

Exercise walk-through

2.1

Particles, bonding and bulk properties

International Baccalaureate · IB Diploma · Chemistry · SL

2.1 Particles, bonding and bulk properties

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS ionic bond • delocalized electron

Objective

Particles, bonding and bulk properties. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

1 Key knowledge and worked examples

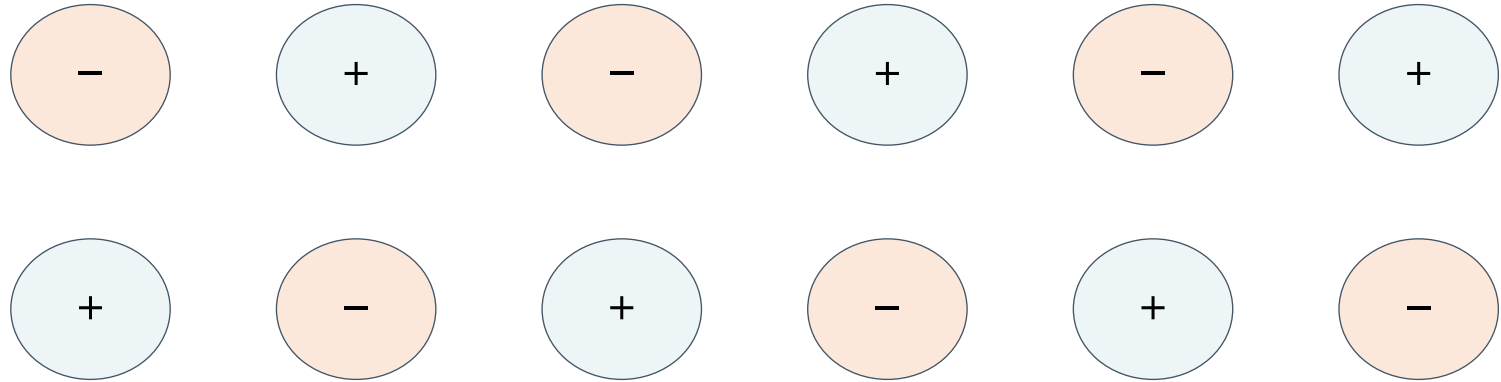
■ What would explain this observation?

- A salt crystal conducts when dissolved but not when solid. The ions exist in both states; their ability to move changes.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

■ Build the model

- **Ionic bonding** is electrostatic attraction between oppositely charged ions. A covalent bond involves shared electrons. Metallic bonding involves attraction between positive metal ions and **delocalized electrons**.

- ionic bond: Attraction between oppositely charged ions; delocalized electron: An electron not confined to one atom or bond.



Alternating charges in an ionic lattice

■ Choose evidence that can test it

- To explain a bulk property, name the structure, particles, forces and mobile charge carriers. Simple molecular substances can have strong covalent bonds inside molecules but weak attractions between molecules.
- Compare substances using evidence such as melting point, conductivity when solid and molten, and solubility. One property rarely proves a structure; use a pattern of evidence.

■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions

fit this case, then rearrange before substitution.

- Known: an element has atomic number 12 and mass number 24. Protons = 12; neutrons = mass number - atomic number = $24 - 12 = 12$. A $2+$ ion has electrons = $12 - 2 = 10$. Charge changes electron count, not the nucleus.

Example:

An atom has atomic number 17 and mass number 35. Find its number of neutrons. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

■ Check the conclusion and its limits

- Melting a simple molecular substance usually overcomes intermolecular attractions; it

does not require breaking all covalent bonds within each molecule.

- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Warn:

All covalent substances have low melting points. This claim is false: Melting a simple molecular substance usually overcomes intermolecular attractions; it does not require breaking all covalent bonds within each molecule.

Key:

Particles, bonding and bulk properties: To explain a bulk property, name the structure, particles, forces and mobile charge carriers. Simple molecular substances can have strong

covalent bonds inside molecules but weak attractions between molecules.

Exercises 2.1·2.3

2.1 Why does molten sodium chloride conduct? Choose one answer.

- **A** Its ions can move
- **B** Its atoms become electrons
- **C** Its molecules contain no charge

[1]

2.2 An atom has atomic number 17 and mass number 35. Find its number of neutrons. Show the relation, substitution and units.

[2]

2.3 Decide whether this claim is true and justify: All covalent substances have low melting points.

[2]

Exercises 2.1·2.3

2.1 Why does molten sodium chloride conduct? Choose one answer.

- **A** Its ions can move
- **B** Its atoms become electrons
- **C** Its molecules contain no charge

[1]

2.1 A To explain a bulk property, name the structure, particles, forces and mobile charge carriers. Simple molecular substances can have strong covalent bonds inside molecules but weak attractions between molecules.

2.2 An atom has atomic number 17 and mass number 35. Find its number of neutrons. Show the relation, substitution and units.

[2]

2.2 $\text{neutrons} = \text{mass number} - \text{atomic number} = 35 - 17 = 18$.

2.3 Decide whether this claim is true and justify: All covalent substances have low melting points.

[2]

2.3 False. Melting a simple molecular substance usually overcomes intermolecular attractions; it does not require breaking all covalent bonds within each molecule.

Exercises 2.4·3.1

2.4 Attraction between oppositely charged ions: write the technical term. [1]

3 Exam-style questions

3.1 An atom has $Z=12$, $A=25$ and forms a $2+$ ion. State protons, neutrons and electrons before/after ion formation. What changes in an isotope instead? [4]

Exercises 2.4·3.1

2.4 Attraction between oppositely charged ions: write the technical term. [1]

3 Exam-style questions

2.4 ionic bond. ionic bond means Attraction between oppositely charged ions.

3.1 An atom has $Z=12$, $A=25$ and forms a $2+$ ion. State protons, neutrons and electrons before/after ion formation. What changes in an isotope instead? [4]

3.1 12 protons, 13 neutrons; electrons 12 then 10. Ion formation changes electrons. An isotope has the same Z but a different neutron count; it need not have a different charge.