

# GCSE Chemistry

## Worksheet: Properties of metals and alloys

|                       |                          |                              |                                   |
|-----------------------|--------------------------|------------------------------|-----------------------------------|
| TIME<br><b>30 min</b> | TOTAL<br><b>30 marks</b> | CALCULATOR<br><b>Allowed</b> | DIFFICULTY<br><b>Easy, Medium</b> |
|-----------------------|--------------------------|------------------------------|-----------------------------------|

**Topics:** Properties of metals and alloys

|                   |                    |                   |
|-------------------|--------------------|-------------------|
| <b>NAME</b> _____ | <b>CLASS</b> _____ | <b>DATE</b> _____ |
|-------------------|--------------------|-------------------|

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Metals and alloys are used for many purposes.

0 1 . 1

Complete the sentence.

Tick (✓) **one** box.

In pure metals, the atoms are arranged in .....

layers

☐

pairs

☐

a random mixture

☐

small molecules

☐

[1 mark]

0 1 . 2

What is an alloy?

.....

.....

[1 mark]

0 1 . 3

Why are alloys used instead of pure metals for many purposes?

Tick (✓) **one** box.

Alloys are harder.

☐

Alloys are softer.

☐

Alloys are always cheaper.

☐

Alloys conduct electricity better.

☐

[1 mark]

0 1 . 4

Most metals have high melting points.

Explain why.

.....

.....

.....

.....

[2 marks]

0 2

Alloys are mixtures of a metal with one or more other elements.

0 2 . 1

Why are alloys usually harder than pure metals?

Tick (✓) **one** box.

Different-sized atoms distort the layers, so the layers cannot slide as easily

☐

Alloys contain ionic bonds instead of metallic bonds

☐

Alloys have fewer delocalised electrons

☐

Alloys always have lower melting points

☐

[1 mark]

0 3

Solder is an alloy used to join electrical components. One type of solder contains 63% tin and 37% lead by mass.

Table 1 shows the melting points of tin, lead and this solder.

**Table 1**

| Substance                  | Melting point in °C |
|----------------------------|---------------------|
| Tin                        | 232                 |
| Lead                       | 327                 |
| Solder (63% tin, 37% lead) | 183                 |

0 3 . 1

Calculate the mass of tin and the mass of lead in 250 g of this solder.

.....

.....

.....

.....

**[2 marks]**

0 3 . 2

A student claimed:

‘Mixing metals to make an alloy always increases the melting point.’

Use Table 1 to evaluate this claim.

.....

.....

.....

.....

**[2 marks]**

0 3 . 3

Suggest why a low melting point is an advantage for solder.

.....

.....

**[1 mark]**

0 3 . 4

Solder is harder than pure tin.  
Explain why.

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[2 marks]

0 4

A technician has a sample of a pure metal and a sample of an alloy of the same metal, and wants to compare their hardness.

0 4 . 1

Describe a simple test the technician could use to compare the hardness of the two samples.

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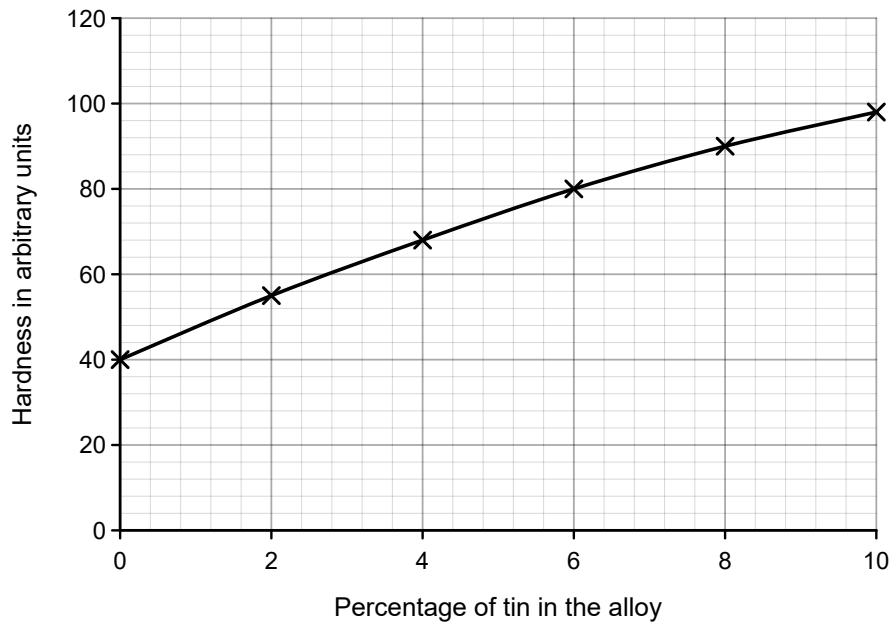
[2 marks]

0 5

Bronze is an alloy of copper and tin. A student measured the hardness of samples of bronze containing different percentages of tin.

Figure 1 shows the results.

**Figure 1**



0 5 . 1

Describe how the hardness changes as the percentage of tin increases.

.....

.....

.....

.....

**[2 marks]**

0 5 . 2

Use Figure 1 to find the percentage of tin needed to make bronze with a hardness of 75 units.

.....

.....

.....

Percentage of tin = ..... %

**[1 mark]**

0 5 . 3

Explain why adding tin makes copper harder.

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[3 marks]

0 6

Pure metals and alloys both have metallic bonding, but they often have different properties.

0 6 . 1

Describe, in terms of the arrangement of atoms, why pure metals are usually softer than alloys of the same metal.

