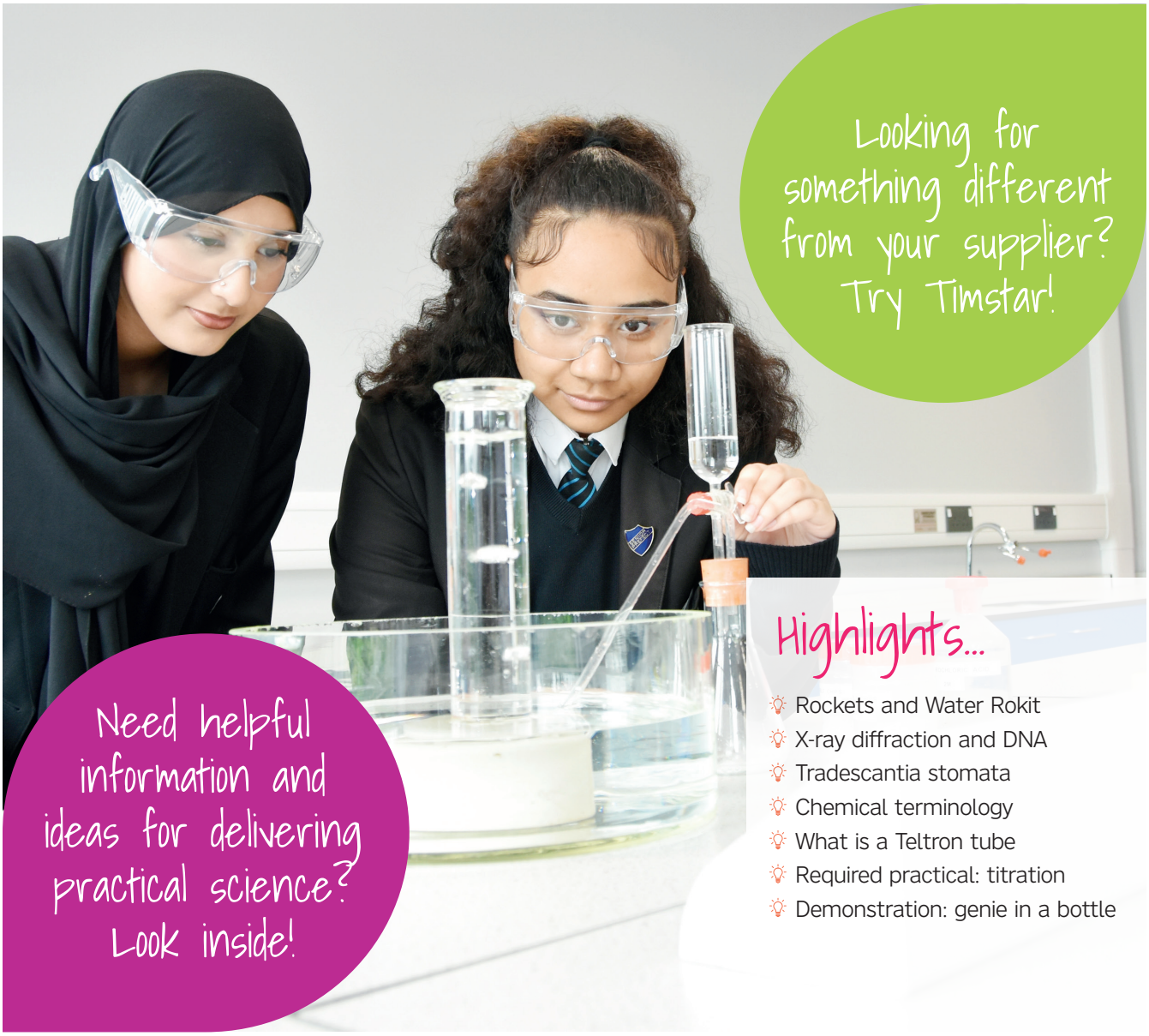
TIMSTAR

Part of WF Education Group™

INSPIRING TOMORROW'S SCIENTISTS THROUGH PRACTICAL SCIENCE

This is for you! Take a look inside and see what you think!



Looking for something different from your supplier? Try Timstar!

Need helpful information and ideas for delivering practical science? Look inside!

Highlights...

- Rockets and Water Rokit
- X-ray diffraction and DNA
- Tradescantia stomata
- Chemical terminology
- What is a Teltron tube
- Required practical: titration
- Demonstration: genie in a bottle

VISIT OUR RESOURCE HUB, FULL OF USEFUL IDEAS AND INSPIRATION

shop.wf-education.com/science

Some of our highlights...

Supportive, informative, instructive

Here at Timstar we believe that selling equipment is just one aspect of our role, we also want to educate, inform, and support our valued customers and your students.

We have filled this new brochure with information to aid you in the day-to-day running of the prep room, from keeping yourselves and students safe, to valuable practical guidance and some interesting articles as well as exciting demonstrations to try.

We hope that you will find something inspiring in this autumn's brochure, as well as our high-quality product ranges, obviously!

Enjoy browsing!

Delivery charges

FREE delivery on all orders* of £75 and over. Orders of less than £75 are subject to a £7.50 delivery charge (within UK mainland).

We aim to dispatch all stocked items ordered before 11am, on the same day.

* Delivery to Scottish Highlands and Islands is subject to a surcharge. Please, contact Customer Support for an estimate.

Carriage Surcharges

Certain chemicals e.g., lithium, potassium, methanol, bromine etc, may now only be transported by ADR vocationally trained drivers. As such, we have implemented a carriage surcharge of £12.50 if an order contains these chemicals.

All chemicals with the surcharge are clearly highlighted online. Any over-sized or weighted items may be subject to specific delivery charges, for help and advice email us at customer.support@wf-education.com

Need advice?

Please, call our friendly Customer Support team (Mon - Fri, 8.30am - 5pm, excl. Bank Holidays) on 01743 812 200 for advice on your delivery options, prices, and product selection. We offer additional delivery options including guaranteed next day.

We also have an experienced Technical Team to answer all your questions regarding our products, troubleshooting, or any health and safety queries.

These mailers are **100% recyclable**

The important bit...

T&C's: All prices shown in this brochure are ex. VAT. Online orders only, framework and overseas customers excluded. Listed prices valid until 31/10/2024. Timstar reserves the right to stop or amend any promotions at any time. Items marked as CX incur additional delivery charges. All hazardous goods, chemicals (incl. live cultures/media) are non-returnable. Accurate at the time of print.

For full and most up-to-date terms and conditions, please, visit wf-education.com/terms-and-conditions

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Brochure top picks!

Here are our brochure top picks, we hope that you enjoy them too!

A great read about the work of teams at London and Cambridge universities and the importance of Rosalind Franklin's x-ray crystallography work in the discovery of DNA.

See pages 34-35

Propel physics into the stratosphere with Water Rokit kits! See how this fantastic product works and enhances both physics and chemistry sessions. Great for open evenings and transition days!

See pages 10-11

From the Royal Society of Chemistry: the catalytic decomposition of hydrogen peroxide. A super demonstration of oxygen production. Everyone could use a little genie magic in their labs!

See pages 20-21

Objective lenses are one of the most important components within a microscope as they are responsible for image formation and quality.

Magnification

Objectives are a key component in magnifying the specimen you are looking at. The magnification power of an objective for a typical educational microscope would be between 4x and 100x (this will be further magnified by the eyepiece which tends to be 10x).

Navigating microscope numerical aperture - NA

The numerical aperture is related to the angles of light which are collected in a lens which in turn affects the image resolution - the ability to distinguish details within the specimen you are viewing. The **higher** the NA value the **better** the resolution.

Please note that the numerical aperture also relates to the condenser. The numerical aperture of the condenser must be equal to or exceed the numerical aperture of the objective.

For example, the objective pictured above has a numerical aperture of 1.25 and would be best suited for use on a microscope with an Abbe condenser which will offer a numerical aperture of 1.25 too. It would not be advisable to use this objective on a microscope with a 0.65 NA condenser as optimal results would not be achieved.

BMS 146 FLARQ Microscopes

These BMS FLArQ microscopes are ergonomically designed with a reverse nosepiece for ease of access to the slide. They feature magnification of x40, x100 and x400. a rack and pinion system for the condenser and an integrated mechanical stage.

MI240050	Monocular	£210.00
MI240060	Binocular	£305.00
MI240070	Trinocular	£350.00

Want to know more about microscope objectives? Trying to understand the difference between achromatic, Semi-Plan, E-Plan, Plan?

Visit our Resource Hub

TIMSTAR

What is the objective tube length?

This is the distance from the opening of the nosepiece, where the objective is screwed in, to the top of the observation tube, where you insert the eyepiece.

If this distance was lengthened, for example by adding an accessory like a polarizer, then the image would be distorted.

To use the accessories, you need to have objectives that are marked as infinity corrected

The standard thickness for a cover slip is 0.17 mm, this is a number 1½ cover slip. Higher numbers indicate thicker glass.

Choosing the correct thickness of coverslip

A coverslip is usually made from thin borosilicate glass and is used to cover specimens to be viewed on a microscope slide.

For optimum results use the thickness of coverslip identified on your microscope objective.

BMS EDULED FLARQ Microscopes

A high-quality, well-equipped microscope with Semi Plan objectives and a height adjustable Abbe condenser with iris diaphragm, making it suitable for the addition of a 100x oil immersion objective. Coarse and fine coaxial focussing and a mechanical stage combined with an ergonomic design and built in carry handle make this the ideal microscope for advanced microscopy.

MI240080	Monocular	£285.00
MI240090	Binocular	£380.00
MI240100	Trinocular	£425.00

BMS D2 Microscopes, 1000X

Developed for use in education and professional laboratories, this high-specification microscope offers ergonomic design, sturdy components and high-quality LED. Featuring sPlan objectives, integrated X-Y specimen holder and an Abbe condenser which can be exchanged for darkfield or phase contrast condensers.

MI240110	BMS D2-211SP Monocular	£370.00
MI240120	BMS D2-220SP Binocular	£475.00
MI240130	BMS D2-223SP Trinocular	£545.00

A spirometer allows you to measure tidal volume (the volume of inhaled /exhaled air into and out of the lungs), and thus investigate oxygen uptake.

Traditionally it is a large tank, with a counterbalanced float, containing oxygen and sealed by water. A tube connects the float to the user and as the user breathes in and out (using the oxygen in the float), the float moves up and down. The float arm is marked with graduations, so the litres of oxygen moved can be measured.

Carbon dioxide is removed with soda lime and a pen arm is attached if a real time trace is required – you can also use data logging capture software with some spirometer machines.

Measuring tidal volume (volume of air inhaled/exhaled) can lead to investigations in oxygen uptake, respiratory rate, and vital capacity.

Best Seller!

Clifton Spirometer

For investigating tidal volumes, respiratory rate, pulmonary ventilation, reserve volumes and vital capacity. A simple lever control enables the subject to be connected either to the atmosphere or to the float for recording. A container for soda lime crystals is fitted which absorbs the CO_2. The float is constructed from lightweight plastic and is calibrated in 0.5 litre steps with maximum capacity of 7 litres. A pen arm allows attachment of a fibre tipped pen for recording results or for attachment to a position sensor for datalogging. Two flexible corrugated breathing hoses 0.8 m long are provided. Supplied with two mouth pieces and noseclip. Complete with full instructions.

HE63100 £1125.00

See the Phywe website for some experiment ideas using the Phywe spirometer:

The Phywe spirometer

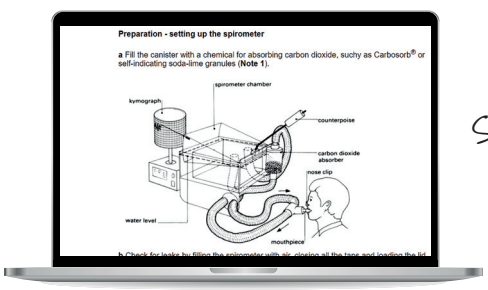
The spirometer has come a long way in this digital age, and now you can use a spirometer that requires no water, and no large tank.

PHYWE
excellence in science

The Phywe datalogging spirometer fits in your hand, and when connected to the free measure app software, can give you immediate results of lung function. There is an offline function where you can collect the data separately to be analysed at a later date.

The flow rate has a range of +/- 10 L/s and the volume has a range of +/-15 L.

Some great experiments you can do with the Phywe spirometer include standard tidal volume and lung capacity.



See a lesson plan for investigating lung function using a spirometer from The Royal Society of Biology

✓ Lung function is a feature of all biology curriculums, in the gas exchange topics and respiratory system.

Cobra SMARTsense Spirometer Sensor

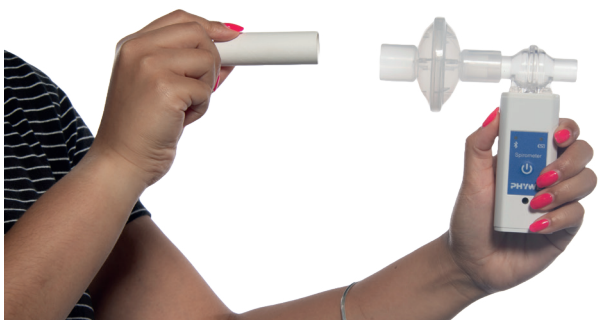
- Quick and easy connection via Bluetooth and the free measureAPP
- Contains a USB-C rechargeable lithium polymer battery
- Up to 50 hours use on one battery charge

- Flow rate:
  - o Range: ±10 l/s
  - o Resolution: 0.01 l/s

- Volume:
  - o Range: ±15 l
  - o Resolution: 0.01 l

- Sample rate: 200 Hz

DA220130 £347.00



Spare Mouthpieces

These cardboard mouthpieces can be placed on the Cobra SMARTsense Spirometer mouthpiece and come with built-in filter.

DA220135 £12.70

To see the entire range, search Phywe

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Search Phywe

Here we dabble into the mysteries of chemical grades and purity

In some of our earlier brochures we included technician training modules, covering health and safety, chemical storage, risk assessment, making solutions and chemical labelling and hazard symbols (for more information on these topics visit the Resource Hub or download our previous brochures).

