

The Oxidising Power of the Halogens (AS)

Instructions Sheet

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Sample Page

Introduction:

All halogens are oxidising agents. Their oxidising strength decreases down the group:

	E^{\ominus} (volts)
$\frac{1}{2} \text{F}_2 + \text{e}^- \rightleftharpoons \text{F}^-$	+2.87
$\frac{1}{2} \text{Cl}_2 + \text{e}^- \rightleftharpoons \text{Cl}^-$	+1.36
$\frac{1}{2} \text{Br}_2 + \text{e}^- \rightleftharpoons \text{Br}^-$	+1.09
$\frac{1}{2} \text{I}_2 + \text{e}^- \rightleftharpoons \text{I}^-$	+0.54

Aim:

The aim of this practical is to confirm this order using halogen-halide ion displacement reaction for chlorine, iodine and bromine.

Safety during practical work:

Eye protection

Eye protection must be worn

Harmful

Bromine water

Irritant

Chlorine water
Iodine solution

Procedure:

- To each of two test tubes add 1cm³ of chlorine water.
- To one of the tubes add 1cm³ of potassium iodide.
- To the other tube add 1cm³ of potassium bromide.
- To each tube add 1cm³ of Volasil 244.
- Cork and shake the tubes.
- Record your observations.
- To each of two fresh test tubes add 1cm³ of bromine water.
- To one of the tubes add 1cm³ of potassium iodide.
- To the other tube add 1cm³ of potassium bromide.
- To each tube add 1cm³ of Volasil 244.
- Cork and shake the tubes.
- Record your observations.
- To each of two fresh test tubes add 1cm³ of iodine solution.
- To one of the tubes add 1cm³ of potassium bromide.
- To the other tube add 1cm³ of potassium chloride.
- Cork and shake the tubes.
- To each tube add 1cm³ of Volasil 244.
- Record your observations.

Student's Result Sheet

1 Record your results:

Reaction	Observations	Inferences
$\text{Cl}_2 + \text{KI}$		
$\text{Cl}_2 + \text{KBr}$		
$\text{Br}_2 + \text{KI}$		
$\text{Br}_2 + \text{KCl}$		
$\text{I}_2 + \text{KBr}$		
$\text{I}_2 + \text{KCl}$		

2 Volasil 244 is an inert organic solvent. Explain why it is used in all the tests carried out.

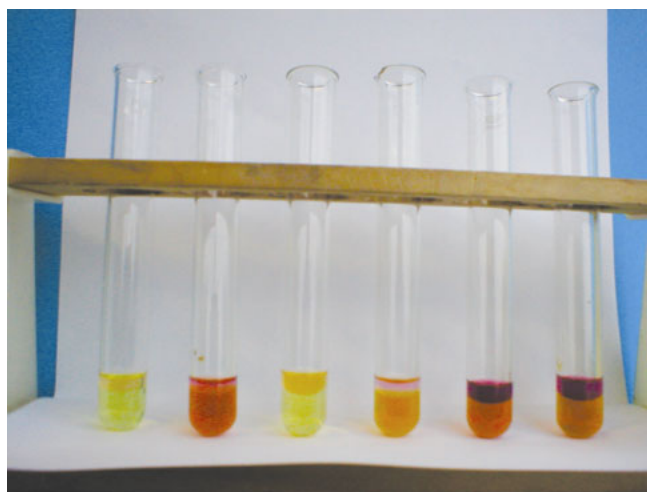
Answer Sheet

1 Record your results:

Reaction	Observations	Inferences
$\text{Cl}_2 + \text{KI}$	initially colourless, turns to purple – upper layer and yellow – bottom layer	iodine formed iodide ion has been oxidised by chlorine
$\text{Cl}_2 + \text{KBr}$	initially colourless, turns to red/orange – upper layer and colourless – bottom layer	bromine formed bromide ion has been oxidised by chlorine
$\text{Br}_2 + \text{KI}$	initially orange, turns to purple – upper layer and yellow – bottom layer	iodine formed iodide ion has been oxidised by bromine
$\text{Br}_2 + \text{KCl}$	initially orange, turns to red/orange – upper layer and colourless – bottom layer	no redox reaction chlorine stronger oxidising agent than bromine/bromine dissolves in Volasil
$\text{I}_2 + \text{KBr}$	initially brown, turns to purple – upper layer and yellow – bottom layer	no redox reaction chlorine stronger oxidising agent than iodine/iodine dissolves in Volasil
$\text{I}_2 + \text{KCl}$	initially brown, turns to purple – upper layer and yellow – bottom layer	no redox reaction chlorine stronger oxidising agent than iodine/iodine dissolves in Volasil

2 Volasil 244 is an inert organic solvent. Explain why it is used in all the tests carried out.

halogens are sparingly soluble in water, but very soluble in organic solvents; Volasil is used to dissolve the halogen present in the solution/ indicate whether halogen has been oxidised.



From left to right:

chlorine reduces bromide ion to bromine (top orange layer) and iodide ion to iodine (top pink layer).

bromine does not reduce chloride ions (top orange layer) but reduces iodide ions to iodine (top pink layer).

iodine does not reduce wither chloride or bromide ions (top purple layer).

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Oxidation and Reduction

Technical Support Sheet

Safety during practical work:

Eye protection

Eye protection must be worn

Harmful

Bromine water

Irritant

Chlorine water
Iodine solution

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Oxidation and Reduction

Requirements	Per student	Per group (20)	Checklist
test tube	6	120	
drop pipette	6	120	
rubber bung	6	120	
test tube rack	1	20	
Volasil 244*	6cm ³	120cm ³	
chlorine water	6cm ³	120cm ³	
bromine water	6cm ³	120cm ³	
0.01M iodine solution	6cm ³	120cm ³	
0.1M potassium chloride	6cm ³	120cm ³	
0.1M potassium bromide	6cm ³	120cm ³	
0.1M potassium iodide	6cm ³	120cm ³	

* Volasil 244 can be substituted by cyclohexane

See 'Preparation of Bench Solutions'.

Cost:	££
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