Name & Surname: _____ Class: _____ Date: _____

BALANCING CHEMICAL EQUATIONS

Keep every atom counted



About 35 minutes Level ★★★☆☆

BALANCING IN BRIEF

A symbol equation uses formulae to show what reacts and what is made. The **reactants** are on the left of the arrow and the **products** are on the right, joined by + signs. Atoms cannot be created or destroyed, so each element must have the same number of atoms on both sides. To balance, change only the big **coefficients** in front of a formula, never the small subscripts inside it, and keep the smallest whole numbers that work.



- Check all formulae are correct first.
- Balance one element at a time, then recount atoms on both sides.
- Add state symbols in brackets: (s) solid, (l) liquid, (g) gas, (aq) dissolved in water.
- Example: N2 + 3H2 → 2NH3 has 2 nitrogen and 6 hydrogen atoms on each side.

TASK A /3

Circle the odd one out in each row and explain why it is different.

1. CH4 + 2O2 → CO2 + 2H2O | H2 + O2 → H2O | 2H2 + O2 → 2H2O | N2 + 3H2 → 2NH3

Why?

2. coefficient | subscript | big number in front | the big 2 in front of H2O

Why?

3. (l) | → | (s) | (g)

Why?

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WHAT IF UNBALANCED?

Think through what goes wrong if equations are not balanced.

KEY WORDS

reactant: substance on the left that reacts

coefficient: big number in front that can be changed

conservation of mass: no atoms lost or made, mass stays the same

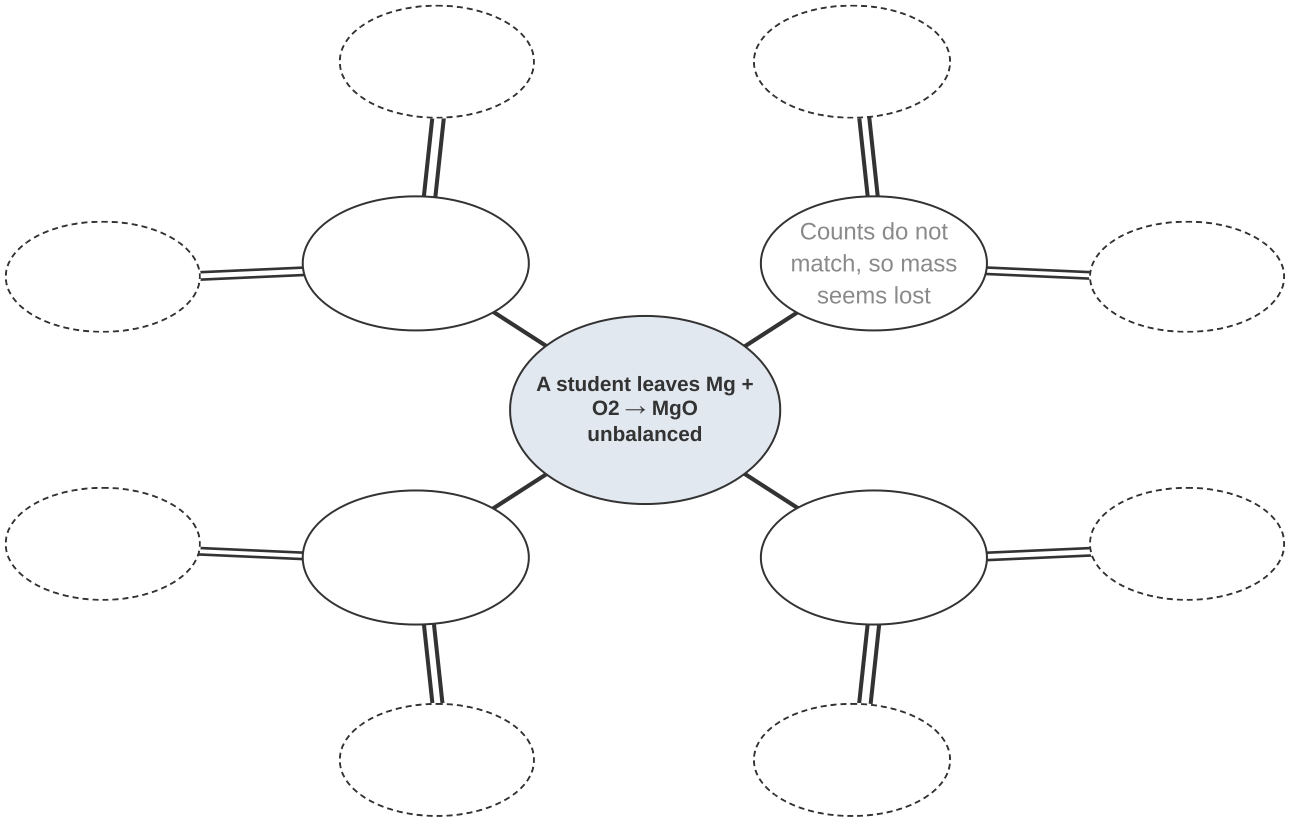
product: substance on the right that is made