Chemical grades

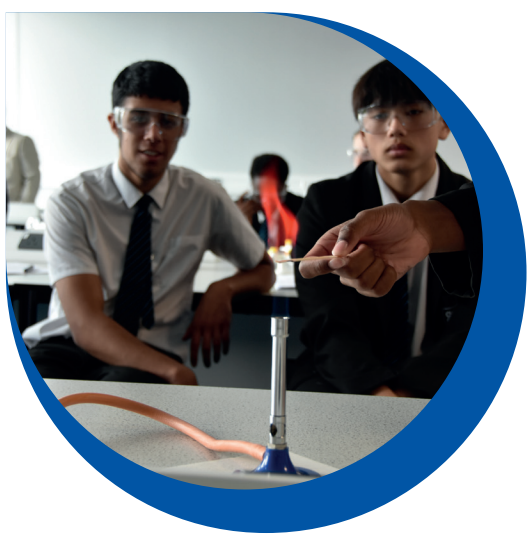
The different grades of chemical usually depend on the chemicals' purity, and the difference between them all is really very slight.

From lowest to highest grade, they are:

Technical Grade (T) → Lab Reagent (LR) → Analytical Reagent (AR)

For most school practical work, Lab Reagent (LR) and even Technical Grade (T) is suitable.

When you get to A level and practicals requiring purification and pure reagents you should choose Analytical Reagent (AR) where you can.



Explore the full blog and find advice on making solutions and dilutions here!

What % is a liquid?

This is a question we often get asked, especially with liquid enzymes: “I need 0.5% (for example) but what is the % of the liquid I have bought?”

If you buy a liquid enzyme or any stock liquid, you can consider it to be 100% concentration unless the label tells you otherwise (in which case it has already been diluted and this dilution will be given).

Therefore, you use the liquid as your starting point and a 0.5% solution will be 0.5 mL of the stock solution added to 99.5 mL of (usually) water to make a final 100 mL (diluted) solution.

View our full range of competitively priced chemicals here

IMS or ethanol?

IMS: industrial methylated spirit, also called ethanol (mineralised). In most practicals ethanol can be substituted for IMS.

IMS is ethanol with some toxic additives present (including methanol) to render the ethanol denatured and unpalatable (and cheaper), but you do need a signed document for larger orders. Ethanol is usually 95% pure and fine for most school science applications.

Absolute ethanol (ethyl alcohol) is the purest form of ethanol that you can buy (min. 99% pure). It is often called 100% ethanol. You may want to reserve absolute ethanol for A level, and practicals that specifically ask for it, as it is considerably more expensive than IMS (no licence is required to hold ethanol).

DID YOU KNOW?

70% alcohol (can be IMS or ethanol) can be used to sterilise benches and equipment in microbiology practicals.

Make sure sprayed bench tops are dry before working. 70% ethanol is flammable.

50% ethanol can be used to make flame test sprays for demonstration through a Bunsen flame. See RSC for a method using spray bottles.

Making rockets is a fun and visually engaging activity that can cover physics and chemistry topics and is an excellent opportunity for applied thinking, creative working, and teamwork, as well as some healthy competition!

There are a number of different rocket activities that can easily be done in schools. Starting small are film canister pop rockets, and moving on to air propelled rockets which use air pressure to launch paper rockets. For details of how to do these activities, as well as the science behind how they work, visit our Resource Hub.

A popular activity is rockets propelled with water, and here the commercial Water Rokit is one of the most popular choices. Once launched these can reach heights of up to 100 ft (over 30 m) using water pressure as the propellant.

Water Rokit

Scan to read our rocket content

Here's where Newton's 3rd law comes to life! This law states that whenever two bodies interact, the forces they exert on each other are equal and opposite. In the Water Rokit, blasting out water under pressure propels the rocket upward. Forcing the water downwards creates an equal force upwards, similar to how a space rocket's fuel and oxygen mixture generates thrust, the gases are pushed out of the bottom of the rocket with such force, that the rocket is propelled upwards at great speed.

To keep the Water Rokit flying straight up, fins are added to the bottom. These fins act to counteract the sideways motion of the rocket caused by the uncontrolled nature of high-pressure water leaving the bottle.

If the rocket starts to drift, the air striking the fins pushes it back on track. Strong gusts can still overcome the stabilising effect of the fins, so it is always worth checking the weather before launch day! Like all rocket practicals, the Water Rokit meets the **physics forces** requirement in the curriculum.

Coming soon is the Water Rokit logger, to measure the rocket's height and acceleration.

This data is fed back to a computer, allowing students to graph the flight and link it to the speed/time/distance part of the physics specification, and Newton's second law: Force = mass x acceleration.

Check the Water Rokit and Timstar websites for the release date and new activities.

For more information and loads of Water Rokit based activities including video demonstrations and lesson plans, head to the Water Rokit site

Water Rokit Kit

The Rokit Water Rocket Kit is a precision water rocket used by schools, colleges and space cadets throughout the world to demonstrate the Laws of Motion. Complete Rokit Kit comprises of:

- 3 Fins
- Bottle Screw Collar
- Collar O-Ring
- Rubber Nozzle
- Pressure Tube (with fittings)
- Assembly Instructions

The kit makes use of an empty 1 or 1.5 L plastic bottle. The special cap, nozzle and fins supplies are attached to the bottle. An air tube and adapter are supplied to connect the bottle to cycle pump. The bottle is part filled with water and air pumped into the bottle. The pump connector on the bottle releases at set pressure and the rocket is then launched. The rocket will reach height of approximately 20 metres. The bottle and cycle pump are not supplied, all spares available.

RO12950 £10.00

Rocket Factory Kit

Design and make your own realistic rockets and launch them safely to heights of up to 100 metres. The rockets are made by rolling paper around a plastic tube and attaching a plastic nose cone. They are propelled using an electrically-controlled compressed air launcher which gives near-chemical performance but at zero cost per launch. Provides opportunities for exploring basic rocket science enhancing subject teaching in design and technology, science and maths.

RO95655 £350.00

Foot Pump

Car foot pump with 120 mm barrel and 450 mm hose with nylon connector and football inflator adapter. Complete with integral pressure gauge marked 0-100 p.s.i. and 0-7 kg/cm2 (7 bar).

PU12750 £22.65

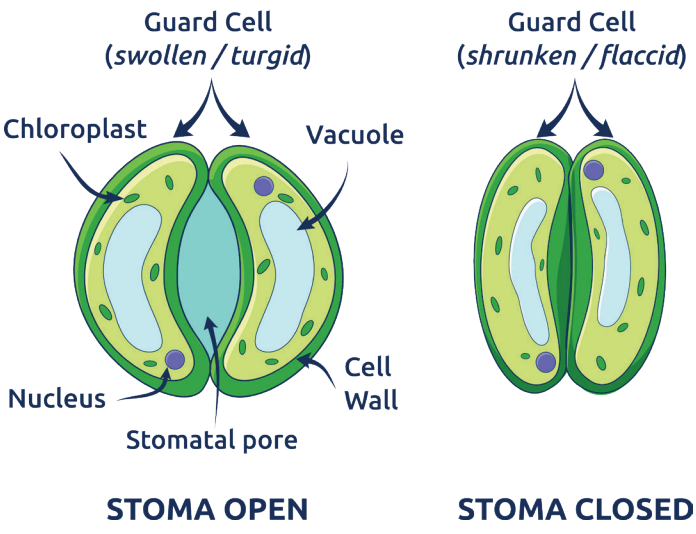
Tradescantias are extremely easy plants to grow and look after in the prep room, often known as spiderwort or inch plant.

What are stomata?

These are often described as pores (holes) in the leaf epidermis, which allow for gases and water vapour to diffuse into and out of the leaf. The pores are surrounded by two 'guard' cells which can open and close the pore depending on whether they are swollen or deflated. When the guard cells lose water, they become deflated (flaccid) causing them to come together and close the pore. This occurs when the plant needs to retain water inside the leaf.

If water needs to leave the cell the pores open by the guard cells taking in water themselves and swelling, pulling apart from each other.

There is a balance to be had in retaining or losing water and regulating gas movement in and out of the leaf cells.



TOP TIPS

- A bright windowsill is best to maintain the variegation.
- Water when the top of the soil appears dry.
- They are also good trailing plants, and cuttings will readily root in water.

BMS D3 Microscopes

A new approach for higher demands in microscopy. In a nutshell: flexible, efficient, stable and comfortable in use. Offering quintuple nosepiece with ePlan objectives, large working stage which will hold 2 microscope slides and magnification of up to 1000x.

MI240220	Binocular	£725.00
MI240230	Trinocular	£825.00

BMS 200 FL LED Microscope

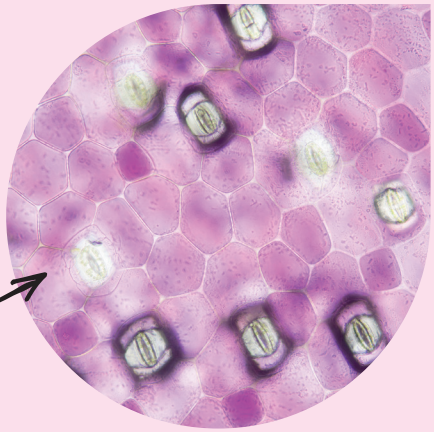
The highly popular 100 FL LED microscope with the facility to add a camera of your choosing.

MI240030 £160.00

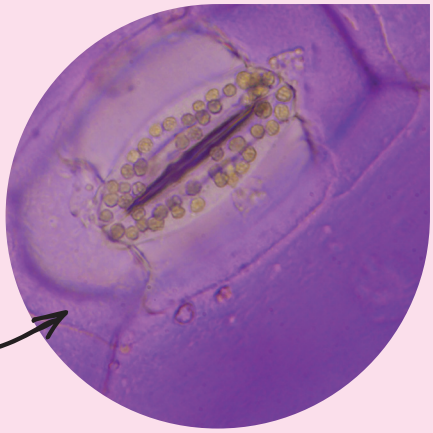
The stomata on the underside of the tradescantia leaf are quite spectacular. Requiring no treatment or staining of any kind, just remove a leaf and place underneath the microscope objective with the underside of the leaf facing upwards.

These are the results you should be able to see:

Tradescantia leaf showing closed stomata

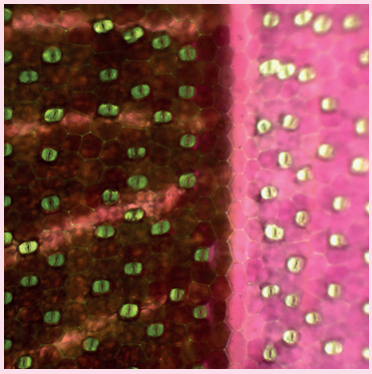


Tradescantia leaf under high power showing chloroplasts in stomatal guard cells

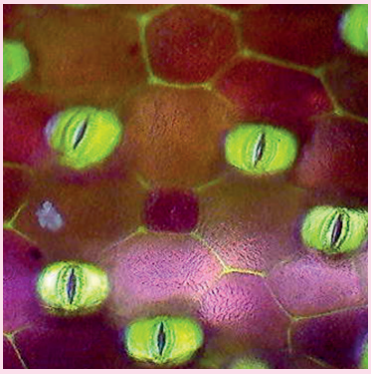


Underside of tradescantia leaf showing stomata

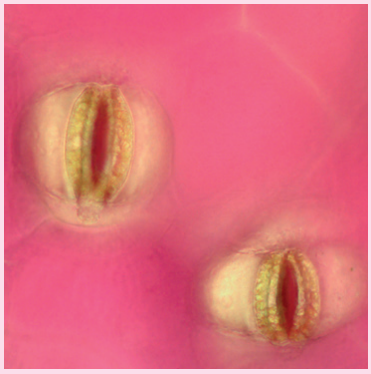
X4 objective



X10 objective



X40 objective



Want to know how to do a stomatal peel? Visit our Resource Hub!

USB Cameras

A USB microscope camera connects to your microscope on a c-mount adapter or over the microscope eyepiece and plugs directly into your computer or laptop with a USB connection.

MI240150	USB 2.0, 3.1MP	£175.00
MI240160	USB 2.0, 5MP	£199.00

WiFi Cameras

WiFi microscope cameras connect to your microscope and create their own WiFi signal.

MI240170	WIFI 2.5MP	£420.00
MI240180	WIFI, 1.0MP	£215.00

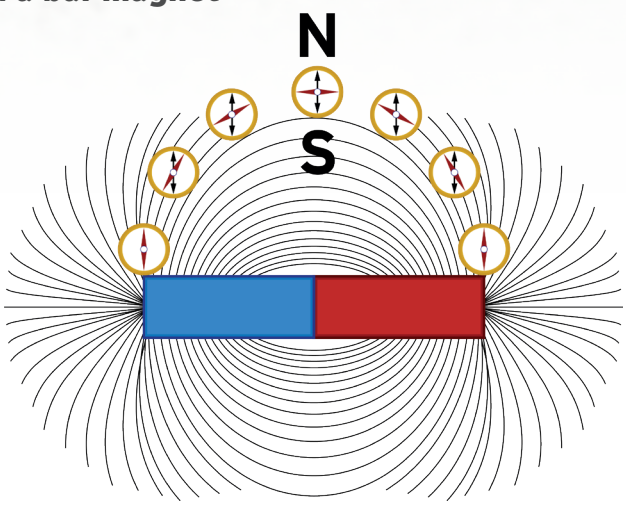
From primary through to A level, magnets are ever present in the physics curriculum.

At the simplest level, they show the force of attraction and repulsion between conductor and insulator material types. Once into key stage 3 and 4, the finer scientific detail of magnetic fields including electromagnetism, solenoids, Fleming's rule, and motors, through to magnetic flux density at A level.

