# 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/3E2J8Dl>

* 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:

3Cu(s) + 8HNO3(aq) → 3Cu(NO3)2(aq) + 2NO(g) + 4H2O(l)

then: 2NO(g) + O2(g) → 2NO2(g)

## 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: IO3–(aq) + 5I–(aq) + 6H+(aq) → 3I2(g) + 3H2O(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 EN166 3).
* Nitrogen dioxide is extremely toxic and corrosive if inhaled, with sometimes delayed effects. It is important to ensure that the amount of NO2 generated does not result in significant leakage from the Petri dish (see CLEAPSS Hazcard [HC068b](https://science.cleapss.org.uk/Resource-Info/HC068B-Nitrogen-oxides.aspx)). No more than 2 copper turnings should be used.
* Concentrated Nitric acid, HNO3(aq), 5 mol dm–3, is CORROSIVE and gives of toxic fumes (see CLEAPSS Hazcard [HC067](https://science.cleapss.org.uk/Resource-Info/HC067-Nitric-V-acid.aspx)).
* Potassium iodate(V), KIO3(aq),0.1 mol dm–3, Potassium bromate(V), KBrO3(aq), 0.1 mol dm–3 (see CLEAPSS Hazcard [HC080](https://science.cleapss.org.uk/Resource-Info/HC080-Potassium-bromate-V-and-iodate-V.aspx)), Potassium bromide, KBr(aq), 0.2 mol dm–3 and Potassium iodide, KI(aq), 0.2 mol dm–3are low hazard (see CLEAPSS Hazcard [HC047b](https://science.cleapss.org.uk/Resource-Info/HC047b-Halide-salts-Group-1-chlorides-bromides-iodides.aspx)).
* Ammonia solution, NH3(aq), 3 mol dm–3is corrosive and a respiratory IRRITANT (see CLEAPSS Hazcard [HC006](https://science.cleapss.org.uk/Resource-Info/HC006-Ammonia-solution-NH3-aq.aspx)).