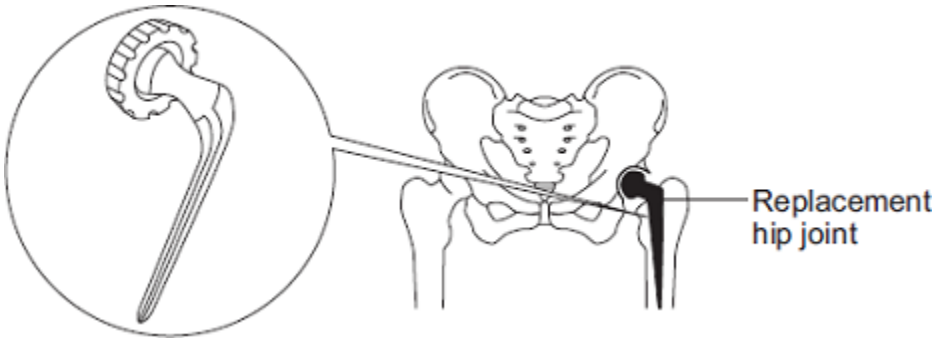
Element ☐

Mixture ☐

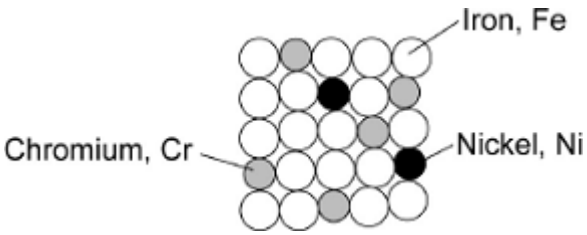
(1)

(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.



Paticle diagram of stainless steal

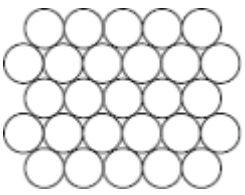
(a) Use the diagram to complete the percentages of metals in this stainless steel.

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.

_____

_____

_____

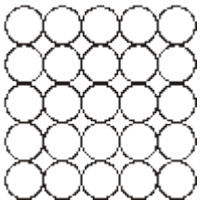
_____

(2)

(Total 6 marks)

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

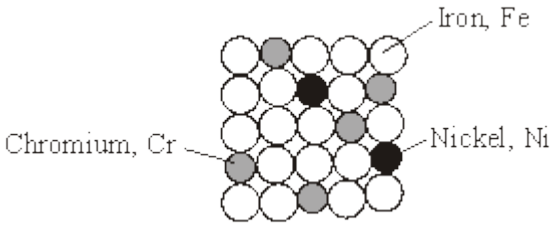
atoms
compounds
metals

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**

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.

_____

_____

(1)

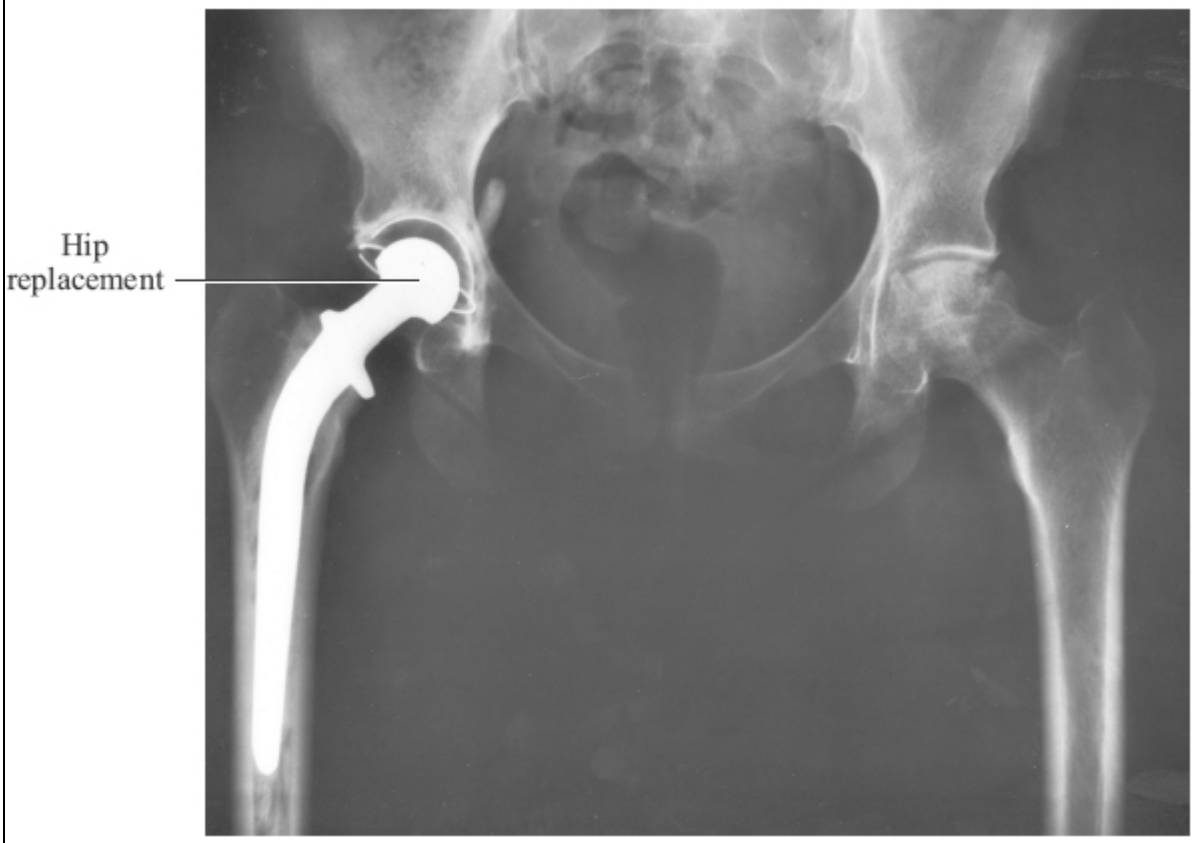
(Total 8 marks)

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.

_____

_____

(1)

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

_____

_____

(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.

_____

_____

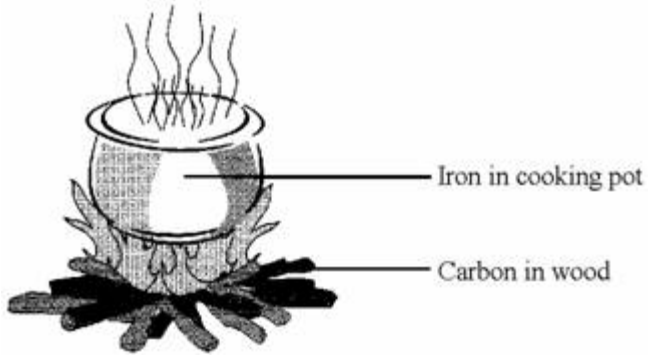
_____

_____

(2)

(Total 4 marks)

5. The uses of *elements* depend on their properties.



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

_____

_____

(1)

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

~~Non-Metals~~	Metals	can be hammered into shape.
Non-Metals	Metals	often have low melting point.
Non-Metals	Metals	are good conductors of heat.

(2)

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

copper iron sodium

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)