Key stage 3: Showing magnetic field lines around a bar magnet

Equipment

- Bar magnet with North and South marked
- Iron filings in a pepper shaker or similar
- White paper
- Tray to fit the paper into (optional)
- Safety spectacles
- Plotting compass (optional)



Method

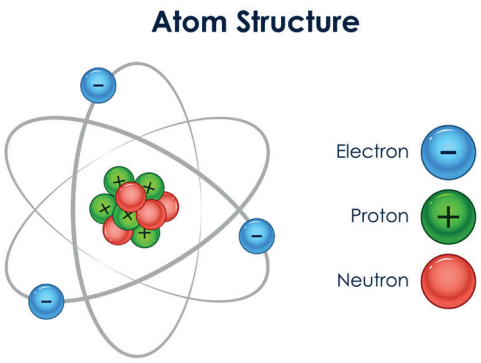
1. Place the paper into the tray, covering the bottom.
2. Place the bar magnet into the middle of the paper.
3. Sprinkle a light layer of iron filings over the paper and watch the magnetic field lines form.
5. At the end of the practical, remove as many filings from the magnet as possible, depositing them onto the paper.
6. Place the magnet to one side and pour the iron filings into a central container, for the technician to remove.
7. Wash hands before removing safety spectacles.
8. This activity can be made more suitable for older students by replacing the iron filings with small plotting compasses. Placing compasses around the magnet will allow the students to draw in the field lines.

TOP TIPS

Wrap the bar magnet in clingfilm before use to make clean up easier. When you remove the cling film, the iron fillings will come with it.

Magnetic field lines show the attractive and repulsive forces which surround the magnet.

- ✓ All materials are made up of atoms, which have electrons (negatively charged particles) spinning around them.
- ✓ The spinning negative charge makes a tiny electric current which causes a tiny magnetic field (domain).
- ✓ For most materials, both metal and non-metal, electrons spin equally in opposite directions and the magnetic effect is cancelled out.
- ✓ In three naturally existing metals; cobalt, iron, and nickel, most of the electrons are spinning in the same direction, making these metals magnetic, and can be magnetised when another magnetic material enters the magnetic field.



Want to know which type of magnet to use?

E.g., if you rub a piece of iron along a piece of cobalt all the electrons in the cobalt will line up and face the same direction, creating a North and South pole (and thus a magnet).

If you repeatedly drop the cobalt, the electrons will lose the rigid alignment and magnetism will decrease, rubbing it again with iron will restore the strength of charge. These naturally magnetic metals are known as permanent magnets.

At GCSE, students will also learn how electric currents can produce magnetic fields, showing how a solenoid, a device converting electrical energy into mechanical energy (power), works.

Bar Magnets, Plastic Coated, Ceramic

MA10125 £4.90 Pair

Bar Magnets, 'Alnico'

MA10130 50 mm £31.50 Pair
MA10135 75mm £14.70 Pair

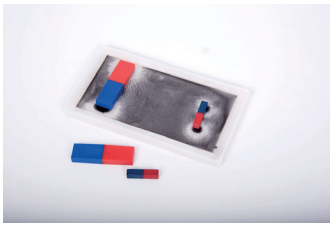
Horseshoe Magnet, 'Alnico'

MA10145 £5.30

Major Magnet, 'Alcomax'

One of the most powerful permanent magnets ever produced.

MA10147 £288.80



Magnetic Pole Pattern

A white frame with transparent window containing magnetic powder in a water based solution for showing magnetic field patterns.

MA10187 £38.80

Iron Filings Shaker

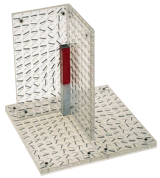
225 g of Iron filings.

MA10193 £2.80

Bar Magnets Set, Ferrite

A set of 20 painted (red/blue) ferrite magnets for general use in exploring magnetism.

MA170300 £21.50 Set



Magnetic Field Plates Set

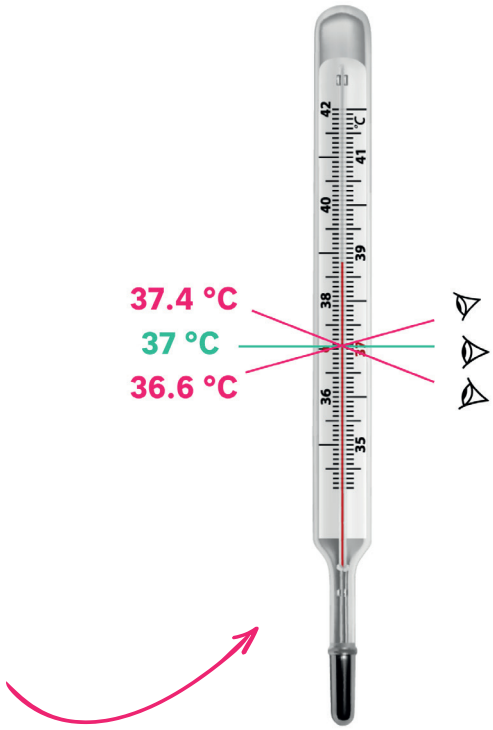
A versatile and impressive tool for displaying field patterns and simulating the magnetising of bar. When four plates are stacked together, they model metal bar that can be magnetised by stroking with bar magnet and demagnetised by shaking. 98 magnetic pins in each plate.

MA55050 £39.95

A thermometer works through thermal expansion: as temperature rises, the liquid inside expands and rises; as temperature drops, the liquid contracts, and falls, indicating the temperature.

What liquid is used in a thermometer?

- ✓ Mercury liquid thermometers give the most reliable and repeatable results. Because of the toxicity of mercury these are not usually used in schools.
- ✓ The preferred liquids are alcohol-based solutions, dyed red, green, or blue to make them easier to read. Spirit filled thermometers cover temperatures down to -200^{0}C.
- ✓ LO-tox™ is an organic filling offering a wide temperature span and providing the lowest practical levels of hazard.
- ✓ ECO-therm thermometers are green spirit thermometers filled with a non-toxic expansion liquid. The quality and resolution make these ideal as a substitute for mercury thermometers.



How to read a thermometer.

The correct way to accurately read a thermometer is to ensure it is level with the eye, to avoid reading errors caused by parallax error.

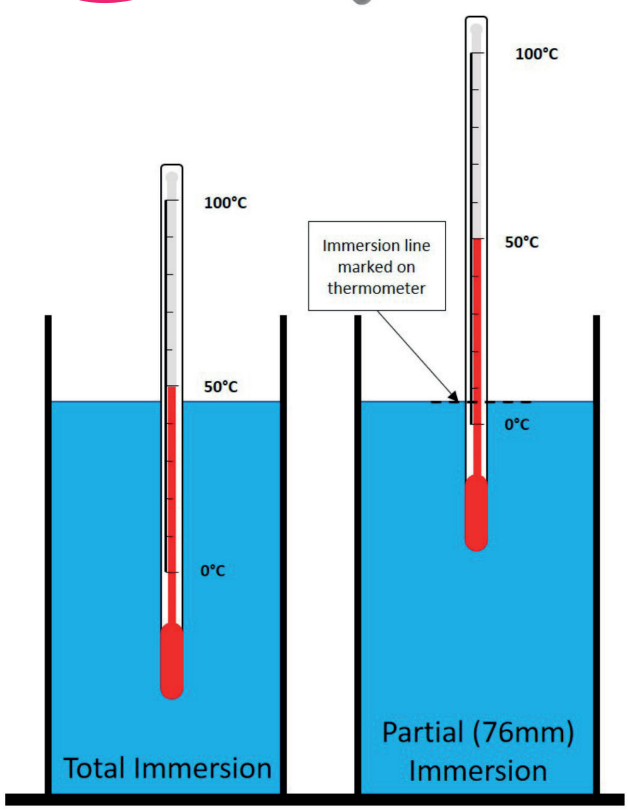
Partial or total immersion?

Partial immersion thermometers are designed to measure temperatures accurately when immersed in the test liquid up to a marked line. This is usually 76 mm. They can show variances in temperatures as the temperature around the stem can affect the overall temperature being measured.

Total immersion thermometers should be immersed up to the level of the liquid column (i.e., the meniscus of the liquid in the thermometer) or can be completely immersed.

They are usually more accurate than partial. However, they can be more difficult to read and cannot be used with very shallow liquids.

If you use the thermometer at the incorrect immersion, you will get an erroneous reading.

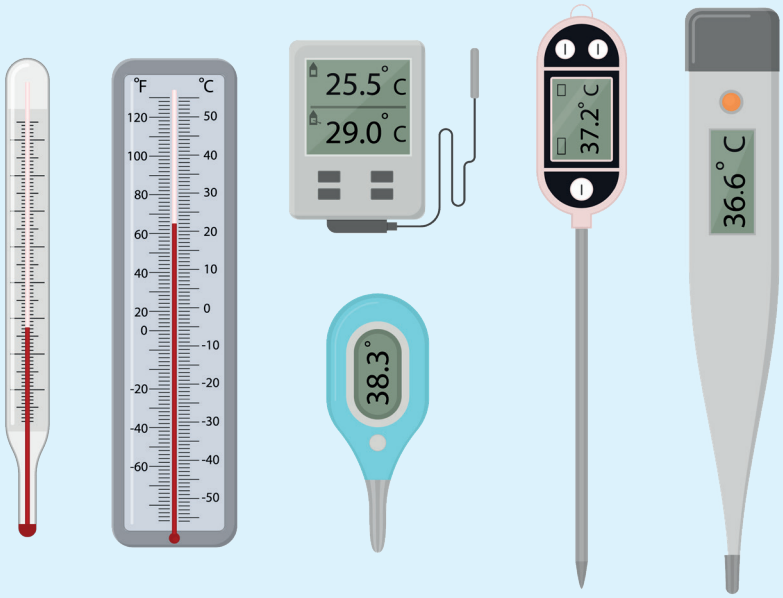


Digital or glass?

Glass thermometers are sufficiently accurate for general measuring, especially in schools. They are versatile, durable, and easy to use.

In some circumstances it may be preferable to use a digital thermometer, which can adjust more rapidly to sudden changes in temperature.

Why not consider datalogging for temperature measurement? See our Phywe sensor here!



How to rejoin separated liquid in a thermometer.

Sometimes the liquid in a thermometer can separate. It is relatively easy to rejoin the spirit. For small separations, gently tap against your finger or hand as this can break the contact of the spirit against the capillary wall and allow it to drain into the main column. Gentle centrifugal force is another option. Swinging the thermometer in a slow arc can help to push the spirit back towards the bulb.

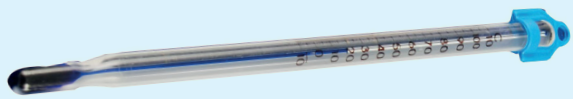
A final option is to carefully heat the thermometer until the spirit reaches the expansion chamber at the top.

When the liquid has rejoined, leave the thermometer in a vertical position with the bulb down for several hours to allow any spirit clinging to the sides to drain down the column.

Red Spirit Thermometers

White enamel back with reinforced bulb.

TH15430	305 mm, -10/50°C, 76 mm immersion	£3.00 Each
TH15431	305 mm, -10/50°C, 76 mm immersion	£29.20 Pack of 10
TH15432	155 mm, -10/110°C, Total immersion	£2.50 Each
TH15433	155 mm, -10/110°C, Total immersion	£23.40 Pack of 10
TH15435	205 mm, -10/110°C, 76mm immersion	£2.60 Each
TH15436	205 mm, -10/110°C, 76mm immersion	£24.50 Pack of 10
TH15440	305 mm, -10/110°C, 76 mm immersion	£2.70 Each
TH15441	305 mm, -10/110°C, 76 mm immersion	£25.00 Pack of 10
TH15445	305 mm, -10/150°C, 76 mm immersion	£3.00 Each
TH15446	305 mm, -10/150°C, 76 mm immersion	£29.40 Pack of 10



Blue Spirit Thermometers

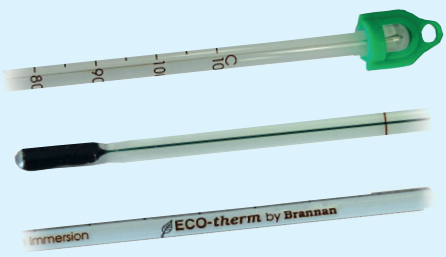
White enamel back with reinforced bulb.

TH15425	155 mm, -10/110°C, Total immersion	£3.00 Each
TH15426	155 mm, -10/110°C, Total immersion	£27.50 Pack of 10
TH15427	305 mm, -10/110°C, 76 mm immersion	£3.10 Each
TH15428	305 mm, -10/110°C, 76 mm immersion	£30.20 Pack of 10

Lo-Tox Thermometers

Laboratory thermometers with environmentally friendly filling. An ideal alternative to mercury filled thermometers.

TH29500	305 mm, -10/50°C, 76 mm immersion	£3.75 Each
TH29504	305 mm, -20/110°C, 76 mm immersion	£3.40 Each
TH29506	305 mm, -20/150°C 76 mm immersion	£3.75 Each
TH29508	405 mm, -10/260°C, 76 mm immersion	£4.15 Each
TH29510	305 mm, -10/300°C, 76 mm immersion	£5.50 Each
TH29530	405 mm, -10/210°C, Total immersion	£5.90 Each
TH96370	305 mm, -10/330°C, 76 mm immersion	£5.50 Each



ECO-therm Lab Thermometers

These ECO-therm laboratory thermometers are green spirit thermometers filled with non-toxic expansion liquid.

TH150308	-10 to +110 0C x 1.0 305mm 76mm Imm	£2.40 Each
TH150310	-10 to +110 0C x 1.0 305mm Total Immersion	£2.55 Each
TH150312	-10 to +150 0C x 1.0 305mm 76mm Imm	£2.55 Each

If your school or college is refurbishing or creating new science teaching or preparation spaces, this guide is for you!

"Your Laboratory Design Guide" supports school staff, facilities management, and leadership in making informed decisions with architects and space planners. Ensure your facility is fit-for-purpose for years to come.

Scan to download your FREE comprehensive guide to lab design

School science laboratories are an expensive investment and are expected to last for many years. A poor design will impact on generations of pupils, teachers, and technicians.

The Association for Science Education

Why quality lab design matters

Investing in well-designed science labs impacts generations of students, teachers, and technicians. Poor design can hinder learning and safety.

Customised lab design solutions

- Versatile labs: support activities from demonstrations to research.
- Engaging spaces: stimulate student learning.
- Well-planned prep areas: efficient for teaching and technical staff.

TIMSTAR
Part of Education Group

Insights include...

