Q1. This question is about mixtures and analysis.

(a) Which **two** substances are mixtures?

Tick **two** boxes.

Air ☐

Carbon dioxide ☐

Graphite ☐

Sodium Chloride ☐

Steel ☐

(2)

(b) Draw **one** line from each context to the correct meaning.

Context	Meaning
	A substance that has had nothing added to it
Pure substance in chemistry	A single element or a single compound
	A substance containing only atoms which have different numbers of protons
Pure substance in everyday life	A substance that can be separated by filtration
	A useful product made by mixing substances

(2)

(c) What is the test for chlorine gas?

Tick **one** box.

A glowing splint relights ☐

A lighted splint gives a pop ☐

Damp litmus paper turns white ☐

Limewater turns milky ☐

(1)

(d) A student tested a metal chloride solution with sodium hydroxide solution.

A brown precipitate formed.

What was the metal ion in the metal chloride solution?

Tick **one** box.

Calcium ☐

Copper(II) ☐

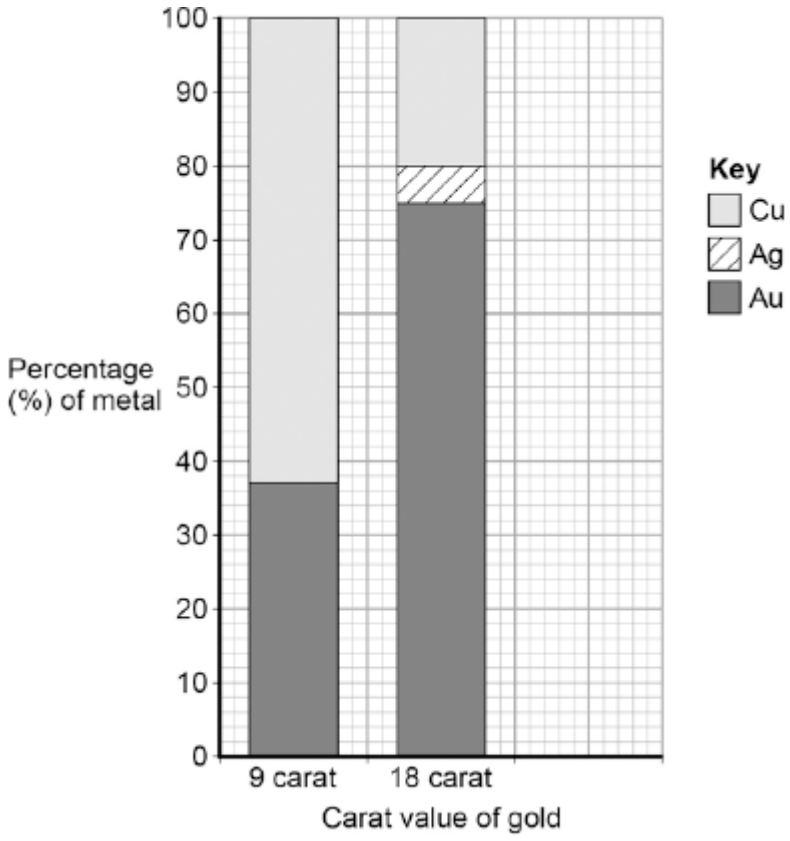
Iron(II) ☐

Iron(III) ☐

(1)
(Total 6 marks)

Q2. Gold is mixed with other metals to make jewellery.

The figure below shows the composition of different carat values of gold.



(a) What is the percentage of gold in 12 carat gold?

Tick **one** box.

12 % ☐ **30 %** ☐ **50 %** ☐ ☐

(1)

(b) Give the percentage of silver in 18 carat gold.

Use the figure above to answer this question.

Percentage = ... %

(1)

(c) Suggest **two** reasons why 9 carat gold is often used instead of pure gold to make jewellery.

1 .....

.....

2 .....

.....

(2)
(Total 4 marks)

Q3. This question is about salts.

(a) Salt (sodium chloride) is added to many types of food.