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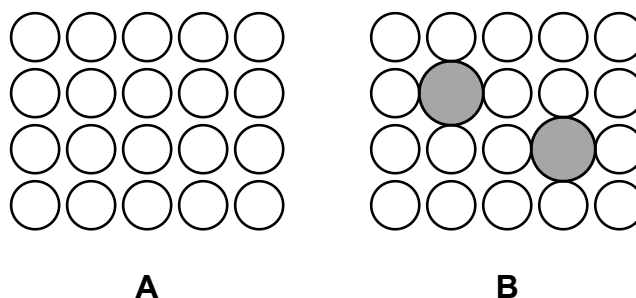
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[4 marks]

0 7

Figure 2 shows the arrangement of atoms in a pure metal and in an alloy.

**Figure 2**



0 7 . 1

Which diagram, **A** or **B**, shows the alloy?  
Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Explain why a pure metal can be bent and shaped.

.....

.....

[1 mark]

0 7 . 3

Explain why the alloy is harder than the pure metal.

.....

.....

.....

.....

[2 marks]

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**END OF QUESTIONS**

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

# Mark scheme

## GCSE Chemistry · Worksheet: Properties of metals and alloys · 30 marks

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### Question 1 (5 marks)

01.1 [1 mark]

**Correct:** layers

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01.2 [1 mark]

**Answer:** A mixture of a metal with at least one other element (usually another metal).

- a mixture of a metal with (at least) one other element / other metals (1)
- 

01.3 [1 mark]

**Correct:** Alloys are harder.

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01.4 [2 marks]

**Answer:** Metals have giant structures with strong metallic bonding, which needs a lot of energy to overcome.

- giant structure with strong metallic bonding / strong attraction between positive ions and delocalised electrons (1)
  - a lot of energy is needed to overcome the metallic bonding (1)
- 
- 

### Question 2 (1 mark)

02.1 [1 mark]

**Correct:** Different-sized atoms distort the layers, so the layers cannot slide as easily

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### Question 3 (7 marks)

#### 03.1 [2 marks]

**Answer:** tin 157.5 g; lead 92.5 g

- tin:  $250 \times 0.63 = 157.5$  (g) (1)
  - lead:  $250 - 157.5 = 92.5$  (g) (1)
- 

#### 03.2 [2 marks]

**Answer:** The solder melts at 183 °C, lower than both tin (232 °C) and lead (327 °C), so the claim is not true for this alloy.

- the solder melts at a lower temperature (183 °C) than both tin (232 °C) and lead (327 °C) (1)
  - so the claim is wrong / not always true (1)
- 

#### 03.3 [1 mark]

**Answer:** It can be melted without damaging the electrical components.

- it can be melted without damaging the components / less energy is needed to melt it (1)
- 

#### 03.4 [2 marks]

**Answer:** The lead atoms are a different size from tin atoms and distort the layers, so the layers cannot slide over each other easily.

- lead atoms are a different size from tin atoms and distort the layers (1)
  - so the layers cannot slide over each other easily (1)
- 

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### Question 4 (2 marks)

#### 04.1 [2 marks]

**Answer:** Try to scratch each sample with the same hard object, using the same force, and compare the scratches; the sample that is scratched less easily is harder.

- try to scratch each sample with the same object (e.g. a steel nail), using the same force (1)
- compare the depth / visibility of the scratches: the sample that is scratched less is the harder one (1)

**Notes:** Allow: drop the same mass from the same height onto each sample and compare the size of the dents.

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## Question 5 (6 marks)

### 05.1 [2 marks]

**Answer:** The hardness increases, but the increase gets smaller at higher percentages of tin.

- hardness increases (as the percentage of tin increases) (1)
- the rate of increase gets smaller / the curve levels off at higher percentages (1)

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### 05.2 [1 mark]

**Answer:** 5.1% (allow 5.0–5.3%)

- any value from 5.0 to 5.3 (%) (1)

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### 05.3 [3 marks]

**Answer:** Tin atoms are a different size from copper atoms, so they distort the layers and the layers cannot slide over each other as easily.

- tin atoms are a different size from copper atoms (1)
- (so) the layers of atoms are distorted (1)
- (so) the layers cannot slide over each other as easily (1)

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## Question 6 (4 marks)

### 06.1 [4 marks]

**Answer:** In a pure metal all the atoms are the same size and arranged in regular layers that slide over each other easily; in an alloy, atoms of a different size distort the layers so they cannot slide as easily.

### Levels of response

- **Level 2 (3–4)** A clear, logically linked answer covering the key points accurately.
- **Level 1 (1–2)** One or two relevant points with little linking.
- **No marks (0)** Nothing relevant or worthy of credit.

### Indicative content

- in a pure metal, all the atoms are the same size and arranged in regular layers
  - these layers can slide over each other easily, so the pure metal is soft and easily shaped
  - in an alloy, atoms of a different size are mixed in, which distorts the regular layers
  - the distorted layers cannot slide over each other as easily, so the alloy is harder
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## Question 7 (5 marks)

### 07.1 [2 marks]

**Answer:** B, because it contains atoms of different sizes.

- B (1)
  - it contains atoms of different sizes (1)
- 

### 07.2 [1 mark]

**Answer:** The layers of atoms can slide over each other.

- the layers of atoms can slide over each other (1)
- 

### 07.3 [2 marks]

**Answer:** The different-sized atoms distort the layers, so the layers cannot slide over each other as easily.

- the different-sized atoms distort the layers (1)
  - so it is more difficult for the layers to slide over each other (1)
-