- Considerations when designing a science space
- Requirements for different types of lab
- Storing hazardous materials
- The prep room
- Fume cupboards
- Technical information

Comprehensive Service

Our service streamlines the process from design approval to installation, providing coordination of all trades for a seamless experience. Additionally, we offer a unique chemical store service, advising on your chemical storage with expert care and compliance.

Our experienced team pays attention to every detail, from DfE requirements to acoustics, ensuring a comprehensive approach to your space.

Contact us today to embark on your customised lab journey with Timstar!

Don't just take our word for it!

Wendy Thorburn, Lead Science Technician, Kingdown School

"Timstar's service was excellent, communication was very good between the project manager, me and our site team who worked on the refurbishment of the new lab. We're delighted!"

The catalytic decomposition of hydrogen peroxide.

If you attended our Timstar Supertech meet at Stowe school, you will have enjoyed this fabulous demonstration given by the incomparable James Tearle, head of science (and ably assisted by his wonderful technician Judy Gracie).

The practical is known as the genie in a bottle and was taken from the Royal Society of Chemistry's education in chemistry resources.

Essentially the demonstration is a larger version of the method for making oxygen in the laboratory, utilising the action of manganese oxide on hydrogen peroxide, only here it is allowed to become rather more vigorous for the WOW! factor.

The reaction is vigorous and, according to Cleapss, the demonstrator would be advised to wear protective clothing and goggles, with a safety screen between them and nearby audience members. It is advised that viewers sit 5 m away from the demonstration, with eye protection provided should they wish.

Equipment

- ✓ Narrow neck conical flask, 250 mL or carbonated drinks bottle (PET)* (e.g. FL07905)
- ✓ 1 holed bung to fit conical flask
- ✓ Tissue paper
- ✓ Cotton thread
- ✓ 25 cm^3 measuring cylinder (e.g. CY130415)
- ✓ Filter funnel (e.g. FU08302)
- ✓ Balance (BA160002)
- ✓ Hydrogen peroxide (100 vol), 25 cm^3 (HY14015)
- ✓ Manganese (IV) Oxide 0.5 g (MA3756)

Note: ** see the online full content for comprehensive safety information**

Explore the full experiment online!

Method

1. Wear goggles and gloves.
2. Measure out 25 cm^3 hydrogen peroxide and add to a clean 250 mL conical flask.
3. Weigh out approx. 0.5 g manganese (IV) oxide into an 8 cm^2 piece of tissue paper.
4. Create a pouch with the manganese oxide filled tissue paper square and tie the corners together with a long piece of cotton thread (long enough to easily suspend the pouch in the flask).
5. Lower the pouch into the flask – do not allow it to touch the hydrogen peroxide.
6. Insert the bung to hold the cotton in place (the hole is necessary should the pouch slip too early into the hydrogen peroxide and the reaction begins; the bung will not be blown out nor the flask explode).
7. Set up the flask (with suspended pouch) behind the safety screen in the lab.
8. When ready, remove the bung allowing the pouch to fall into the liquid and the reaction to begin.
9. For a more 'magical' effect cover the flask in foil or paper and present a dark backdrop to the 'show'.

The reaction will produce large volumes of oxygen and condensed water vapour which will shoot out of the top of the flask or bottle. The reaction vessel will get hot – the liquid remaining can reach temperatures of around 80°C.

The science bit...

The decomposition of hydrogen peroxide using manganese (IV) oxide as a catalyst is as follows:

$$\text{hydrogen peroxide (aq)} \rightarrow \text{water (l)} + \text{oxygen (g)}$$

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Hydrogen peroxide will decompose into water and oxygen slowly over time, the addition of a catalyst (MnO_2) speeds up this reaction significantly, generating large volumes of oxygen gas and heat.

Note: ** see the online full content for comprehensive safety information**

If you go down in the woods today....

- Moss are ancient non-flowering plants. They produce spores but no true roots, they have stems and leaves like plants. Along with liverworts and hornworts they make the Bryophyta phylum from the plant kingdom. Their ancient status means that mosses have survived through extremes of temperature and climate to still be thriving today, and they can be found in every habitable ecosystem on the planet (that uses the sun to provide the energy for photosynthesis).
- As an organism they are an ecosystem in themselves, being able to hold many times their own weight in water. They can support many other tiny organisms, and they are instrumental supporters of newly developing ecosystems.
- The way they grow and colonise landscapes helps retain water in the soil and gives it stability, allowing anchorage for other plants, they also help to maintain the temperature of the soil.

Schistostega Pennata (luminious Moss)

- Although most are well suited to growth in areas that receive sunlight many are adapted to low light levels and can be found in caves, some are even luminous – using chloroplasts in the moss to reflect light.

Studying moss

Looking at the creatures that make moss their home can offer a fun activity for transition days, open days, or science clubs and is suitable for a wide age range.

If the student can operate a microscope, then they can go on a moss safari!

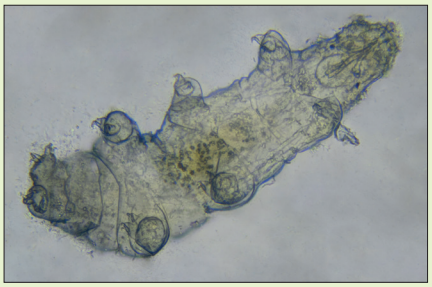
✓ Younger students get to be 'wild animal hunters' as they seek out what creatures may reside in their moss sample.

✓ Older students can use a moss safari as part of the classification topic in biology and use keys to identify the creatures they can find. You could also have a moss identification key for distinct types of moss itself.

✓ A wider discussion around ecosystems can also be had using moss as a great example (ecology and ecosystems topics in the GCSE curriculum).

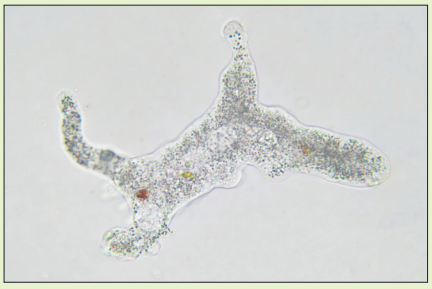
Some of the creatures you might find in a moss safari:

Tardigrade



Rotifer

Amoeba



Nematode

Visit the Resource Hub to explore the full moss safari practical!

TOP TIPS

For more information and comprehensive resources including identification charts, visit the moss safari website: https://mosssafari.com/

BMS Cellpad Mini, 7-INCH

Mounts onto the microscope head of the 037, 146, EduLed, D2 and D3 microscopes.

MI240200 £435.00

BMS Cellpad 3, WIFI, HDMI, 5MP

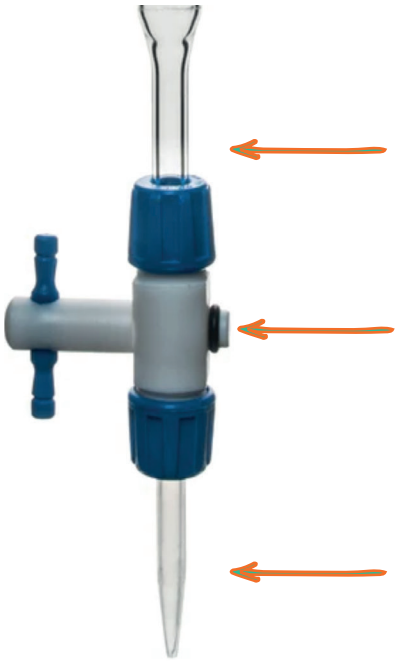
All in one C-mount camera (HDMI, WiFi, SD card) with high sensitive and ultra high performance Sony CMOS sensor. HDMI and WiFi are used to transfer the data to either a HDMI display (screen) or to a computer.

MI240210 £900.00

The burette is a long, graduated tube narrowing at one end into a point (the jet) with a tap. The graduations are marked, and it is used clamped with the pointed end and tap downwards.

Burettes are commonly made of borosilicate glass to a minimum standard, although some can be made of plastic (PVC or PETG).

The taps can also differ in their construction: some glass burettes have an integral tap design; others have a PTFE tap which can be changed. These burettes have the jet end separate from the rest of the burette cylinder, allowing it to also be changed, which is handy if the end of the burette gets broken or irreparably blocked.



Denotes volume of burette (here = 50 mL)

Denotes class of burette (A or B) A is more accurate (tolerance to +/-0.05 mL)

Denotes that an accurate volume is delivered at 20°C

Denotes the accuracy and tolerance of the burette: here accurate to +/- 0.1 mL

Denotes manufacturing standard

What do the markings on the burette mean?

Similar markings can be found on other volumetric glassware used in the laboratory.

The graduations also come in different colours, the most common being blue, white and amber

Blue is a good general contrasting colour, although white and amber are especially good when using potassium manganate VII solution in the burette, (common at A level).

How to read the liquid level:

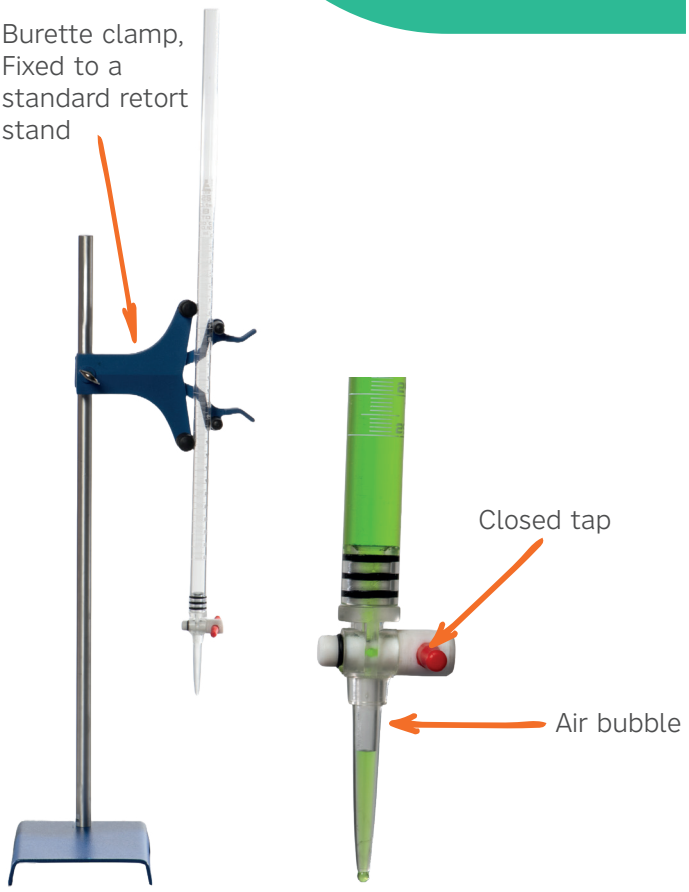
Read the liquid level at the bottom of the meniscus.

Titrations are used at both GCSE and A level chemistry and are a staple of the curriculum. See pages 26-27

Filling the burette:

There are several things to remember when filling a burette:

1. Always make sure the burette is clamped securely and upright. You might want to use specific burette clamps, which fix to a normal clamp stand, are very easy to use and cannot be overtightened on the burette causing it to break.
2. Ensure the tap is in the off position before you start filling (perpendicular to the body of the burette).
3. Place the burette at a height where you can comfortably fill it without stretching to above head height, this might mean placing the clamped burette on the floor or a lower surface to fill it and returning it to the bench afterwards.
4. Initially overfill the burette to above the top (0) mark, then with a beaker underneath, allow some liquid to run out of the burette, ending with the top of the liquid at the 0 mark. This will ensure that the burette tip is filled with liquid and that air bubbles are eliminated from the end of the burette.

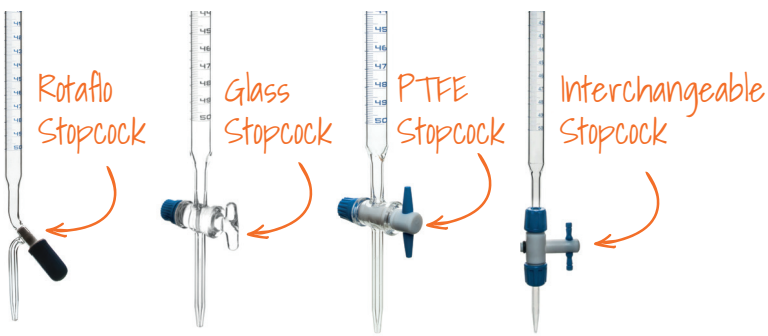


When are burettes used?

The most common reason to use the burette is for titrations in chemistry. A titration is done to ascertain a precise concentration of a solution, by reacting it with another of known concentration. The reaction equation's ratio of reactants is known, and thus the concentration can be determined.

Burettes, 50 mL

BU100584	Acrylic, white graduations	£5.80
BU03660	Glass stopcock, Blue graduations	£8.45
BU110228	Glass stopcock, White graduations	£7.30
BU03725	Glass stopcock, Blue graduations, Class A	£18.30
BU03685	PTFE stopcock, Blue graduations	£18.70
BU03765	Interchangeable PTFE stopcock, Blue graduations	£28.70
BU110200	PTFE stopcock, Blue graduations, Class A	£19.10
BU110224	PTFE stopcock, Black graduations	£18.10
BU03686	PTFE stopcock, Amber graduations	£11.30
BU110220	PTFE stopcock, White graduations	£17.70
BU03720	Schellbach, PTFE stopcock, Blue graduations	£20.45
BU03710	Rotaflo stopcock, Blue graduations	£7.95



Working out the unknown concentration of a strong acid by titration (AQA GCSE RP2)

The ability of acids and alkalis to neutralise each other, and the use of coloured indicators that change colour on neutralisation, give an ideal opportunity to understand how equations and titrations can be used to work out concentrations.

Materials

- 25 cm^3 volumetric pipette (PI12260)
- Pipette filler (PI95044 or PI67100)
- 50 cm^3 burette (e.g. BU03765)
- 250 cm^3 conical flask (e.g. FL07921)
- Small funnel (FU08301)
- Clamp stand and clamp or burette clamp (BU160300 or ST13900)
- White tile (PL12555)
- 0.1 $moldm^{-3}$ sodium hydroxide solution (concentration shown) (SO5686)
- 0.08 $moldm^{-3}$ sulfuric acid* *see note at end* (concentration NOT shown) (SU6112)
- Phenolphthalein indicator (PH4574). Methyl orange can also be used. (ME3982)

Note Indicator colour changes:

Phenolphthalein is pink in alkali (sodium hydroxide) and becomes colourless in acid. Methyl orange is orange in alkali and turns pink in acid.

