

Properties of transition metals – GCSE Chemistry

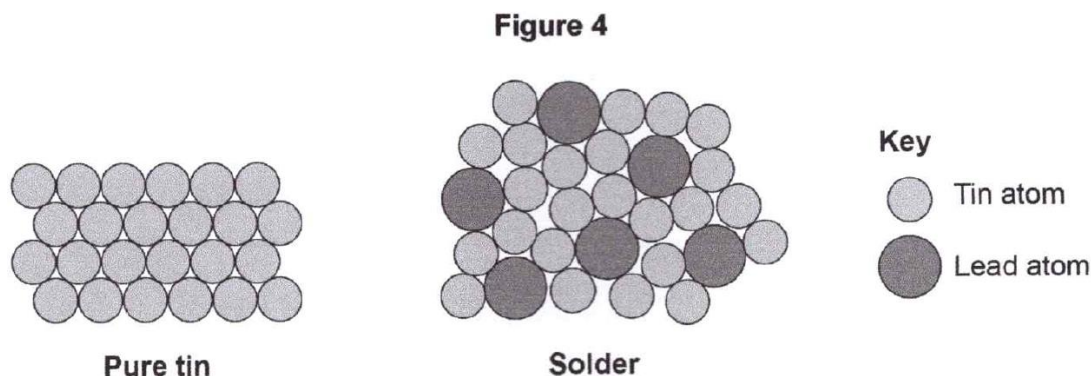
1. No.4

0 4

This question is about alloys.

Solders are alloys of tin and lead.

Different solders have different percentages of tin and lead.

Figure 4 shows the arrangement of atoms in pure tin and in a solder.

0 4 . 1

The solder in **Figure 4** has 6 lead atoms for every 24 tin atoms.Determine the percentage of atoms that are lead atoms in the solder in **Figure 4**.**[3 marks]**

(i) Calculate total number of atoms in the solder. $6 + 24 = 30$	$6/30 = 0.2$
(ii) Fraction of lead atoms in the solder.	(iii) Convert fraction to percentage. 0.2×100 $= 20\%$

Percentage of lead atoms = 20 %

0 4 . 2

Explain why solder is harder than pure tin.

Complete the sentences.

