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| Microscale Chemistry |
| The Ostwald Process |

A picture containing maraca

Description automatically generated

**Curriculum links**

**CfE Level 3**

Through experimentation, I can identify indicators of chemical reactions having occurred. I can describe ways of controlling the rate of reactions and can relate my findings to the world around me.

SCN 3-19a

**National 4 –** Chemical change and structure

Atomic Structure and Bonding related to properties of material

**Introduction**

Industrial chemistry is very important to a nation’s economy. The [Ostwald process](http://en.wikipedia.org/wiki/Ostwald_process) is used still used extensively as the main source of nitrates. The industrial conditions of a pressure of around 5 atm with a platinum catalyst and a temperature of around 250°V to obtain a high yield are impossible in the school lab. Yet using this equipment is possible to demonstrate the process.

**Health & Safety**

Wear eye protection. Make sure that any long hair is tied back.

**You will need**

|  |  |
| --- | --- |
| 1 x 60 cm3 syringe | Ammonia gas |
| Oxygen gas | Copper turnings or wire\* |
| 6mm wall borosilicate tubing | Burner |
| 1 x Small test tube (or bijou) | Slightly alkaline water with universal indicator. |
| Silicone tubing to connect |  |

**Preparation**

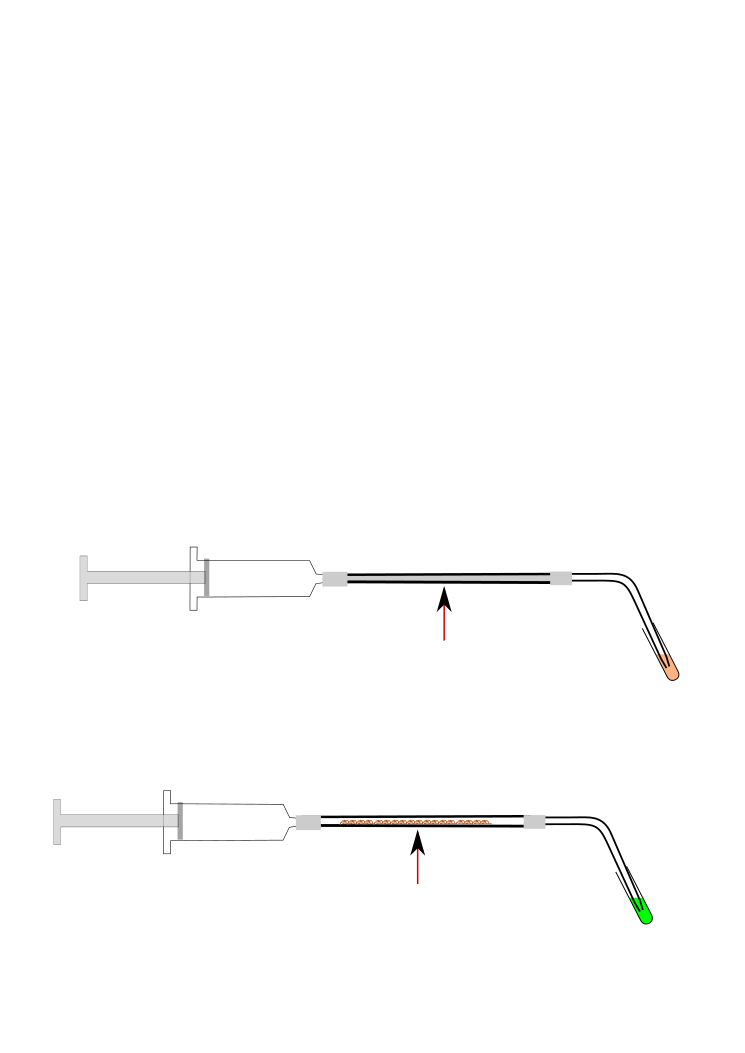
Fill your 60 cm3 syringe with 25 cm3 of ammonia and 35 cm3 of Oxygen.

Set up the apparatus as in the diagram.

6-mm medium wall borosilicate tubing filled with copper turnings or wire

60-ml plastic syringe containing about 25 ml of ammonia and 35 ml of oxygen

Small test tube with tap water (slightly alkaline)



Heat with a mini-Bunsen burner

**To Do**

1. You are provided with a weighing boat and a marble chip.
2. Wear eye protection
3. The approximate 10cm length of 6 (or7) mm medium-wall borosilicate tubing is filled with copper turnings or electrical wire.\*
4. Set up the equipment by clamping the 60-ml syringe. The small test tubes can be stabilised by placing it in a 100-ml beaker.
5. The test tubes are filled one-quarter filled with tap water which is often slightly alkaline due to dissolved hydrogen carbonate ions. A few drops of Universal Indicator are added to each tube and the liquid should turn green. In a demonstration, two test tubes can be used, one acting as a control.
6. Light the mini-Bunsen Burner and when the copper gets very hot, start pushing the barrel to force the gas mixture slowly over the catalyst. This is best done by holding the stem of the barrel rather than pushing the end with the palm of the hand.
7. The aim is to make nitrogen oxide and dioxide causing the water in the test tube to become acidic which is indicated by a red colour.

\* If you have access then palladium beads (palladium coated on porcelain) are more effective.