METALS & NON-METALS 3

Q1. The table shows the composition and melting points of four alloys, **A**, **B**, **C** and **D**.

Alloy	Melting point in °C	Percentage composition (%)				
		Tin	Indium	Bismuth*	Lead*	Cadmium*
A	100	24.0	0	49.0	27.0	0
B	62	16.5	51.0	32.5	0	0
C	70	13.0	0	50.0	27.0	10.0
D	47	8.3	19.1	44.7	22.6	5.3

Toxic substances are marked with *.

Match alloys, **A**, **B**, **C** and **D**, with the numbers **1– 4**.

1 It has the highest melting point.

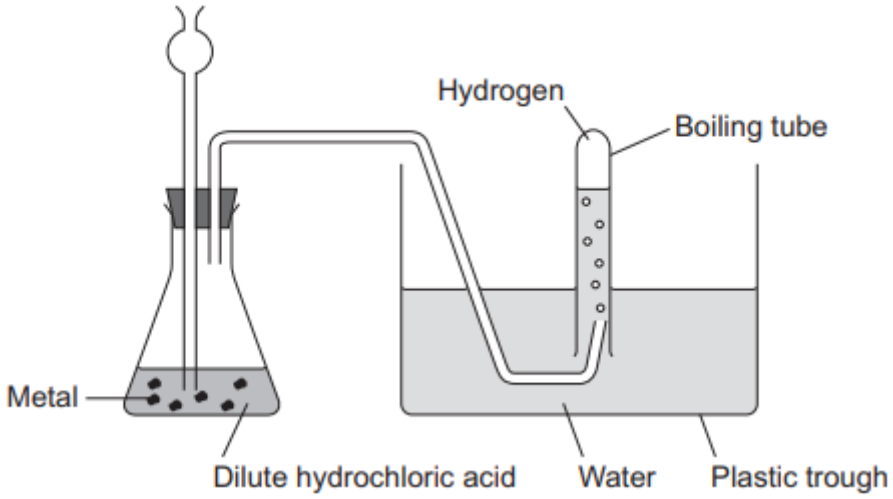
2 It is made up from the largest number of substances.

3 It contains the least bismuth.

4 It contains the largest percentage of toxic substances.

(4 marks)

Q2. Some students were trying to decide which one of the metals, **K**, **L**, **M** or **N**, was the most reactive. They set up the apparatus shown in the diagram.



Dilute hydrochloric acid was added to the metal K. Hydrogen was given off. The students recorded how long it took to fill the boiling tube with the hydrogen. They did the experiment twice more under exactly the same conditions. They repeated the experiment, using equal-sized pieces of metals L, M and N. The results are shown in the table.

	Time taken to fill the boiling tube with hydrogen in seconds		
Metal	**Experiment 1**	**Experiment 2**	**Experiment 3**
K	600	479	649
L	189	220	178
M	81	82	78
N	125	132	143

(a) To make it a fair test, the students made sure that the boiling tube was always completely filled with hydrogen before they recorded the time.

What else should they do to make it a fair test?

1 use a different acid for each metal

2 use the same volume of the acid for each test

3 replace the water in the plastic trough for each test

4 use different temperatures for each metal

(1 mark)

(b) Which metal was the most reactive?

1 metal K

2 metal L

3 metal M

4 metal N

(1 mark)

(c) Why did the students take more than one reading for each metal?

1 to make an error less likely

2 so that they could plot a graph

3 to make it easier to see the relationship between the two variables

4 to make it a fair test

(1 mark)

(d) Some of their results were anomalous. Which of the following experiments should the students repeat?

1 metal K, experiment 2

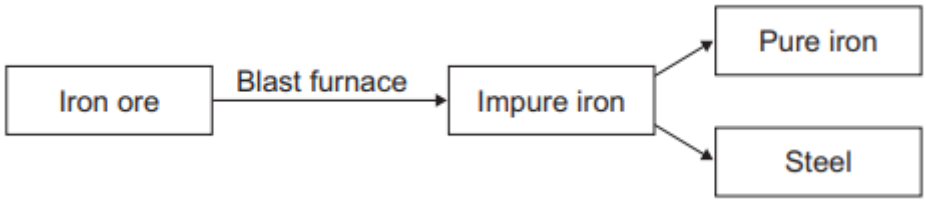
2 metal L, experiment 3

3 metal M, experiment 3

4 metal N, experiment 1

(1 mark)

Q3. The flow chart shows how iron ore can be changed into useful materials.



