

# REDOX

**O** — Oxidation  
**I** — is  
**L** — Loss of electrons

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**R** — Reduction  
**I** — is  
**G** — Gain of electrons

Oxidation	Reduction
Oxidation is a chemical process involving the loss of electrons by a molecule, atom, or ion, leading to the increase in the oxidation state of the chemical species	Reduction is a chemical process involving the gain of electrons by a molecule, atom, or ion, that leads to a decrease in oxidation states of the chemical species
Oxidation is addition of oxygen	Reduction is the removal of oxygen
Oxidation involves the loss of electrons	Reduction involves the gain of electrons
Oxidation is the removal of hydrogen	Reduction is the addition of hydrogen
There is an increase in oxidation state	There is a decrease in the oxidation state
Oxidation is caused by oxidizing agents	Reduction is caused by reducing agents

**Oxidising agent** is the substance that oxidises another and is itself is reduced.

**Reducing agent** is a substance that reduces another substance and is itself oxidised.

Elemental form	<b>zero (0)</b> . Only one kind of atom present, no charge
Atomic ions	= <b>the charge on the atom</b> (monatomic ion)
Group 1A Li, Na, K, Rb, Cs	<b>+1</b> unless in elemental form
Group 2A Be, Mg, Ca, Sr, Ba	<b>+2</b> unless in elemental form
Hydrogen (H)	<b>+1</b> when bonded to a nonmetal, <b>-1</b> when bonded to a metal
Oxygen (O)	<b>-1</b> in peroxides $O_2^-$ , <b>-2</b> in all other compounds (most common)
Fluorine (F)	<b>-1</b> , always
Neutral compounds	The sum of all oxidation numbers of atoms or ions in a neutral compound is <b>zero</b> .
Ionic compounds	The sum of all oxidation numbers of atoms in an ionic compound is the <b>charge</b> on the polyatomic ion.

## Working out the oxidation state

$CO_2$  (**carbon ??**)

$$C + (2X-2) = 0$$

$$C = +4$$

What is the oxidation state of nitrogen in nitrate ion

$NO_3^-$

$$N + (3X-2) = -1$$

$$N = -1 + 6 = +5$$

### Test for reducing agents

1-Add the suspected **reducing agent to acidified potassium manganate(VII)** . It is a strong oxidising agent.

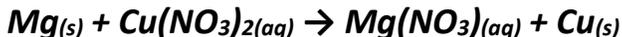
*if the reducing agent is present then the solution turns from **purple to colourless***

### Test for oxidising agent

1-add the suspected **oxidising agent to KI (colourless)** .KI is strong reducing agent.

*If the oxidising agent is present then the solution turns from **colourless to dark brown***

Which species in the reaction is oxidised and which is reduced?



Magnesium is **more reactive than copper**, so it will **displace copper** from the solution.

1-write a split ionic equation



2- Remove the spectator ions (ions that did not change the oxidation state) to produce the full ionic equation.



Cu ions **gained 2 electrons to become copper atoms (reduction)**

Mg atoms **lost 2 electrons to become magnesium ions (oxidation)**

Copper is the oxidising agent

Magnesium is the reducing agent

- (ii) Write an ionic equation for the formation of lead iodide,  $\text{PbI}_2$ , when potassium iodide and lead nitrate react with each other.  
State symbols are **not** required.

..... [2]

(b)(ii)	$\text{Pb}^{2+} + 2\text{I}^- \rightarrow \text{PbI}_2$ formulae of ions correct; rest correct;	2
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When chlorine gas is bubbled through an aqueous solution of potassium iodide, a redox reaction takes place.



- (i) State the colour change expected in this reaction.

start colour ..... Colourless .....

end colour ..... Brown .....

[2]

- (ii) Identify the reducing agent in this reaction. Explain your answer.

..... I<sup>-</sup> / Iodide ion is the reducing agent as it loses electrons/ or it oxidises/its oxidation number increases .....

.....

..... [2]

Iron has two oxidation states +2 and +3. There are two possible equations for the redox reaction between iron and bromine.



(i) Indicate, on the first equation, the change which is oxidation. Give a reason for your choice.

Fe to Fe<sup>2+</sup> is Oxidation as the lose of electron is taking place./Increase in oxidation state takes place.

.....  
..... [2]

(ii) Which substance in the first equation is the reductant (reducing agent)?

..... Fe is the reductant ..... [1]

Describe how you could test the solution to find out which ion, Fe<sup>2+</sup> or Fe<sup>3+</sup>, is present.

Add sodium hydroxide/aqueous ammonia

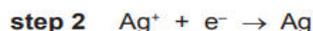
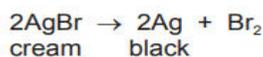
..... Fe<sup>2+</sup> gives green precipitate .....

..... Fe<sup>3+</sup> gives red-brown precipitate .....

..... [3]

The rate of a photochemical reaction is affected by light.

(a) The decomposition of silver bromide is the basis of film photography. This is a redox reaction.



(i) Which step is reduction? Explain your answer.

Step 2 is reductyion as it gains electrons / oxidation state decreases

..... [1]

(ii) Which ion is the oxidising agent? Explain your answer.

Silver ion as it accepts electrons /oxidation state increases.

..... [1]