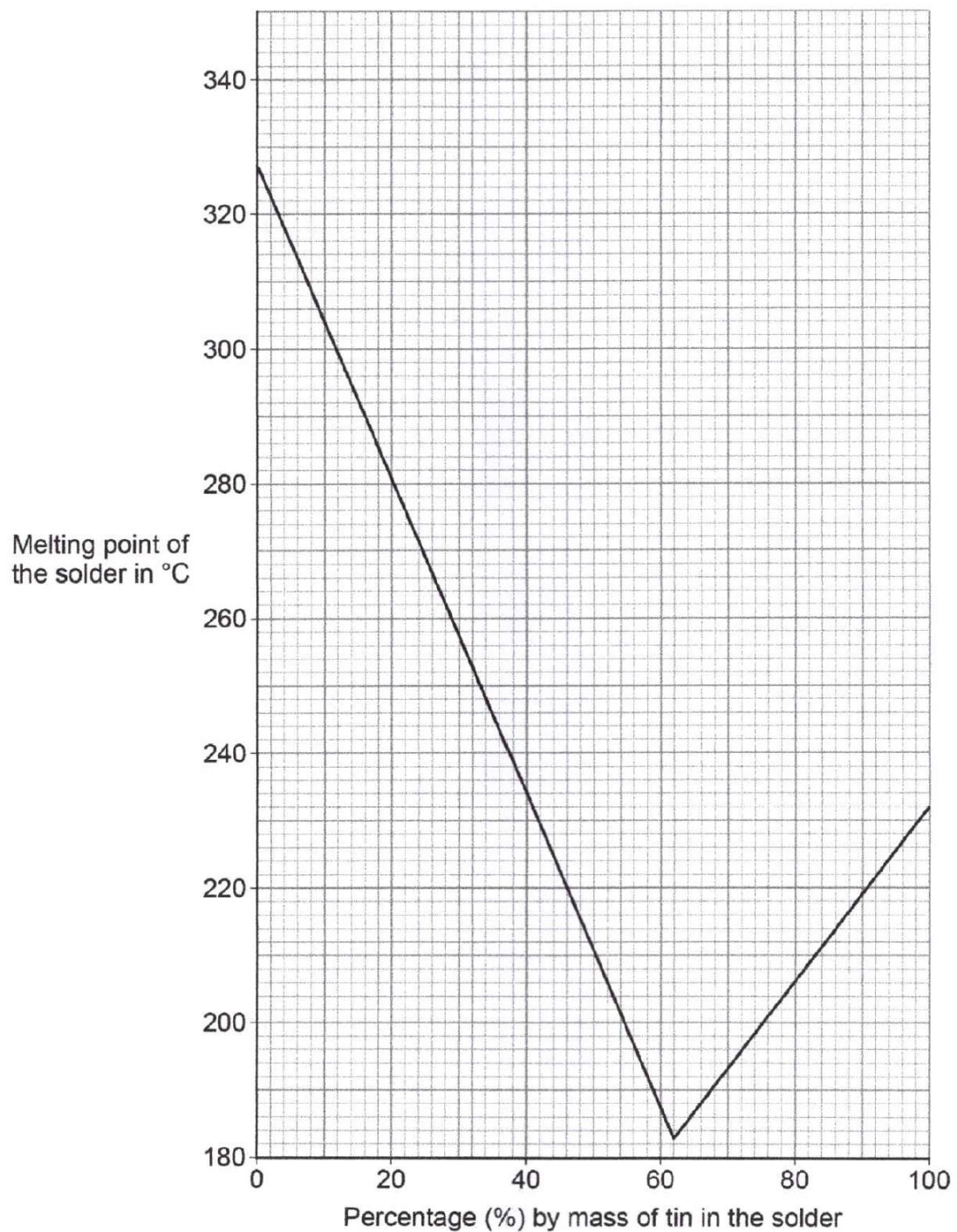
Use **Figure 4**.**[2 marks]**

In solder the layers are distorted.

This is because the atoms of tin and lead have different Size.Therefore the layers cannot easily slide past each other.

Figure 5 shows how the melting point of the solder changes with the percentage by mass of tin in the solder.

Figure 5



0 4 . 3

Describe what happens to the melting point of the solder as the percentage by mass of tin increases.

Use data from **Figure 5**.

[3 marks]

As the percentage by mass of tin increases, the melting point of solder decreases to 183°C the increases.

0 4 . 4

What is the melting point of pure tin?

Use **Figure 5**.

[1 mark]

Melting point of pure tin = 232°C $^{\circ}\text{C}$

0 4 . 5

What happens to the atoms in pure tin as the tin melts?

[1 mark]

Tick (✓) **one** box.

The atoms gain energy and their arrangement becomes less ordered.

☒

The atoms gain energy and their arrangement becomes more ordered.

☐

The atoms lose energy and their arrangement becomes less ordered.

☐

The atoms lose energy and their arrangement becomes more ordered.

☐

During melting atoms in a solid gain energy and start to vibrate. Increased vibration disrupts ordered arrangement of atoms in solid state, leading to less ordered arrangement in the liquid state.

2. No.6

0 6

This question is about metals.

0 6

. 1

Platinum is used to make jewellery.

Suggest **one** reason why platinum is used to make jewellery.

[1 mark]

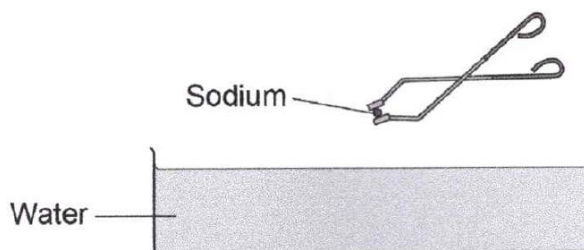
It is unreactive; It has a high resistance to corrosion and tarnish. It maintains its shine and luster overtime.

0 6

. 2

Figure 7 shows a piece of sodium being added to water.

Figure 7

Give **two** observations that could be seen when sodium is added to water.

[2 marks]

- 1 Sodium moves rapidly across the surface of water.
- 2 Sodium reacts vigorously, producing hydrogen gas which is observed as bubbles of a gas.

0 6 . 3

Copper is a transition element.

Sodium is a Group 1 element.

What are **two** differences between copper and sodium?**[2 marks]**Tick (✓) **two** boxes.

Copper has a lower melting point.

☐

Copper is harder.

☒

Copper is less dense.

☐

Copper is less reactive.