(a) Iron ore is the starting material for making iron because . . .

1 iron ore is magnetic.

2 iron ore contains a reasonable amount of iron oxide.

3 a lot of energy is needed to convert iron ore into iron.

4 mining iron ore does not cause any environmental problems.

(1 mark)

(b) In the blast furnace, iron oxide is converted to iron using carbon. This is because . . .

1 iron is less reactive than carbon.

2 iron is more reactive than carbon.

3 carbon is a cheap material to use.

4 carbon combines with the metal impurities in the iron ore, leaving iron.

(1 mark)

(c) Impure iron is hard and brittle. This is because in impure iron . . .

1 the impurities distort the layers of atoms so they cannot slide over each other.

2 the carbon breaks up the iron structure, allowing it to bend easily.

3 its structure has been destroyed by heating to a very high temperature.

4 all the atoms are the same and so remain in a regular arrangement.

(1 mark)

(d) When impure iron is converted into steel, . . .

1 all the carbon is removed and not replaced.

2 the amount of carbon is carefully controlled.

3 all the metal impurities are removed and not replaced.

4 chromium is always added to the iron.

(1 mark)

Q4. This question is about the substances in this reaction:

$$Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$$

Match substances, **A**, **B**, **C** and **D**, with the numbers **1**– **4** in the table.

A C

B Fe

C CO

D Fe_2O_3

1	In the reaction, it is reduced.
2	It is a transition element.
3	In the reaction, it is oxidised.
4	It is formed by oxidation of a non-metal element.

(4 marks)

Q5. The table gives some information about four metals, A, B, C and D.

	Metal	Main ore	Price in £ per tonne	Percentage abundance of the metal in the Earth's crust
A	Aluminium	Bauxite, Al_2O_3	1800	7
B	Copper	Chalcopyrite, $CuFeS_2$	3300	0.005
C	Tin	Cassiterite, SnO_2	8000	0.0002
D	Iron	Haematite, Fe_2O_3	30	4

Match metals, A, B, C and D, with the numbers 1– 4 in the table below.

1	It is the least expensive metal.
2	It is the least abundant metal.
3	The main ore of this metal is not an oxide.
4	This metal cannot be obtained from its main ore by reduction with carbon.

(4 marks)

Q6. Copper is in high demand. Copper is extracted from ores containing copper sulfide. Most of these ores contain only low percentages of copper sulfide.

The copper sulfide is heated in a furnace. Oxygen is blown through the molten copper sulfide.

Copper and sulfur dioxide are produced.

(a) A company uses copper sulfide ores to produce copper.

The company will make more profit if . . .

1 the cost of the fuel to heat the furnace increases.

2 the ores contain a higher percentage of copper sulfide.

3 their workers are paid more.

4 there is a reduced demand for copper.

(1 mark)

(b) The company wants to know the amount of sulfur dioxide released into the atmosphere from the chemical works.

It would be best to measure the amount of sulfur dioxide . . .

1 in the nearest town.

2 in the area around the chemical works.

3 in the gases coming out of the chimneys at the chemical works.

4 in the country as a whole.

(1 mark)

(c) The company wants to know the total amount of sulfur dioxide given off by the chemical works in a 24-hour period.

The best way to calculate this would be from measurements taken . . .

1 at midday.

2 at 10.00 am and 10.00 pm.

3 at 9.00 am, midday and 4.00 pm.

4 every hour.

(1 mark)

(d) Ores containing very low percentages of copper sulfide are being used to produce copper.

One factor that would increase the use of these ores is . . .

1 the discovery of large deposits of high grade copper ore.

