1 There are many metallic elements in the periodic table.

(a) Which row of the table correctly shows two metals that are in group 1 and two metals that are transition metals?

Put a cross (☒) in the box next to your answer.

(1)

	group 1	transition metals
☐ **A**	lithium and zinc	calcium and copper
☐ **B**	potassium and caesium	copper and iron
☐ **C**	sodium and potassium	copper and magnesium
☐ **D**	sodium and magnesium	manganese and nickel

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

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(ii) Explain how metals conduct electricity.

(2)

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(c) (i) Describe what you would **see** when a small piece of sodium is added to water.

(2)

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(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

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(Total for Question 1 = 10 marks)

2 Gold is used to make some jewellery.

(a) Explain why gold is used to make jewellery.

(2)

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(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

The purity of gold can be measured in carats.

Pure gold is

(1)

- ☐ **A** 9 carat
- ☐ **B** 18 carat
- ☐ **C** 24 carat
- ☐ **D** 100 carat

(c) Gold can be alloyed with other metals to produce alloys that have a higher strength than pure gold.

Explain why gold alloys are stronger than gold.

(3)

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*(d) Iron and aluminium occur in the Earth's crust as their oxides.

Different methods are used to extract iron and aluminium from their oxides.

Explain, in terms of the position of the metal in the reactivity series and the cost of the extraction processes, why iron and aluminium are extracted by different methods.

(6)

(Total for Question 2 = 12 marks)

3 Metals have many uses.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

Aluminium and magnesium are melted together to form magnalium.

Magnalium is

(1)

☒ **A** an element

☒ **B** an ore

☒ **C** an alloy

☒ **D** a type of steel

(b) Describe how iron is extracted from its ore.

(2)

(c) Copper oxide reacts with hydrogen to form copper and water.

The equation for the reaction is

$$CuO + H_2 \rightarrow Cu + H_2O$$

Explain how this reaction involves both oxidation and reduction.

(3)

(d) Some modern spectacle frames are made of shape memory alloys.



Explain why shape memory alloys are better than other alloys for making spectacle frames.

(2)

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(e) Complete the sentence by putting a cross (☒) in the box next to your answer.

Alloys are usually stronger than the pure metals from which they are made because they

(1)

☒ **A** have stronger bonds between the molecules they contain

☒ **B** combine the properties of the metals from which they are made

☒ **C** have atoms of different sizes in their structures

☒ **D** are made using electrolysis

(Total for Question 3 = 9 marks)

4 Modern European coins contain mixtures of metals.

The 1 cent and 1 euro coins are shown.



(a) (i) Suggest why the 1 cent coin is coated with copper.

(1)

.....

(ii) The 1 euro coin has a silver-coloured centre and a gold-coloured rim.

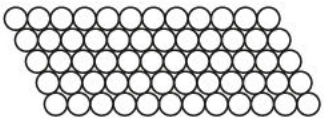
Compare the compositions of the two parts of the coin to suggest which metal causes the alloy to become gold-coloured.

(1)

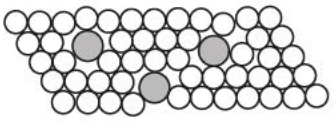
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(b) The diagrams show the structure of a pure metal and an alloy it forms with another metal.



pure metal



alloy

Use these diagrams to help you explain why alloying increases the strength of the pure metal.

(3)

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(c) Aluminium and iron are both extracted from their oxides.

(i) Complete the sentence by putting a cross (☒) in the box next to your answer.

Iron is extracted from its oxide by heating the oxide with carbon.

In this process the iron oxide is

(1)

☐ **A** thermally decomposed

☐ **B** oxidised

☐ **C** neutralised

☐ **D** reduced

(ii) Aluminium cannot be extracted from its oxide by heating the oxide with carbon. Electrolysis must be used.

Explain why electrolysis must be used to extract aluminium from its oxide.

(2)

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(Total for Question 4 = 8 marks)

5 Objects made from transition metals are sometimes coated with a thin layer of another transition metal to improve their appearance and to protect against corrosion.

(a) Figure 10 shows equipment that can be used to electroplate an iron spoon with silver.

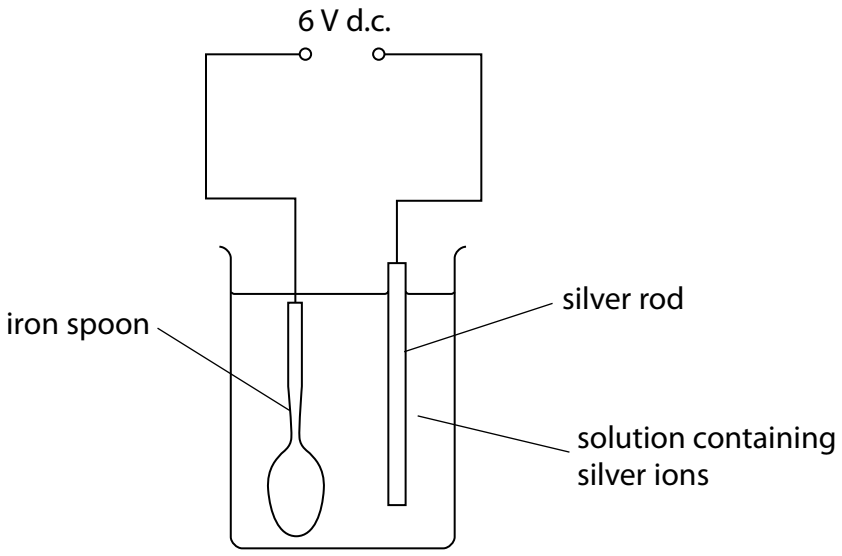


Figure 10

(i) Which row of the table correctly shows the charge on the silver rod electrode and the type of reaction occurring at this electrode?

(1)

		charge	type of reaction
☒	**A**	negative	oxidation
☒	**B**	negative	reduction
☒	**C**	positive	oxidation
☒	**D**	positive	reduction

(ii) Silver metal is deposited on the spoon.

Which half-equation represents this reaction?

(1)

☒ **A** $Ag + e \rightarrow Ag^+$

☒ **B** $Ag \rightarrow Ag^+ + e^-$

☒ **C** $Ag^+ + e \rightarrow Ag$

☒ **D** $Ag^+ \rightarrow Ag + e^-$

(b) The voltage of a cell is 1.5 V.

Give a reason why this voltage of the cell decreases when the cell is left connected in a circuit.

(1)

.....

.....

(c) Duralumin is an alloy of aluminium and copper.

The radii of the aluminium and copper atoms are shown in Figure 11.

	radius of atom / m
aluminium	1.43×10^{-12}
copper	1.27×10^{-12}

Figure 11

Explain why copper added to aluminium to form the alloy makes the alloy stronger than pure aluminium.

(2)

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(d) Gold is often alloyed with other metals when it is used to make jewellery.

The proportion of gold in a piece of gold jewellery is measured in carats.

Pure gold is 24 carats.

A 9 carat gold ring has a mass of 12 g.

Calculate the mass of gold in this ring.

(2)

mass of gold ring = ... g

(Total for Question 5 = 7 marks)