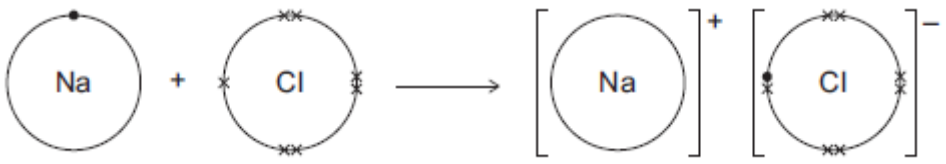
Sodium chloride is produced by reacting sodium with chlorine.

sodium + chlorine ⟶ sodium chloride

The diagram shows what happens to atoms of sodium and chlorine in this reaction.

The dots (•) and crosses (×) represent electrons.

Only the outer electrons are shown.



Describe, in terms of electrons, what happens when a sodium atom reacts with a chlorine atom to produce sodium chloride.

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.....

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.....

.....

(3)

(b) Lack of iodine can affect the learning ability of children.

One idea is that salt (sodium chloride) should have iodine added.

(i) Iodine consists of simple molecules.

What is a property of substances that have simple molecules?

Tick (✓) **one** box.

Have no overall electric charge ☐

Have high boiling points ☐

Have giant covalent structures ☐

(1)

(ii) Which one of the following questions cannot be answered by science alone?

Tick (✓) **one** box.

How much sodium chloride is in food? ☐

What harm does a lack of iodine do? ☐

Should iodine be added to salt in food? ☐

Give **one** reason why this question cannot be answered by science alone.

.....

.....

(2)

(c) A student produced the salt ammonium nitrate by adding an acid to ammonia solution.

(i) Name the acid used.

.....

(1)

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

an acid	an alkali	a salt

Ammonia solution (ammonium hydroxide) is ..... .

(1)

(iii) The student added a few drops of a solution which changed colour when the reaction was complete.

Complete the sentence.

The solution added is an ..... .

(1)

(d) Farmers buy solid ammonium nitrate in poly(ethene) sacks.

(i) How is solid ammonium nitrate made from a solution of ammonium nitrate?

Tick (✓) **one** box.

Crystallisation ☐

Decomposition ☐

Electrolysis ☐

(1)

(ii) Why do farmers use ammonium nitrate on their fields?

.....

.....

(1)

(iii) The properties of poly(ethene) depend on the reaction conditions when it is made.

State **one** reaction condition that can be changed when making poly(ethene).

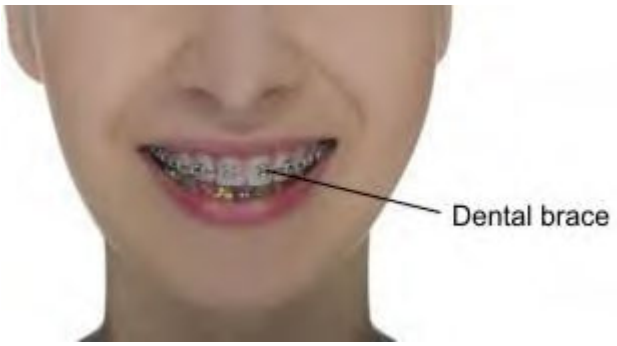
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(1)

(Total 12 marks)

Q4. Dental braces are made from nitinol wires. Nitinol is a mixture of metals.



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(a) Nitinol can return to its original shape after being deformed.

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

Nitinol is a shape memory

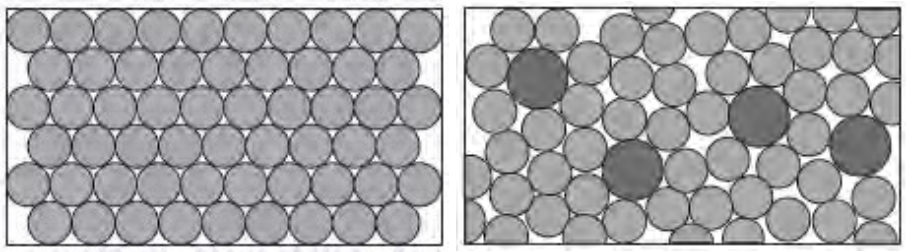
alloy.
catalyst.
polymer.

