

COMMENTS:

- straightforward chapter
- closely linked to chapters like Metals (Displacement reactions), Periodic table, Acids & Bases
- Usually tested in MCQs & add-ons to other chapters (e.g. chemical equations)

Redox reaction

- A redox reaction is a chemical reaction which involves the oxidation of a substance while another substance undergoes reduction. * BOTH processes always occur TOGETHER. *

Oxidation happens when!

- Gaining of oxygen
- Loss of hydrogen
- Loss of electrons
- Increase in oxidation state. ★ MOST IMP.

Reduction happens when:

- Loss of oxygen
- Gaining of hydrogen
- Gaining of electrons
- Decrease in oxidation state ★ MOST IMP.

★ Identifying change in oxidation state is the most accurate way of deducing whether the substance had undergone oxidation or reduction.

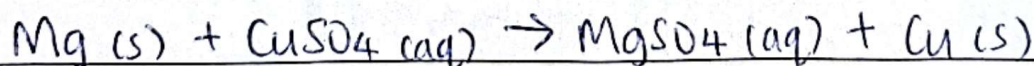
Ionic half-equations

- An equation to show the number of electrons gained or lost.

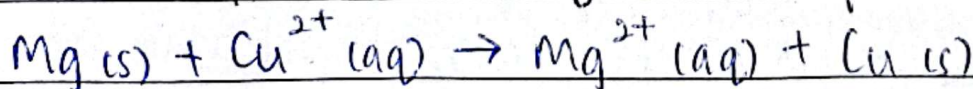
Steps:

1) Write out the balanced chemical equation.

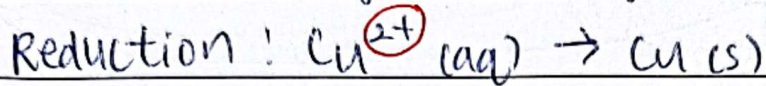
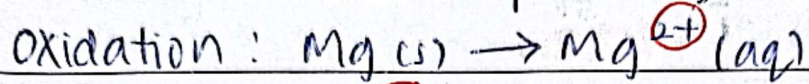
(Optional) ← If you can see/visualise it then optional



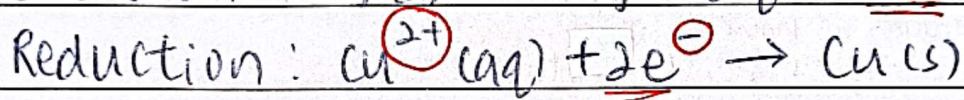
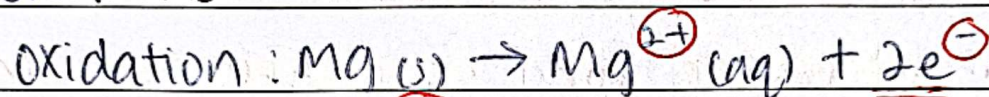
2) Convert it to ionic equation (Optional) ←



3) Identify the substance undergoing oxidation and reduction respectively



4) Balance the number of charges on both sides of each half-equation using electrons



Oxidising & Reducing agents

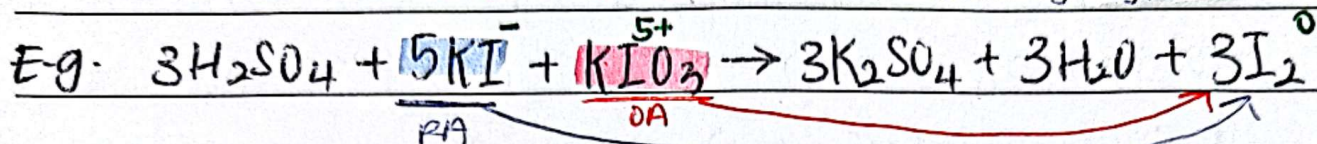
Oxidising agents:

- A reagent that causes another substance to be oxidised. An oxidising agent itself will undergo reduction instead.

~~Examples: Acidified potassium manganate (VII) $[\text{KMnO}_4]$, Acidified potassium dichromate (VI) $[\text{K}_2\text{Cr}_2\text{O}_7]$~~

- Test: Add reducing agent such as aqueous potassium iodide, KI, to the solution to be tested. Colourless potassium iodide turns brown.

↳ Explanation: Solution tested + Potassium iodide
oxidising agent reducing agent



1) KI is oxidised. The oxidation number of iodine increased from -1 in KI to 0 in I₂.

2) KIO₃ is reduced. The oxidation number of iodine decreased from +5 in KIO₃ to 0 in I₂.

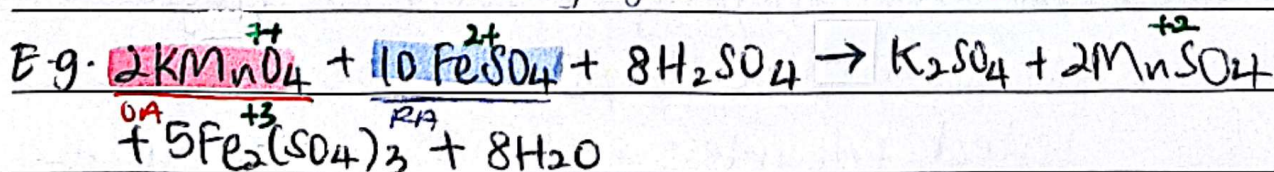
★ Pay attention to how it is phrased.

Reducing agents:

- A reagent that causes another substance to be reduced. A reducing agent itself will undergo oxidation instead.

- Test: Add oxidising agent such as acidified potassium manganate (VII), KMnO₄, to the solution to be tested. Purple acidified potassium manganate (VII) turns colourless.

↳ Explanation: Solution tested + Potassium manganate (VII)
reducing agent oxidising agent



1) KMnO_4 is reduced. The oxidation number of manganese decreased from +7 in KMnO_4 to +2 in MnSO_4 .

2) FeSO_4 is oxidised. The oxidation number of iron increased from +2 in FeSO_4 to +3 in $\text{Fe}_2(\text{SO}_4)_3$.

★ Pay attention to how it is phrased.

Examples of oxidising & reducing agents

Acidified potassium manganate (VII) • RMB

Acidified potassium dichromate (VI) • RMB

Oxygen • RMB

Chlorine

Hydrogen peroxide

Manganese (IV) oxide

Concentrated sulfuric acid

Concentrated nitric acid

Iron (III) compounds • RMB

oxidising
agents

Aqueous potassium iodide • RMB

Hydrogen • RMB

Carbon

Carbon monoxide

Ammonia • RMB

Metals • RMB

Hydrogen peroxide

Iron (II) compounds • RMB

Reducing
agents

Questions:

1) In which reaction is substance X reduced?

A. Acidified potassium manganate (VII) is decolourised on addition to an aqueous solution of X.

B. Adding aqueous potassium iodide to an aqueous solution of X gives a brown colour.

C. $X \rightarrow X^{2+} + 2e^{-}$

D. $XO^{-} + O_2 \rightarrow XO_3^{-}$

Ans: B

2) Colour changes are often observed when redox reactions occur. Which colour change is due to the reduction of the named reagent?

A. Black solid copper(II)oxide changes to blue aqueous copper(II)sulfate.

B. Colourless aqueous potassium iodide changes to become a brown solution.

C. Green aqueous iron(II)chloride changes to yellow / brown aqueous iron(III) chloride.

D. Purple acidified potassium manganate(VII) changes to become colourless.

Ans: D