Method

1. Set up the burette on a clamp stand (tap end downward). Make sure the tap is closed.
2. Fill the burette from the top with sulfuric acid. You might need to move the burette/stand to a lower level and use a small (burette) funnel. Fill to above the 0 mark.
3. Replace the burette/stand arrangement onto the bench if necessary.
4. Place a beaker underneath the burette and open the tap allowing the liquid to flow out of the burette until the top level is exactly at 0. This will fill the jet end and eliminate air bubbles in the process.
5. Measure out 25 cm^3 sodium hydroxide solution using a volumetric pipette and filler (fill exactly to the line on the pipette) into a conical flask.
6. Replace the beaker under the burette with the conical flask containing sodium hydroxide.
7. Add a white tile underneath the conical flask.
8. Add a few drops of phenolphthalein indicator solution to the sodium hydroxide in the conical flask.
9. Gently swirl the conical flask to mix in the indicator.
10. Whilst constantly swirling the flask, open the tap and allow the acid to run into the flask until the colour changes from pink to clear, then stop. This is your rough titre and gives an indication of the volume you will need to neutralise the sodium hydroxide solution.
11. Repeat the process from step 5 at least 3 more times to get an accurate, repeatable titre for the sulfuric acid.

See all of our other required practicals here...

The science bit...

Using the stoichiometry of the reaction the volume of sulfuric acid, along with the concentration and volume of sodium hydroxide, can be used to work out the concentration of sulfuric acid that was used:

Equation for the reaction:

sodium hydroxide + sulfuric acid → sodium sulfate + water

$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

The sodium hydroxide and sulfuric acid react in a 2:1 way

For example:

- ✓ The titre of sulfuric acid was 16 cm^3 (0.016 dm^3)
- ✓ The concentration of sulfuric acid was unknown
- ✓ The concentration of sodium hydroxide was 0.1$moldm^{-3}$
- ✓ The volume of sodium hydroxide was 25 cm^3 (0.025 dm^3)

1. Work out the moles of NaOH: moles = concentration x volume = 0.1 x 0.025 = 0.0025 moles
2. You know that 2 moles of NaOH reacts with 1 mole H_2SO_4
3. Work out the number of moles of H_2SO_4 using that ratio = 0.0025/2 = 0.00125 moles
4. Rearrange the first equation to work out the concentration of sulfuric acid: concentration = moles/volume = 0.00125/0.0016 = 0.078$moldm^{-3}$

You can alter the concentration of sulfuric acid provided to the students, but bear in mind that this will affect the volume of sulfuric acid needed to neutralise the sodium hydroxide. If the concentration is lower, the titre needed of sulfuric acid will be higher.

A 0.05$moldm^{-3}$ concentration of sulfuric acid should require a titre of 25 cm^3 for neutralisation.

*AQA recommends a concentration of 0.08$moldm^{-3}$ as this gives volume of 15 cm^3, allowing 3 titres to be taken from one 50 cm^3 burette fill up.

Curriculum

- ✓ This skill is covered in OCR PAG 6, Edexcel Core practical 5.2.2 and WJEC using the reaction between sodium hydroxide and hydrochloric acid.

The misconception that "the thicker the walls, the better" occasionally resurfaces within the scientific community.

Heavy-duty beakers, with thickened walls, base, and often reinforced rim, are more mechanically robust but less suitable for heating and cooling compared to standard beakers with thinner walls and base. The bottom line is that **you should not heat heavy-duty glassware!**

- In the UK and Europe, ISO 3819 is the common beaker standard that manufacturers should adhere to, to ensure consistency in glass thickness (i.e. walls and base) as well as capacity, dimensions, and construction details, including the base, edges, spout, scale and markings.
- Thicker walled heavy duty glass beakers are not ideal for heating applications. Thicker glass prolongs heat distribution, potentially causing uneven expansion due to temperature variations, creating internal stress within the glass that can result in cracking or shattering.
- Standard glass beakers have thinner walls and base and are designed to withstand high temperatures allowing uniform glass expansion and even heat distribution. This reduces internal stress, making them the ideal option for heating applications.
- Standard beakers should preferably be heated uniformly in an oven or water bath, or on a hot plate, but they can also be heated directly with an open flame from a Bunsen burner, through a wire gauze to help distribute heat more evenly.
- Despite having thinner walls and base, they still offer excellent mechanical strength and durability, as well as high resistance to chemical attack and thermal shock, owing to the inherent properties of borosilicate 3.3 glass.
- The ***consistency*** of glass thickness throughout the beaker is also important. Irregular wall and base thickness allows different rates of temperature change across the glassware. When exposed to higher temperatures this can cause hotspots, leading to higher stress and breakages.

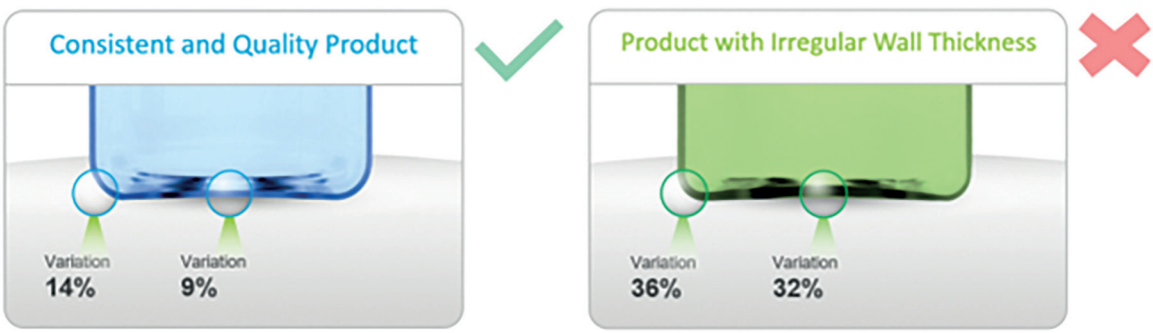


Figure 1. a quality product with lower variations vs a product with higher variations. It is important to prioritize health & safety, functionality and sustainability when acquiring labware, and avoid false economy by selecting high-quality, durable labware that meets operational needs and safety standards

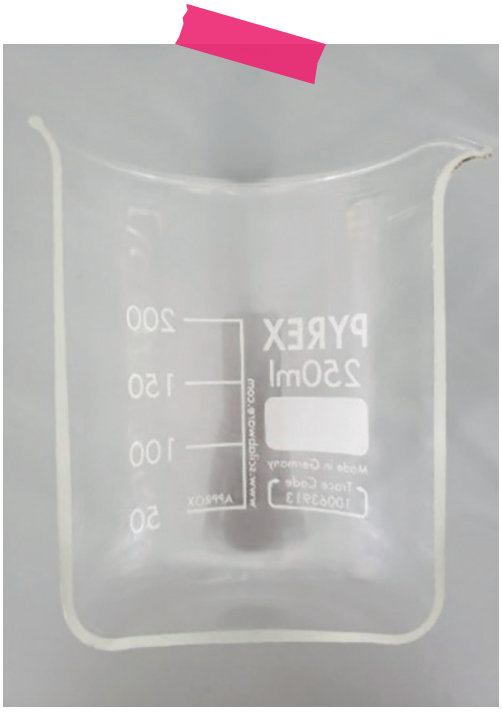


Figure 2.a cut-in-half PYREX® beaker showing consistent wall and base thickness throughout

Figure 3. other beaker with irregular base thickness

- Borosilicate 3.3 glass, with a lower coefficient of thermal expansion than other glass types offers higher thermal shock resistance, resulting in lower risk of breakage when exposed to sudden temperature changes.
- The borosilicate 3.3 glass used to manufacture all PYREX® laboratory glassware complies with strict ISO 3585 standards, which tightly control the chemical composition of every manufacturing batch and guarantees that key performance indicators are met. Regardless of the quality standard, glass thickness or glass type, any temperature change should be applied gently, uniformly, and gradually to optimise safety in the lab.

DWK LIFE SCIENCES
DURAN WHEATON KIMBLE

DWK Life Sciences at a glance

DWK Life Sciences is a leading global manufacturer and supplier of precision labware. The company's offering includes over 35,000 glass and plastics products, marketed under the acclaimed brands DURAN®, WHEATON®, KIMBLE® and PYREX® - a licensed brand owned by Corning. DWK Life Sciences' world-leading and trusted glass is complemented by an innovative research and life science portfolio.

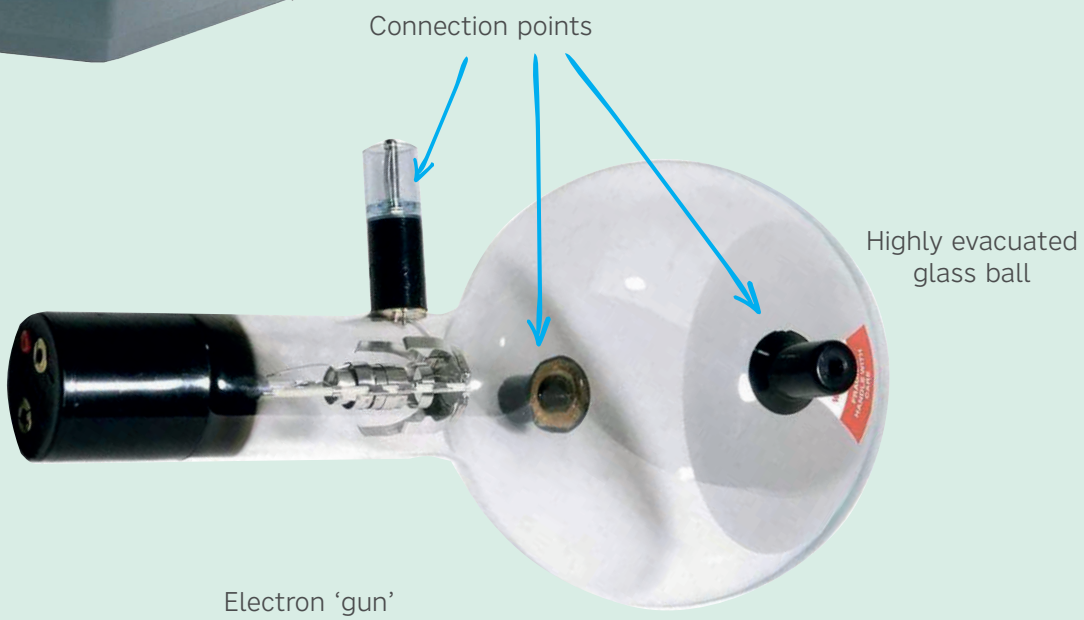
Article kindly contributed by DWK Life Sciences.

To see the full range of PYREX® and view our latest offers scan here

The Teltron tube is a form of cathode ray tube used to demonstrate the motion and properties of electrons.

Teltron tubes are a good way of visually demonstrating the behaviour of electrons to students, at both GCSE and A level.

Although not specifically mentioned in the physics specifications, Teltron tubes are a good way of visually demonstrating the behaviour of electrons to students, at both GCSE and A level. They can be used to work out the speed of electron travel at A level and to demonstrate Thomson's experiment: the charge to mass ratio on the electron (using the electron deflection tube).



Setting up the Teltron tube.

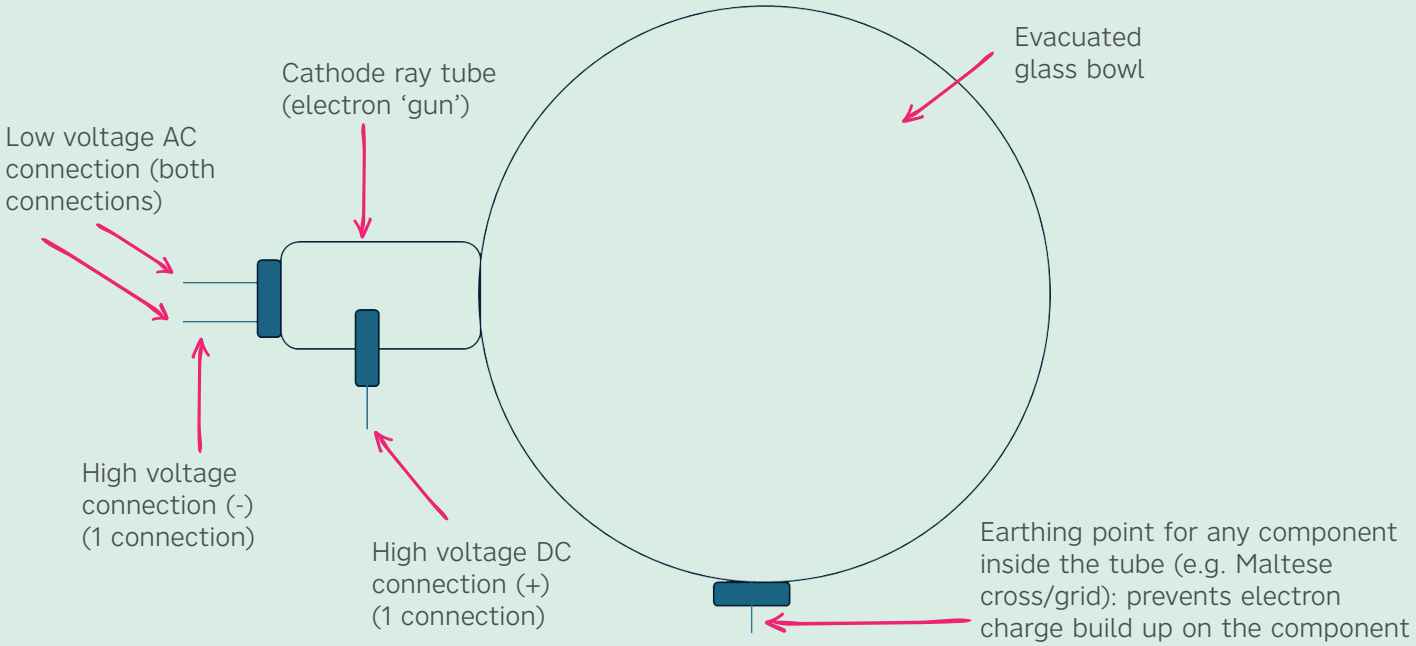
For the Teltron tube to work, you will need a Teltron tube stand/holder and an EHT power supply. The power supply will run up to 5-6000 V DC for the anode and a low voltage (6 V AC) supply to connect and heat the cathode.

