

## Ionic bonding: true or false?

This resource is from **Chemical misconceptions – prevention, diagnosis and cure**, which can be viewed at: [rsc.li/456d4ff](https://rsc.li/456d4ff). This series of resources includes classroom activities you can use to identify learner misconceptions; to challenge some of these alternative ideas; and to help learners construct the chemical concepts required by the curriculum.










### Resource components

The student sheet contains a diagram of sodium chloride, followed by twenty true or false statements for learners to consider. Download the student sheet at: [rsc.li/3JoVHe9](https://rsc.li/3JoVHe9)

### How to use this resource

Use the student sheet to identify and address any misconceptions about ionic bonding with your learners. Some learners see ionic bonding in sodium chloride as a molecular phenomenon, with discrete NaCl pairs which are internally ionically bonded but attracted to each other by weaker forces (read more about learners' misconceptions about chemical bonding at [rsc.li/3pgyO61](https://rsc.li/3pgyO61)).



When to use?				
	Introduce	Develop	Revise	Assess
Use with learners in the 14–16 age range who have studied chemical bonding.				
Group size?				
	Independent	Small group	Whole class	Homework
Suitable for independent work either in class or at home. Or use the questions for group or class discussions to diagnose learners' misconceptions.				
How long?			10–15 mins	

Emphasise to learners that the diagram shows just a small part of a slice through the lattice structure and that the real structure is three-dimensional.

Provide learners with a copy of the answers after they have completed the student sheet.

## Answers

1. A positive ion will be attracted to any negative ion.

**True:** Any positively charged object will be attracted to any negatively charged object. It does not matter how the objects acquired the charge; the attraction only depends on the amount of charge and the distance between two charged objects.

2. A sodium ion is only bonded to the chloride ion it donated its electron to.

**False:** Each positive sodium ion is bonded to each of the neighbouring negative chloride ions. It is irrelevant how the ions came to be charged.

3. A sodium atom can only form one ionic bond because it only has one electron in its outer shell to donate.

**False:** A sodium ion can strongly bond to as many chloride ions as can effectively pack around it in the regular crystal lattice. In NaCl there will be six chloride ions strongly bonded to each sodium atom.

4. A bond is formed between chloride ions and sodium ions because an electron has been transferred between them.

**False:** The reason a bond is formed between chloride ions and sodium ions is because they have opposite electrostatic charges – negative and positive.

5. In the diagram, a chloride ion is attracted to one sodium ion by a bond and up to three other sodium ions just by forces.

**False:** In the diagram each chloride ion is attracted to up to four sodium ions by a bond that is an electrostatic force. (There would be a fifth sodium ion above the chloride ion and one more below – but these are not shown in the 2D diagram.)

6. In the diagram, each molecule of sodium chloride contains one sodium ion and one chloride ion.

**False:** There are no molecules in sodium chloride, just ions. A molecule is comprised of a group of atoms strongly bound together and only weakly bonded (if at all) to other molecules. In sodium chloride, each ion is strongly bonded to each of its six nearest neighbours.

7. An ionic bond is the attraction between a positive ion and a negative ion.

**True:** The opposite charges attract them together and this electrostatic force of attraction is the ionic bond.

8. A positive ion can be bonded to any neighbouring negative ion, if it is close enough.

**True:** The bond is just the attraction between the oppositely charged ions. If the ions are close together this force will be a strong bond.

9. A negative ion will be attracted to any positive ion.

**True:** Any negatively charged object will be attracted to any positively charged object. It does not matter how the objects acquired the charge, the attraction only depends on the amount of charge and the distance between the two charged objects.

10. You cannot identify ionic bonds, unless you know which chloride ions accepted electrons from which sodium ions.

**False:** As the bonding is just the attraction between ions, there will be a bond between any adjacent oppositely charged ions.

11. A chloride ion is only bonded to the sodium ion it accepted an electron from.

**False:** Each negative chloride ion is bonded to each of the neighbouring positive sodium ions. It is irrelevant how the ions came to be charged.

12. A chlorine atom can only form one strong ionic bond, because it can only accept one more electron into its outer shell.

**False:** A chloride ion can strongly bond to as many sodium ions as can effectively pack around it in the regular crystal lattice. In NaCl there will be six sodium ions strongly bonded to each chloride ion.

13. There is a bond between the ions in each molecule, but no bonds between the molecules.

**False:** There are no molecules in sodium chloride but there is a continuous network of bonds throughout the lattice.

14. A negative ion can only be attracted to one positive ion.

**False:** There is no limit to the number of positive ions that a negative ion can be attracted to (although there is a limit to how many can cluster around it).

15. A bond is formed between chloride ions and sodium ions because they have opposite charges.

**True:** The opposite charges attract them together and this electrostatic force of attraction is the ionic bond.

16. In the diagram, a sodium ion is attracted to one chloride ion by a bond and is attracted to other chloride ions just by forces.

**False:** In the diagram, each sodium ion is attracted to up to four chloride ions by a bond that is an electrostatic force. (There would be a fifth chloride ion above the sodium ion and one more – a sixth – below but these are not shown in the diagram.)

17. A positive ion can only be attracted to one negative ion.

**False:** There is no limit to the number of positive ions that a negative ion can be attracted to (although there is a limit to how many can cluster around it).

**18.** An ionic bond is when one atom donates an electron to another atom, so that they both have full outer shells.

**False:** An ionic bond is the electrostatic force which holds two oppositely charged ions together. The ions could have become charged by electron transfer, but usually the ions were charged long before they came into contact.

**19.** A negative ion can be bonded to any neighbouring positive ion, if it is close enough.

**True:** The bond is just the attraction between the oppositely charged ions. If the ions are close together this force will be a strong bond.

**20.** There are no molecules shown in the diagram.

**True:** A molecule comprises a group of atoms strongly bound together and only weakly bonded (if at all) to other molecules. In sodium chloride, each ion is strongly bonded to each of its six nearest neighbours.