

# Ionic Bonding

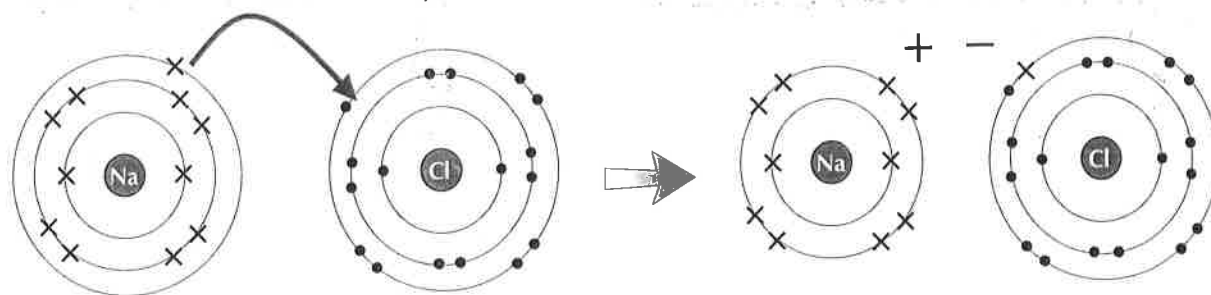
Q1 True or false?

- a) In ionic bonding, atoms lose or gain electrons.  
 b) Ions with opposite charges attract each other.  
 c) Ionic bonds always produce giant ionic structures.  
 d) Ions in a giant ionic structure are loosely packed together.  
 e) Ionic compounds dissolve to form solutions that conduct electricity.

True False

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Q2 Use the **diagram** to answer the following questions.



- a) Which **group** of the periodic table does **sodium** belong to? .....
- b) How many **electrons** does **chlorine** need to gain to get a full outer shell of electrons? .....
- c) What is the **charge** on a **sodium ion**? .....
- d) What is the chemical formula of **sodium chloride**? .....

Q3 Elements react in order to get a **full outer shell** of electrons.

- a) How many electrons does magnesium need to **lose** to get a full outer shell? .....
- b) How many electrons does oxygen need to **gain** to get a full outer shell? .....
- c) Draw a 'dot and cross' diagram to show what happens to the outer shells of electrons when magnesium and oxygen react.

The diagrams in question 2 are 'dot and cross' diagrams.

- d) What is the chemical formula of magnesium oxide? .....
- e) What type of **structure** would you expect magnesium oxide to have? .....

## Ionic Bonding

**Q4** Sodium chloride (salt) has a **giant ionic structure**.

a) Circle the correct words to explain why sodium chloride has a high melting point.

Salt has very **strong** / **weak** chemical bonds between the **negative** / **positive** sodium ions and the **negative** / **positive** chlorine ions. This means that it needs a **little** / **large** amount of energy to break the bonds.

b) Name two other **properties** of compounds with **giant ionic structures**.

1. ....

2. ....

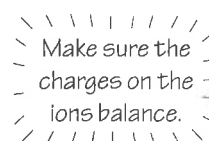
**Q5** Here are some elements and the ions they form:

beryllium,  $\text{Be}^{2+}$

potassium,  $\text{K}^+$

iodine,  $\text{I}^-$

sulfur,  $\text{S}^{2-}$



Write down the formulas of four compounds which can be made using these elements.

1. .... 2. ....

3. .... 4. ....

**Q6** Mike conducts an experiment to find out if **calcium chloride** conducts electricity. He tests the compound when it's solid, when it's dissolved in water and when it's molten.

a) Complete the following table of results.

	Conducts electricity?
When solid	
When dissolved in water	
When molten	



b) Explain your answers to part a).

.....  
 .....  
 .....

### Top Tips:

Giant ionic structures are the first of four different types of structure that you need to know about. You'll have to be able to identify the structure in different compounds later on — so make sure you can describe and recognise their properties now.

## **Electron Shells and Ions**

**Q1** Complete the following sentences by circling the correct words.

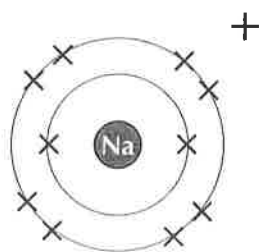
- a) Atoms that have lost or gained electrons are called **isotopes** / **ions**.
- b) Elements in Group 1 **readily** / **rarely** form ions.
- c) Elements in Group 8 **readily** / **rarely** form ions.
- d) Positive ions are called **anions** / **cations**.



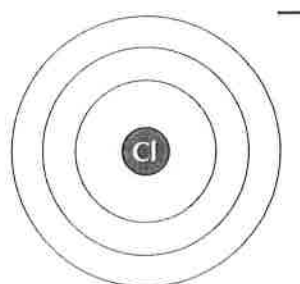
**Q2** Atoms can **gain** or **lose** electrons to get a full outer shell.

- a) How many **electrons** do the following elements need to **lose** in order to get a **full outer shell**.
  - i) Lithium .....
  - ii) Calcium .....
  - iii) Potassium .....
- b) How many **electrons** do the following elements need to **gain** in order to get a **full outer shell**.
  - i) Oxygen .....
  - ii) Chlorine .....
  - iii) Fluorine .....

