

# GCSE Combined Science: Trilogy

## Worksheet: Properties of ionic compounds

|                       |                          |                              |                                   |
|-----------------------|--------------------------|------------------------------|-----------------------------------|
| TIME<br><b>30 min</b> | TOTAL<br><b>28 marks</b> | CALCULATOR<br><b>Allowed</b> | DIFFICULTY<br><b>Easy, Medium</b> |
|-----------------------|--------------------------|------------------------------|-----------------------------------|

**Topics:** Properties of ionic compounds

|             |              |             |
|-------------|--------------|-------------|
| <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

Ionic compounds have typical properties that result from their structure and bonding.

0 1 . 1

Which property is typical of ionic compounds?

Tick (✓) **one** box.

Low melting point

☐

Conducts electricity only when solid

☐

High melting point

☐

Never dissolves in water

☐

[1 mark]

0 2

Sodium chloride is an ionic compound.

0 2 . 1

Why does sodium chloride have a high melting point?

Tick (✓) **one** box.

Large amounts of energy are needed to break the many strong bonds.

☐

Its molecules are very large.

☐

The intermolecular forces are weak.

☐

The ions are free to move.

☐

[1 mark]

0 2 . 2

When does sodium chloride conduct electricity?

Tick (✓) **two** boxes.

When it is solid

☐

When it is molten

☐

When it is dissolved in water

☐

Never

☐

[2 marks]

0 2 . 3

Explain why solid sodium chloride does not conduct electricity.

.....

.....

[1 mark]

0 3

Table 1 gives information about four substances, **A**, **B**, **C** and **D**.

Table 1

| Substance | Melting point in °C | Conducts as a solid? | Conducts when molten? |
|-----------|---------------------|----------------------|-----------------------|
| A         | 1710                | no                   | no                    |
| B         | 770                 | no                   | yes                   |
| C         | 1085                | yes                  | yes                   |
| D         | −95                 | no                   | no                    |

0 3 . 1

Identify the substance that is an ionic compound. Give **two** reasons for your answer.

.....

.....

.....

.....

.....

.....

[3 marks]

0 3 . 2

Suggest the type of structure of substance D.

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[1 mark]

0 4

A technician has an unlabelled white solid and needs to find out whether it is an ionic compound.

0 4 . 1

Describe a test the technician could carry out, and the results that would show the solid is ionic.

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[3 marks]

0 5

Lithium fluoride, LiF, melts at 845 °C. Potassium bromide, KBr, melts at 734 °C. Both compounds contain ions with charges of 1+ and 1–, but the ions in lithium fluoride are closer together.

0 5 . 1

Use the information to explain why lithium fluoride has a higher melting point than potassium bromide.

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[2 marks]

0 6

A student tested whether four substances conduct electricity when solid, and when mixed with water.

Table 2 shows the results.

Table 2

| Substance        | Conducts when solid? | Conducts when mixed with water? |
|------------------|----------------------|---------------------------------|
| Sodium chloride  | no                   | yes                             |
| Glucose          | no                   | no                              |
| Copper           | yes                  | does not dissolve               |
| Potassium iodide | no                   | yes                             |

0 6 . 1

Which **two** substances are ionic compounds?

Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain why solid potassium iodide does not conduct electricity.

.....

.....

[1 mark]

0 6 . 3

Explain why potassium iodide solution conducts electricity.

.....

.....

[1 mark]

0 6 . 4

Explain why glucose solution does not conduct electricity.

.....

.....

[1 mark]

0 6 . 5

Solid copper conducts electricity.

Explain why this does not show that copper is an ionic compound.

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[1 mark]

0 7

A student says:

‘Solid potassium bromide does not conduct electricity, so it cannot be an ionic compound.’

0 7 . 1

Evaluate the student’s statement.

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[2 marks]

0 8

Magnesium oxide melts at 2852 °C. Sodium chloride melts at 801 °C.

0 8 . 1

Explain why magnesium oxide has a high melting point.

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[3 marks]

0 8 . 2

Suggest why magnesium oxide has a higher melting point than sodium chloride.

.....

.....

.....

.....

[2 marks]

0 8 . 3

Magnesium oxide is used to line the inside of furnaces.  
Suggest why.

.....

.....

