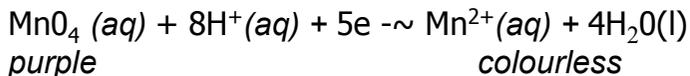


## Ex 2

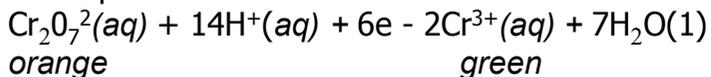
# Manganate(V11) and Dichromate(V1) as oxidizing agents

### Background

The permanganate ion and dichromate ion are commonly used oxidising agents in aqueous solution. In acid solution the permanganate ion ( $\text{MnO}_4^-$ ), which is deep purple in colour, may be reduced to manganese(II) ion ( $\text{Mn}^{2+}$ ) which is almost colourless (actually a very pale pink). The equation for the half-reaction is



The orange dichromate ion ( $\text{Cr}_2\text{O}_7^{2-}$ ) may be reduced in acid solution to green chromium(III) ion ( $\text{Cr}^{3+}$ ). The equation for this half-reaction is



In this experiment some reactions involving the permanganate and dichromate ions will be investigated.

## Equipment required

Test tubes (seven)

Dropper

Potassium permanganate solution  $\text{KMnO}_4$  0.02 mol L<sup>-1</sup> (3mL)

Potassium dichromate solution  $\text{K}_2\text{Cr}_2\text{O}_7$  0.05 mol L<sup>-1</sup> (3mL)

Potassium chloride solution  $\text{KCl}$  0.5 mol L<sup>-1</sup> (5 mL)

Potassium bromide solution  $\text{KBr}$  0.5 mol L<sup>-1</sup> (5 mL)

Potassium iodide solution  $\text{KI}$  0.5 mol L<sup>-1</sup> (5 mL)

Hydrogen peroxide solution  $\text{H}_2\text{O}_2$  6% (5 mL)

Sulfuric acid  $\text{H}_2\text{SO}_4$  2 mol L<sup>-1</sup> (6 mL)

Dichloromethane  $\text{CH}_2\text{Cl}_2$  (6 mL)

Iron(II) sulfate-7-water  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  (about 1 g) Graduated cylinder (10 mL)

## Procedure

#1 Make up a stock solution of acidified potassium permanganate solution by mixing 3 mL of  $0.02 \text{ mol L}^{-1} \text{ KMnO}_4$  with 3 mL of  $2 \text{ mol L}^{-1} \text{ H}_2\text{SO}_4$ .

#2 Place 2 mL of  $0.5 \text{ mol L}^{-1} \text{ KI}$  into a test tube. Using a dropper add dropwise about 1 mL of the stock permanganate solution and shake well. If a redox reaction occurs the purple permanganate colour will disappear, or at least be greatly reduced in intensity.

## Safety Note

**Dichloromethane is poisonous and must be handled with care.**

**Do not breathe in  $\text{CH}_2\text{Cl}_2$  vapour or allow it to come in contact with your skin.**

#3 Add 1 mL of dichloromethane to the test tube and shake well to see if any halogen has been formed.

#4 Repeat instructions #2 and #3 using the KBr and KCl solutions in place of the KI solution.

#5 Place a small quantity of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  in a test tube and dissolve in about 2 mL of water. Repeat instruction #2 using the  $\text{FeSO}_4$  solution in place of the KI solution.

#6 Repeat instruction #2 using  $\text{H}_2\text{O}_2$  solution in place of the KI solution.

#7 Make up a stock solution of acidified potassium dichromate by mixing 3 mL of  $0.05 \text{ mol L}^{-1} \text{ K}_2\text{Cr}_2\text{O}_7$  with 3 mL of  $2 \text{ mol L}^{-1} \text{ H}_2\text{SO}_4$ .

#8 Repeat instructions #2 to #6 using about 1 mL of the acidified dichromate solution instead of the acidified permanganate solution.

### **Processing of results, and questions**

1 Where reactions were observed, identify the reducing agent in each case.

2 Write balanced ionic equations for all the reactions observed.