METALS & NON-METALS 5

Q1. This question is about uses of metals.

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

A Aluminium

B Calcium

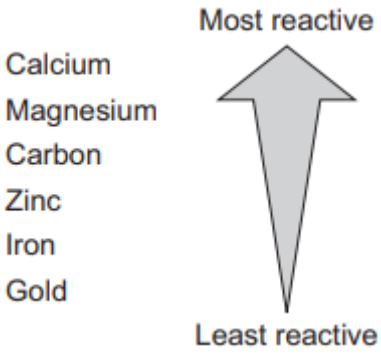
C Copper

D Iron

1	When alloyed with carbon, this metal can form a hard steel.
2	Water pipes in the home are usually made from this metal.
3	Drinks cans are made from this metal because it does not easily corrode.
4	A carbonate of this metal is used to make quicklime.

(4 marks)

Q2. This is the order of reactivity for some elements.



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

A Carbon

B Gold

C Magnesium

D Zinc

1	It is a non-metal element.
2	It does not react with oxygen or water even at high temperatures.
3	It is more reactive than iron but **can** be extracted from its oxide by mixing with carbon and heating the mixture.
4	It is less reactive than calcium but **cannot** be extracted from its oxide by mixing with carbon and heating the mixture.

(4 marks)

Q3. This question is about the extraction and recycling of copper.

Copper is used in its pure form or mixed with other metals. Large amounts of scrap copper metal from a variety of sources can easily be recycled by re-melting.

(a) Pure copper can be extracted directly by . . .

1 thermal decomposition of copper carbonate.

2 thermal decomposition of copper oxide.

3 carbon reduction of copper oxide in a blast furnace.

4 electrolysis of copper compounds dissolved in water.

(1 mark)

(b) Small amounts of other metals are sometimes added to copper to produce . . .

1 compounds that conduct electricity better.

2 compounds that are softer.

3 alloys that are harder.

4 new elements that are harder.

(1 mark)

(c) The price of copper would increase if there was . . .

1 a decrease in the demand for copper.

2 an increase in energy costs.

3 an increase in the amount of copper being recycled.

4 a discovery of a low grade copper ore in a remote area of the world.

(1 mark)

(d) One disadvantage of recycling copper is that it . . .

1 prevents heaps of scrap metal from building up.

2 still requires the use of energy resources.

3 will increase the price of copper.

4 will contaminate the world's supplies of copper.

(1 mark)

Q4. This question is about the positions of four metals in the reactivity series.

- Only metal C can be extracted by heating the metal oxide in hydrogen.
- Only metals B and C can be extracted by mixing their oxides with carbon and heating strongly.
- When the oxide of metal A is mixed with metal D and heated, metal A is produced.

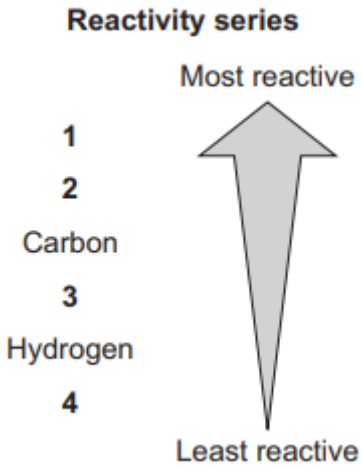
Match metals, A, B, C and D, with the numbers 1– 4 in the reactivity series.

A Metal A

B Metal B

C Metal C

D Metal D



(4 marks)

Q5. This question is about four elements, A, B, C and D.

Element	Melting point in °C	Boiling point in °C	Density in g per cm^3	Electrical conductivity
A	115	444	2.10	poor
B	660	2470	2.70	very good
C	–7	59	3.10	poor
D	98	890	0.97	good

Match elements, A, B, C and D, with the sentences 1– 4 below.

