

Balanced chemical equations

1. A chemical reaction is a process during which substances react to form new substances.

Use the words below to complete the sentences to describe what happens to atoms during a chemical reaction. You do not have to use all the words.

reactants products created
destroyed rearranged
greater than lower than equal to

The atoms of the _____ present at the start of a chemical reaction are _____ to form the new substances, which are known as _____.

The number of atoms of each element present in the substances formed is _____ the number of atoms of each element in the reacting substances.

(4 marks)

2. The changes that occur during chemical reactions can be described using chemical formulas in chemical equations.

(a) Determine the number of atoms of each element present in the molecules listed in the table. Use a periodic table, and the chemical formulas provided. The first row has been completed for you.

Hint: Remember the subscript numbers show how many atoms of the element they follow are present in the molecule.

Chemical formulas	Names and number of atoms of each element present
ZnCl_2	1 zinc atom and 2 chlorine atoms
Na_2CO_3	
Fe_2O_3	
$\text{Mg}(\text{NO}_3)_2$	

(3 marks)

(b) State symbols are used in chemical equations to show the physical state of the reactant or product at room temperature.

Identify the physical state represented by each of the following state symbols.

State symbol	Physical state
(s)	
(l)	
(g)	
(aq)	

(2 marks)

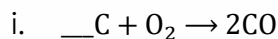
(c) Use the words and formulas provided to complete the table for each of the following common compounds and elements. The first row has been completed for you.

	H_2O	O_2	HCl	CO
	hydrogen	carbon dioxide	sulfuric acid	ammonia
Name	Chemical formula			
nitric acid	HNO_3			
hydrochloric acid				
oxygen				
	H_2			
	CO_2			
carbon monoxide				
	H_2SO_4			
water				
	NH_3			

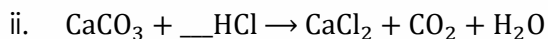
(4 marks)

3. A balanced chemical equation has the same number of atoms of each type of element in the products and the reactants.

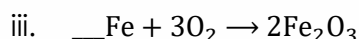
(a) Write in the correct number to balance each of the equations below.



(1 mark)



(1 mark)



(1 mark)

(b) The table shows the chemical equations for four reactions. Complete the table by ticking the boxes to identify the balanced and unbalanced chemical equations.

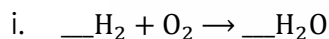
Hint: When an equation is balanced the number of atoms of each element are equal in the reactants and products.

Chemical equations	Balanced	Unbalanced
$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$		
$2\text{Al} + \text{Br}_2 \rightarrow 2\text{AlBr}_3$		
$\text{Cu}_2\text{O} + \text{H}_2 \rightarrow 2\text{Cu} + \text{H}_2\text{O}$		
$\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow \text{Fe} + 3\text{CO}_2$		

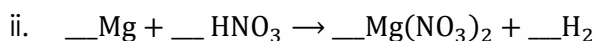
(2 marks)

(c) Complete the chemical equations below by adding the missing numbers in front of the **relevant** formulas to balance the equation.

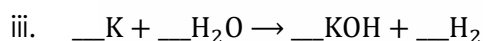
Hint: You do not need to add numbers in front of all of the formulas in the equations.



(1 mark)



(1 mark)



(1 mark)



(1 mark)

(d) Write balanced chemical equations for each of the chemical reactions described below. Use the formulas provided in the question and add the state symbols (from **question 2b**).

- i. Nitrogen gas (N_2) reacts with hydrogen gas (H_2) to produce ammonia gas (NH_3).

(2 marks)

- ii. Solid sodium metal reacts with oxygen gas (O_2) to produce solid sodium oxide (Na_2O).

(2 marks)

- iii. An aqueous solution of sodium hydroxide (NaOH) reacts with an aqueous solution of sulfuric acid (H_2SO_4) to produce an aqueous solution of sodium sulfate (Na_2SO_4) and liquid water (H_2O).

(2 marks)

- iv. Solid potassium carbonate (K_2CO_3) reacts with an aqueous solution of hydrochloric acid (HCl) to produce an aqueous solution of potassium chloride (KCl), carbon dioxide gas (CO_2) and liquid water.

(2 marks)

[Total: 30 marks]



Which question(s) did you get wrong? Why?

What will you do next time you're asked a similar question?