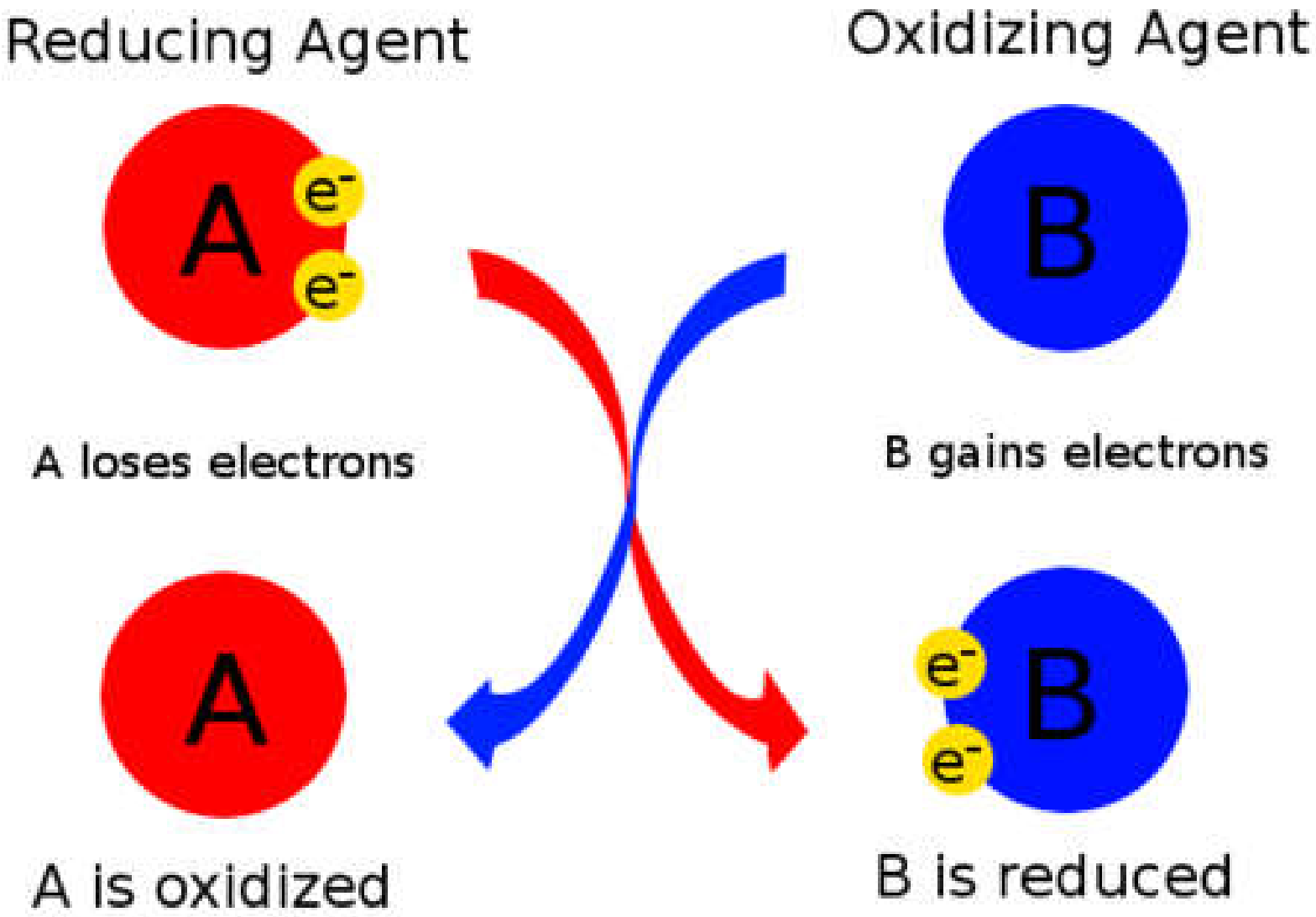
OGUN DIGICLASS

SUBJECT: CHEMISTRY

TOPIC: OXIDATION-REDUCTION REACTION


Reducing Agent
Oxidizing Agent
A
e-
e-
B
A loses electrons
B gains electrons
A
e-
e-
B
A is oxidized
B is reduced

Oxidation and Reduction

Lesson Objectives

- Be able to state the definition of oxidation and reduction
- Be able to state definition of oxidizing agents and reducing agents
- Be able to test for oxidizing and reducing agent.

.. Be able to calculate oxidation number of elements in a compound

Lesson Menu

- Be able to balance ionic equations.

DEFINITION OF OXIDATION - REDUCTION

- Oxidation is addition of oxygen
- Reduction is removal of oxygen
- Oxidation is the removal of hydrogen
- Reduction is the addition of hydrogen
- Oxidation is the addition of electronegative elements
- Reduction is the removal of electronegative elements

Oxidation is the removal of electropositive elements

Reduction is the addition of electropositive elements

Oxidation is the increase in oxidation number

Reduction is the decrease in oxidation number

Oxidation is the loss of electron

Reduction is the gain of electron

OXIDIZING AGENTS AND REDUCING AGENTS

Oxidizing agents are substances which accept or gain electron(s). That Is, they are electron acceptors. Common examples are: acidified $KMnO_4$ and $K_2Cr_2O_7$.