1 It is the metal with the lowest density.

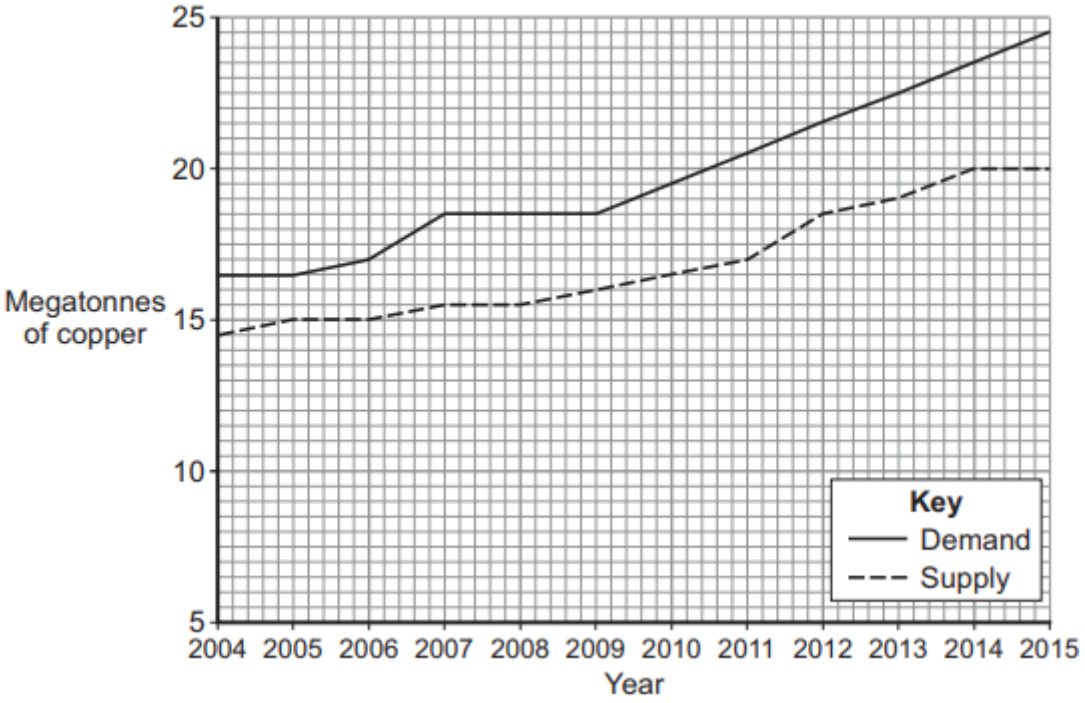
2 It is the non-metal that is a liquid at 20 °C.

3 It is the metal with the highest melting point.

4 It is the non-metal with the highest boiling point.

(4 marks)

Q6. The graph shows information about the supply of copper and the demand for copper.



(a) Between 2007 and 2010, demand for copper increased by about . . .

1 1.0%.

2 5.4%.

3 18.5%.

4 19.5%.

(1 mark)

(b) It is estimated that between 2012 and 2015, . . .

1 both supply and demand will increase; supply more than demand.

2 demand will increase by about twice as much as supply.

3 supply will increase by about 3 megatonnes.

4 demand will increase by about 0.5 megatonnes.

(1 mark)

Copper is extracted from high-grade ores by first smelting the mined ore and then purifying by electrolysis.

Copper salts can be extracted from low-grade ores by leaching. Sulfuric acid is run through the ore to produce a solution of copper sulfate. Electrolysis of copper sulfate solution produces copper.

(c) One advantage of leaching over smelting is that . . .

1 there are no waste products made during leaching.

2 there is no environmental damage caused by leaching.

3 leaching does not require large quantities of energy.

4 leaching avoids the need to recycle copper.

(1 mark)

(d) An increase in the use of leaching could occur if . . .

1 the price of copper falls dramatically.

2 deposits of high-grade copper ore become depleted.

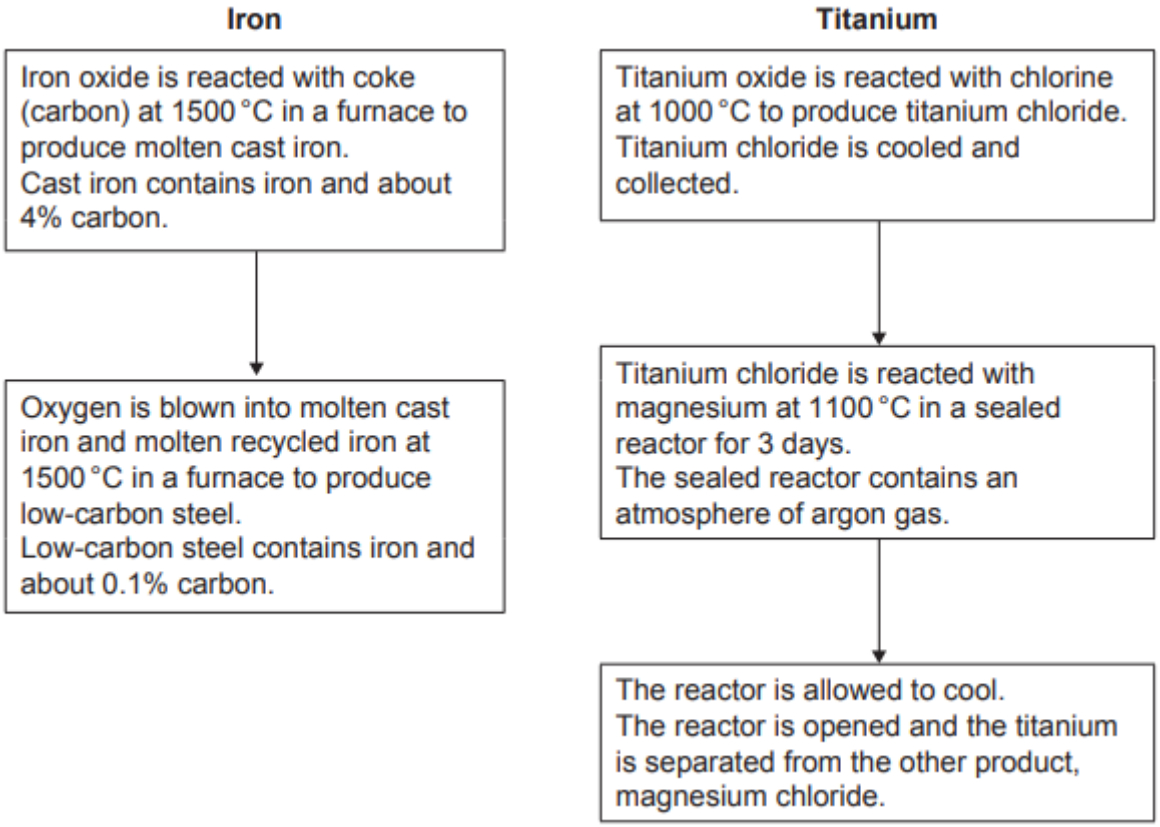
3 there is a steady fall in the cost of energy.

