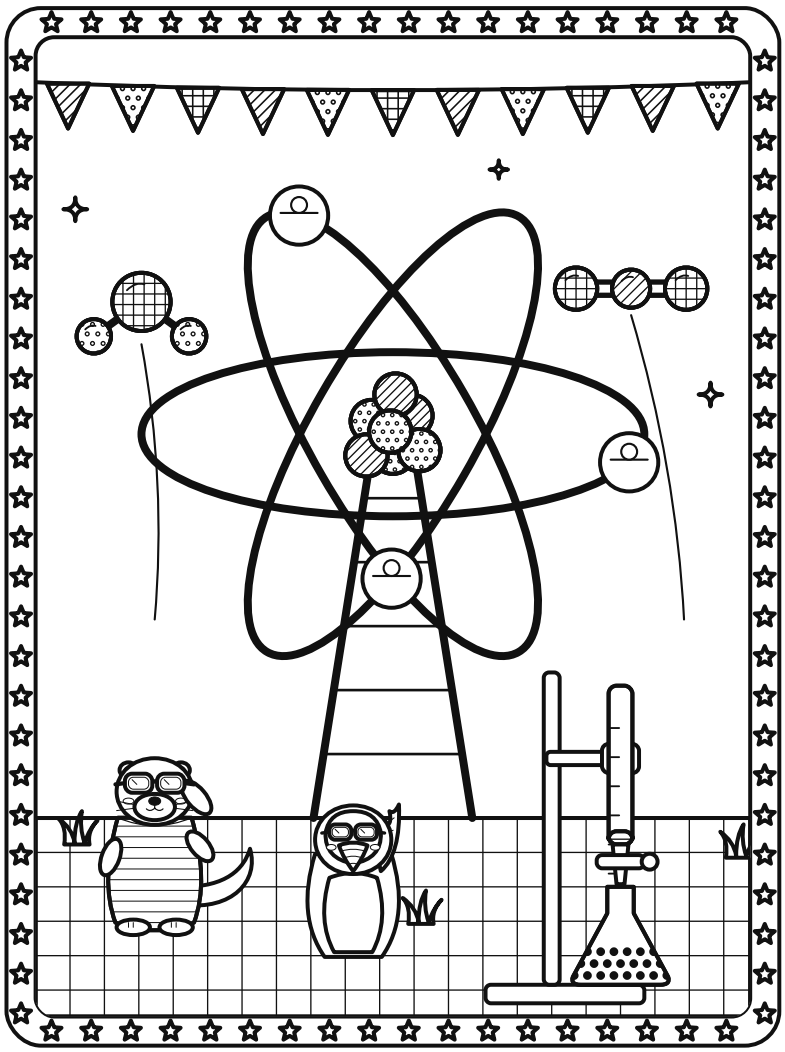
REAL-LIFE CHEMISTRY

Chemical Changes and Structure

Workbook for National 5 Chemistry

Unit: Chemical Changes and Structure



C. Blewis

Blewis LEARNING

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How to use this book

This book covers Chemical Changes and Structure for National 5 Chemistry: rates of reaction, atomic structure, bonding and properties, formulae and equations, the mole and calculations, and acids and bases. Each topic follows the same pattern, so you always know what comes next.

EACH TOPIC HAS

Opener	the story for the topic, what you will learn and the key words
Learn pages	short explanations with diagrams, and questions to try
Practical	You plan the investigation yourself, carry it out safely, take repeat readings, draw a graph and evaluate your method.
Brain break	a calm puzzle or colouring page
Check-up	a few questions to show what you know, and a checklist

PRACTICAL WORK: STAY SAFE

- Only start a practical when an adult says it is OK.
- Read the whole method and the Stay safe table first.
- Tell your teacher about anything that might affect you, like asthma or an allergy.
- Stop and tell an adult if you feel unwell or something goes wrong.

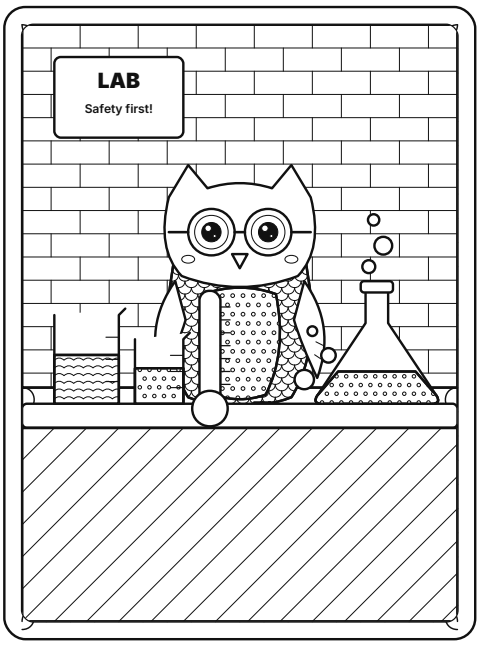
NO LAB TODAY?

