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# How to use the book

The Practice Book is a set of practice problems, made of *examples and 'your turn' questions*.



## Detect

✓ Diagram

✓ Values

✓ Unknown

✓ Concept

**1. Detect.** Do what experts do - look at the situation and work out what concepts you need. There are 4 parts to this:

- draw the essentials of the situation
- write down key information
- write down what you have to find
- identify the science ideas to apply



## Recall

**2. Recall.** Bring to mind what you already know about the concept.

This section summarises two kinds of knowledge:

- scientific ideas and what you need to understand
- skills and the steps to follow



## Solve

✓ Selection

✓ Inference

**3. Solve.** Go from what you know to the answer, step-by-step.

- identify the most relevant ideas from Recall
- make deductions from the information

✓ Claim

✓ Evidence

✓ Reasoning

The example ends with an answer, often set out as an argument:

- the answer that you believe it true
- information in the question or knowledge
- how to get from the evidence to the answer

Why is this evidence?

Do answer the questions in speech bubbles. They help you follow the example and remember the main points.

## Your turn

The *'your turn'* pages are practice questions. The first is very similar to the example. Look back and copy the steps. The other two questions might look different but they are testing the same thinking process.

1 /3 2 /3 3 /3 4 /3 Total /12

Use the scoring box to check how you're doing. Award yourself 3 points if you did Detect, Recall and Solve well. Subtract 1 point for each step you didn't do well.

## Hints & Answers

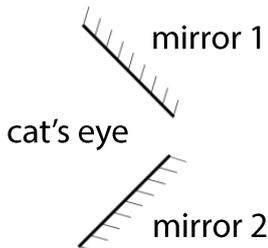
If you're stuck, go to the *Hints* pages at the back. The *Answers* are also there. If you made a mistake, look at the example to see what you did wrong. Good luck!

# 1.1 Use reflection



A cat's eye is a small safety device in the road. The driver needs to see the middle of the road at night. When a car's headlights shine on a cat's eye, it lights up.

A cat's eye is made of two mirrors placed at a 90° angle.



Explain by drawing a diagram how a car driver can see the cat's eye.



## Detect

✓ **Values**

I know that headlights give off light and that we see things when light reaches our eyes.

✓ **Unknown**

I need to work out how the light comes back to the driver's eyes from the mirrors.

Light must bounce off both mirrors somehow.

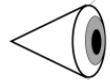
✓ **Concept**

To understand how light bounces off objects I need to use the concept **Reflection**.

headlights



driver



mirror 1



mirror 2



## Recall

### 1. How light travels as rays

Light travels in straight lines. We picture these as rays.

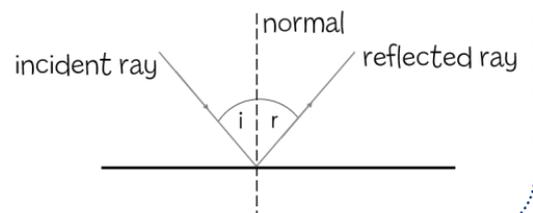


→ arrow shows direction light travels

### 2. How light reflects

Light bounces off a flat surface in a regular way.

angle of incidence (i) = angle of reflection (r)



How would light reflect off the cat's eye mirrors?



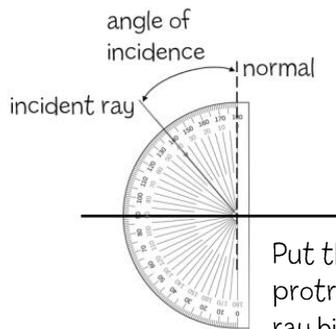
## Recall

### 3. How to draw a reflection diagram

To draw an accurate diagram, use a protractor to measure the angles (if not, just sketch it).

Step 1. Use a ruler to draw the normal line  $90^\circ$  to the surface.