4 transport costs decrease.

(1 mark)

Q7. Iron is produced from the ore haematite (iron oxide).

Titanium is produced from the ore rutile (titanium oxide).



(a) The production of low-carbon steel uses oxygen but the production of titanium uses argon. Explain why.

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(3 marks)

(b) There is less titanium than iron in the Earth's crust. Apart from titanium's scarcity, explain why titanium costs much more than iron.

Use the two flow diagrams to help you to answer this question.

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(3 marks)

(c) Many chemical reactions take place in the production of both metals.

A chemical reaction in the production of iron is:

$$2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$$

A chemical reaction in the production of titanium is:

$$TiCl_4 + 2Mg \rightarrow Ti + 2MgCl_2$$

Titanium can be used to produce iron from iron oxide. The chemical reaction is:

$$2Fe_2O_3 + 3Ti \rightarrow 4Fe + 3TiO_2$$

Use these three reactions and the Chemistry Data Sheet to answer this question.

Suggest the position of titanium in the Reactivity Series of Metals. Explain your answer.

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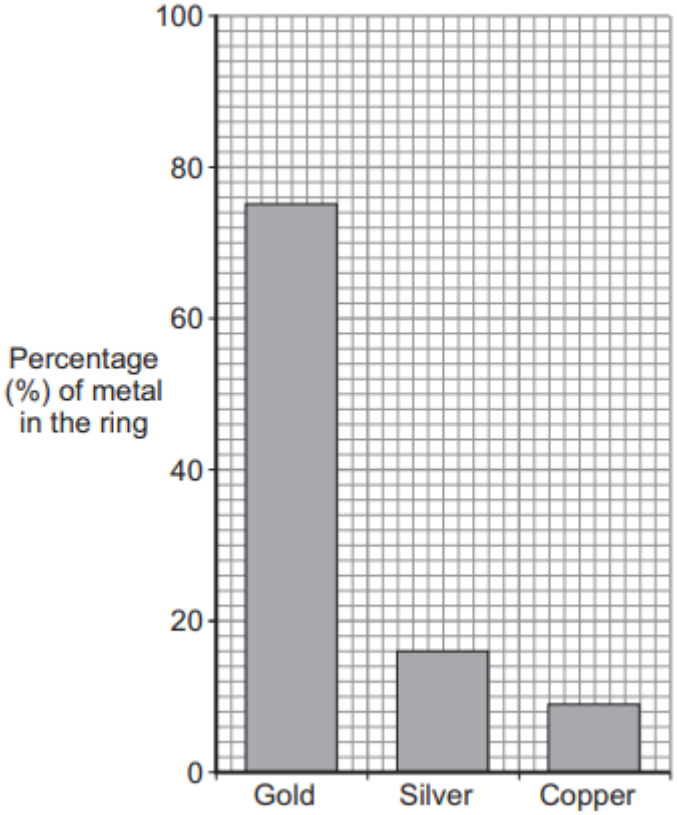
(2 marks)

Q8. 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 mark)

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

Give two reasons why.

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(2 marks)

Total marks (35)