Every practical has a set of example results. If you could not do the experiment, use these to finish the results, graph and conclusion.

DOODLE CORNERS

Some pages have a doodle corner. Colour it or doodle in it when you need a short break.

Rates of reaction



Two indigestion tablets of the same mass are dropped into water. One is whole and one is crushed. Which one stops fizzing first, and why?

Theme: the Port Arrin medicines lab. Mia is on work experience in the quality lab of a medicines factory in Port Arrin. She wants to know why some tablets work faster than others, and how the factory makes its reactions go at the right speed.

IN THIS TOPIC YOU WILL LEARN TO

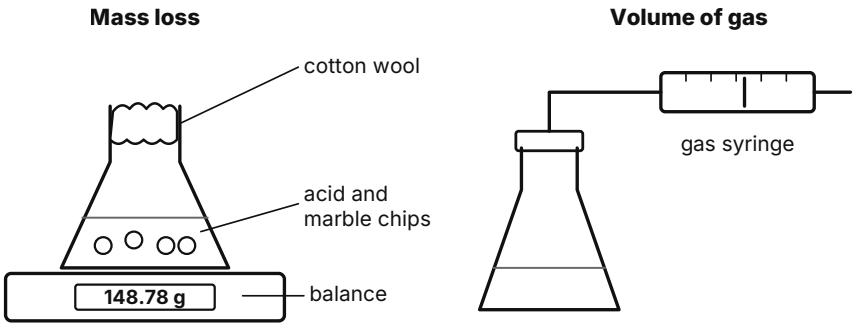
Skill 1	follow the rate of a reaction by measuring a change in mass or a volume of gas, and read rate graphs
Skill 2	explain how temperature, concentration, particle size and a catalyst change the rate, using collisions
Skill 3	calculate an average rate with the correct unit, and plan a fair test of a factor that affects the rate

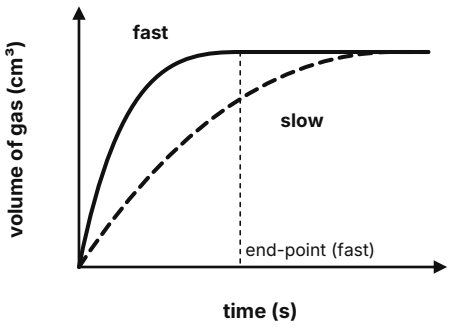
KEY WORDS

Rate	how fast reactants are used up or products are made
End-point	the time when the reaction stops: the graph goes flat
Collision	particles must hit each other with enough energy to react
Concentration	how much substance is dissolved in each litre
Surface area	smaller pieces expose more particles to react
Catalyst	speeds up a reaction and is unchanged at the end

❶ Following a reaction

The **rate** of a reaction is how quickly reactants are used up or products are made. To follow a reaction, measure something that changes as it goes: the **mass** of the flask falls as a gas escapes, or the **volume** of gas collected rises.





The curve is **steepest at the start**, when there are most reactant particles to collide. It gets less steep as reactants are used up, and goes **flat at the end-point**, when one reactant has run out. A steeper curve means a faster reaction.

With the same quantities of reactants, a faster reaction makes the **same total** amount of product, so its curve levels off at the same height, sooner.

1 Mia drops a tablet into water on a balance. State **two** things she could measure to follow the reaction.

Answer:

2 Explain why the graph of gas volume against time becomes flat.

Answer:

3 On the graph above, which line shows the faster reaction? How can you tell from the shape of the line?

Answer:

❷ Changing the rate

Particles can only react when they **collide** with enough energy. Anything that makes collisions happen more often, or with more energy, makes the reaction faster.

Change	What happens to the particles	Rate
Raise the temperature	they move faster, so they collide more often and with more energy	faster
Increase the concentration	more particles in the same volume, so more collisions	faster
Use smaller pieces (powder)	larger surface area, so more particles are exposed to collide	faster
Add a catalyst	gives the reaction an easier route; the catalyst is not used up	faster

CATALYSTS AT WORK

A catalyst speeds up a reaction and is **chemically unchanged** at the end, so it can be used again and again. Factories use catalysts to make products faster at lower temperatures, which saves energy and money. Car exhausts contain catalysts that change harmful gases into less harmful ones.

1 Explain, in terms of particles, why a crushed tablet fizzes faster than a whole one of the same mass.

Answer:

2 Mia warms the water before adding a tablet. Explain why the reaction is faster.

Answer:

3 Manganese dioxide speeds up the breakdown of hydrogen peroxide. After the reaction, Mia filters it out, dries it and finds its mass is unchanged. What does this show?

Answer:

4 Circle the change that would **not** make zinc react faster with acid: (warmer acid) (zinc powder) (more acid of the same concentration) (more concentrated acid)

PRACTICAL 1

Plan it: does the concentration of acid change the rate?

