# Microscale chemistry

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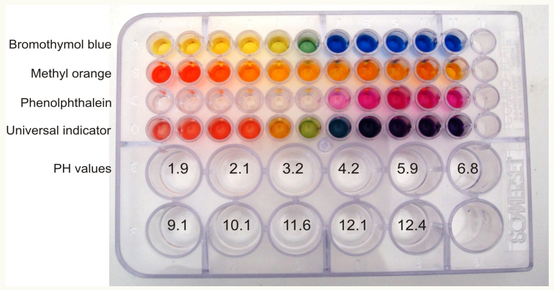
Microscale chemistry activities will enhance your practical work. They use small amounts of chemicals, usually less than 60cm$^3$ of gas, 0.1g of solids and 2cm$^3$ of solution. Microscale also brings the following advantages:

- Variety of approach
- Safer procedures
- Reduced practical time, allowing for more discussion and questioning
- Easier for students to manage
- Reduced cost
- Reduced waste
- Less time clearing up and disposing of waste
- Easier to provide students with everything needed on a small tray- reduces movement in the lab
- Quantitative results and data manipulation are possible
- Uses modern materials and equipment
- A laboratory is not always required
- Images can be projected onto a white board using a webcam or video microscope
- Photographs can be taken by students for their notes.
- Makes some hard-to-do preparations possible, or much easier.

See these activities on CLEAPSS You-Tube channel
http://www.youtube.com/user/CLEAPSS

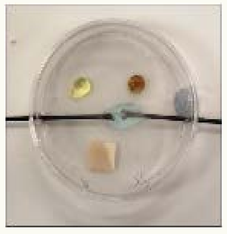
## pH AND INDICATORS




## VANADIUM OXIDATION STATES

## MICROELECTROLYSIS

$CuCl_2$ solution is placed between carbon fibre electrodes.
$Cl_2$ gas diffuses into, and reacts with the litmus paper KI and KBr solutions.
Only 6cm$^3$ of chlorine gas is produced.



## THE CROWN BOTTLE TOP AS CRUCIBLE

% water in $CuSO_4.5H_2O$

Using this equipment gives superior results to using porcelain crucibles

Determining the increase in mass on burning Mg in air

## HOFMANN VOLTAMETER

The arrangement costs less than £25.
Uses 0.8M $Na_2SO_4$ as the electrolyte.
Rockets and explosions can be powered by the hydrogen & oxygen produced.

## GAS DIFFUSION CHEMISTRY

Uses a single tablet blister pack as the reaction vessel. Only a small volume of gas is generated. The gas diffuses to aqueous solutions of various reagents and into moist indicator paper.

**The Chemistry Of Ammonia**

## CHEMISTRY IN DROPS

An instruction sheet is inserted into a plastic folder. Tiny quantities of aqueous chemicals can be dropped onto the sheet to carry out reaction. Removes the need for lots of test tubes.

Adding an Mg turning to $FeSO_4$ solution to get a magnetic product.

## ELECTRODE POTENTIALS

The time taken is substantially reduced with this quick and easy method.

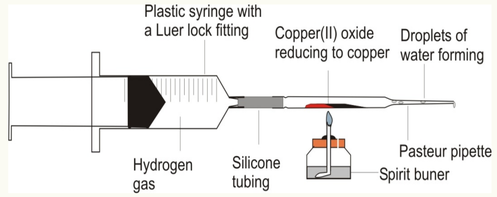
## IONS DIFFUSING

One soluble salt is placed 1.5 cm from another on a plastic sheet.
Water is dripped in between them and a precipitate forms

## TITRATING

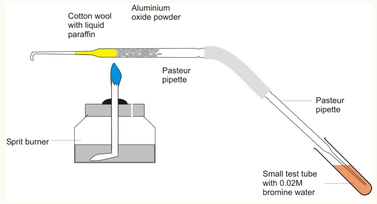
Uses the screw of the clamp or a Hofmann clip to add drops of one reagent from the special pipette to the other reagent in the vial.
Measurements carried out by weighing.

## HYDROGEN REDUCTION OF METAL OXIDES




No risk of hydrogen/ air explosions

## CRACKING




Cracking liquid paraffin and preparation of propene by dehydration of propan-2-ol can be carried out safely with no risk of suckback. Hydrogenation of propene can be achieved.