[1 mark]

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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 Combined Science: Trilogy · Worksheet: Properties of ionic compounds · 28 marks

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### Question 1 (1 mark)

01.1 [1 mark]

**Correct:** High melting point

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### Question 2 (4 marks)

02.1 [1 mark]

**Correct:** Large amounts of energy are needed to break the many strong bonds.

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02.2 [2 marks]

**Correct:** When it is molten; When it is dissolved in water

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02.3 [1 mark]

**Answer:** The ions are held in fixed positions, so they cannot move to carry charge.

- the ions are in fixed positions / cannot move (to carry charge) (1)

**Notes:** Do not accept references to electrons.

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### Question 3 (4 marks)

03.1 [3 marks]

**Answer:** B: it has a high melting point, and it conducts when molten but not when solid.

- B (1)
  - high melting point (1)
  - does not conduct when solid but conducts when molten (ions free to move only when molten) (1)
- 

03.2 [1 mark]

**Answer:** small molecules

- small molecules / simple molecular (1)
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## Question 4 (3 marks)

### 04.1 [3 marks]

**Answer:** Test the solid for electrical conductivity using electrodes connected to a power supply and a bulb; then dissolve it in water (or melt it) and test again. If it does not conduct as a solid but conducts when dissolved or molten, it is ionic.

- use electrodes connected to a power supply and a bulb / ammeter to test electrical conductivity (1)
  - test the solid, then test it again after dissolving it in water (or melting it) (1)
  - ionic: it does not conduct as a solid, but conducts when dissolved or molten (because the ions are then free to move) (1)
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## Question 5 (2 marks)

### 05.1 [2 marks]

**Answer:** Because the ions are closer together, the electrostatic forces between the ions in lithium fluoride are stronger, so more energy is needed to overcome them.

- the electrostatic forces of attraction between the ions are stronger in lithium fluoride (because the ions are closer together) (1)
  - so more energy is needed to overcome the forces / to melt lithium fluoride (1)
-

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## Question 6 (6 marks)

### 06.1 [2 marks]

**Answer:** Sodium chloride and potassium iodide; they conduct when dissolved in water but not when solid.

- sodium chloride and potassium iodide (1)
- (they) conduct when dissolved but not when solid (1)

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### 06.2 [1 mark]

**Answer:** The ions are held in fixed positions and cannot move.

- the ions are in fixed positions / cannot move (1)

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### 06.3 [1 mark]

**Answer:** The ions are free to move and carry charge.

- the ions are free to move (and carry charge) (1)

**Notes:** Do not accept electrons.

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### 06.4 [1 mark]

**Answer:** Glucose is made of molecules with no overall charge, so there are no ions.

- glucose is made of molecules with no overall charge / contains no ions (1)

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### 06.5 [1 mark]

**Answer:** Copper is a metal: it conducts because of its delocalised electrons, not moving ions.

- copper is a metal / element and conducts because of delocalised electrons (not ions) (1)

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## Question 7 (2 marks)

### 07.1 [2 marks]

**Answer:** The student is wrong: potassium bromide is ionic, but in the solid its ions are held in fixed positions and cannot move to carry charge. It conducts when molten or dissolved, when the ions are free to move.

- the student is wrong: potassium bromide is an ionic compound (1)
- in the solid the ions are in fixed positions and cannot move to carry charge; it conducts when molten or dissolved (when the ions are free to move) (1)

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## Question 8 (6 marks)

### 08.1 [3 marks]

**Answer:** It is a giant ionic lattice with strong electrostatic forces between oppositely charged ions; lots of energy is needed to overcome them.

- giant (ionic) lattice / structure (1)
- strong electrostatic forces of attraction between oppositely charged ions (1)
- a lot of energy is needed to overcome the forces / break the bonds (1)

**Notes:** Do not accept references to intermolecular forces or covalent bonds.

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### 08.2 [2 marks]

**Answer:**  $\text{Mg}^{2+}$  and  $\text{O}^{2-}$  ions have larger charges than  $\text{Na}^{+}$  and  $\text{Cl}^{-}$  ions, so the electrostatic attraction is stronger.

- the ions in magnesium oxide have larger charges ( $2+$  and  $2-$ ) than those in sodium chloride ( $1+$  and  $1-$ ) (1)
  - so the electrostatic attraction between the ions is stronger (1)
- 

### 08.3 [1 mark]

**Answer:** It has a very high melting point, so it does not melt at furnace temperatures.

- (very) high melting point / does not melt at high temperatures (1)
-