# The chemical properties of hydroxybenzene– teacher notes

## Topic

 Organic compounds, chemical properties.

## Timing

20 minutes

## Description

In this experiment students observe and interpret some of the chemical reactions of hydroxybenzene (phenol).

## Apparatus

* Eye protection
* Clear plastic sheet (eg OHP sheet)
* Plastic Petri dish, 9 cm diameter

## Chemicals

* Deionised water
* Full-range indicator solution – diluted 1:1 with deionised water
* Nitric acid,1 mol dm–3
* Iron(III) nitrate, 0.1 mol dm–3
* Sodium carbonate, 1 mol dm–3
* Sodium hydroxide, 1 mol dm–3
* Hydrochloric acid, 1 mol dm–3
* Hydroxybenzene (phenol)
* The students should sample the bottle of hydroxybenzene (phenol) using the method in our standard health and safety guidance here <https://rsc.li/3LNbkfo>
* Solution should also be contained in plastic pipettes, instructions for preparing a variety of solutions are found at the above link.

## Observations

* Hydroxybenzene (phenol) is partially soluble in water, and oily drops should be observed. An acidic solution is formed, and the indicator solution should turn red.
* The mixture turns dark as the hydroxybenzene (phenol) reacts with the nitric acid to give a mixture of nitrophenols.
* A violet colouration is seen, which is characteristic of the reaction between iron(III) and phenolic OH groups.
* No reaction is observed with sodium carbonate solution, indicating that hydroxybenzene (phenol), although acidic, is not a strong enough acid to liberate carbon dioxide from carbonates.
* Hydroxybenzene (phenol) dissolves readily in sodium hydroxide to form sodium phenoxide. The hydroxybenzene (phenol) is liberated and oily drops should be observed when this solution is acidified with hydrochloric acid.

## Health, safety and technical notes

* Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3).
* Hydroxybenzene (phenol) is hazardous and gloves should be worn (see CLEAPSS Hazcard [HC070a](https://science.cleapss.org.uk/Resource-Info/HC070A-Phenols-1.aspx)).
* Nitric acid, 1 mol dm–3 HNO3 (aq), is CORROSIVE (see CLEAPSS Hazcard [HC067](https://science.cleapss.org.uk/Resource-Info/HC067-Nitric-V-acid.aspx)).
* Sodium hydroxide,1 mol dm–3 is corrosive, iron(III) nitrate, Fe(NO3)3.9H2O (aq),0.2 mol dm–3, sodium carbonate 1 mol dm–3 and hydrochloric acid, HCl(aq), 1 mol dm–3, are of low hazard (see CLEAPSS Hazcard [HC091a](https://science.cleapss.org.uk/Resource-Info/HC091a-Sodium-hydroxide.aspx), [HC055c](https://science.cleapss.org.uk/Resource-Info/HC055C-Iron-III-salts.aspx), [HC095a](https://science.cleapss.org.uk/Resource-Info/HC095A-Sodium-and-potassium-salts-1.aspx), [HC047a](https://science.cleapss.org.uk/Resource-Info/HC047a-Hydrochloric-acid.aspx)).
* Hydroxybenzene (phenol) is CORROSIVE, TOXIC by all routes and causes damage to organs on repeated or prolonged exposure (see CLEAPSS Hazcard [HC070a](https://science.cleapss.org.uk/Resource-Info/HC070A-Phenols-1.aspx)). Dangerous if in contact with sodium nitrate (see CLEAPSS Hazcard [HC093](https://science.cleapss.org.uk/Resource-Info/HC093-Sodium-and-potassium-nitrate-III.aspx))
* Depending on the formulation of the Universal indicator, a 1:1 dilution with water might still be flammable. Keep away from sources of ignition.