## MICROELECTROLYSIS OF MOLTEN SALTS

Molten lead bromide is electrolysed with an iron nail cathode (you can write with this to show the lead) and a nichrome wire anode, which releases bromine

## POLYMERISATION

Methyl methacrylate is mixed with the initiator in a closed glass Pasteur pipette and warmed in hot water. The pipette is broken apart to obtain the plastic in the shape of the pipette.
No smells!

# Equipment and further information for microscale chemistry

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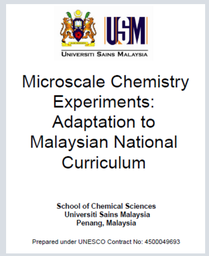
## IT'S ALL ROUND THE WORLD

http://www.radmaste.org.za/index.htm



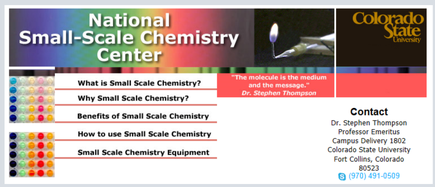
http://micrecol.de/

http://mattson.creighton.edu/Microscale_Gas_Chemistry.html



http://www.unesco.org/new/en/natural-sciences/special-themes/science-education/basic-sciences/microscience/




http://www.smallscalechemistry.colostate.edu/

## BALANCES

www.digitalscalesuk.biz
Amazon and other sites.
Cost from £5 to £20
Look for jewellers' balances, pocket balances.
Capacity 100g, reading to 0.01g; Balances even reading to 0.001g available but with lower capacity. On the downside, they are not as robust as school balances and need to be counted back in at the end of an activity.

## CROWN BOTTLE TOPS

These are the metal caps found on soda and beer bottles. Try not to distort the teeth too much when removing them from the bottle. They comfortably fit a small pipe clay triangle.

Made of steel with a plastic insert which has to be burned out in the fume cupboard first. Insert small nut and bolt for holding with tongs or pliers.

## DROPPING BOTTLES

One supplier is http://www.ampulla.co.uk/default.asp? and there are others.
Cost about £25 for 100

Using dropping bottle negates the need for pipettes, and reduces cross contamination.

## ELECTRODES

These robust yet flexible carbon-fibre electrodes, with a diameter less than 2mm are obtained from online kite shops and cost about £5 a metre. See www.thehighwaymen.co.uk and search for carbon rod.

Unfolded metal paper clips can be used as well

## SPIRIT BURNER

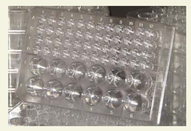
These are based on small jam jars (< 50cm$^3$) which you can obtain online, or from with jam, etc. from shops. You will need to drill a hole to insert the glass tube. Remember to drill a small escape hole as well. The wick is string. The fuel is methylated spirit. More details can obtained from CLEAPSS

## PASTEUR PIPETTES

Broken ones from the biology dept are useful. They can be sealed with a flame from a spirit or Bunsen burner, and used as small disposable test tubes.
They are also used for delivery tubes and combustion tubes.

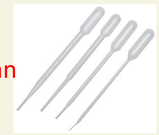
## COMBO AND WELL PLATES

Available from most suppliers. Used in place of test tubes or beakers.



## PLASTIC PIPETTES

Used for transferring liquids. 3 ml size delivers 20 drops to the ml. Those used in titrating deliver 50 drops to the ml.
Go to http://www.alphalabs.co.uk/product.aspx?p=1450.
There are lots of creative uses for the pipette. They can be converted into spatulas, funnels, etc.

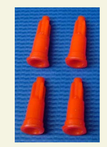


## SILICONE TUBING

Much easier to use than natural rubber. Inserting small diameter in larger diameter tubing allows objects to be connected together.

## SYRINGES, CAPS & TAPS

Used to collect and store gases and deliver precise quantities of liquid.



Stored hydrogen in a syringe for many days using a cap. http://www.adhesivedispensing.net and search for syringe cap.

Useful because gases and reagents can be added or removed from syringes without disturbing the experiment.

## CORIFLUTE AND SUPPORT

Corriflute

Aluminium sheet

Meccano