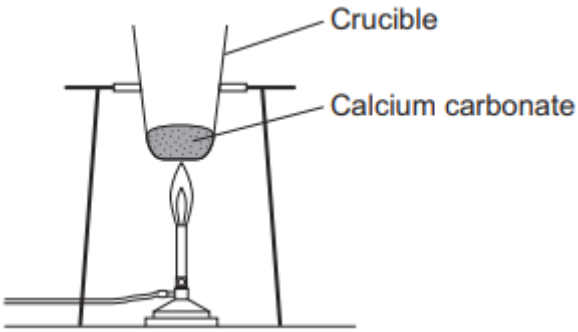
2 an increase in the use of plastics instead of copper for water pipes.

3 a large increase in the price of copper.

4 an increase in the amount of copper that is recycled.

(1 mark)

Q7. A student investigated the change in mass when two metal carbonates were heated. He heated 4.00 g of calcium carbonate in an open crucible. He measured the mass of crucible and contents every minute for 6 minutes.



He then repeated the whole experiment in the same way but used 4.00 g of copper carbonate in the same crucible. The student's results are shown in the table.

(a) The results show that . . .

1 both carbonates were fully decomposed after 3 minutes.

2 copper carbonate showed the larger loss in mass after 6 minutes.

3 copper carbonate was the first to be fully decomposed.

4 neither carbonate was fully decomposed after 6 minutes.

(1 mark)

(b) The change in mass in both experiments is because carbon dioxide gas is lost from the crucible. During which period of time was most carbon dioxide lost?

1 0 – 1 minutes

2 1 – 2 minutes

3 2 – 3 minutes

4 5 – 6 minutes

(1 mark)

(c) The student could find a more precise time for the end of each reaction by . . .

1 heating larger masses of the calcium and copper carbonates.

2 measuring the mass of the crucible and contents every 30 seconds.

3 heating the carbonates in a larger crucible.

4 measuring the mass of the crucible and contents for another 3 minutes.

(1 mark)

(d) One variable that is difficult to control in the experiment is . . .

1 the mass of the crucible.

2 the masses of the calcium carbonate and copper carbonate.

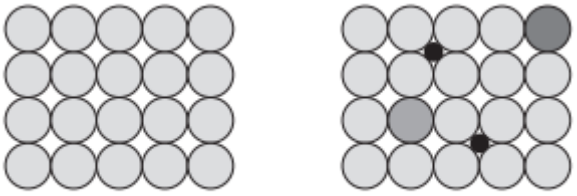
3 the times for which the calcium carbonate and copper carbonate are heated.

4 the temperature of the crucible.

(1 mark)

Q8. This question is about iron and different types of steel.

(a) The diagrams show the arrangement of atoms in pure iron and in stainless steel.



Pure iron Stainless steel

Pure iron is soft and easily shaped because the atoms . . .

1 are not arranged in a regular pattern.

2 are small and spherical.

3 are in layers that can slide over each other.

4 are of different sizes.

(1 mark)

(b) Stainless steel rather than pure iron is used for making cutlery.

Which row in the table gives two reasons why stainless steel is used?

Stainless steel . . .		
1	is harder.	is a better heat conductor.
2	is more resistant to corrosion.	is harder.
3	is a better heat conductor.	can be more easily shaped.
4	can be more easily shaped.	is more resistant to corrosion.

(1 mark)

(c) Which type of iron or steel is used to make hammer heads and chisels?

1 cast iron (iron from a blast furnace)

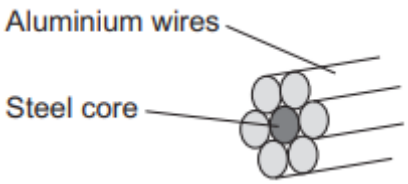
2 pure iron

3 low carbon steel

4 high carbon steel

(1 mark)

(d) The diagram shows the structure of an overhead power cable. The steel core gives strength to the cable.



Aluminium is used because it is a good conductor of electricity and . . .

1 it has a low density.

2 it is a good conductor of heat.

3 it can be hammered into shape.

4 it is a hard metal.

(1 mark)

Q9. This question is about metals.

Match metals, A, B, C and D, with statements 1– 4 in the table.

