

GCSE Combined Science: Trilogy

Worksheet: Ionic compounds

TIME 25 min	TOTAL 22 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Ionic compounds

NAME	CLASS	DATE
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- 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 giant structures of ions.

0 1 . 1

In which directions do the electrostatic forces act in a giant ionic lattice?

Tick (✓) **one** box.

Only between neighbouring pairs of ions

☐

In all directions throughout the structure

☐

Only along one direction in the lattice

☐

Only at the surface of the lattice

☐

[1 mark]

0 2

This question is about ionic compounds.

0 2 . 1

Which of these substances is an ionic compound?

Tick (✓) **one** box.

Carbon dioxide

☐

Copper

☐

Magnesium oxide

☐

Methane

☐

[1 mark]

0 2 . 2

What holds the particles together in an ionic compound?

Tick (✓) **one** box.

Weak forces between molecules

☐

Shared pairs of electrons

☐

Strong electrostatic forces between oppositely charged ions

☐

Delocalised electrons

☐

[1 mark]

0 2 . 3

In which directions do these forces act?

.....

.....

[1 mark]

0 2 . 4

What name is given to the regular arrangement of ions in an ionic compound?

.....

.....

.....

.....

[1 mark]

0 3

Table 1 shows the formulae of some ions.

Table 1

Positive ions	Negative ions
Na^+	Cl^-
Mg^{2+}	O^{2-}
Al^{3+}	OH^-
Ca^{2+}	SO_4^{2-}
Fe^{3+}	NO_3^-

0 3 . 1

Give the formula of magnesium chloride.

.....

.....

[1 mark]

0 3 . 2

Give the formula of aluminium oxide.

.....

.....

[1 mark]

0 3 . 3

Give the formula of sodium sulfate.

.....

.....

[1 mark]

0 3 . 4

Give the formula of calcium hydroxide.

.....

.....

[1 mark]

0 3 . 5

Give the formula of iron(III) nitrate.

.....

.....

[1 mark]

0 4

Table 2 shows the formulae of some ions.

Table 2

Positive ions	Negative ions
NH_4^+	CO_3^{2-}
Zn^{2+}	PO_4^{3-}
Fe^{3+}	OH^-

0 4 . 1

Give the formula of ammonium carbonate.

.....

.....

[1 mark]

0 4 . 2

Give the formula of zinc phosphate.

.....

.....

[1 mark]

0 4 . 3

Give the formula of iron(III) hydroxide.

.....

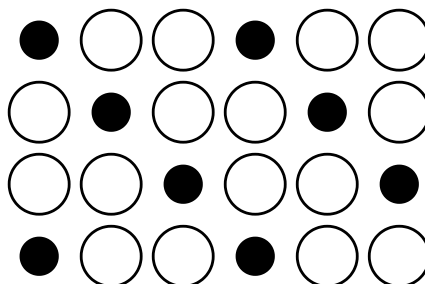
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[1 mark]

0 5

Figure 1 is a two-dimensional model of part of the structure of calcium fluoride.
The small filled circles represent calcium ions. The large open circles represent fluoride ions.

Figure 1



0 5 . 1

Use Figure 1 to work out the ratio of calcium ions to fluoride ions.

.....

.....

[1 mark]

0 5 . 2

Give the empirical formula of calcium fluoride.

.....

.....

[1 mark]

0 5 . 3

Explain why the calcium ions and fluoride ions must be in the ratio you found.

.....

.....

.....

.....

[2 marks]

0 5 . 4

Give **one** limitation of using a two-dimensional model such as Figure 1 to represent an ionic compound.

.....

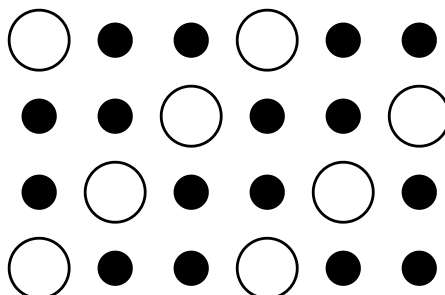
.....