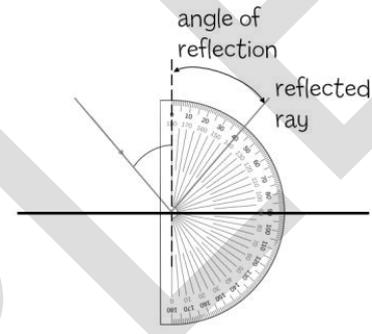
Step 2. Measure the angle of incidence. Draw the incident ray at this angle.



Put the centre of a protractor where the ray hits the mirror.

normal

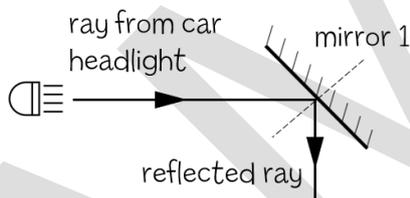
Step 3. Measure the same angle on the other side of the normal. Draw the reflected ray at this angle.



## Solve

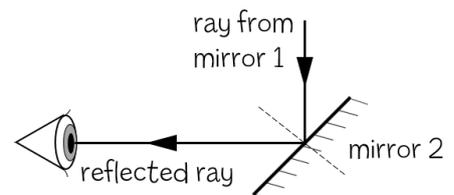
✓ Selection

✓ Inference



From 2 and 3 I can work out how the light reflects off mirror 1. The angle of incidence and reflection are  $45^\circ$ .

If I repeat this for mirror 2, I can see how the reflected ray can enter the driver's eyes.



Why must the angles be  $45^\circ$  for the cat's eye to work?

### Answer

✓ Claim

The driver can see the cat's eye because the mirrors reflect light rays from the car headlights back into their eyes.

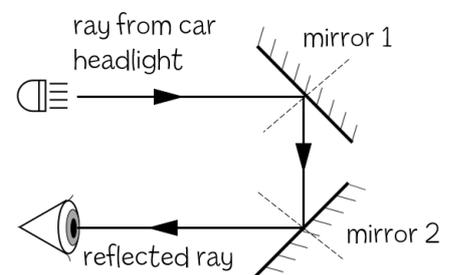
✓ Evidence

When light reflects off a mirror the angle of incidence = the angle of reflection.

✓ Reasoning

The first reflection of mirror 1 directs the rays towards mirror 2.

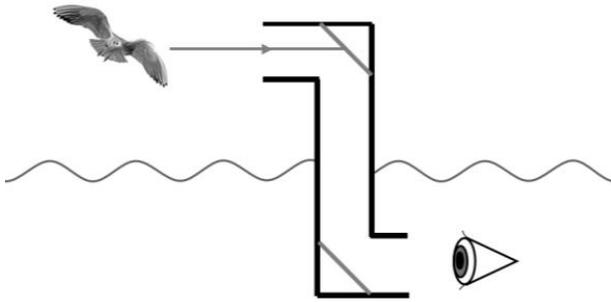
Then mirror 2 reflects the towards the driver's eyes.



# Your turn

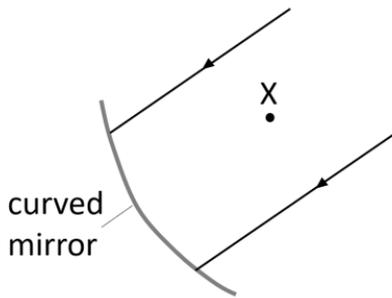


**Q1**



Submarines used to use periscopes to see above the water.  
Copy and complete the diagram to explain how this periscope works.

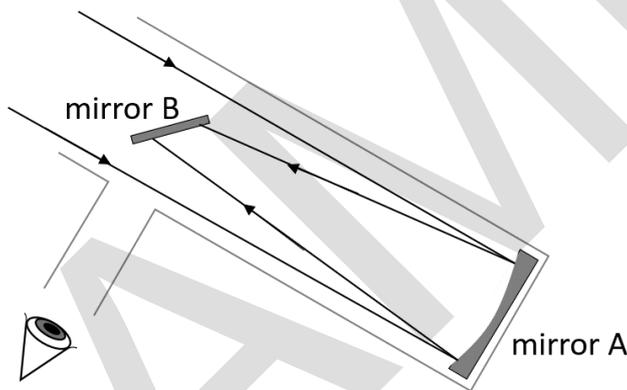
**Q2**



The diagram shows light rays hitting a curved mirror.