A aluminium

B copper

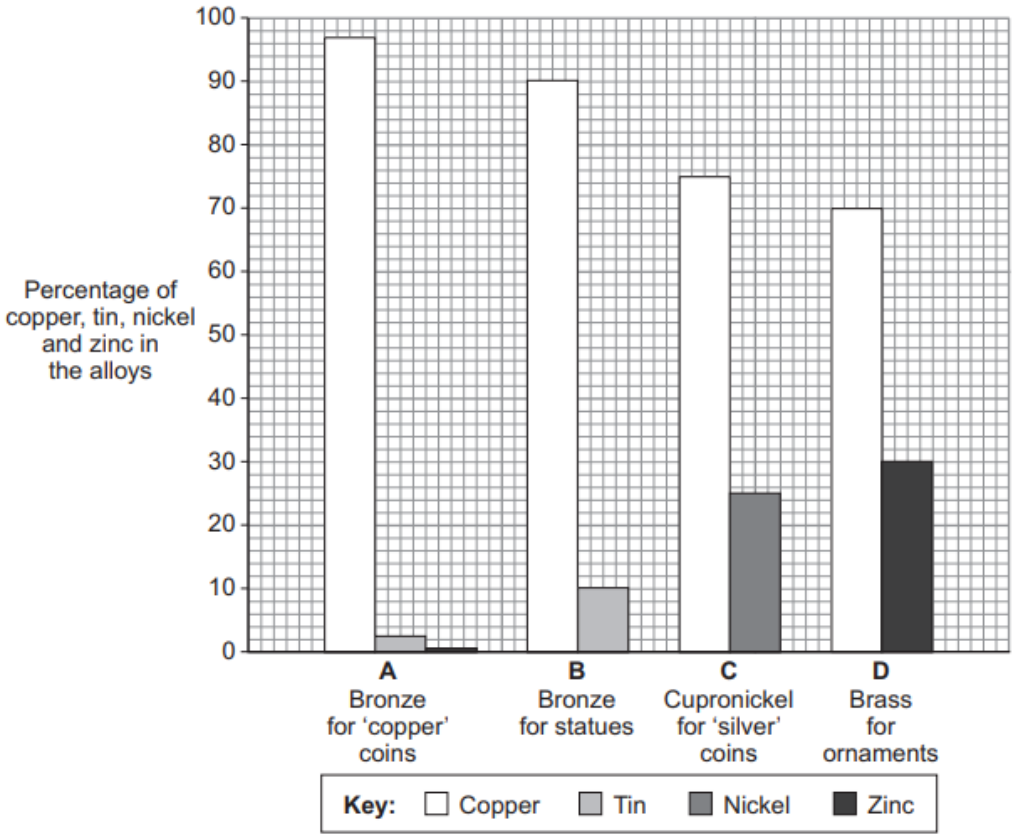
C iron

D sodium

1	It is represented by the symbol Na
2	It is used for electrical wiring and in plumbing
3	It is used in aircraft construction because of its low density
4	It can be converted into stainless steel

(4 marks)

Q10. The bar chart shows the composition of four copper alloys, A, B, C and D.



Match alloys, A, B, C and D, with the numbers 1– 4 in the table.

A bronze for 'copper' coins

B bronze for statues

C cupronickel for 'silver' coins

D brass for ornaments

1	It is an alloy of three metals
2	It contains copper and one other metal in the ratio 75:25
3	It is the alloy with the lowest proportion of copper
4	It contains copper and tin only

(4 marks)

Q11. This question is about some substances that can be obtained from copper carbonate.

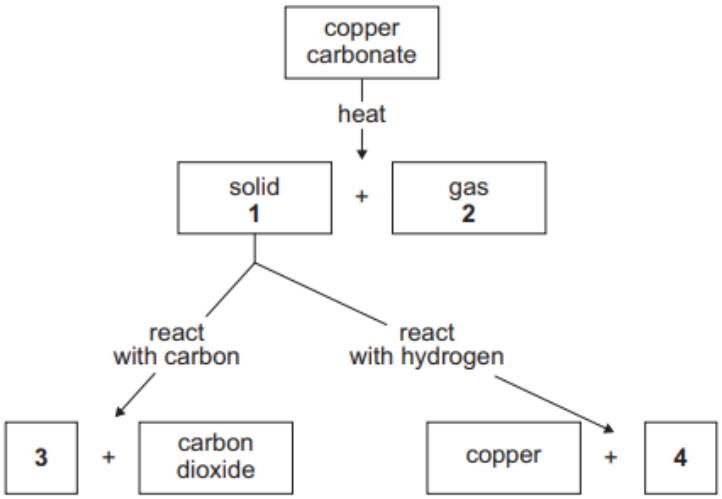
Match substances, A, B, C and D, with the numbers 1– 4 in the flow chart.

