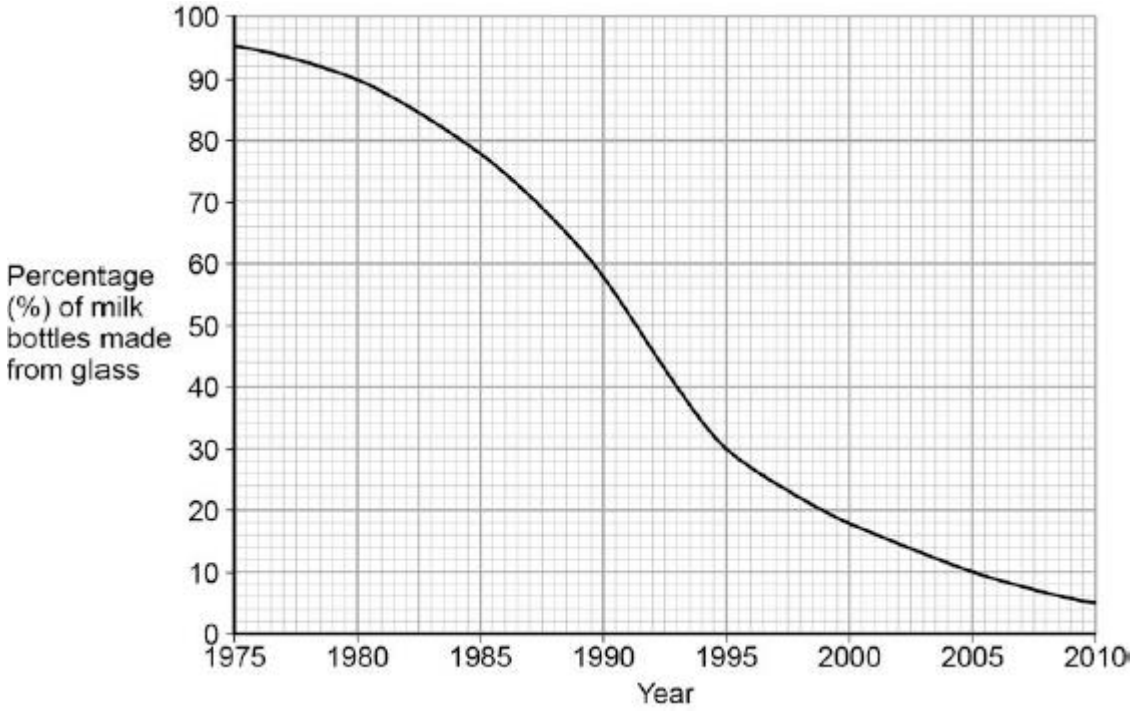
Q1. Plastic and glass can be used to make milk bottles.

The figure below shows the percentage of milk bottles made from glass between 1975 and 2010.



(a) Plot the points and draw a line on the figure above to show the percentage of milk bottles made from materials **other** than glass between 1975 and 2010.

(3)

(b) The table below gives information about milk bottles.

	Glass milk bottle	**Plastic milk bottle**
Raw materials	Sand, limestone, salt	Crude oil
Bottle material	Soda-lime glass	HD poly(ethene)
Initial stage in production of bottle material	Limestone and salt used to produce sodium carbonate.	Production of naphtha fraction.
Maximum temperature in production process	1600 °C	850 °C
Number of times bottle can be used for milk	25	1

Size(s) of bottle	0.5 dm^3	0.5 dm^3, 1 dm^3, 2 dm^3, 3 dm^3
Percentage (%) of recycled material used in new bottles	50 %	10 %

Evaluate the production and use of bottles made from soda-lime glass and those made from HD poly(ethene).

Use the information given and your knowledge and understanding to justify your choice of material for milk bottles.

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(6)
(Total 9 marks)

Q2. This question is about metals and alloys.

(a) Explain how electricity is conducted in a metal.

To gain full marks you must include a description of the structure and bonding of a metal.

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(4)

(b) Describe how the structure of an alloy is different from the structure of a pure metal.

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(2)

(c) Alloys are used to make dental braces and coins.