Sara puts a piece of paper at point X.  
The paper catches fire. Explain why.

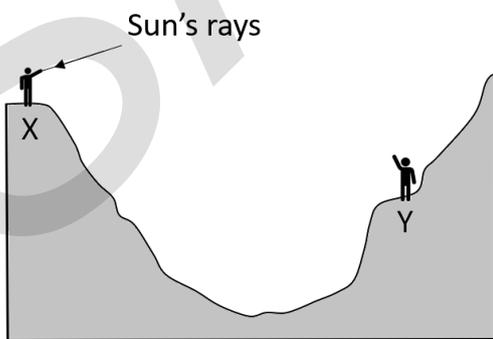
**Q3**



The diagram shows the inside of a reflecting telescope.

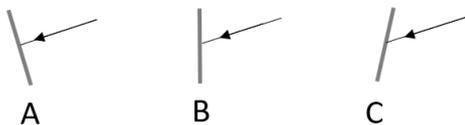
Explain how the person can see light from faraway objects.

**Q4**



Person X is holding a mirror.

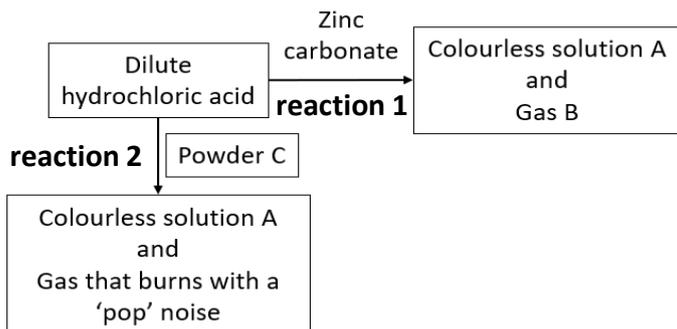
Which position (A, B or C) do they need to hold the mirror in for person Y to see the Sun's reflected rays?



1 /3 2 /3 3 /3 4 /3 Total /12



# 5.1 Products of acid reactions



The diagram shows two reactions of hydrochloric acid.

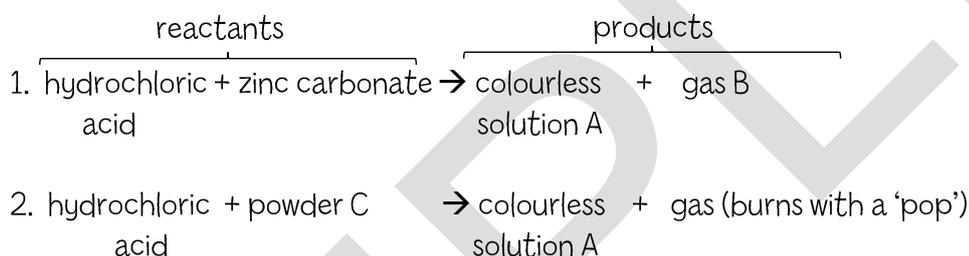
Name these substances:

- Solution A
- Gas B
- Powder C



## Detect

We can turn the information about the reactions into word equations.



I need to work out the identity of:

- Colourless solution A. This is a product of both reactions.
- Gas B. This is a product of reaction 1.
- Powder C. This is a reactant in reaction 2.

In both reactions the reactants are acids. So the concept I need is **'acid reactions'**.