AIM To find out how the **CONCENTRATION OF HYDROCHLORIC ACID** affects the **TIME** taken for a 2 cm strip of magnesium ribbon to react completely.

1 Variables

I will change the independent variable	
I will measure the dependent variable	
I will keep the same controlled variables (give three)	

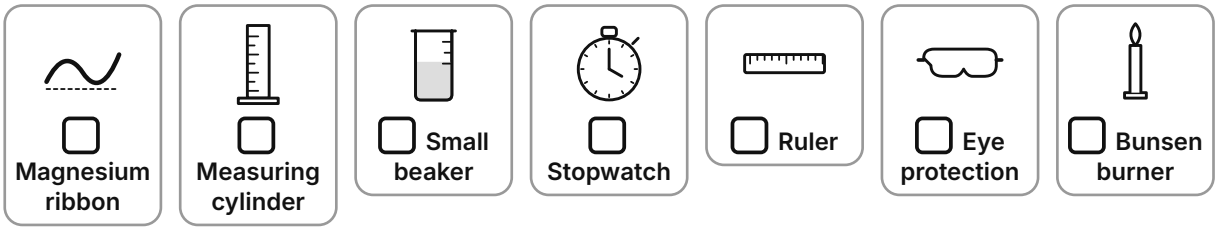
2 Prediction

I think that .....

because .....

3 Equipment

Tick the equipment you need. Not everything here is useful.



4 Stay safe

The first row is done for you. Add two more hazards.

Hazard What could cause harm?	**Risk** What could happen?	**Control** How will I stay safe?
Hydrochloric acid (dilute) is an irritant	It could get in your eyes or on your skin	Wear eye protection; wipe up spills; wash skin with water.

Method and results

5 Write your method

1. How will you measure out the acid? What volume will you use each time?

2. How will you cut and measure the magnesium so every strip is the same?

3. When will you start and stop the stopwatch?

4. How many repeats will you do? How will you work out the mean?

6 Results

Complete the headings, including units.

				Mean time	Rate

NO LAB TODAY? USE THESE RESULTS

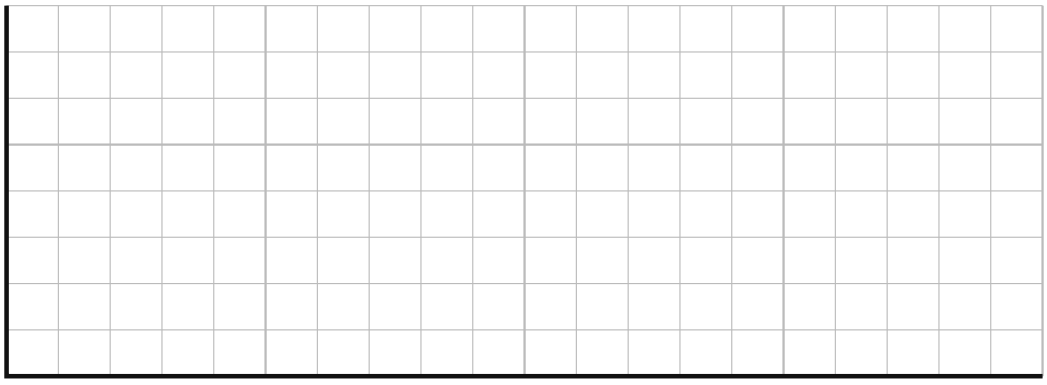
Concentration (mol l^{-1})	Time 1 (s)	Time 2 (s)	Time 3 (s)	Mean time (s)	Rate = 1 ÷ mean time (s^{-1})
0.5	121	118	124		
1.0	61	64	60		
1.5	42	40	43		
2.0	31	30	32		

25 cm^3 of acid at room temperature each time; 2 cm of magnesium ribbon. Work out the means and rates yourself (rate to 2 significant figures).

Analyse and evaluate

7 Draw a line graph

Plot rate against concentration. Choose your own scales, label both axes with units and draw a line of best fit.



> **MEAN AND RELIABILITY**
> Repeat each test, leave out any result that is clearly wrong (an outlier), then add the rest and divide by how many there are. Repeats that agree closely make the result more reliable. For 1.0 mol l^{-1}: (61 + 64 + 60) ÷ 3 = 61.7 s.

8 Conclusion

As the concentration of acid increased, the rate

9 Evaluate

a Explain your conclusion in terms of collisions between particles.

Answer:

b It is hard to see exactly when the last bit of magnesium disappears. Suggest how this affects the results, and one improvement.

Answer:

> **ASSIGNMENT LINK**
> For an assignment you could compare your results with data from a textbook or a website, and give a reference for that source (title, author or organisation, and date).

FREE SAMPLE

Chemical Changes and Structure (N5 Chemistry)

This sample shows a few pages. The full printed workbook is available from Amazon.

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