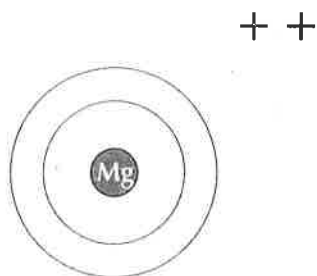
**Q3** Write the **electron configurations** for the following ions and draw the **electrons** on the shells. (The first one's been done for you.)



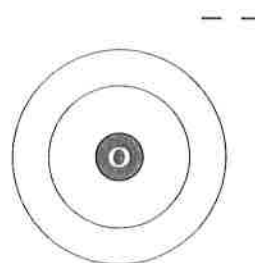
Na<sup>+</sup> Na [2,8]<sup>+</sup> .....



a) Cl<sup>-</sup> .....



b) Mg<sup>2+</sup> .....



c) O<sup>2-</sup> .....

**Q4** What are the **electron configurations** of the following ions?

a) K<sup>+</sup> .....

b) Ca<sup>2+</sup> .....

c) F<sup>-</sup> .....

d) Be<sup>2+</sup> .....

# Covalent Bonding

**Q1** Indicate whether each statement is **true** or **false**.

- a) Covalent bonding involves sharing electrons.  
 b) Atoms react to gain a full outer shell of electrons.  
 c) Some atoms can make both ionic and covalent bonds.  
 d) Hydrogen can form two covalent bonds.  
 e) Carbon can form four covalent bonds.

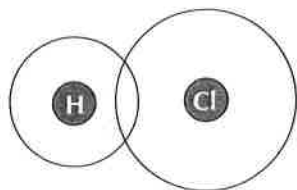
**True** **False**


**Q2** **Complete** the following table to show how many electrons are needed to **fill up** the **outer shell** of these atoms.

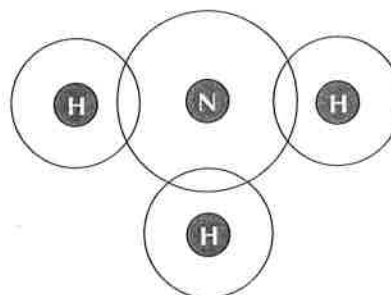
Atom	Carbon	Chlorine	Hydrogen	Nitrogen	Oxygen
<b>Number of electrons needed to fill outer shell</b>					

**Q3** Complete the following diagrams by adding the **electrons**. Only the outer shells are shown.

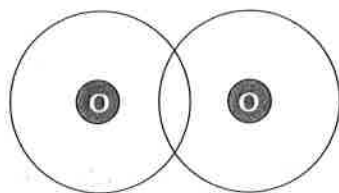
a) Hydrogen chloride (HCl)



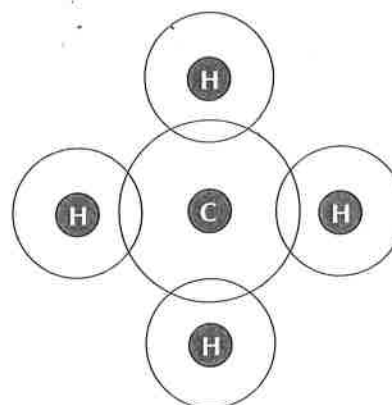
d) Ammonia (NH<sub>3</sub>)



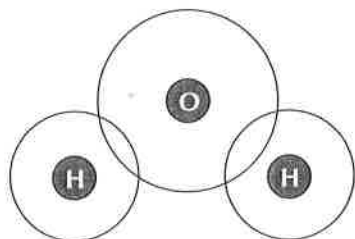
b) Oxygen (O<sub>2</sub>)



e) Methane (CH<sub>4</sub>)



c) Water (H<sub>2</sub>O)



**Q4** Why do some atoms **share** electrons?

.....

.....

## Covalent Substances: Two Kinds

Q1 Which am I — **diamond**, **graphite** or **silicon dioxide** (silica)?

Match up the statements to the drawings.

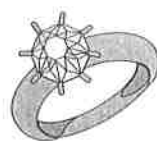
I am used in jewellery.

I am used to make glass.

I am the hardest natural substance.

I have layers which move over one another.

I am used in pencils.



Diamond



Graphite



Silicon dioxide

I am the only non-metal which is a good conductor of electricity.

I am known as sand.

I am not made from carbon.

My carbon atoms form three covalent bonds.

My carbon atoms form four covalent bonds.

Q2 Circle the correct words to complete the following paragraph.

Giant covalent structures contain **charged ions** / **uncharged atoms**. The covalent bonds between the atoms are **strong** / **weak**. Giant covalent structures have **high** / **low** melting points, they usually **do** / **don't** conduct electricity and they are usually **soluble** / **insoluble** in water.

Q3 Hydrogen and chlorine share electrons to form a molecule called **hydrogen chloride**.

Predict two properties hydrogen chloride will have.

1. ....

2. ....

Q4 **Graphite** and **diamond** are both entirely made from **carbon**, but have different properties.

a) Explain why graphite is a good conductor of electricity.

.....  
 .....

b) Explain why diamond's structure makes it hard.

.....  
 .....