Ideas



Diagram



Unknown



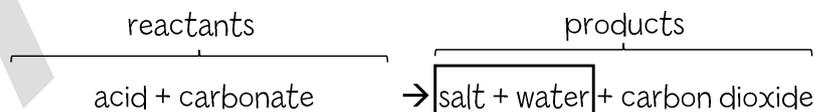
Concept



## Recall

### 1. How acids react with carbonates

The reaction makes 3 products: a salt, water and carbon dioxide:



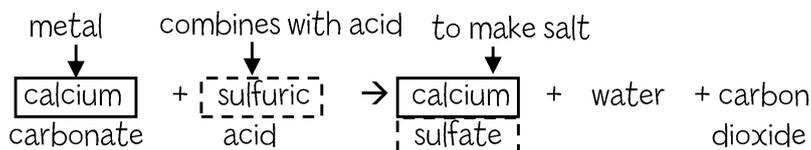
The salt dissolves in the water to make a solution

### 2. How to name the salt formed

Sulfuric acid forms sulfates. Hydrochloric acid forms chlorides.

Nitric acid forms nitrates.

Example:



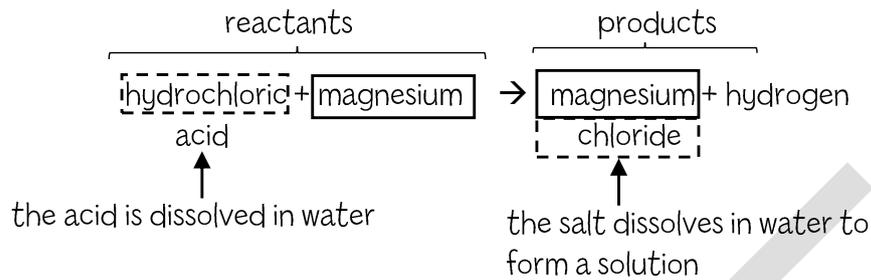
Why does the reaction produce bubbles?



## Recall

### 3. How acids react with metals

The reaction results in 2 products: a salt and hydrogen gas:



Why does the magnesium get smaller?

### 4. How to identify gas products

glowing splint → observation → flame reappears → deduction → gas is oxygen  
 lit splint → observation → POP! → deduction → gas is hydrogen  
 limewater → observation → limewater turns clear to cloudy → deduction → gas is carbon dioxide

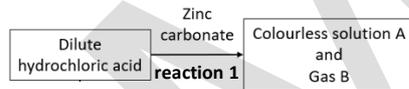
✓ Selection

✓ Inference



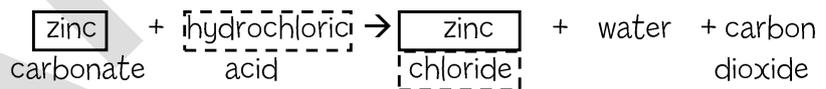
## Solve

a) In reaction 1: zinc carbonate + hydrochloric acid.



From 1 I know an acid + carbonate reaction makes: a salt, carbon dioxide and water.

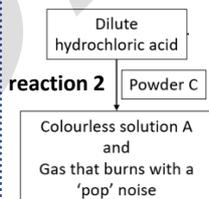
From 2, I know hydrochloric acid forms chloride salts. I can work out the name:



Why is zinc chloride made?

The salt is zinc chloride. It dissolves in the water to make a solution.

b) An acid + carbonate reaction makes carbon dioxide. So gas B is carbon dioxide.

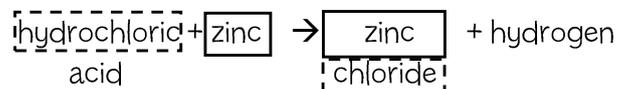


c) In reaction 2, I know that colourless solution A is zinc chloride - the same as in reaction 1.

From 4, I know the gas that burns with a 'pop' is hydrogen.

From 3, I know hydrogen forms when metals react with acid. The name of the salt comes from the metal.

So powder C must be zinc.



## Answer

a) zinc chloride solution

b) carbon dioxide

c) zinc



1

Firework	Test	
	Add powder to acid and collect gas	Burn powder
Silver fountain	Gas turned limewater cloudy	Burnt with a white flame
Crackling flower	Gas burned with a 'pop' noise	Burnt with a red flame

A scientist wanted to identify the substances in these fireworks:

- silver fountain
- crackling flower

In a firework, a powder burns. Metals give the flame different colours. Calcium makes red light. Magnesium makes white light.

