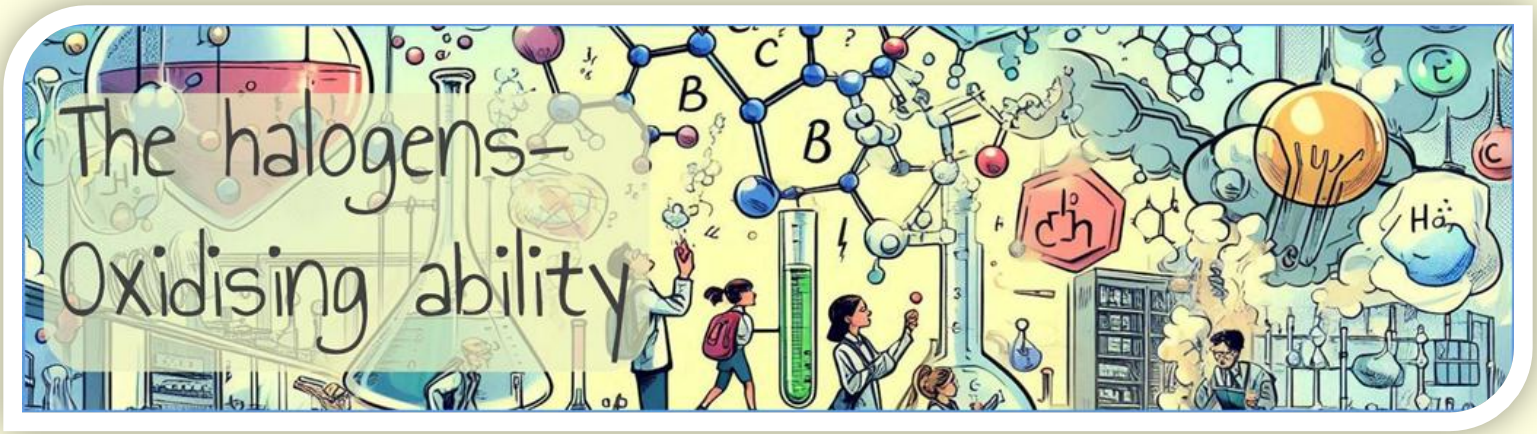


Answer all the questions below then check your answers

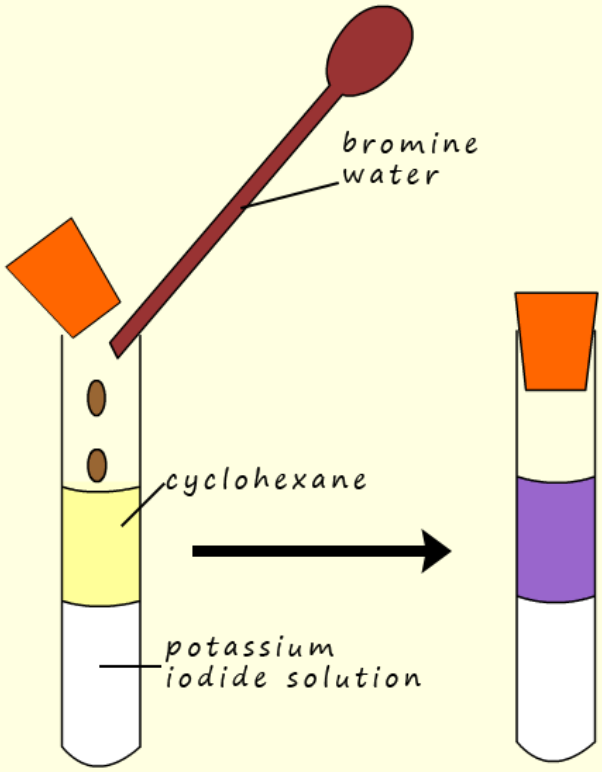
1. What is the difference between an oxidising agent and a reducing agent?

2. Describe the trend in the ability of the group 7 elements to act as oxidising agents.

a. What factors influence the ability of the halogens to act as oxidising agents?

