Formula & Equation Writing

Book 1

Ionic Equations

Ionic Formulae

Balanced Equations

Formula Equations

Word Equations

Transition Metals

Using Brackets

Awkward Customers

More than 2 Elements

2 Elements Only

Using the Name Only

These sheets belong to

KHS Sept 2013

S3 - Book 1
What is a Formula?

The formula of a compound tells you two things about the compound:

i) which elements are in the compound using symbols,

ii) how many atoms of each element are in the compound using numbers.

Test Yourself

What would be the formula for each of the following?

- **SiO**$_2$
- **H**$_2$$O$
- **KMnO**$_4$

Using the Name Only

Some compounds have extra information in their names that allow people to work out and write the correct formula.

The names of the elements appear as usual but this time the number of each type of atom is included using:

- mono- = 1
- di- = 2
- tri- = 3
- tetra- = 4
- penta- = 5
- hexa- = 6

Test Yourself 1

What would be the formula for each of the following?

1. sulfur trioxide
2. silicon tetrafluoride
3. dinitrogen oxide
4. phosphorus trichloride
5. dinitrogen tetroxide
6. nitrogen monoxide
7. nitrogen dioxide
8. tin dibromide
9. nitrogen triiodide
10. sulfur dioxide
11. diphosphorus pentachloride
12. dinitrogen pentoxide
13. xenon hexafluoride
14. phosphorus trihydride
15. carbon tetrachloride
Apart from the Noble Gases (column 8), all atoms can form bonds and join to other atoms in compounds.

The number of bonds an atom can form is called its Valency and depends on which Group in the Periodic Table an atom belongs to.

<table>
<thead>
<tr>
<th>Group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valency No.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Valency Pictures

To begin with, you may be given a special Periodic Table which you can use to find the Valency Number of an Element.

Use the Name of the Element and then draw the correct Valency Picture.

Test Yourself 2

Draw the Valency Picture for each of these Elements.

1. beryllium  2. boron  3. nitrogen  4. fluorine
5. sodium  6. silicon  7. sulfur  8. calcium
9. chromium  10. cobalt  11. arsenic  12. selenium
Writing a **correct formula** is all about looking up the **correct symbol**, identifying the **correct valency number** and then **balancing** the two halves of the compound. This is easier if you use **Valency Pictures**.

For example, to work out the formula for **potassium oxide**.

1. Draw the Valency Pictures for atoms of **potassium** and **oxygen**.
2. Draw them as shown. This valency picture is not complete.
3. Draw another potassium atom to complete the picture.
4. Now write the correct formula for potassium oxide.

**Test Yourself 3**

Work out the formula for each of these compounds.

1. sodium chloride  
2. lithium iodide  
3. potassium fluoride  
4. rubidium bromide  
5. beryllium oxide  
6. calcium sulfide  
7. barium bromide  
8. magnesium iodide  
9. lithium sulfide  
10. potassium oxide  
11. aluminium iodide  
12. aluminium oxide  
13. magnesium nitride  
14. strontium chloride  
15. gallium sulfide
**Word Equations**

We write a “Word Equation” to describe the changes that take place during a chemical reaction.

\[
\text{magnesium} + \text{hydrogen chloride} \rightarrow \text{magnesium chloride} + \text{hydrogen chloride}
\]

1. The + sign means *and*.

2. The → sign means *change into*.

3. The chemicals which react are called the **Reactants** and are written on the *left*.

4. The chemicals which are produced are called the **Products** and are written on the *right*.

**Test Yourself 4**

Write a **Word Equation** for each of the reactions described below.

1. When magnesium ribbon burns, it reacts with oxygen in the air to form magnesium oxide, a white powder.

2. In the Blast Furnace, iron is made by reacting diiron trioxide with carbon monoxide gas. Carbon dioxide gas is also produced.

3. In the Haber Process, nitrogen, which we get from the air, reacts with hydrogen gas in the presence of a platinum catalyst to form ammonia (nitrogen hydride) which can be used to make many things including fertilisers.

4. When calcium metal is added to water, a gas is given off and calcium oxide solution is formed. When tested with a burning splint, the hydrogen gas "popped".

5. Aluminium is a reactive metal but protected by a layer of corroded metal. Chlorine gas can penentrate the corrosion to produce aluminium chloride.

**Formula Equation**

The next stage is to replace all the names of chemicals with their *form*, ie write a **Formula Equation**. e.g.

\[
\text{word equation} \\
\text{magnesium} + \text{hydrogen chloride} \rightarrow \text{magnesium chloride} + \text{hydrogen}
\]

\[
\text{formula equation} \\
\text{Mg} + \text{H Cl} \rightarrow \text{Mg Cl}_2 + \text{H}_2
\]
Elements in Equations

Most **ele** ments are easy. They are simply represented by their **symbol**.

There are, however, 7 **elem** ents which are made up of **mol** ecules, each with 2 **at** omes. This needs to be shown in their **form** ulae, such as \( H_2 \) for **hydr** ogen.

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<tr>
<th><strong>GEN</strong></th>
<th><strong>INE</strong></th>
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</table>
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**“The Diatomic 7”**

- **H** ydrogen
- **N** itrogen
- **O** xygen
- **F** luorine
- **C** hlorine
- **B** romine
- **I** odine

An easy way to remember this is **GENuINE** – the diatomic elements end in either GEN or INE!

Test Yourself 5

Write a **Formula Equation** for each of the reactions described by the **Word Equations** shown below.

1. **magnesium** + **oxygen** \( \rightarrow \) **magnesium oxide**

2. **diiron trioxide** + **carbon monoxide** \( \rightarrow \) **carbon dioxide** + **iron**

3. **nitrogen** + **hydrogen** \( \rightarrow \) **nitrogen trihydride**

4. **calcium** + **water** \( \rightarrow \) **calcium oxide** + **hydrogen**

5. **aluminium** + **chlorine** \( \rightarrow \) **aluminium chloride**
You may be shown a series of video demonstrating various reactions.

For each one, write a **Word Equation** and then try to write the correct **Formula Equation**.

www.new.chemistry-teaching-resources.com/EquationWriting.html

**'Starting' Set 1 - magnesium with dry ice**

**Word Equation:**

**Formula:**

**'Starting' Set 1 - combustion of sulfur**

**Word Equation:**

**Formula:**

**'Starting' Set 2 - aluminium with chlorine**

**Word Equation:**

**Formula:**

**'Starting' Set 3 - thermite reaction**

**Word Equation:**

**Formula:**

**'Starting' Set 3 - making salt**

**Word Equation:**

**Formula:**