The scientist tested each firework and put his results in the table.

Name the substance in each firework. Give a reason for your answers.

2



Some golf courses are next to the sea. Unfortunately, this means that many golf balls end up in the water.

Engineers have invented a new type of golf ball. It is a mixture of citric acid and sodium carbonate, wrapped in paper.

Explain how this ball is better for the environment than a plastic golf ball.

3

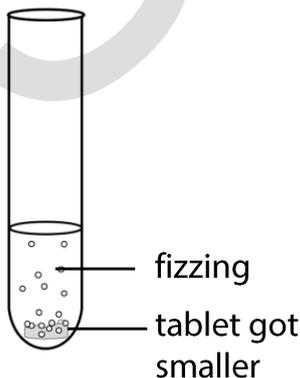


Food cans are made of a metal called steel.

Inside the can, a layer of plastic covers the steel.

Explain why the plastic is important.

4



Huda suffers from indigestion. She wants to find out how indigestion tablets work.

Indigestion happens when the stomach makes too much hydrochloric acid. Indigestion tablets contain magnesium carbonate.

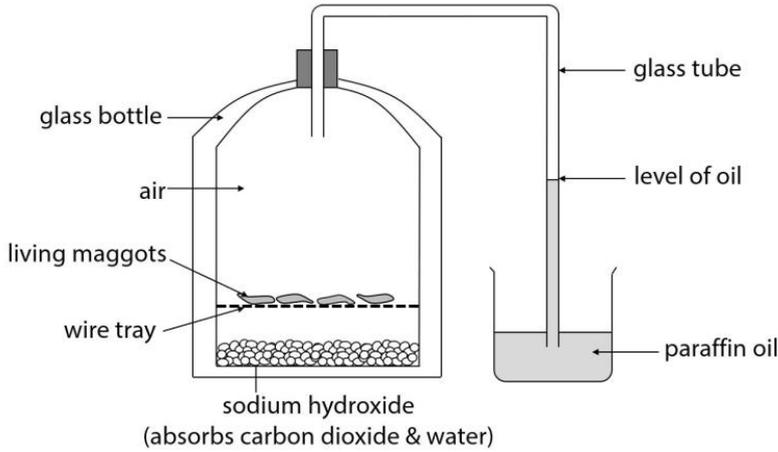
Huda adds an indigestion tablet to hydrochloric acid. The diagram shows her observations.

a) Explain the observations. Include a word equation.

b) Explain how indigestion tablets treat indigestion.



# 9.1 Predict respiration results



Clara sets up an experiment where she put maggots inside a glass bottle.

The maggots start to carry out respiration.

- a) Predict what happens to the level of oil inside the tube. Give a reason.
- b) Explain why Clara should not leave the experiment running for very long.

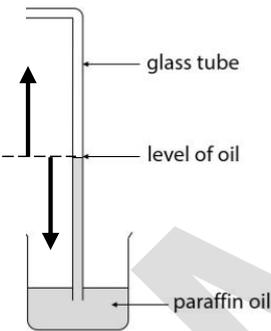


## Detect

There is air inside the glass bottle and glass tube.

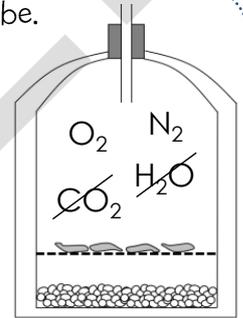
Air contains oxygen, nitrogen, carbon dioxide and water vapour.

The sodium hydroxide removes the carbon dioxide and water.



I need to work out:

- a) If the oil goes up, down or stays the same.
- b) why the experiment cannot be left for very long.