Reducing agents are substances which donate or loss electron(s) . they are electron donors. Examples are: $LiAlH_4$, $FeCl_2$ etc

REDUCTION

Carbon + copper oxide ⟶ copper + carbon dioxide

Key - we are removing oxygen from the copper.
This is what happens in metal extraction.

This is called REDUCTION

** Reduction is the removal of oxygen.

Now write a balanced equation for the extraction of copper oxide using carbon.

Chemical formula for copper oxide: CuO
Chemical formula for carbon: C

$$2CuO_{(S)} + C_{(S)} \longrightarrow 2Cu_{(S)} + CO_{2\,(g)}$$

Stretch…
If you finish early then think about a balanced equation showing the reduction of Aluminium Oxide: Al_2O_3.

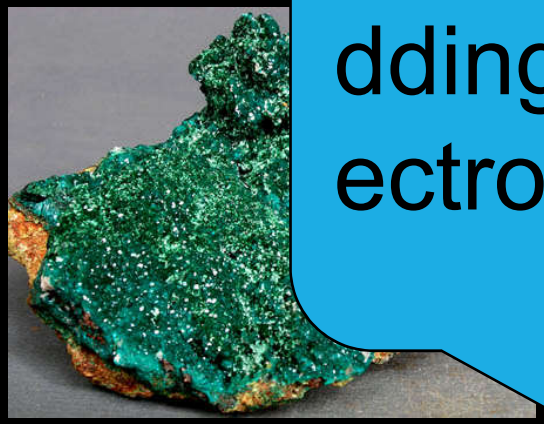
Support…
Think about the gas that's being produced.

Formation of oxides and ores is oxidation…

Bauxite

Galena

Because you are a dding oxygen or el ectrons!



malachite

Zinc Oxide

Let's look at how CuO was forme d…

Copper + oxygen ⟶ copper oxide

Which element is gaining oxygen in this reaction?

This is called **OXIDATION**

** Oxidation is the addition of oxygen.

Now write a balanced equation for the oxidation of copper, Cu.

Don't forget your state symbols!

$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$

Stretch…

If you finish early then think about a balanced equation showing the formation of iron oxide: Fe_2O_3.

Support…

The chemical formula for copper oxide is CuO.

How do we do it?

Increasing reactivity

Potassium
Sodium
Calcium
Magnesium
Aluminium

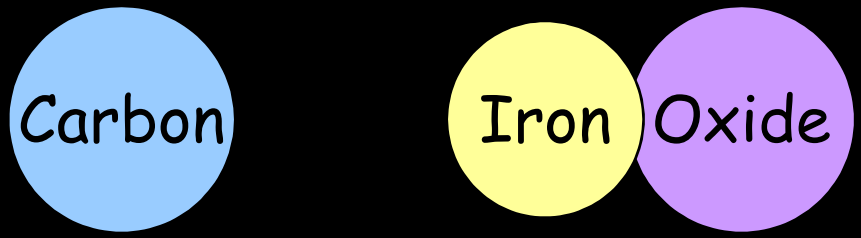
Carbon

Zinc
Iron
Tin
Lead
Copper

Silver
Gold
Platinum

Metals ABOVE CARBON, because of their high reactivity, are extracted by ELECTROLYSIS, which is very expensive!

Metals BELOW CARBON are extracted by heating them with carbon in a BLAST FURNACE. This is a "**displacement reaction**"



These LOW REACTIVITY metals won't need to be extracted because they are SO un-reactive you'll find them on their own, not in a metal oxide

Extension/recap: Extracting metals

- What is an ore?
- In what form are metals usually found in the Earth?
- How do you get a metal out of a metal oxide?
- What is this type of reaction called?

Type of metal	Extraction process (if any)	Examples
High reactivity (i.e anything above carbon)		
Middle reactivity (i.e. anything below carbon)		
Low reactivity		

Practical time

- Worksheet/ method: Is oxygen needed for iron to corrode?

Considering results

2 Explain what your results tell you about the corrosion of iron.

Iron reacts with oxygen (oxide) oxidised (added electrons).

3 Is iron oxidised or reduced when it corrodes?

Oxidised

4 Why was the water boiled?

Speed up reaction times.

5 What was the oil for?

Prevent additional oxygen diffusing into water- keep same a mount oxygen in water. Corrosion requires the oxygen thus proving that it oxidises or adds electrons…

6 What was done to ensure that this experiment was a fair test?

Same type nail, water equipment, quantities of materials etc, same time for experiment….

OIL RIG- stands for what?