If only the low voltage supply is connected, you will see the base of the cathode ray tube glow as it heats, but you won't see the electrons.

Once the high voltage is connected, accelerating the electrons and allowing them to reach the opposite end of the Teltron tube, they will become visible as they hit the luminescent screen which will glow green.

Some Teltron tubes are filled with a fluorescent gas which will show the electron beam within the bowl, as the electrons ionise the gas as they pass through – this type of tube is the fine beam tube and requires a high tension (around 350 V, but with higher current) power supply.

Diagramatic representation of a Teltron tube showing connections



- All Teltron tubes are sealed units, and you cannot exchange internal components between them, therefore you need to buy a complete tube for each experiment you want to do (Maltese cross, deflection tube, diffraction tube, fine beam tube, Perrin tube).
- They all use the same universal stand, and you can add Helmholtz coils to demonstrate the magnetic and electric effect on the electron beam.

Electron Diffraction Tube

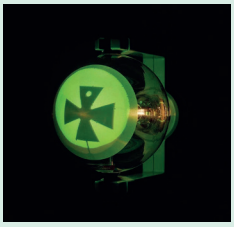
Used to show the path of electrons after passing through a diffraction grating.

RA130500 £875.00

Fine Beam Tube

Used to show the path of the electrons through the tube, as they are injected into a gas (neon) which will fluoresce when ionized. This tube uses HT not EHT, be aware that a high current is associated with HT power supplies. A darkened room allows better visualisation of the beam.

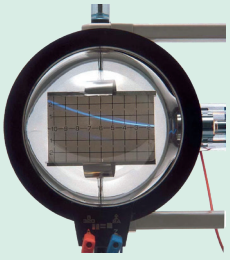
RA130505 £1,050



Maltese Cross Tube

Shows the nature of electrons moving in a straight line, creating the cross image on fluorescent screen. Using a magnet close to the tube will show deflection of the beam and removing the earthing connection at the bottom will allow charge to build up on the cross and the image will become distorted.

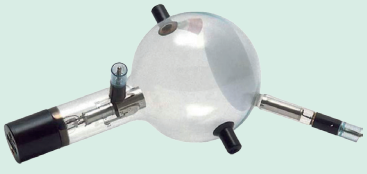
RA67570 £599.00



Electron Deflection Tube

Used to show the deflection of the electron beam in a magnetic (and electric) field, also used to show the charge to mass ratio of the electrons, and their speed.

RA67580 £849.00



Perrin Tube

The Perrin tube is useful for many electron and cathode ray experiments. It can be used to demonstrate the nature of the cathode ray and can be used, with an auxiliary coil, to make a simple cathode ray oscilloscope. As well as the negative charge on the electron, it can also be used to demonstrate buildup of charge, using a proof plane and Faraday cage.

RA75855 £610.00

View all Teltron products here

The Van de Graaff generator

Commonly found in schools but rarely used, the Van de Graaff generator demonstrates static charge build-up and discharge...

- Most machines are electrically driven and can produce voltages of around 200,000 to 400,000 volts, with a discharge arc of around the 5-10 cm mark.
- There are hand driven machines available, with smaller sparks generated, the size of which will depend on the speed of the handle being turned.
- The OCR GCSE physics curriculum lists it as a practical suggestion to provide evidence of the static charge build up on insulators, in topic 3.

Regardless of the visual impact, people are wary of using them because of the safety aspect of potential injury to a student or operator.

NOTE: pregnant ladies or those with cochlear implants, pacemakers or heart issues should not be using the Van de Graaff (CLEAPSS advise they be a 6 m distance away from the equipment).

However, when used correctly these machines are very safe and provide an excellent learning opportunity, with a bit of WOW! thrown in.

Storing charge

A moving rubber belt collects charge and discharges it to a metal dome on the top, producing a high voltage difference between the dome and the earth (like lightening). This can be discharged by bringing another conductor near to the dome, resulting in a spark and crack sound!

For troubleshooting tips when using the Van de Graaff, and how to produce good sparks visit the Resource Hub!

Some experiments to try.

Flying foil cases:

1. Make sure the dome is discharged and switched off.
2. Stack a few foil cake cases on the top of the (discharged) dome.
3. Stand back.
4. Switch on the generator and watch the cases fly off as they repel each other after gathering charge from the negatively charged dome.
5. As they reach the ground the cases will discharge. Allow them to land before collecting them up.

Electric wind:

1. Make sure the dome is discharged and switched off.
2. Attach a metal spinner to the top of the dome (an available accessory).
3. Switch on the generator and watch as the flow of electrons from the dome cause the spinner to rotate: the electrons collect at a point leaving a cloud of ions behind which have the same charge, thus repelling them and allowing the spinner to move.

Hair raising:

1. Most accessory packs contain a hair accessory, although historically this is the experiment that students volunteer for. Those with long fine dry hair often get the best results.
2. Make sure the dome is discharged and switched off and move the discharge dome further away from the main dome to avoid any interference.
3. Allow the student to stand on an insulating step and place both their hands on the sphere.
4. Switch on the generator. Since the student is insulated from the floor the charge leaves the dome and stays in the student, the hairs become charged, and each hair repels each other causing it to stand on end.
5. Switch off and discharge the generator before allowing the student to remove their hands and step down.

Always do a risk assessment before any practical work.

For more information on Van de Graaff safety visit the Institute of Physics

Also see CLEAPSS: GL190: using electrostatic generators – Making sparks!

Frederiksen Van de Graaff Generator

A top quality Van de Graaff featuring a motor or hand drive split dome to show how charge is collected in the dome. The generator uses one nylon and one Teflon roller to create double charging effect and sparks up to 10 cm.

EL62550 £545.00

Van de Graaff Generator

This kit includes demonstrations that cover all aspects of electrostatics such as charge conservation and transfer, conductors, insulators, ionisation. The typical discharge arch is 2 – 8 cm.

EL85100 £335.00

Hand Driven Van de Graaff Generator

A hand driven Van de Graaff generator, which is a very effective unit for introducing electrostatics. The length of the sparks generated is wholly dependent upon the speed at which the user turns the handle but sparks of around 20-30 mm are comfortably achievable.

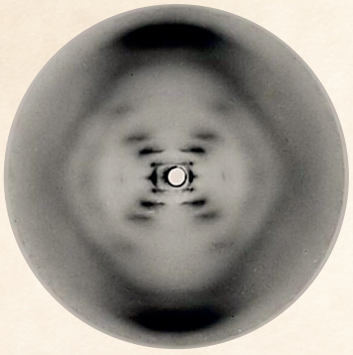
EL101544 £110.00

X-ray diffraction and the discovery of the structure of DNA

From the personal collection of Jenifer Glynn

In 1953 Rosalind Franklin, working at King's College London, discovered the helical structure of DNA using the process of X-ray crystallography: passing X-rays through the crystalline form of pure DNA, and allowing the pattern to be imprinted on X-ray film. Once developed the film showed a cross pattern.

Using this and theoretical information, James Watson and Francis Crick were able to deduce the 3D structure of DNA, and thus one of the biggest breakthroughs in the history of science was made.



Published in Nature on 25th of April 1953

For an interesting explanation of X-ray diffraction and the double helix, watch this YouTube video

Courtesy of Cold Spring Harbor Laboratory Archives

✓ X-rays feature in the A level physics specifications (medical physics), as does diffraction.

James Watson, an American biologist, moved to the University of Cambridge in 1951 and began working with Englishman Francis Crick who, although primarily a physicist, had swapped to biology and joined the Cavendish Laboratory in 1949, working on the X-ray crystallography of proteins. The pair met over a shared interest in the structure of the DNA molecule.

Laser Diffraction Kit

A diffraction kit containing 18 slides. See online for the full contents.

OP84670 £220.00

TIMSTAR

Want to reproduce the diffraction pattern produced by Rosalind Franklin using the filament of a light bulb? Click here to visit our Resource Hub!

The existence of a 'DNA molecule' was first discovered in 1869 by Swiss chemist Frederich Miescher, who named the material inside the nucleus of white blood cells 'nuclein' which later became nucleic acid, and then deoxyribonucleic acid (DNA) - this discovery being made by Russian scientist Phoebus Levene in the early 1900s, along with chemists including Albrecht Kossel and Emil Fischer.

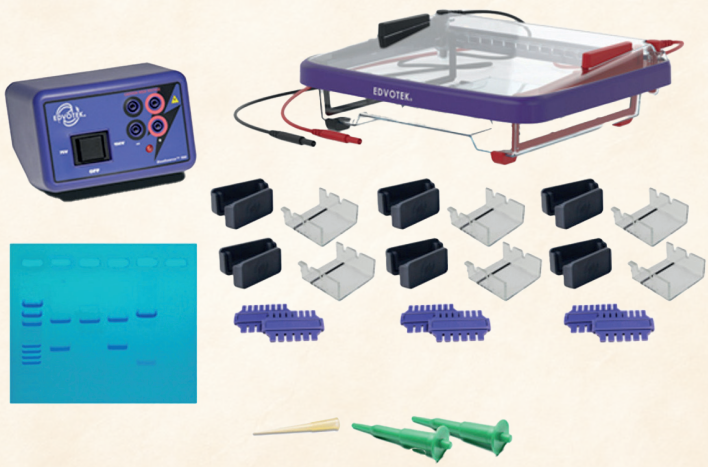
By the time Watson and Crick came along, more was known about the sugar and the phosphate and base structures within the DNA, but how they fitted together remained a big mystery.

Having the expertise of X-ray crystallographer Rosalind Franklin, and the experience of Maurice Wilkins who had been studying X-ray crystallography patterns of nucleic acids since 1950, gave the duo the information they needed to complete their now famous model of DNA.

In 1953 they published a short letter in the Nature journal, describing the discovery of a 2-chain helical structure for DNA. This formed a trio of papers in that Nature issue describing the structure of DNA, eventually leading to the Nobel prize in physiology/medicine (1962) being awarded to Watson and Crick, shared with Maurice Wilkins. Sadly, Rosalind Franklin died in 1958 at the age of 37. Since the Nobel prize can only be awarded to living people, she was not included in the award.

Over the years people have disputed the claim that Watson and Crick 'discovered the structure of DNA' alone. Without her work they could not have achieved their model in the time frame that they did, not only did she determine the helix pattern and produce the definitive proof with her technician Ray Gosling, she also discovered two forms of DNA, A and B that exist in different humidity conditions.

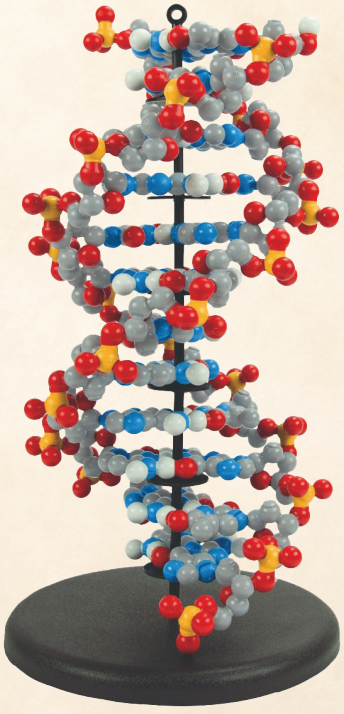
- ✓ The molecular structure of DNA features in the A level biology specifications.
- ✓ A basic DNA structure, and wave diffraction also feature in the GCSE specifications for biology and physics.



Edvotek Classroom DNA Electrophoresis LabStation™

An economical way to introduce DNA electrophoresis to the classroom. This LabStation™ provides all the equipment you need to run any of our DNA or dye electrophoresis kits with your students. Supports 24 students.

BT100510 £490.00



Dynamic DNA Kit

The kit contains the following: 12 base pairs. Includes 6 A-T and 6 G-C base pairs; 5' hydrogen and 3' oxygen parts; oxygen atoms to model RNA; removable carbons for uracil; ATP, TTP, GTP and CTP models; display stand; teacher resources and lesson ideas.

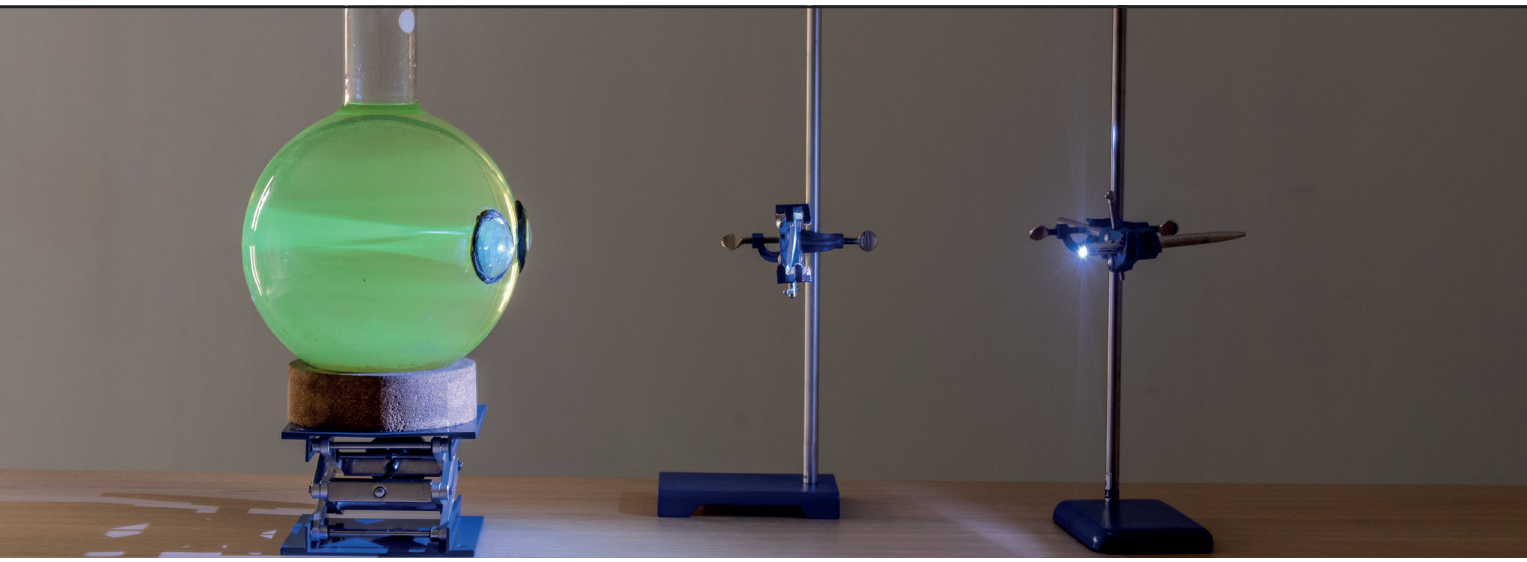
MO190104 £281.20

The kits we recommend for exploring DNA further are:

BT140338, Edvotek® Determination of Protein Molecular Weight Kit

BT97925, Edvotek® What Is PCR and How Does It Work? Kit

BT97875, The Secret of the Invisible DNA: A Genetics Exploration.