✓ Ideas

✓ Diagram

✓ Unknown

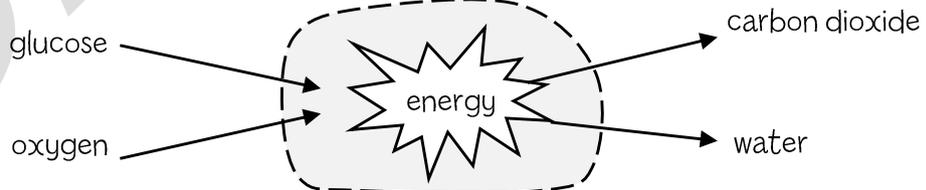
✓ Diagram

✓ Concept



## Recall

### 1. How respiration releases energy

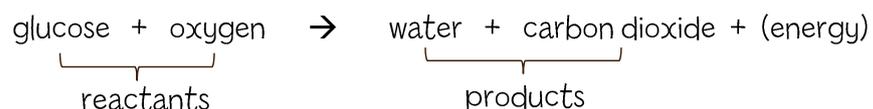


Glucose and oxygen enter a cell

When they react, stored energy in glucose is released

This makes carbon dioxide and water, which exit the cell (carbon dioxide is poisonous)

Here is the word equation for this respiration reaction:

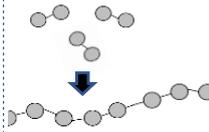




## Recall

### 2. How organisms use energy

Organisms need energy for life processes:



Movement requires energy to contract muscles



Mammals and birds also need energy for heating the inside of their body when it is cold outside.

What will happen to an organism if it cannot respire?



## Solve

✓ Selection

a) From 1 I know

reactants in respiration:

Oxygen + glucose



products:

carbon dioxide + water (+ energy)

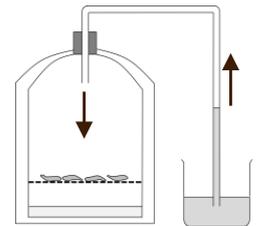
✓ Inference

Oxygen inside the gas jar is used up.

Carbon dioxide and water are produced but are absorbed by the sodium hydroxide.

So there is less gas inside the bottle.

The oil must rise up to replace this lost gas.



✓ Selection

b) From 2, I know the maggots carry out respiration to release energy for life processes.

✓ Inference

Without respiration and energy, the maggots will die.

✓ Cause

### Answer

a) Maggots carry out respiration. This causes the amount of oxygen in the bottle to decrease and the amount of carbon dioxide and water to increase.

✓ Effect

The water and carbon dioxide get absorbed by the sodium hydroxide. Overall the amount of gas inside the bottle will decrease.

So, I predict that the level of oil inside the tube rises to replace the lost gas.

✓ Claim

b) Clara has to stop the experiment otherwise the maggots will die.

✓ Evidence

They carry out respiration, which uses up oxygen and releases carbon dioxide.

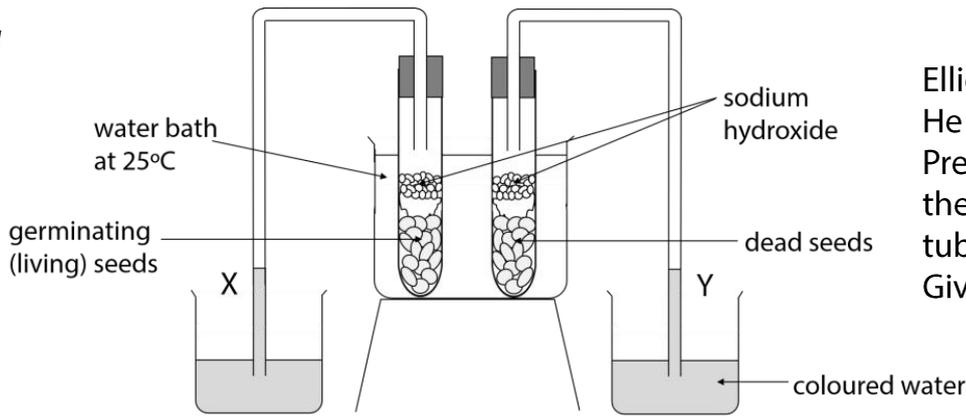
✓ Reasoning

After a while there will be less oxygen, which will affect respiration. Also, there will be more carbon dioxide in the bottle, which is poisonous.