(i) Nitinol is an alloy used in dental braces.

Why is Nitinol used in dental braces?

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(1)

(ii) Suggest **one** reason why coins are not made of pure copper.

Do **not** give cost as a reason.

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(1)

(iii) Some coins are made from an alloy of aluminium.

Complete the sentence.

Aluminium is manufactured by the electrolysis of a molten mixture of cryolite and

.....

(1)

(iv) Banks keep coins in poly(ethene) bags. These bags are made from low density poly(ethene).

High density poly(ethene) can also be made from the same monomer.

How can the same reaction produce two different products?

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(1)

(d) Give **two** reasons why instrumental methods of analysis are used to detect impurities in metals.

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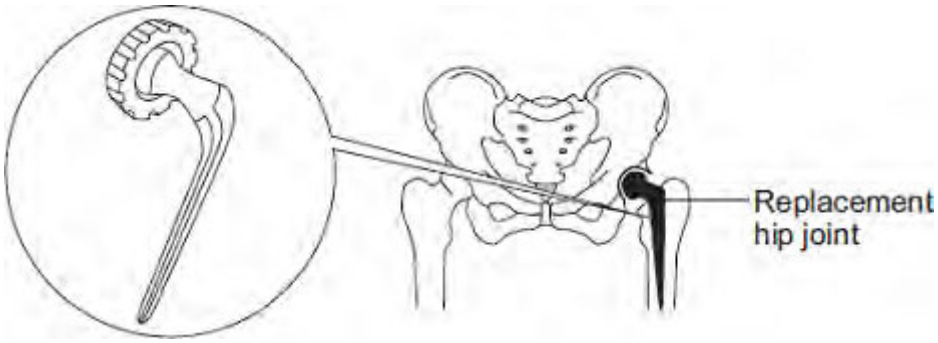
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(1)
(Total 11 marks)

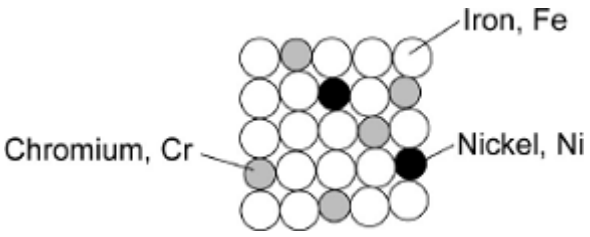
Q3. The hip joint sometimes has to be replaced.

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

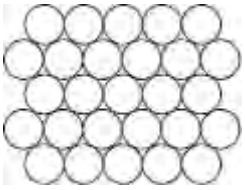
(a) Use the diagram to complete the percentages of metals in this stainless steel.

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*?

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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)

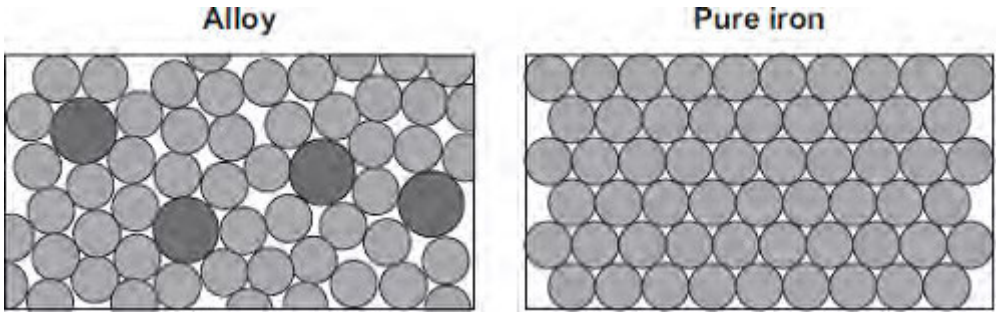
Q4. Oil rigs are used to drill for crude oil.



© Digital Vision/Photodisc

(a) Drills are made from an alloy of iron.

The diagrams show the particles in the alloy and in pure iron.



Use the diagrams to explain why the alloy is harder than pure iron.

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(2)

(b) Drill heads contain diamonds.

