A3 · Ionic bonds · 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 · Show an ionic bond forming

Show the ionic bond forming between sodium (group 1) and fluorine (group 17) with electron dot diagrams. Give the formula.

1. Draw each atom's electron dot diagram: sodium has 1 dot and fluorine has 7.
2. Move electrons from the metal to the non-metal: the 1 electron moves to fluorine.
3. Add atoms until every atom is full: both are full, so no more atoms are needed.
4. Draw the ions in brackets, with charges: Na^+ has no dots, and F^- has 8 dots.
5. Check: 1 electron lost equals 1 electron gained.

Answer: The formula is NaF.

Example 2 · Show an ionic bond when the numbers do not match

Show the ionic bond forming between magnesium (group 2) and chlorine (group 17) with electron dot diagrams. Give the formula.

1. Draw each atom's electron dot diagram: magnesium has 2 dots and chlorine has 7.
2. Move electrons from the metal to the non-metal: one chlorine atom takes only 1.
3. Add atoms until every atom is full: 2 chlorine atoms are needed.
4. Draw the ions in brackets, with charges: one Mg^{2+} and two Cl^-.
5. Check: 2 electrons lost equal 2 electrons gained.

Answer: The formula is $MgCl_2$.

Practice

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

EASY

1. A lithium atom has 1 valence electron. A chlorine atom has 7. Which atom loses an electron, and which atom gains it?

1. Lithium is a metal, so it loses its 1 electron.
2. Chlorine is a non-metal, so it gains that electron.

EASY

2. Draw the electron dot diagram of a sodium ion.

1. A positive ion has no dots.
2. Write Na in square brackets, with + outside at the top right.

EASY

3. Draw the electron dot diagram of a chloride ion.

1. A negative ion has eight dots, in four pairs.
2. Write Cl with 8 dots in square brackets, with the charge 1− outside at the top right.

EASY

4. What is an ionic bond?

1. Opposite charges attract.
2. An ionic bond is the attraction between a positive ion and a negative ion.

MEDIUM

5. Show the ionic bond forming between calcium (group 2) and sulfur (group 16) with electron dot diagrams. Give the formula.

1. Calcium has 2 dots and sulfur has 6.
2. Both electrons move from calcium to sulfur.
3. The ions are Ca^{2+} and S^{2-}. The formula is CaS.

MEDIUM

6. Show the ionic bond forming between sodium (group 1) and oxygen (group 16) with electron dot diagrams. Give the formula.

1. Sodium has 1 dot and oxygen has 6.
2. Oxygen needs 2 electrons, so 2 sodium atoms are needed.
3. The ions are Na^{+} and O^{2-}. The formula is Na_2O.

MEDIUM

7. Write the balanced equation, with state symbols, for solid magnesium reacting with chlorine gas to make solid magnesium chloride.

1. $Mg(s) + Cl_2(g) \rightarrow MgCl_2(s)$
2. Chlorine is one of the seven two-atom elements, so it is written Cl_2.
3. Each side has 1 magnesium atom and 2 chlorine atoms.

MEDIUM

8. A magnesium atom has 2 valence electrons to lose. A bromine atom needs 1. How many bromine atoms does one magnesium atom need? Give the formula.

1. One bromine atom takes only 1 electron.
2. So 2 bromine atoms are needed.
3. The ions are Mg^{2+} and Br^{-}. The formula is $MgBr_2$.

HARDER

9. Calcium (group 2) and phosphorus (group 15) form an ionic compound. Explain how many atoms of each are needed. Give the charge of each ion and the formula.

1. Calcium loses 2 electrons. Phosphorus gains 3.
2. The smallest total both can reach is 6.
3. 3 calcium atoms lose 6 electrons. 2 phosphorus atoms gain 6.
4. The ions are Ca^{2+} and P^{3-}. The formula is Ca_3P_2.

HARDER

10. A student draws a calcium ion as Ca with 2 dots and the charge 2+. Say what is wrong. Then describe the correct diagram.

1. A calcium atom loses both of its valence electrons.
2. So the ion has no dots.
3. The correct diagram is Ca in square brackets, with 2+ outside at the top right.