# Ion Migration – Copper(II) chromate(VI)

## Introduction

We had some queries from technicians unable to get this demonstration to work. Furthermore we found that some younger technicians and chemistry staff had never even heard of it! It can be used in Standard Grade Chemistry to help show the existence of ions.

## What you will need

### Chemicals

copper(II) chromate(VI) solid (toxic)
hydrochloric acid, 1M (irritant)
nitric acid, 1M (corrosive)
urea

### Equipment

filter funnel
filter paper
beaker, 250 $cm^3$
hot plate
spatula
stirring rod
thermometer, stirring
teat droppers, 2 off
"W" tube (Griffin Education Catalogue, page 101 Cat. No EKW-224-552B, £7, [1])
beaker, 500 $cm^3$ (used as a water bath with cold water to minimise convection of solutions)
stand, with bosshead and clamp
power supply, low voltage (0-12 V dc)
wires, platinum (for electrodes)
crocodile clips, 2 off
leads, 4 mm connecting, 2 off
goggles, indirect vent
gloves, nitrile

## Preparing the solution

Heat some 1M hydrochloric acid to about 60-70°C and add excess copper(II) chromate to make a hot saturated solution. Allow to cool and filter off the excess solid.

Dissolve urea in this solution. Urea is very soluble and a large amount will be required. The density of this solution is critical, not the concentration of urea it. This should be sufficient to allow the formation of two distinct layers when added to the 1M nitric acid (see 'Setting up the apparatus'). Something approaching a saturated solution of urea in the copper chromate is ideal.

## Setting up the apparatus

Use a teat dropper to place some 1M nitric acid down the back limb into the "W" tube (Figure 2).

Now use a second dropper to carefully and slowly pour copper(II) chromate(VI) solution down the back limb into the "W" tube, making sure the tip of the dropper touches the glass. This should form a bottom layer and force the nitric acid up the side arms of the tube.


**Figure 1 -** Apparatus & chemicals

**Figure 2 -** Using dropper

**Figure 3 -** with electrodes

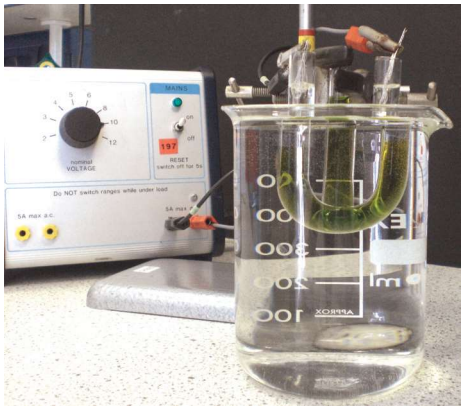


**Figure 4 -** Connect Pt electrodes and immerse W-tube partially in water-bath beaker

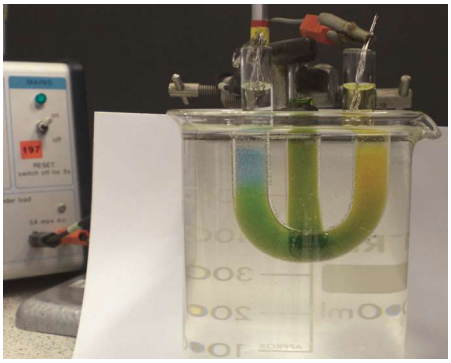
Connect up the platinum wires (Figure 3) and immerse these in the top of the nitric acid, ensuring they are some distance from the top of the chromate solution.

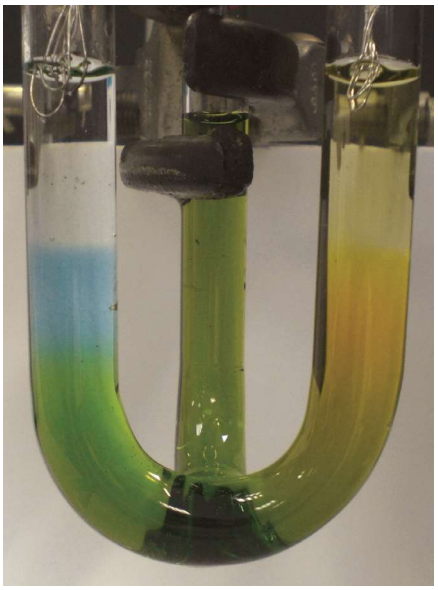
Carefully clamp the "W" tube and lower the legs into the 500 $cm^3$ beaker. Fill the beaker with cold water to minimise convection currents in the W-tube.

## The Demonstration

Set the voltage to between 10-12 V dc and switch on. Bubbles should appear at the wires.

Leave it running for about an hour to see a blue colour in the acid at the negative electrode, and an orange colour in the acid at the positive electrode (Figure 6).





**Figures 5 & 6 -** Blue and orange colours evident at the negative and positive electrodes after about an hour.

### Hazards and Control Measures

| Chemical | Main Hazard | Control Measures |
|---|---|---|
| Copper(II) chromate(VI) | May cause cancer and is a skin sensitiser | Avoid raising dust from compounds in the solid state and wear nitrile gloves and indirect vent goggles while preparing the solution. |
| Hydrochloric acid (1M) | Irritant | Wear gloves and eye protection. |
| Nitric acid (1M) | Corrosive | Wear gloves and indirect vent goggles. |
| Hot plate | Electrical:<br><br>Burns | Check wires etc. & that it has been PAT tested before use;<br>Ensure safety notice on view while hot. |
| Power supply | Electrical | Check power packs (wires etc) plus been PAT tested before use. Use low voltage. |

**1.** http://www.catalogue.fisher.co.uk/catalogue/griffinbrowse.htm
(Copy "EKW-224-552B" into Product Code box)