

IB Chemistry HL - S2.1

The ionic model

Exercises + Practice questions

Official answers appended at the end

Exercise

- Q1.** Which is the best description of ionic bonding?
- A** The electrostatic attraction between positive ions and non-bonding electrons
 - B** The electrostatic attraction between positive ions and bonding electrons
 - C** The electrostatic attraction between positively charged nuclei and an electron pair
 - D** The electrostatic attraction between oppositely charged ions
- Q2.** What is the formula for the compound formed by aluminium and sulfur?
- A** AlS **B** AlS_2 **C** AlS_3 **D** Al_2S_3
- Q3.** What happens when lithium reacts with bromine?
- A** lithium atoms gain one electron bromine atoms gain one electron
 - B** lithium atoms gain one electron bromine atoms lose one electron
 - C** lithium atoms lose one electron bromine atoms gain one electron
 - D** lithium atoms lose one electron bromine atoms lose one electron
- Q4.** Which of the following are ionic compounds?
- I. NH_4Cl II. NH_4NO_3 III. HCl
- A** I and II only **B** I and III only **C** II and III only **D** I, II and III

Q5. Write the formula for each of the following compounds:

- (a) potassium bromide (b) zinc oxide (c) sodium sulfate
(d) copper(II) bromide (e) chromium(III) sulfate (f) aluminium hydride

Q6. Name the following compounds:

- (a) $\text{Sn}_3(\text{PO}_4)_2$ (b) $\text{Ti}(\text{SO}_4)_2$ (c) $\text{Mn}(\text{HCO}_3)_2$ (d) BaSO_4
(e) Hg_2S (f) V_2O_3 (g) Cr_2O_3 (h) PbO_2

Q7. What is the formula of the compound that forms from element X in group 2 and element Y in group 15?

Q8. Explain what happens to the electron configurations of the elements Mg and Br when they react to form the compound magnesium bromide.

Exercise

Q9. Describe the bonding in ammonium nitrate.

Q10. Which fluoride is the most ionic?

- A** NaF **B** CsF **C** MgF₂ **D** BaF₂

Q11. You are given two white solids and told that only one of them is an ionic compound. Describe three tests you could carry out to determine which is the ionic compound.

Q12. Element **E** is in group 1 of the periodic table and element **G** is in group 16. E and G are not the symbols for the elements.

(a) Deduce the formula of the compound formed between E and G.

- A** EG **B** EG₆ **C** EG₂ **D** E₂G

(b) Identify the nature of the bonding in the compound formed between E and G.

- A** ionic **B** covalent **C** dative covalent **D** metallic.

(c) Describe the electrical conductivity of the compound formed between E and G.

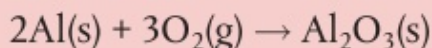
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| A conducts when solid and liquid | B conducts when solid but not when liquid |
| C conducts when liquid but not when solid | D does not conduct when solid or liquid |

Q13. **HL** Which one of the following compounds would be expected to have the highest lattice enthalpy?

- A** Na₂O **B** MgO **C** CaO **D** KCl

Practice questions

- Which element does not generally form ions during chemical reactions?
A aluminium **B** calcium **C** carbon **D** iodine
- Which statement is true for most ionic compounds?
 I. They contain metal and non-metal elements.
 II. They conduct electricity in the solid state.
 III. They have high melting and boiling points.
A I and II only **B** I and III only **C** II and III only **D** I, II and III
- Which electron transfer describes the reaction between aluminium and oxygen?



- A** Each Al atom loses two electrons. **B** Each Al atom loses three electrons.
C Each O atom loses two electrons. **D** Each O atom loses three electrons.
- Three substances, **X**, **Y** and **Z** have the physical properties shown.

Substance	X	Y	Z
Melting point / °C	747	1610	2614
Boiling point / °C	1390	2230	2850
Electrical conductivity of liquid state	high	poor	high

Identify X, Y and Z.

	X	Y	Z
A	CaO	NaBr	SiO ₂
B	CaO	SiO ₂	NaBr
C	NaBr	CaO	SiO ₂
D	NaBr	SiO ₂	CaO

5. What is the formula of barium phosphate?

- A Ba₃P₂ B Ba₃(PO₄)₂ C Ba₂P₃ D Ba₂(PO₄)₃

6. Which substance shows the most ionic character?

	Electrical conductivity in aqueous solution	Solubility in heptane	Volatility
A	low	low	high
B	low	high	low
C	high	low	low
D	high	low	high

7. What are the IUPAC names for CuBr and CuO?

- A copper bromide and copper oxide B copper(I) bromide and copper(I) oxide
C copper(II) bromide and copper(I) oxide D copper(I) bromide and copper(II) oxide

8. Which of the following substances show predominantly ionic character?

I. magnesium chloride II. iron(II) chloride III. silicon tetrachloride

- A I and II only B I and III only C II and III only D I, II and III

9. Explain why the melting point of magnesium oxide is higher than barium sulfide? (3)

(Total 3 marks)

10. Iron forms many compounds with oxygen.

(a) Describe the bonding in Fe₂O₃. (2)

(b) State the full electron configuration of the bonding species. (2)

(c) The compound Fe₂O₃ was previously known as ferric oxide.

State the IUPAC name for the compound. (1)

(d) Explain why iron(III) oxide can demonstrate brittleness. (2)

(e) Magnetite, Fe₃O₄, contains an additional ion of iron. Identify the ion. (1)

(Total 8 marks)