subscript: small number in a formula that cannot change

state symbol: letters showing solid, liquid, gas or aqueous

TASK B

Show the direct effects in the inner circles and knock-on effects outside. Start with: This means that...



Single lines lead to direct effects; double lines lead to knock-on effects.

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TWELVE MINUTE RECAP

Summarise the whole method in twelve quick notes.

TASK C

Fill each wedge with one short note about the method. Start with: The first step is...



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CHECK AND MATCH

Practise balancing equations and link the key terms.

TASK D

/4

Complete the table by adding the missing coefficients. Start with: Count atoms on the left...

Unbalanced equation	Balanced equation
H2 + O2 → H2O	
N2 + H2 → NH3	
Mg + O2 → MgO	
CH4 + O2 → CO2 + H2O	

TASK E

Example done for you

/5

Match each term to its meaning by writing the number in the circle.

1 reactant	◯ total mass of reactants equals total mass of products
2 product	(1) substance on the left that reacts
3 coefficient	◯ big number in front that can be changed
4 subscript	◯ small number in a formula that cannot be changed
5 conservation of mass	◯ substance on the right that is made
6 state symbol	◯ (s), (l), (g) or (aq) after a formula

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THINK LIKE CHEMISTS

Use evidence to explain equations.

TASK F

/3

Read the lab note and use the evidence to explain each answer.

Yesterday our class burned magnesium in air. The teacher wrote on the board: 2Mg(s) + O2(g) → 2MgO(s). A student asked why a big 2 was put in front of Mg and MgO instead of changing MgO to MgO2. The teacher said the formula of magnesium oxide is fixed as MgO, and the 2s make sure magnesium and oxygen atoms are equal on both sides, so no mass is lost. She added that the (s) and (g) show the physical states.

Question	It says...	I say...	And so...
Why is 2Mg + O2 → 2MgO **balanced** but Mg + O2 → MgO is not?	The board shows 2Mg with O2 on the left and 2MgO on the right give 2 magnesium and 2 oxygen atoms on each side.	Equal atoms on both sides means nothing is lost or made.	The first equation obeys conservation of mass, the second does not.
Why cannot we just change MgO to MgO2 to get more **oxygen**?			
What do the (s) and (g) tell us about the **states**?			

HOW DID I DO?

Circle a face for each line.

I can explain why equations must balance to conserve mass ☹ 😐 ☺

I can balance symbol equations using coefficients ☹ 😐 ☺

I can add state symbols to show physical states ☹ 😐 ☺

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Answer sheet: Balancing Chemical Equations

Task A

1. $H_2 + O_2 \rightarrow H_2O$ (It is the only unbalanced equation; hydrogen and oxygen atoms are not equal on both sides.)
2. subscript (It is the only small number inside a formula that must never be changed to balance.)
3. → (It is the only arrow showing direction, the others are state symbols for solid, liquid and gas.)

Task B

Answers will vary, e.g. Counts do not match, so mass seems lost

Task C

Answers will vary.

Task D

$H_2 + O_2 \rightarrow H_2O$ | $2H_2 + O_2 \rightarrow 2H_2O$

$N_2 + H_2 \rightarrow NH_3$ | $N_2 + 3H_2 \rightarrow 2NH_3$

$Mg + O_2 \rightarrow MgO$ | $2Mg + O_2 \rightarrow 2MgO$

$CH_4 + O_2 \rightarrow CO_2 + H_2O$ | $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Task E

1. reactant → substance on the left that reacts
2. product → substance on the right that is made
3. coefficient → big number in front that can be changed
4. subscript → small number in a formula that cannot be changed
5. conservation of mass → total mass of reactants equals total mass of products
6. state symbol → (s), (l), (g) or (aq) after a formula

Task F

1. The first equation obeys conservation of mass, the second does not.
2. We must change only coefficients, not subscripts.
3. State symbols show what each substance is like in the reaction.

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