[1 mark]

0 6

Figure 2 is a two-dimensional model of part of the structure of lithium oxide. The small filled circles represent lithium ions. The large open circles represent oxide ions.

Figure 2



0 6 . 1

Use Figure 2 to give the empirical formula of lithium oxide.

.....

.....

.....

[1 mark]

0 6 . 2

Lithium ions are Li^+ and oxide ions are O^{2-} .

Explain why the ions must be in the ratio shown by Figure 2.

.....

.....

.....

.....

[2 marks]

0 6 . 3

Give **one** limitation of using a two-dimensional model such as Figure 2 to represent lithium oxide.

.....

.....

[1 mark]

END OF QUESTIONS

Mark scheme

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Question 1 (1 mark)

01.1 [1 mark]

Correct: In all directions throughout the structure

Question 2 (4 marks)

02.1 [1 mark]

Correct: Magnesium oxide

02.2 [1 mark]

Correct: Strong electrostatic forces between oppositely charged ions

02.3 [1 mark]

Answer: in all directions

- in all directions (1)
-

02.4 [1 mark]

Answer: a (giant ionic) lattice

- (giant ionic) lattice (1)
-

Question 3 (5 marks)

03.1 [1 mark]

Answer: MgCl_2

- MgCl_2 (1)
-

03.2 [1 mark]

Answer: Al_2O_3

- Al_2O_3 (1)
-

03.3 [1 mark]

Answer: Na_2SO_4

- Na_2SO_4 (1)
-

03.4 [1 mark]

Answer: $\text{Ca}(\text{OH})_2$

- $\text{Ca}(\text{OH})_2$ (1)

Notes: Brackets are required.

03.5 [1 mark]

Answer: $\text{Fe}(\text{NO}_3)_3$

- $\text{Fe}(\text{NO}_3)_3$ (1)

Notes: Brackets are required.

Question 4 (3 marks)

04.1 [1 mark]

Answer: $(\text{NH}_4)_2\text{CO}_3$

- $(\text{NH}_4)_2\text{CO}_3$ (1)

Notes: Brackets are required.

04.2 [1 mark]

Answer: $\text{Zn}_3(\text{PO}_4)_2$

- $\text{Zn}_3(\text{PO}_4)_2$ (1)

Notes: Brackets are required.

04.3 [1 mark]

Answer: $\text{Fe}(\text{OH})_3$

- $\text{Fe}(\text{OH})_3$ (1)

Notes: Brackets are required.

Question 5 (5 marks)

05.1 [1 mark]

Answer: 1 : 2 (8 calcium ions : 16 fluoride ions)

- 1 : 2 (1)

Notes: Allow 8 : 16.

05.2 [1 mark]

Answer: CaF_2

- CaF_2 (1)
-

05.3 [2 marks]

Answer: Calcium ions are Ca^{2+} and fluoride ions are F^- , so two F^- ions are needed to balance the charge on one Ca^{2+} ion and the compound has no overall charge.

- calcium ions have a 2+ charge and fluoride ions have a 1– charge (1)
 - so two fluoride ions balance the charge on one calcium ion / the compound has no overall charge (1)
-

05.4 [1 mark]

Answer: It does not show the three-dimensional arrangement of the ions.

- does not show the 3D arrangement of ions / only shows a small part of the giant lattice / does not show the forces between the ions (1)
-

Question 6 (4 marks)

06.1 [1 mark]

Answer: Li_2O

- Li_2O (16 lithium ions : 8 oxide ions = 2 : 1) (1)

06.2 [2 marks]

Answer: Two Li^+ ions (total 2+) are needed to balance the charge of one O^{2-} ion, so the compound has no overall charge.

- the compound must have no overall charge (1)
- two Li^+ ions ($2 \times 1+$) balance one O^{2-} ion (2-) (1)

06.3 [1 mark]

Answer: It does not show the three-dimensional arrangement of the ions.

- it does not show the 3D arrangement of the ions / only shows one layer (1)

Notes: Allow: does not show the forces between the ions; the ions are not shown to scale; only part of the lattice is shown.