(1)

(b) **Figure 1** shows the arrangement of atoms in a pure metal and in a mixture of metals.

Figure 1

Pure metal **Mixture of metals**



The mixture of metals is harder than the pure metal.

Use **Figure 1** to explain why.

.....

.....

.....

.....

(2)

(c) Gold and stainless steel are also used for dental braces.

Suggest **two** factors to consider when choosing which metal to use for dental braces.

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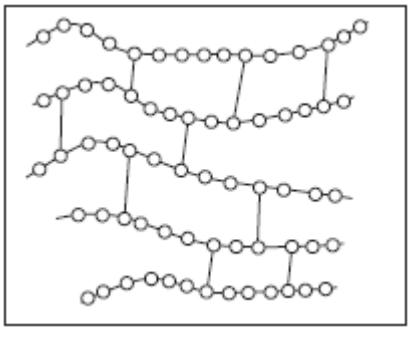
(2)

(d) A thermosetting polymer is used to hold dental braces on the teeth.

Figure 2 shows the structure of a thermosetting polymer.

Figure 2

Thermosetting polymer



How can you tell from **Figure 2** that the polymer is thermosetting?

.....

.....

(1)
(Total 6 marks)

Q5. Printed pictures can be made using etchings.



© Eduardo Jose Bernardino/iStock

An etching can be made when a sheet of brass reacts with iron chloride solution.

(a) Brass is a mixture of two metals, copper and zinc.

(i) A mixture of two metals is called ..... .

(1)

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

Copper and zinc atoms are different sizes.

This makes brass

harder
more flexible
softer

than the pure metals.

(1)

(b) Iron chloride has the formula $FeCl_3$

Relative atomic masses (A_r): Cl = 35.5; Fe = 56.

(i) Calculate the relative formula mass (M_r) of iron chloride ($FeCl_3$).

.....

.....

.....

Relative formula mass (M_r) of iron chloride = ...

(2)

(ii) Calculate the percentage of iron in iron chloride ($FeCl_3$).

.....

.....

.....

Percentage of iron in iron chloride = ...%

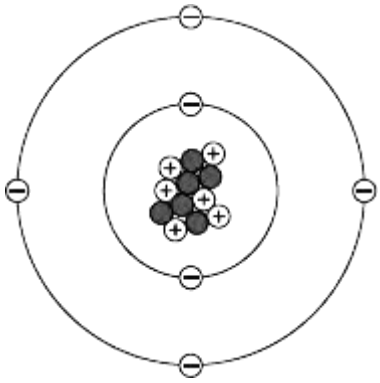
(2)
(Total 6 marks)

Q6. The picture shows a diamond ring.



Photograph supplied by Comstock/Thinkstock

(a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	-1

(2)

(b) Use the Chemistry Data Sheet to help you to answer these questions.

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

Gold and carbon are

compounds.

elements.

mixtures.

(1)

(ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a .....

(1)

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

Pure gold is not used to make the ring because pure gold is too

hard.

reactive.

soft.

The gold ring is made by mixing pure gold with other metals to form

a compound.

an atom.

an alloy.

(2)

(d) The data in the table shows some information about the three metals in the gold ring.

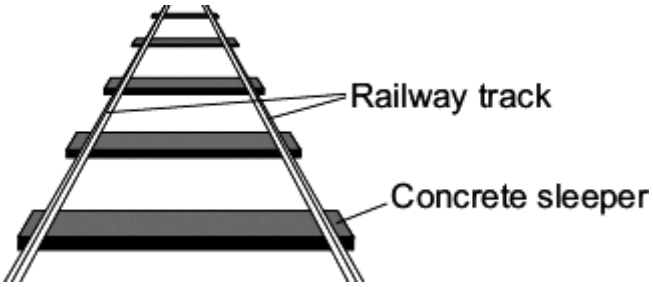
Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
How many electrons are there in a copper atom?	61
How many neutrons are in an atom of silver with a mass number of 108?	75
	79