3. Write ion-electron half equations to show the reduction of chlorine to chloride and iodine to iodide.

4. A student set-up the experiment opposite. A few cm^3 of a solution of potassium iodide was placed in a boiling tube. A few centimetres of the solvent cyclohexane was then added to the boiling tube. Finally a few drops of brown bromine water was added and the tube shaken for a few seconds.



i. Cyclohexane and potassium iodide solution are immiscible, what does this mean?

ii. Complete the word and symbolic equation for the displacement reaction taking place:

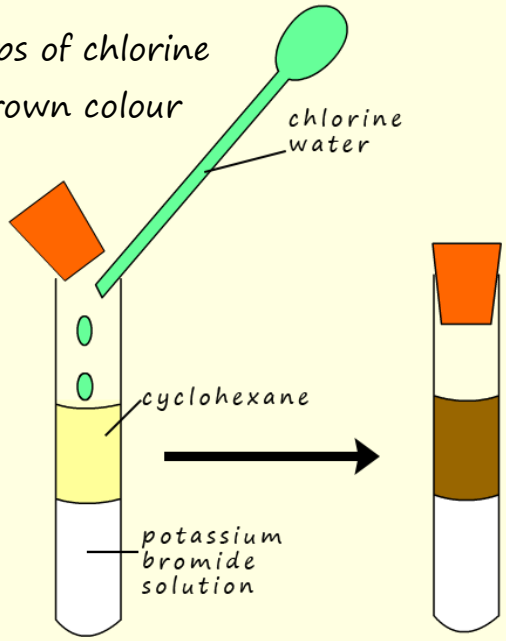
potassium iodide$_{(aq)}$ + bromine$_{(aq)}$ ⟶

$KI_{(aq)}$ + $Br_{2(aq)}$ ⟶

iii. In the second test tube what was causing the purple colour present in the cyclohexane layer?

5. A second displacement reaction was set-up as shown below:

a. This time a potassium bromide solution has a few drops of chlorine water added to it. After shaking the boiling tube a brown colour was seen in the cyclohexane layer in the second tube.



b. Why is cyclohexane used in these displacement reactions?

c. Complete the word and symbolic equation for the displacement reaction taking place:

potassium bromide$_{(aq)}$ + chlorine$_{(aq)}$ ⟶

$KBr_{(aq)}$ + $Cl_{2(aq)}$ ⟶

d. What was responsible for the brown colour in the cyclohexane layer?

e. Write ion-electron half equations to show the oxidation and reduction reactions that are taking place here.

f. What is the name given to reactions where one substance is oxidised and one is reduced?

6. Complete the word equations for the displacement reactions shown below.

b. Write symbolic equations for the reaction taking place in question 3.

7. Explain how solutions of $Fe^{2+}_{(aq)}$ and $Fe^{2+}_{(aq)}$ can be used to show a partial trend in the oxidising abilities of the halogens. Describe observations that can be made during these reactions.

Answers

1. What is the difference between an oxidising agent and a reducing agent?

An oxidising agent is an electron acceptor; a reducing agent is an electron donor.

2. Describe the trend in the ability of the group 7 elements to act as oxidising agents.

Fluorine > chlorine> bromine > iodine

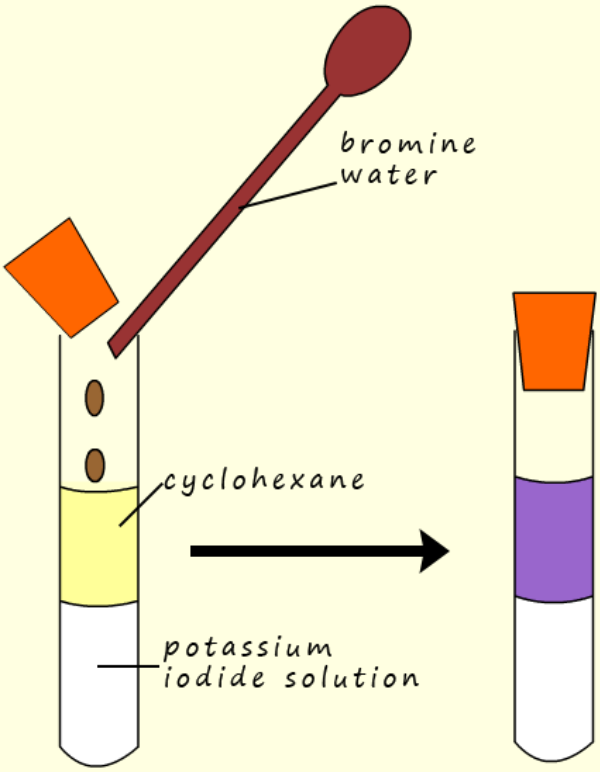
a. What factors influence the ability of the halogens to act as oxidising agents?

- Bond enthalpy of the halogen.
- Electron affinity of the halogen.
- Energy released when halide ions goes into solution or forms a solid ionic lattice.