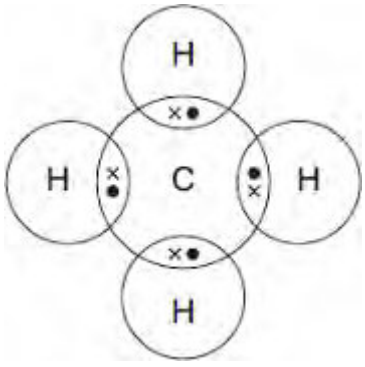
Tick (✓) **two** reasons why diamonds are hard.

Reason	Tick (✓)

Diamonds have a giant covalent structure.	
Diamonds have high melting points.	
Diamonds are unreactive.	
Diamonds have strong bonds between carbon atoms.	

(2)

(c) Methane gas is often found where crude oil is found.
The diagram shows how atoms bond in methane.
Only the outer electrons are shown.



(i) Draw a ring around the correct answer to complete the sentence.

Methane is

a compound.

an element.

a mixture.

(1)

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

The formula of methane is

C_4H_4

C_4H

CH_4

(1)

(iii) Name the type of bond between the carbon and hydrogen atoms in methane.

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(1)

(d) Explain why methane is a gas at 20°C.

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(2)
(Total 9 marks)

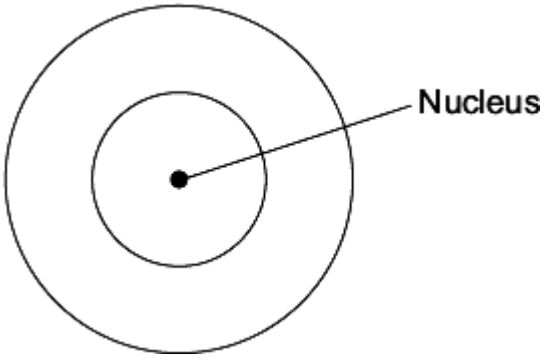
Q5. The picture shows a diamond ring.



Photograph supplied by Comstock/Thinkstock

(a) Diamond is a form of carbon. A carbon atom has six electrons.

Draw the electronic structure of a carbon atom.



(1)

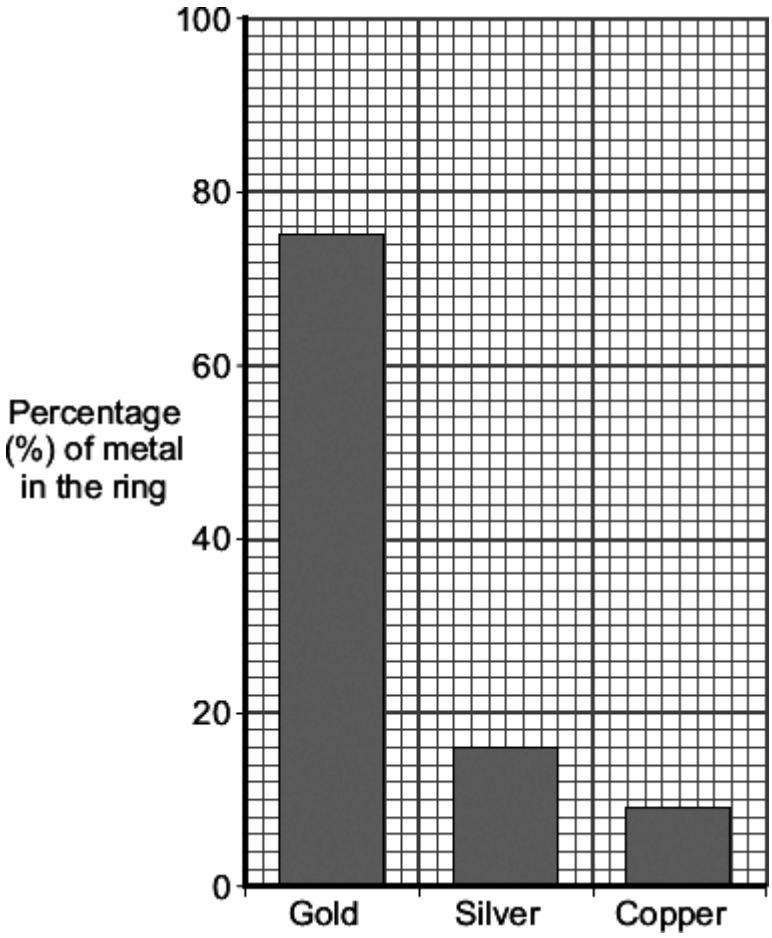
(b) A gold atom has an atomic number of 79 and a mass number of 197.