## Your turn

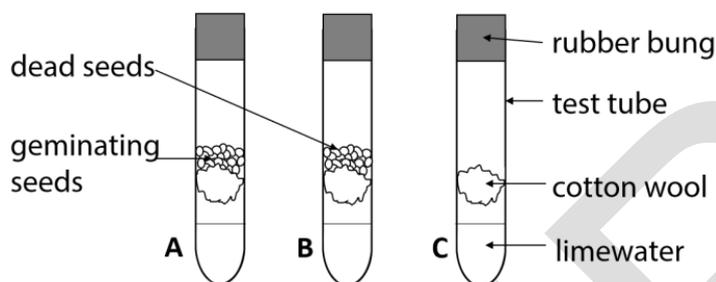


1



Elliot sets up this equipment. He leaves it for 24 hours. Predict what will happen to the level of coloured water in tube X and tube Y. Give a reason for each.

2

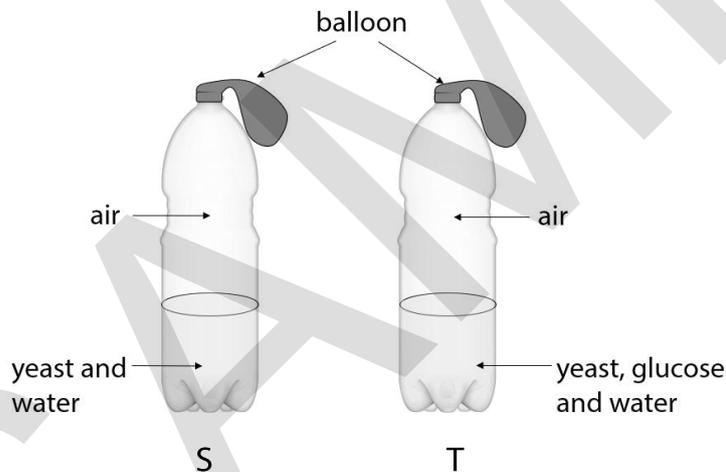


Jay sets up this equipment and leaves it for 2 hours.

In which tube(s) does the limewater go cloudy?

Explain your answers.

3



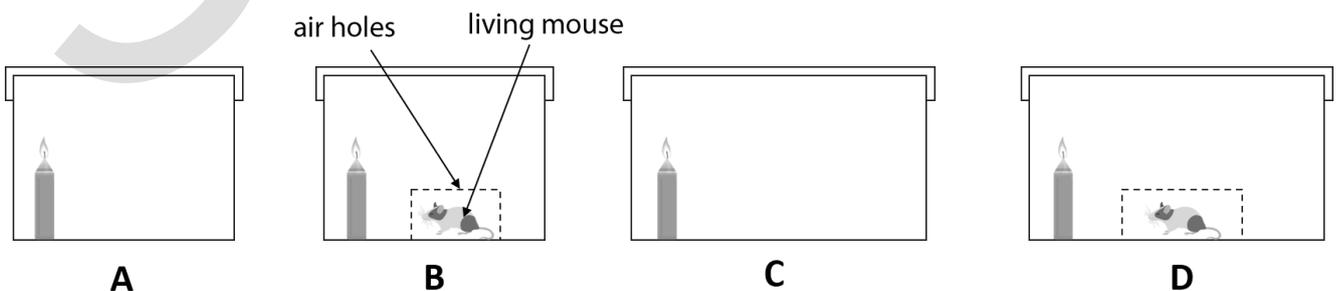
These bottles are left in a room for 2 hours at 25°C.

Predict what will happen to the balloon on top of each bottle.

Give a reason.

4

In which box will the candle stop burning first? Give a reason for your choice.