3. Write ion-electron half equations to show the reduction of chlorine to chloride and iodine to iodide.

$$Cl_2 + 2e \longrightarrow 2Cl^-$$
$$I_2 + 2e \longrightarrow 2I^-$$

4. A student set-up the experiment opposite. A few cm^3 of a solution of potassium iodide was placed in a boiling tube. A few centimetres of the solvent cyclohexane was then added to the boiling tube. Finally a few drops of brown bromine water was added and the tube shaken for a few seconds.



i. Cyclohexane and potassium iodide solution are immiscible, what does this mean?

Won't mix, but forms two separate layers.

ii. Complete the word and symbolic equation for the displacement reaction taking place:

potassium iodide$_{(aq)}$ + bromine$_{(aq)}$ ⟶ potassium bromide$_{(aq)}$ + iodine$_{(aq)}$

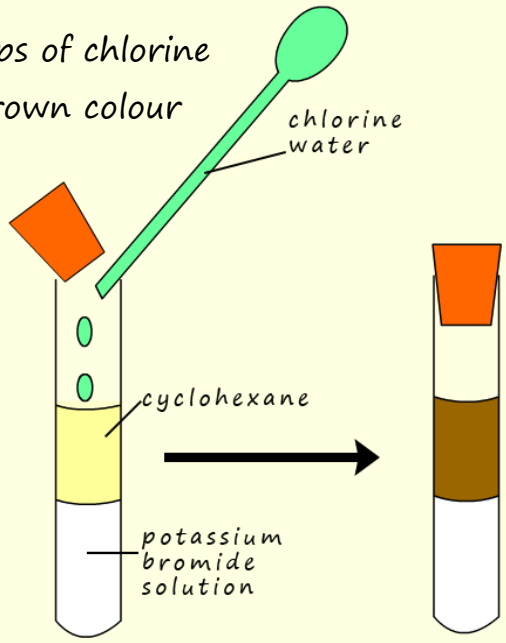
$2KI_{(aq)}$ + $Br_{2(aq)}$ ⟶ $2KBr_{(aq)}$ + $I_{2(aq)}$

iii. In the second test tube what was causing the purple colour present in the cyclohexane layer?

Iodine dissolved in the cyclohexane layer.

5. A second displacement reaction was set-up as shown below:

a. This time a potassium bromide solution has a few drops of chlorine water added to it. After shaking the boiling tube a brown colour was seen in the cyclohexane layer in the second tube.



b. Why is cyclohexane used in these displacement reactions?

Halogens are more soluble in organic solvents than they are in water. Also the colours formed when halogens dissolve in organic solvents are bright and clear which helps identify the halogen present.

c. Complete the word and symbolic equation for the displacement reaction taking place:

potassium bromide$_{(aq)}$ + chlorine$_{(aq)}$ ⟶ potassium chloride$_{(aq)}$ + bromine$_{(aq)}$

$2KBr_{(aq)} + Cl_{2(aq)} \longrightarrow 2KCl_{(aq)} + Br_{2(aq}$

d. What was responsible for the brown colour in the cyclohexane layer?

bromine

e. Write ion-electron half equations to show the oxidation and reduction reactions that are taking place here.

Oxidation: $2Br^- \longrightarrow Br_2 + 2e$

reduction: $Cl_2 + 2e \longrightarrow 2Cl^-$

f. What is the name given to reactions where one substance is oxidised and one is reduced?

Redox reactions

6. Complete the word equations for the displacement reactions shown below.

i $2NaCl_{(aq)} + F_{2(aq)} \longrightarrow 2NaF_{(aq)} + Cl_{2(aq)}$

ii. no reaction

iii. no reaction

iv. $2NaI_{(aq)} + Br_{2(aq)} \longrightarrow 2NaBr_{(aq)} + I_{2(aq}$

b. Write symbolic equations for the reaction taking place in question 3.

See above

7. Explain how solutions of $Fe^{2+}_{(aq)}$ and $Fe^{2+}_{(aq)}$ can be used to show a partial trend in the oxidising abilities of the halogens. Describe observations that can be made during these reactions.

Chlorine and bromine are both strong enough oxidising agents to oxidise $Fe^{2+}_{(aq)}$ ions to $Fe^{2+}_{(aq)}$ ions, however iodide is not a strong enough oxidising agent to oxidise $Fe^{2+}_{(aq)}$ ions. The colour changes are from pale green for the $Fe^{2+}_{(aq)}$ ion to pale yellow for the $Fe^{3+}_{(aq)}$ ion.