A4 · Ionic lattices and the properties they explain · Practice key

This is the worked key. Every practice question is worked step by step.

Worked examples

Read these first. There is one for each kind of question in this lesson.

Example 1 · Compare the melting points of two ionic compounds

Potassium chloride and potassium iodide are both ionic. A chloride ion is smaller than an iodide ion. Predict which has the higher melting point.

1. Write the ions of each compound, with charges: K^+ and Cl^-; K^+ and I^-.
2. Compare the charges: both have 1+ and 1−, so the charges are the same.
3. Compare the sizes: the chloride ion is smaller. Smaller ions sit closer and pull more strongly.
4. State which melts higher, and why: potassium chloride, because its ions are smaller.
5. Check: only one thing differs between the two compounds, the size.

Answer: Potassium chloride has the higher melting point.

Example 2 · Explain a property with the lattice

Explain why a solution of potassium chloride in water conducts electricity.

1. Water pulls the ions out of the lattice.
2. The ions spread through the water and are free to move.
3. Moving ions carry electricity.

Answer: The dissolved ions are free to move, so the solution conducts.

Practice

Questions 1 to 4 are easy. Questions 5 to 8 are medium. Questions 9 and 10 are harder.

EASY

1. What is a crystal lattice?

1. The ions of an ionic solid pack together in a repeating pattern.
2. The pattern is called a crystal lattice.

EASY

2. Name three properties of an ionic solid.

1. It is hard, and it is brittle.
2. It has a high melting point.

EASY

3. Crystals of potassium bromide are stirred into water and seem to vanish. Explain what happened to the ions.

1. The solid has dissolved.
2. Water pulled the ions out of the lattice.
3. The ions spread through the water. Every ion is still there.

EASY

4. In a crystal lattice, what surrounds each positive ion? Say what this means for the pull on each ion.

1. Each positive ion is surrounded by negative ions.
2. So every ion is pulled by all its neighbours, not by one partner.

MEDIUM

5. Explain why an ionic solid has a high melting point.

1. Melting means the ions break free of the pattern.
2. The pulls in the lattice are strong and act in every direction.
3. So melting takes a lot of energy.

MEDIUM

6. Solid sodium chloride does not conduct electricity. Melted sodium chloride does. Explain why.

1. In the solid, the ions are fixed in the lattice.
2. When it is melted, the ions are free to move.
3. Moving ions carry electricity.

MEDIUM

7. Sodium chloride and sodium bromide both have ions with charges 1+ and 1−. A chloride ion is smaller than a bromide ion. Predict which has the higher melting point. Explain.

1. The charges are the same, so compare the sizes.
2. Smaller ions sit closer together and pull more strongly.
3. So sodium chloride has the higher melting point.

MEDIUM

8. Sodium fluoride has the ions Na^+ and F^-. Magnesium oxide has the ions Mg^{2+} and O^{2-}. The ions are close in size. Predict which melts at the higher temperature. Explain.

1. The sizes are close, so compare the charges.
2. Magnesium oxide has bigger charges, 2+ and 2−.
3. Bigger charges pull much more strongly, so magnesium oxide melts higher.

HARDER

9. Calcium chloride is spread on icy roads. Name the property of ionic compounds that this use depends on. Then explain what happens to the ions.

1. It dissolves easily in water.
2. Water pulls the Ca^{2+} and Cl^- ions out of the lattice.
3. The ions spread through the water, each one separate.

HARDER

10. A solid is hard and shatters when hit. It has a high melting point. It conducts electricity only when melted or dissolved. Say what kind of compound it is. Then explain the last property.

1. These are the properties of an ionic solid.
2. In the solid, the ions are fixed in the lattice, so it does not conduct.
3. Melted or dissolved, the ions are free to move, so it conducts.