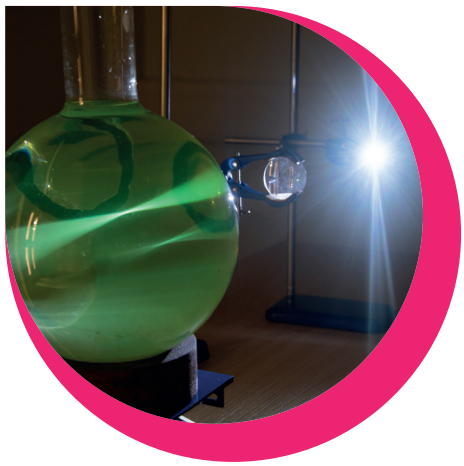


An older but classic demo, the fluorescein eye is a terrific way of showing how light is refracted through the lens of the eye, with the light rays focussing on the back of the eye.

Lenses can be placed in between the light source and the 'eye' and students can clearly see how the refraction is altered, gaining an understanding of long and short sightedness and how lenses can affect this.

The fluorescein eye

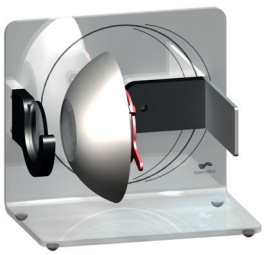
The model is made of a large round flask filled with distilled water with fluorescein dye added, (around half a spatula per 5 L) this produces a yellow/green solution. A strong light source is pointed at the flask and the fluorescein interacts with the light allowing the light rays to be seen as they pass through the flask. Different lenses are added to the outside of the glass of the flask and the rays are refracted accordingly.



Human Eye Model

Classic model of the human eye with highly accurate and detailed colourful components. Dissects into 6 parts: a two-part sclera with cornea and eye muscle attachments, both halves of the choroid with iris and retina, lens and vitreous humour.

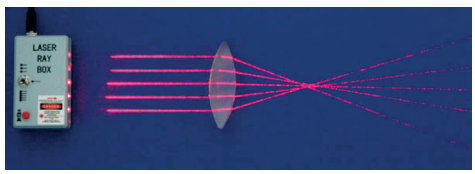
MO104234 £41.95



Functional Eye Model, Non-Liquid

This innovative functional eye model is an open design model, offering high visibility, which does not involve the injection of liquid*! It is composed of a flexible lens with an adjustable focal length, which constitutes the crystalline lens for comprehensive visualisation.

MO120100 £135.00



Optical Kit with 5 Beam Laser Ray Box

This laser optics kit can be used in bright light conditions thanks to the multi-beam red laser light source.

OP120110 £198.00

TOP TIPS

If you do not have access to fluorescein powder, you can colour the water using the ink from a yellow, fluorescent highlighter. Just dip the tip in the water until the desired depth of colour is reached.

We covered how the eye works in our September 2023 brochure. To recap: light rays enter the eye via the pupil and through the cornea and lens. These light rays meet at the back of the eye on the retina, where they are changed into chemical and then electrical signals that travel to the brain via the optic nerves, the brain is then able to 'decode' these signals and interpret the image for us, producing a crisp and clear image.

Defects in vision: short and long sightedness

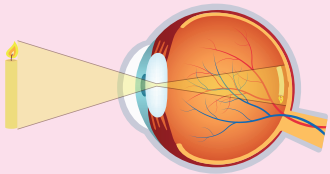
Many people struggle to see a 'crisp and clear' image. Very often this is due to the shape of the eye being too long or too short to allow the precise focussing of light rays onto the retina. As people age, the fluid in the eye changes density which can also have an effect on the way light is bent and whether it reaches the retina.

In order to correct these problems lenses can be placed in front of the cornea, in the form of glasses or contact lenses, which adjust the way the light enters the eye, allowing it to focus exactly on the retina.

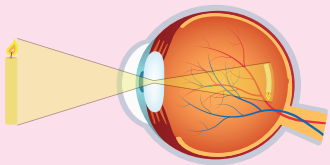
Myopia

People who are short sighted (myopic) can see things that are close to the eye in great detail, but struggle to focus on things far away. This is because the light rays are converging before they reach the retina, and can be due to a longer eyeball, or a lens that is too thick/curved.

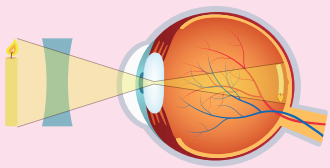
To correct this a concave lens is placed in front of the eye which bends the light out before it enters the eye, so that when it is bent in again inside the eye, the rays land on the retina.



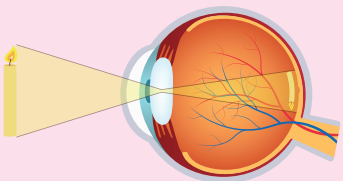
Normal vision



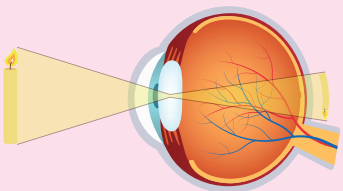
Myopia



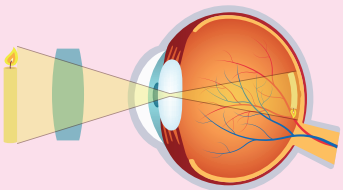
Correction with lens



Normal vision



Hyperopia



Correction with lens

Hyperopia

Those with hyperopia (long sightedness) struggle to focus images close to them but can see objects at a distance clearly. In this case the eyeball is often too short, or the lens is too thin (often age related). The light rays will enter and converge somewhere behind the retina. To correct this a convex lens is used which bends the light a little before it passes through the lens, which then bends it more allowing the rays to arrive exactly on the retina.

TOP TIPS

We have lots of information about the eye on the Resource Hub including astigmatism, eye structure, dissection, refraction lenses and more. Why not take a closer look?

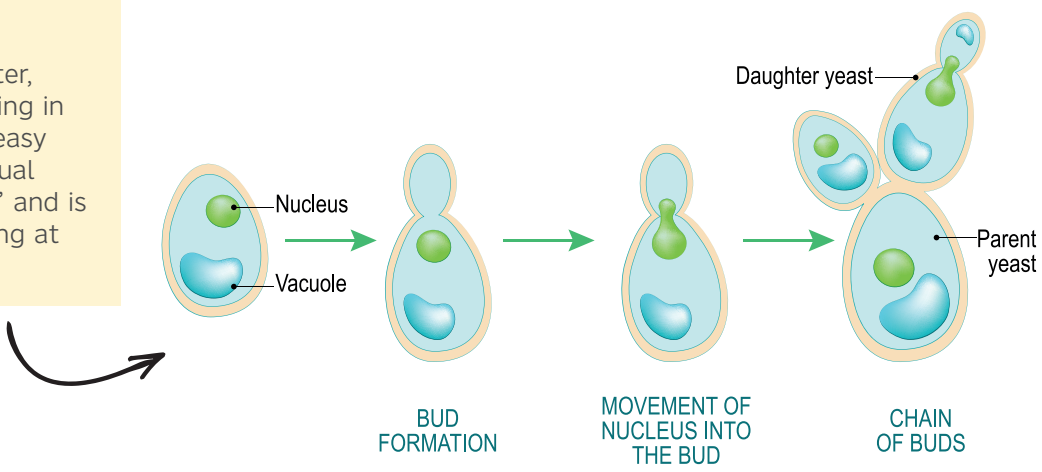
Visit the Resource Hub here!

Yeast are single celled organisms and part of the fungus kingdom. They have a cell wall and vacuole like plants (but cannot make their own food) and all other organelles as in plant and animal cells.

Yeast cells reproduce asexually, by budding, producing an identical new yeast cell. This is different to (most) animal and plant cells which undergo mitosis to produce new identical cells, and to meiosis in animals which results in non-identical offspring.

Yeast reproduces very quickly and therefore is a useful organism to study for research purposes.

With just warm sugar water, yeast can begin reproducing in 15-20 minutes making it easy for students to view asexual reproduction 'in real time' and is a bit more fun than looking at spider plant 'babies'!.



Equipment

- Light microscope with 40x objective (10x eyepiece) lenses (MI240020)
- Microscope slide and cover slip (MI10907 and MI11035)
- Conical flask or beaker (250 mL) (e.g. FL07947)
- Solution of Bakers yeast, sugar, and water (1 teaspoon of dried (active) yeast, 1 teaspoon of sugar, ~50 cm^3 warm water)
- Plastic pipette (PI12415)
- Extra water for diluting

Method

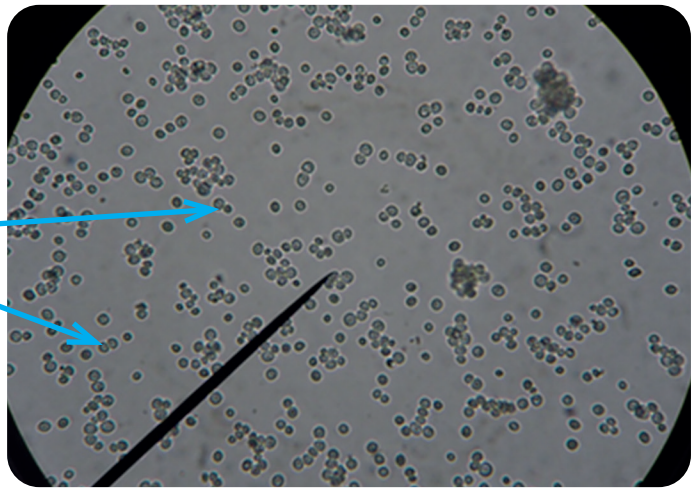
1. Place the yeast, sugar and water in the conical flask or beaker.
2. Leave in a warm place (bench top is fine) for approx. 30 minutes (you should see foam forming on the top of the yeast mixture, indicating that the yeast is active and alive).
3. Remove a drop of the suspension (dilute it a little with water – there will be a lot of yeast cells in 1 drop of suspension – dilute 1-2 drops of yeast suspension in ~10 mL water).
4. Place on a microscope slide, add a coverslip, and observe the yeast cells under x40 objective.

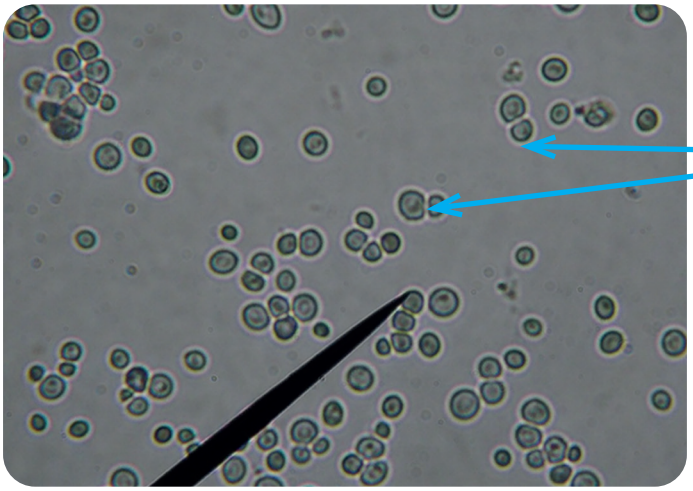
Result

You should easily see the oval/circular yeast cells, have a look around the slide and you should be able to see a few that look like doubles – these will be those in the process of budding to form new cells.

The process of division takes about 90 minutes under optimal conditions so it is unlikely you will see any actively splitting off, but by setting up a microscope camera projected onto your lab screen you could still observe it whilst continuing with the lesson.

Budding yeast cells (Image taken under x40 objective magnification using a digital camera without zoom lens)





Budding yeast cells (Image taken under x40 objective magnification using a digital camera with zoom lens)

Best Seller!

BMS 100 FL LED Microscope

The BMS 100FL offers the perfect solution for educational microscopy. Combining fantastic optics with extremely robust microscope parts. The triple nosepiece offers x4, x10 and x40 objectives, which combined with the x10 eyepiece gives a total magnification of up to x400.

MI240020 £127.50
MI240020PK10 £1,250.00 Pack 10

Observing gas production in yeast

- Like all living cells yeast respire. They can respire in both the presence (aerobic) and absence (anaerobic) of oxygen.
- Anaerobic respiration in yeast is also called fermentation and produces ethanol and carbon dioxide (hence yeast is used in beer making).
- Yeast is also used in bread making as the carbon dioxide produced in both aerobic and anaerobic respiration forms bubbles in the dough giving it a more open structure.

