

Some reactions of nitrogen dioxide – teacher notes

Topic

Gases

Timing

20 minutes

Apparatus

- Eye protection
- Clear plastic sheet (eg OHP sheet)
- Plastic Petri dish (base + lid), 9 cm
- Plastic pipette
- Scissors

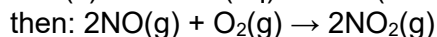
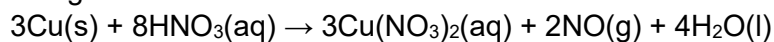
Chemicals

Solutions should be contained in plastic pipettes. See the accompanying guidance on apparatus and techniques for microscale chemistry, which includes instructions for preparing a variety of solutions here <https://rsc.li/3E2J8DI>

- Nitric acid (concentrated HNO₃) diluted 1:1 with water ca 5M
- Full-range indicator solution diluted 1:1 with deionised water
- Potassium iodide, 0.2 mol dm⁻³
- Potassium iodate(V), 0.1 mol dm⁻³
- Potassium bromide, 0.2 mol dm⁻³
- Potassium bromate(V), 0.1 mol dm⁻³
- Ammonia solution, 3 mol dm⁻³
- Copper turnings

Method

Copper turnings + nitric acid generates first nitric oxide, which then reacts with air to give nitrogen dioxide:



Results

Full-range indicator turns from green to yellow-red indicating that nitrogen dioxide is an acidic gas.

The iodate/iodide solution turns black due to: $\text{IO}_3^-\text{(aq)} + 5\text{I}^-\text{(aq)} + 6\text{H}^+\text{(aq)} \rightarrow 3\text{I}_2\text{(g)} + 3\text{H}_2\text{O(l)}$ also indicating the acidic nature of the gas.

A similar reaction occurs with bromide/bromate.

Health, safety and technical notes

- Read our standard health and safety guidance here <https://rsc.li/3LVOUbN>

- Students must wear suitable eye protection (Splash resistant goggles to BS EN1663).
- Nitrogen dioxide is extremely toxic and corrosive if inhaled, with sometimes delayed effects. It is important to ensure that the amount of NO_2 generated does not result in significant leakage from the Petri dish (see CLEAPSS Hazcard [HC068b](#)). No more than 2 copper turnings should be used.
- Concentrated Nitric acid, $\text{HNO}_3(\text{aq})$, 5 mol dm^{-3} , is CORROSIVE and gives off toxic fumes (see CLEAPSS Hazcard [HC067](#)).
- Potassium iodate(V), $\text{KIO}_3(\text{aq})$, 0.1 mol dm^{-3} , Potassium bromate(V), $\text{KBrO}_3(\text{aq})$, 0.1 mol dm^{-3} (see CLEAPSS Hazcard [HC080](#)), Potassium bromide, $\text{KBr}(\text{aq})$, 0.2 mol dm^{-3} and Potassium iodide, $\text{KI}(\text{aq})$, 0.2 mol dm^{-3} are low hazard (see CLEAPSS Hazcard [HC047b](#)).
- Ammonia solution, $\text{NH}_3(\text{aq})$, 3 mol dm^{-3} is corrosive and a respiratory IRRITANT (see CLEAPSS Hazcard [HC006](#)).