Exercise walk-through

2.1 Particles, bonding and bulk properties

International Baccalaureate · IB Diploma · Chemistry · SL

INTERNATIONAL BACCALAUREATE · IB DIPLOMA · CHEMISTRY · SL • EXERCISE SHEET

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. Original classroom practice for IB SL; not an official IB paper.

1 Key knowledge and worked examples

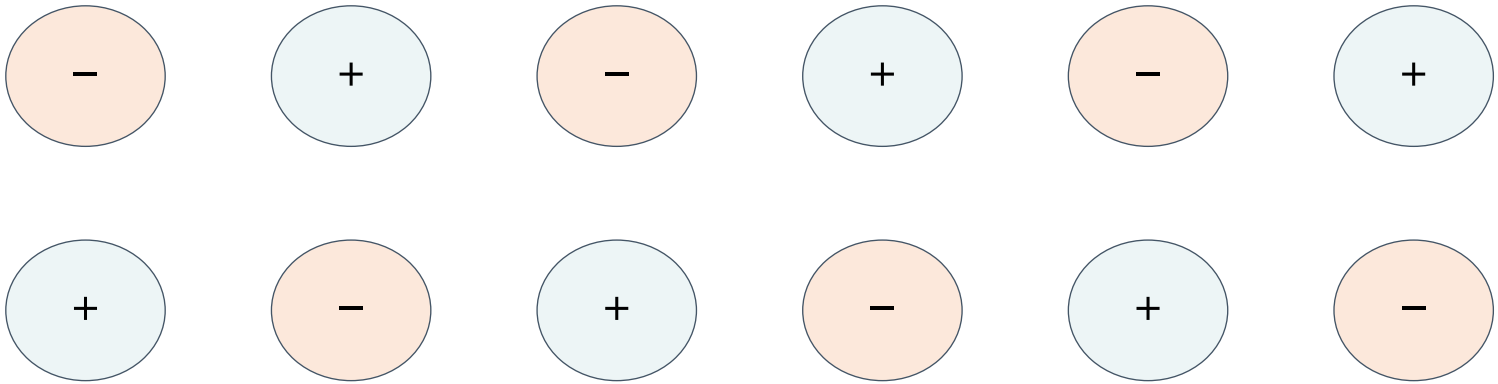
What would explain this observation?

- A salt crystal conducts when dissolved but not when solid. The ions exist in both states; their ability to move changes.

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.

In the lab: 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

- 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.

Your turn: An atom has atomic number 17 and mass number 35. Find its number of neutrons.

■ 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.

Not true: All covalent substances have low melting points. Giant covalent substances such as diamond and silicon dioxide have very high melting points because covalent bonds

must be broken throughout the structure. Low melting points belong to simple molecular substances, where only intermolecular attractions are overcome.

Key:

- Ionic bonding is electrostatic attraction between oppositely charged ions.
- To explain a bulk property, name the structure, particles, forces and mobile charge carriers.
- Watch for: melting a simple molecular substance usually overcomes intermolecular attractions; it does not require breaking all covalent bonds within each molecule.

■ Write from 20 neutrons

- An atom has atomic number 19 and mass number 39.
- Find the neutron count and the electron count in the 1+ ion. The charge does not

change the nucleus.

Exercises 2.1·2.2

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

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

Exercises 2.1·2.2

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

- **A** Its ions can move
- **B** Its molecules contain no charge
- **C** Its atoms become electrons [1]

2.1 A Sodium chloride is ionic; melting frees the ions from the lattice so they can move and carry charge. The solid does not conduct because its ions are fixed, and there are no neutral molecules or free atoms becoming electrons.

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 neutrons=mass number−atomic number=35−17=18.

Exercises 2.3·3.1

2.3 Decide whether this claim is true and justify: All covalent substances have low melting points. [2]

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

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 2.3·3.1

2.3 Decide whether this claim is true and justify: All covalent substances have low melting points. [2]

2.3 False. Giant covalent substances such as diamond and silicon dioxide have very high melting points because covalent bonds must be broken throughout the structure. Low melting points belong to simple molecular substances, where only intermolecular attractions are overcome.

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

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 12protons,13neutrons; electrons12 then10. Ion formation changes electrons. An isotope has the same$Z$ but a different neutron count; it need not have a different charge.