1 /3    2 /3    3 /3    4 /3    Total /12

# Praise for the Mastery Practice books

"They are fantastic. My staff and I are blown away at the quality of these books."

**Raheela Saleem, Challney High School for Girls**



"The detailed explanations of the example questions are excellent and allow students to read and reread them and then take on similar questions."

**Philip Thornley, Immanuel College**

"Very engaging from the start. Presented in an easy-to-follow format that draws the pupil in. Would highly recommend!"

**Maureen O'Regan**

"My students are actually now attempting difficult questions when before they were left blank."

**Dr Karin Bratby, Hall Park Academy**

"The scaffolding of text and diagrams along with a step-by-step guidance has led to all my pupils from SEN to G&T improve their levels to meet their targets. But more importantly, their confidence has grown to such an extent that they look forward to exams and, even more, getting their results."

**Jennifer Clarke**

"This book is a must for any science teacher. The tasks are differentiated so the students can work their way up. The questions are interesting and stimulate deep thinking."

**Irina O'Sullivan**

"A must have resource for every student. Brilliant!"

**Mahamudu Seidu, Eastlea Community School**

"We have been so impressed that we have just ordered a GCSE practice book, rather premature in view of the ages of my three children - but I have been enjoying working with my Year 7 son so much! "

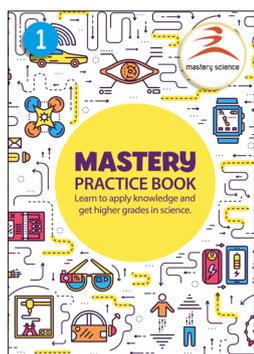
**Clare Sandy, parent**

# Get more from Mastery Science



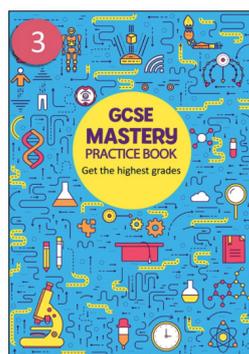
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## Year 7 Apply Practice Book



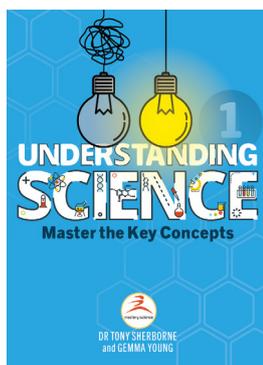
Help students go beyond recalling information and teach them to apply concepts. By starting to practise the strategy of 'Detect, Recall and Solve' from year 7, they will become expert at solving problems by GCSE. This book contains hundreds of questions and covers all the concepts in year 7 of the 5-year plan (Blueprint).

## GCSE/year 9 Apply Practice Book



40 types of problems to develop students' problem solving abilities, and prepare them for the demands of apply questions at GCSE. Covers 24 key concepts taught in year 9/at the beginning of GCSE.

## Understanding Science 1



Not an ordinary textbook, it's designed using cognitive science to help all abilities grasp the difficult ideas. Understanding Science teaches all the year 7 concepts from the 5-year plan (Blueprint), using visual explanations, thinking and mixed-up questions and full reviews of primary science concepts.

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A comprehensive teaching and assessment programme to give students a strong KS3 foundation in all the concepts and skills over two years, ready for GCSE. It supports students to: activate prior knowledge, acquire deep understanding, apply ideas, assess understanding, analyse information and test knowledge and skill - in short, it gives you a pathway to mastery!

## Blueprint



A 'backwards designed' curriculum framework to ensure that students build expert knowledge they can apply in GCSE, not disconnected knowledge. 13 big ideas break down into key concepts, each its own vertical progression for students to revisit ideas in ever greater depth. The free year 7 & 8 planners set out clear yearly teaching objectives for knowledge, understanding, enquiry skills, application and analysis, to help you create coherent schemes of work.

**Y8 SCIENCE**  
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**Created by:** Dr Tony Sherborne

**Lead writer:** Gemma Young



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