The equation for aerobic respiration is:

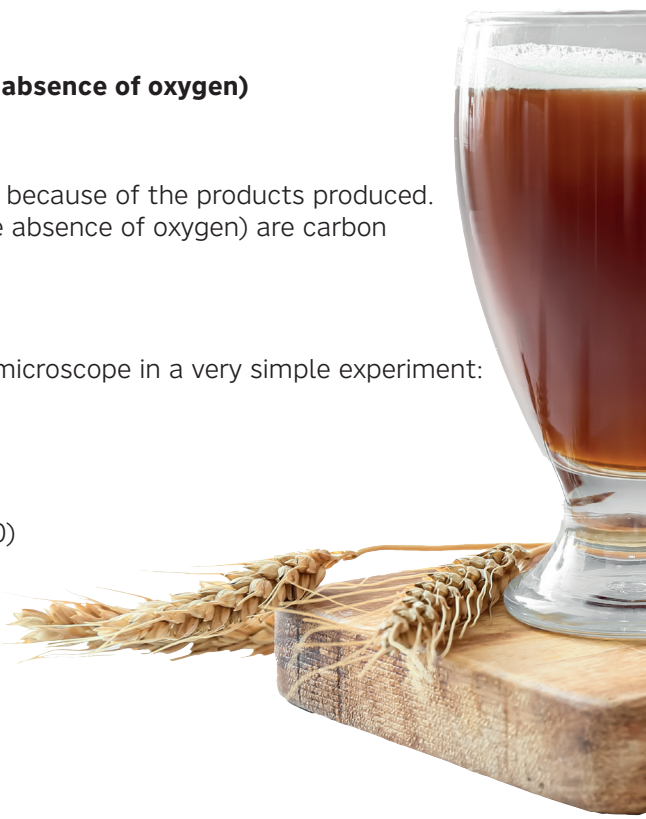
oxygen + glucose → carbon dioxide + water

The equation for anaerobic respiration in yeast is:

glucose → carbon dioxide + ethanol (notice the absence of oxygen)

This anaerobic respiration in yeast differs from that in animal cells because of the products produced. In animal cells the products from the respiration of glucose (in the absence of oxygen) are carbon dioxide and lactic acid.

We can observe the carbon dioxide production in yeast under the microscope in a very simple experiment:



Equipment

- Light microscope with 40x objective and 10x eyepiece (MI240020)
- Microscope slide and cover slip (MI10907 and MI11035)
- Conical flask or beaker (250 mL) (e.g. FL07947)
- Solution of Baker's yeast, sugar, and water (1 teaspoon of dried (active) yeast, 1 teaspoon of sugar, ~50 cm^3 warm water)
- Plastic pipette (PI12415)

Method

1. Place the yeast, sugar and water in a conical flask or beaker.
2. Leave in a warm place (bench top is fine) for approximately 30 minutes, you are looking for the yeast to form a 'foam' on the top of the mixture. If you don't get this then it tells you that the yeast is not respiring. This will (most likely) be because the environment isn't warm enough or you have left out the sugar. Add some sugar and warm water (or move to a warm place) if necessary. If you still have no luck, then replace the source of yeast, and repeat.
3. Remove a drop of the suspension (do not dilute, you need a large number of cells to observe the gas bubbles produced) and place on a microscope slide with a coverslip.
4. Wait for approx. 15 minutes – the slide should start to look like it is drying up – this is because the bubbles have started to be produced and are spreading out – (see Image 1 below).
5. Observe the yeast cells under a 40x objective.

Result

Under the 40x objective you should be able to see many thousands of yeast cells all crowded together. Within this you should see 'holes' – these holes are pockets of carbon dioxide gas being produced by the yeast cells as they respire. The tiny bubbles of gas merge together forming larger bubbles which you can start to see. Around the edge of the bubbles, you should see a rolling wave of yeast cells that look like they are driving the bubble onward. (see Image 2 below)

This really is fascinating to watch and gives a good visual demonstration of gas produced in respiration.

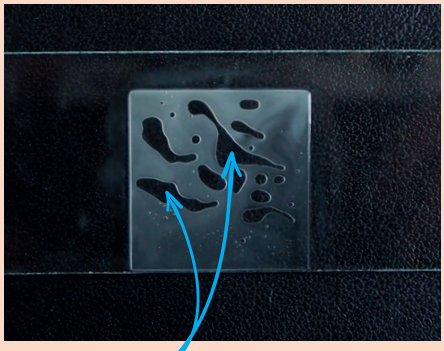


Image 1

Slide showing carbon dioxide bubbles produced from yeast cells clear to the naked eye

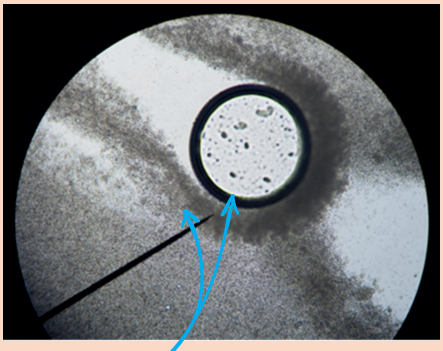


Image 2

Carbon dioxide bubble under 40x objective lens, surrounded by yeast cells

New laboratories and prep room for Co-op Academy, Stoke-on-Trent

Designed by WF Education and built above the existing gymnasium, these new facilities at Co-op Academy Stoke-on-Trent include two cutting-edge laboratories and a fully equipped prep room, accommodating 30 students in each lab.

Featuring modern workstations, mobile fume cabinets, and enhanced safety measures, these spaces are flexible and future-proofed to adapt to any curriculum changes and growing student numbers.

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View all case studies here


Want to discuss your space? Scan here

Lab design - we want to hear from you!

WF Education Group
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At WF Education, we pride ourselves on designing fit-for-purpose laboratories that not only meet but exceed the expectations of educators and students alike. Our team has accumulated a wealth of expertise over the years, crafting environments that foster innovation and learning.

We know that the **best ideas** come from those who work in these spaces every day—that's why we want to hear from you!

You can help shape the future of lab design at WF, ensuring that every detail is tailored to the needs of those who use these spaces most.

Complete our survey to share your thoughts for the chance to be invited onto our Steering Group, to drive forward the future of lab and prep room design!

Willing to share your thoughts?

Request a rep visit or product demo!

Want a closer look at our products? Want to make sure you spend the department's budget wisely?

Schedule a visit from your local rep to see equipment in action and to discuss your needs in more detail.

We are happy to demonstrate key items including microscopes and cameras, datalogging, power supplies and more!

When you book a demo, you will:

- ✓ Be contacted by a member of our friendly team to arrange a date and time to suit you
- ✓ Get a hands-on experience: explore our equipment up close, learning how to make the most of its features
- ✓ Compare: see different models and brands side by side
- ✓ Ensure seamless compatibility: test to see if products are compatible with your existing equipment
- ✓ Engage your team: get everyone involved in the demo, so the whole department is confident in any decision
- ✓ Receive a quote: walk away with a quote, reflecting the best options for your needs

Book your FREE demo here

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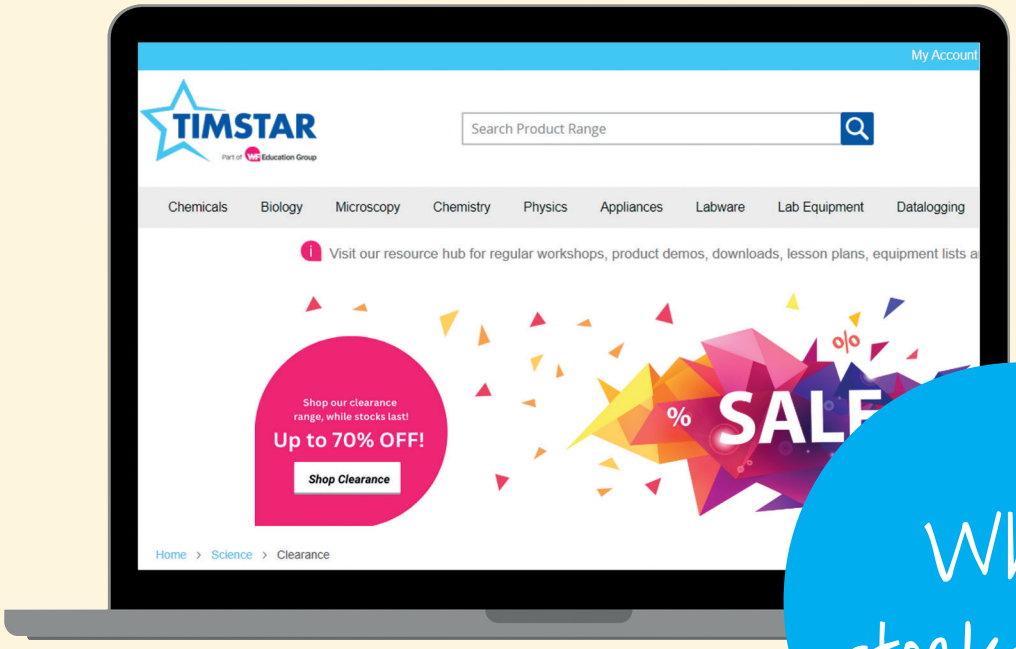

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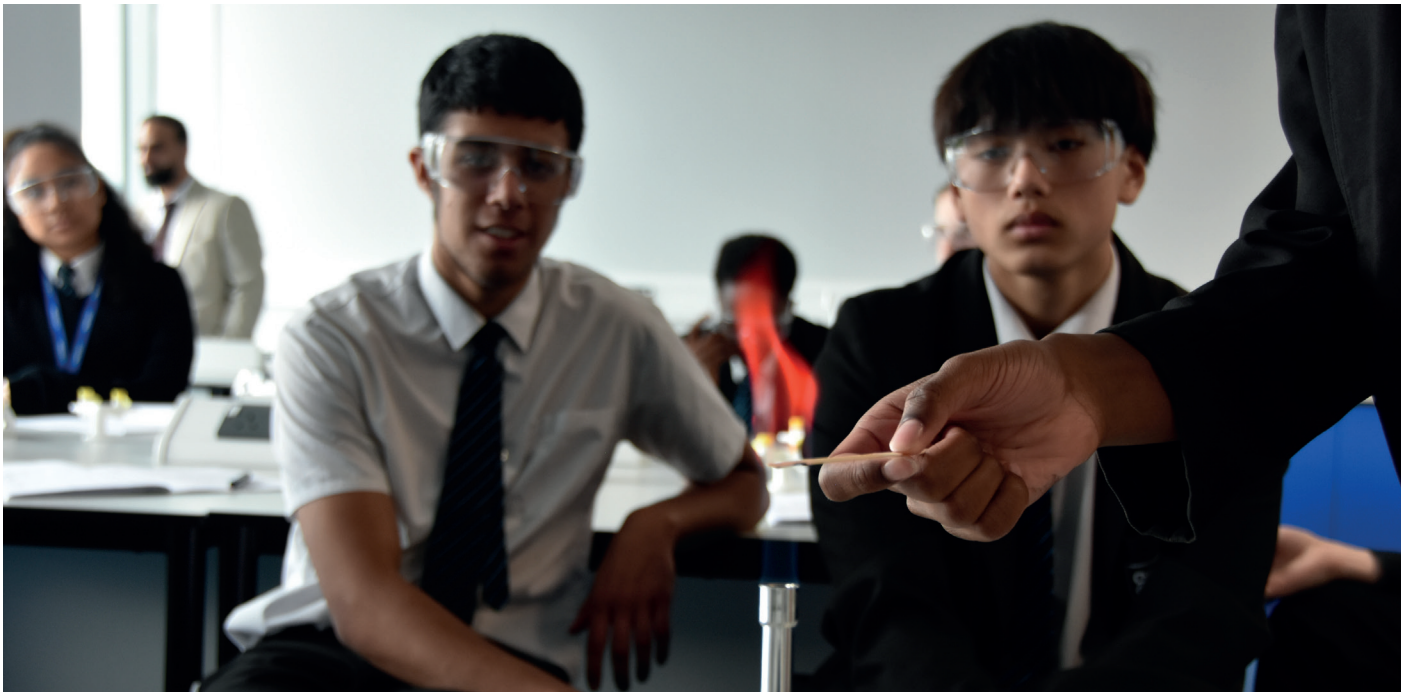

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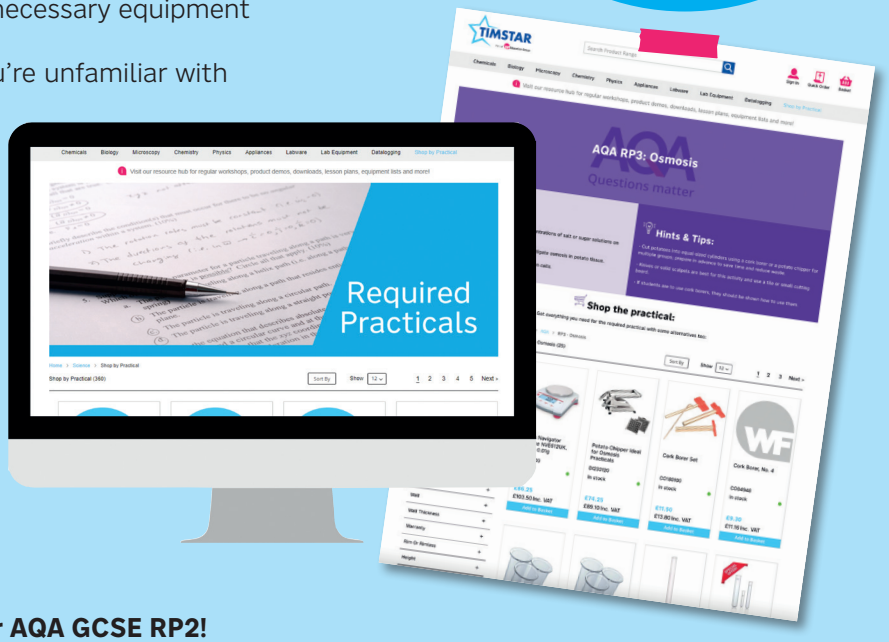
Required Practicals

See biology required practicals for A level and GCSE curricula on our website!

Here's how shop by practical can help you:

- Use it to order the necessary equipment for each practical.
- A handy check that you have all the necessary equipment and supplies.
- Identify any equipment on the list you're unfamiliar with (what even IS a Thiele tube?!).

If you are looking to 'shop by practical', look no further!



See pages 26-27 inside this brochure for AQA GCSE RP2!

TIMSTAR
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