☒

Copper is less strong.

☐

Copper is a transition element while sodium is a group 1 element.

As a result, they have different electron configurations and properties.

- Transition metals are generally harder and denser than group 1 elements
- They are less reactive than group 1 elements

0 6 . 4

The metals aluminium and copper can be used to make pans for cooking.

Table 2 shows information about the two metals.

The higher the value for thermal conductivity, the better the metal conducts thermal energy.

Table 2

	Aluminium	Copper
Thermal conductivity in arbitrary units	250	400
Density in g/cm ³	2.7	8.9
Cost of metal per kg in £	1.50	7.00

Evaluate the use of pans made of aluminium and of copper.

Use Table 2.

[4 marks]

- Thermal conductivity is a measure of how well heat is transferred through a metal. A higher one means the pan will heat up quickly and distribute heat evenly which is desired in cooking to prevent hot spots. Therefore copper is a better conductor than aluminium.
- Density affects the weight of the pan. A higher density means the pan will be more difficult to handle especially when full of food. Copper has a higher density so the pan is heavier than aluminium.
- Cost: Economical considerations are important when choosing cookware materials. Higher cost can make a metal less desirable for someone purchasing cookware on a budget. Copper costs more per kilogram therefore, the pan is more expensive to buy than aluminium.

3. No.6

0 6

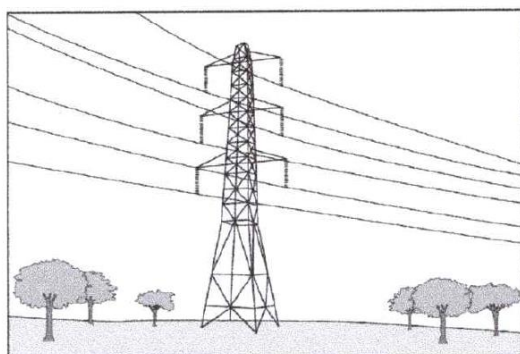
This question is about uses of metals in electrical wires.

Electrical wires can be made from:

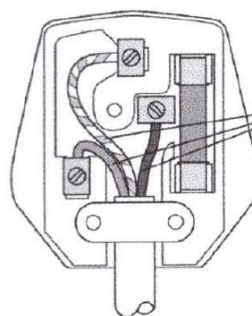
- aluminium
- copper
- silver.

Figure 6 shows three uses of electrical wires.

Figure 6

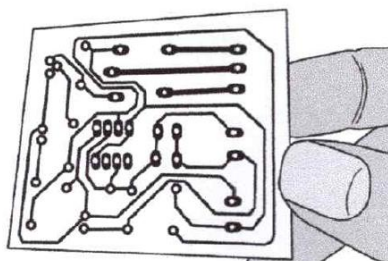


Overhead power cables



Electrical wires

Wiring in homes



Printed circuit boards

Table 5 shows information about the metals.

The higher the value for electrical conductivity, the better the metal is at conducting electricity.

Table 5

	Aluminium	Copper	Silver
Electrical conductivity in arbitrary units	37.7	59.6	63.0
Density in g/cm ³	2.7	9.0	10.5
Cost of metal per kg in £	1.50	7.00	640.00

0 6 . 1

Evaluate the use of aluminium, copper and silver for the types of electrical wires shown in **Figure 6**.

Use **Table 5**.

[4 marks]

Aluminium is a lightweight and inexpensive metal, making it suitable for overhead power lines where weight is a significant factor.

Copper is a better conductor than aluminium and less expensive than silver making it a common choice for domestic wiring. Silver possesses the highest conductivity of three metals but its high cost limits its use to specialized applications where maximum conductivity is critical such as high-frequency circuits or specialized electronics.

0 6 . 2

Describe how metals conduct electricity.

[3 marks]

Due to presence of free-moving electrons within their structure. In metallic bonding, atoms release some of their electrons, which become delocalised and can move freely throughout metal lattice. When voltage is applied across a metal, these free electrons are able to move towards the positive electrode, creating an electric current.

06.3

Electrical wires are usually made of pure metals and **not** alloys. This is because pure metals are better electrical conductors.

Suggest why alloys do **not** conduct electricity as well as pure metals.

Answer in terms of structure and bonding.

[2 marks]

Alloys have a disrupted atomic structure and complex bonding which increases resistance to movement of electrons, reducing conductivity compared to pure metals.