- Oxidation is the gain of oxygen
- Reduction is the loss of oxygen

BUT

- Oxidation is also the loss of electrons
- Reduction is the gain of electrons…

Let's look at what's happening in w ith bonding (electrons etc)…

- When **CuO** reacts to form **Cu**…
  Copper loses electrons…

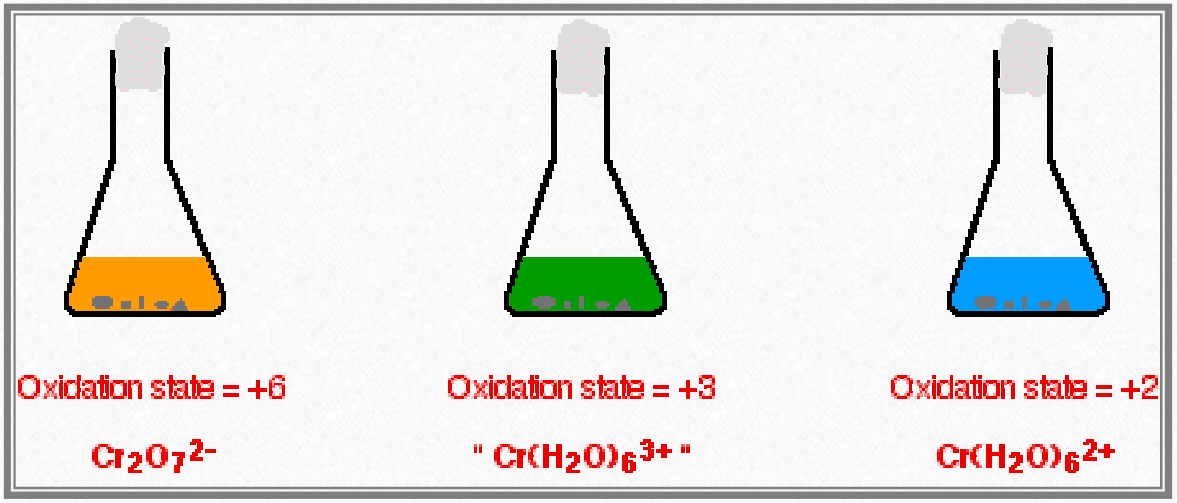
- When CO_2 is formed…
  Carbon gains electrons…

TEST FOR REDUCING AGENTS

Reducing agents change the solution of acidified potassium tetraoxomanganate (vii) from purple to colourless. If acidified potassium heptaoxodichromate (vi) is used, the solution changes from orange to green.

TESTS FOR OXIDIZING AGENTS

Oxidizing agents change solution of iron(ii) chloride from green to reddish brown or when hydrogen sulphide is pass through solution of oxidizing agents there will be yellow deposit of Sulphur. If solution of potassium iodide is used, there will be formation of brown solution



OXIDATION NUMBER

- Oxidation number is the electrical charge on atom of element or group of atoms as determined by set of arbitrary rules.
- RULES FOR OBTAINING OXIDATION NUMBER
- Oxidation number of free element is zero.
- Oxidation number of ions is electrical charge on the ions.
- Sum of the oxidation number of elements in a compound is equal to zero, for radical ions , sum of oxidation number of the elements is equal to charge on the ions.
- **NOTE:** Oxidation number of hydrogen in many compounds is +1 except in hydrides where it is -1. Also, oxidation number of oxygen in many compounds is -2 except in peroxides where it is -1.

CALCULATION ON OXIDATION NUMBER

Calculate the oxidation number of sulphur in the following compounds/ ions:

H_2SO_4

SO_3^{2-}

SO_2

SOLUTION 1

(1*2) + s + (-2*4) = 0

2 + S – 8 = 0

S- 6 = 0

USES OF OXIDATION NUMBER

- Oxidation number is used for the following:
- For naming compounds
- For balancing redox reaction

BALANCING IONIC EQUATIONS

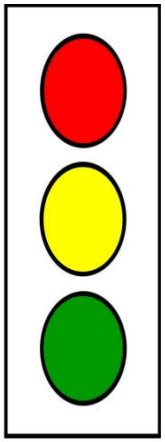
- To balance ionic equations take the following steps;
- Break the equation int0 two half i.e. oxidation half equation and reduction half equation
- Balance each half equation
- Ensure electron loss at oxidation half equation is equal to electron gain at reduction half equation
- Add the two half equations to obtain the balanced ionic equation.

EXERCISES

1.1 Balance the following ionci equations in acidic medium:

1 $MnO_4^- + Fe^{2+} \longrightarrow Mn^{2+} + Fe^{3+}$

2 $Cr_2O_7^{2-} + S^{2-} \longrightarrow 2Cr^{3+} + S$



Progress check- write/tick the things you are now able to do.

- **Must understand metal extraction as the reduction of an oxide.** Grade D/E
- **Should: (all of above plus) describe metal corrosion as oxidation.** Grade D/C
- **Could: (all of above plus) be able to state the definition of oxidation and reduction in terms of loss/gain of oxygen.** Grade B+

At the start of the lesson what colour were you? _____

_____

At the end of the lesson what colour are you now? _____

_____

What else do you need to do? _____

_____

_____

ASSIGNMENT

Balance the ionic equation:

$MnO_4^- + NO_2 \rightarrow Mn^{2+} + NO_3^-$