Complete the table to show the name and number of each sub-atomic particle in this gold atom.

Name	Number
Proton	79
Electron	.....
.....	.....

(3)

(c) The bar chart shows the composition of this gold ring.



(i) Give the percentage of the other two metals in this gold ring.

Silver is ..... % and copper is ..... %

(1)

(ii) This gold ring is not made from 100% gold.

Give **two** reasons why.

1 .....

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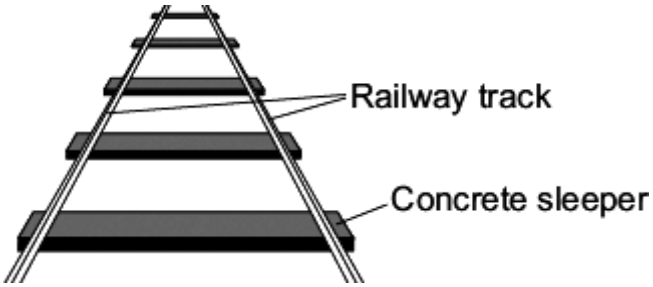
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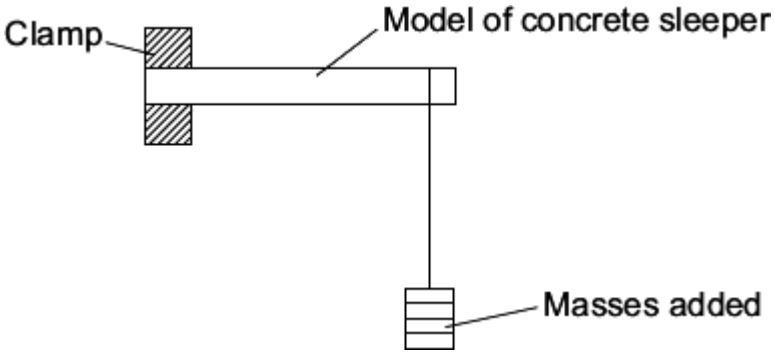
(2)
(Total 7 marks)

Q6. In the UK, railway sleepers were made from wood.
They are now often made from concrete.



A scientist was asked to find the best concrete mixture to use so that railway sleepers would not break easily.The scientist made:

- a mould to make small models of concrete sleepers
- concrete mixtures using crushed rock, sand, cement and water
- the equipment shown to add 0.1 kg masses until the model sleeper broke.



The scientist's results are shown in the table.

Concrete mixture in % by volume			**Total mass added to break the model sleeper in kg**				
Cement	**Sand**	**Crushed rock**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Mean**
10	70	20	1.2	1.1	1.3	1.2	1.2
20	60	20	3.0	2.6	2.5	2.4	
30	50	20	3.5	3.3	3.3	3.3	3.3
40	40	20	3.9	3.8	4.0	3.3	3.9
50	30	20	4.2	4.5	4.2	4.3	4.3

(a) Calculate the mean total mass added to break the model sleeper that has 20 % cement by volume.

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Mean = ... kg

(2)

(b) State **one** conclusion that the scientist could make from these results.

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(1)

(c) The scientist sent the results in a report to a company that makes full-size concrete railway sleepers.

(i) Suggest **two** other factors that the company should take into consideration before deciding which mixture to use to make a full-size concrete railway sleeper.

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(2)

(ii) The scientist's report claimed that using concrete sleepers instead of wooden sleepers would have less environmental impact.
Do you agree with the scientist's claim?
Use your knowledge and understanding to justify your answer.
Remember to compare using concrete with using wood for the sleepers.

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(4)
(Total 9 marks)