(3)
(Total 9 marks)

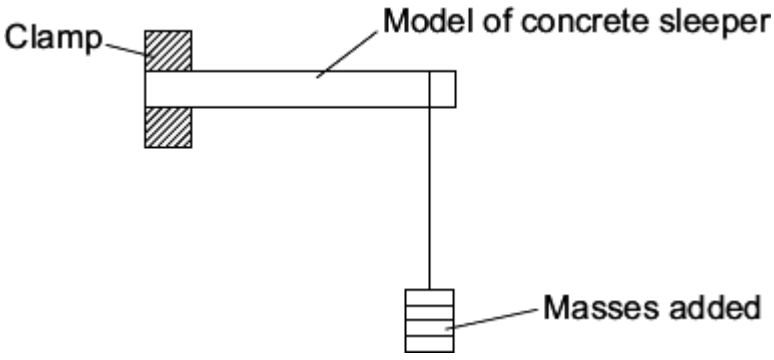
Q7. In the UK, railway sleepers are often made from concrete.



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**	**Mean**
10	70	20	1.1	1.3	1.2	1.2
20	60	20	2.6	2.5	2.4	
30	50	20	3.3	3.3	3.3	3.3
40	40	20	3.8	4.0	3.3	3.9

50	30	20	4.5	4.2	4.3	4.3

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

.....

Mean = ... kg

(1)

(ii) Choose **one** result in the table that the scientist should check and test again.

Result: % cement by volume ..... Test number .....

Explain why you chose this result.

.....

.....

(2)

(iii) What is the relationship between the total mass to break the model sleeper and the percentage (%) of cement by volume in the concrete mixture?

.....

.....

(1)

(iv) Suggest **one** other variable that the scientist should have recorded in the table of results.

.....

(1)

(b) The scientist thought that full-size railway sleepers should be made from 30% cement, 50% sand and 20% crushed rock.

What other information about these three materials is needed before the scientist

recommends using this mixture to make a full-size railway sleeper?

.....

.....

.....

.....

(2)
(Total 7 marks)

Q8. Gold and gold ions are used as catalysts.

(a) An atom of gold is represented as:

$$^{197}_{79}\mathrm{Au}$$

Complete the sentences.

The atomic number of gold is .....

The number of electrons in an atom of gold is .....

(2)

(b) Scientists have found that gold nanoparticles are very good catalysts.

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

A gold nanoparticle contains a few | hundred / thousand / million | atoms.

(1)

(c) The formation of a gold ion (Au^{3+}) from a gold atom (Au) is shown in the symbol equation.

$$Au \rightarrow Au^{3+} + 3e^-$$

(i) Complete the sentence.

The particles lost when a gold atom becomes a gold ion

are called .....

(1)

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

The number of these particles lost when a gold atom becomes a gold ion is

one.
two.
three.

(1)

(d) Gold ions are used as a catalyst in the reaction to make chloroethene.

How does a catalyst help a reaction?

.....

(1)

(e) Chloroethene can react to make a thermosoftening polymer.

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

When heated, a thermosoftening polymer will

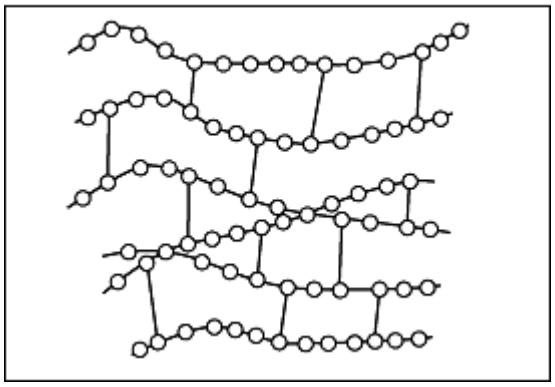
dissolve.
melt.
solidify.

(1)

(ii) Polymer **B** is a different type of polymer.

The diagram shows the structure of polymer **B**.

Polymer B



How can you tell from the diagram that polymer **B** is **not** thermosoftening?

.....

.....

(1)

(Total 8 marks)