A carbon dioxide

B copper

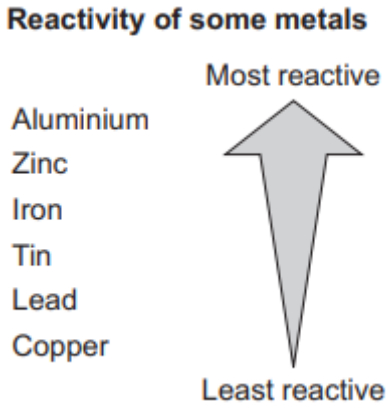
C copper oxide

D water



(4 marks)

Q12. The metal tin occurs in the Earth's crust as the compound called cassiterite, SnO_2.



(a) How would you expect tin to be extracted from its oxide?

1 by mixing the oxide with copper and heating strongly

2 by electrolysis of the solid oxide

3 by mixing the oxide with carbon and heating strongly

4 by electrolysis of a solution of the oxide

(1 mark)

(b) The main reason why food cans made from steel (iron) are coated with tin is because

1 tin has a lower density than iron.

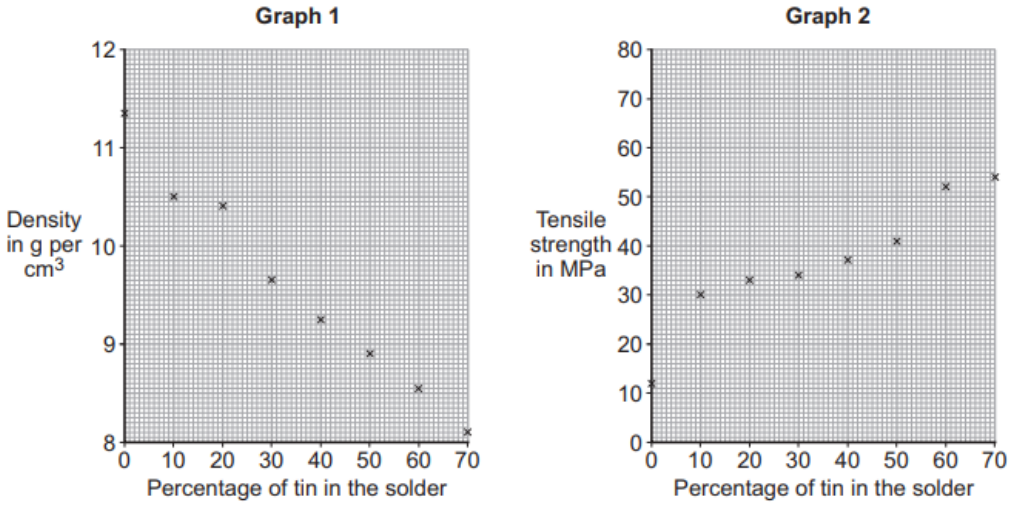
2 tin is less reactive than iron.

3 tin is a better conductor of heat than iron.

4 tin is stronger than iron.

(1 mark)

Solder is an alloy of lead and tin. The graphs show how the percentage (%) of tin in the solder affects the density (Graph 1) and tensile strength (Graph 2) of the solder.



(c) What is the density of lead in g per cm3?

1 8.17

2 8.90

3 9.60

4 11.35

(1 mark)

(d) Increasing the percentage (%) of tin in the solder . . .

1 increases the density and increases the tensile strength.

2 increases the density and decreases the tensile strength.

3 decreases the density and decreases the tensile strength.

4 decreases the density and increases the tensile strength.

(1 mark)

Total marks (48)