

Iron and steel

MANUFACTURE OF IRON

There is less iron than aluminium in Earth's crust, but it is easier and cheaper to extract.

The main ore is **haematite**, Fe_2O_3 .

Iron is below zinc in the reactivity list so it forms fairly reactive compounds. Iron is extracted from haematite by **reducing it with carbon in a blast furnace**.

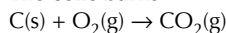
The **charge** is loaded into the top of the furnace.

The charge contains:

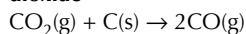
- iron ore – source of iron
- coke – fuel and reducing agent
- limestone – to form a **slag** by dissolving the high melting point non-metal impurities.

REACTIONS

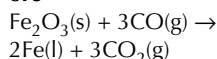
1. The coke burns



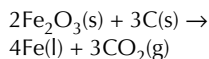
2. More coke reduces the carbon dioxide



3. Carbon monoxide reduces iron ore



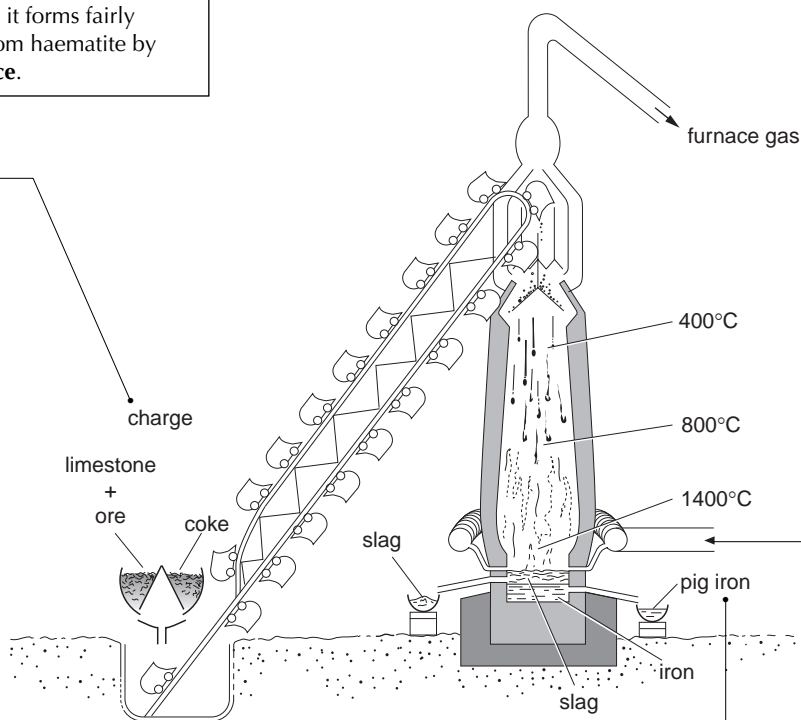
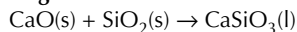
4. Carbon reduces iron ore



5. Limestone decomposes



6. Slag forms



A **blast of hot air** goes into the bottom.

'**Pig**' iron is produced. This contains C, Si, S, P. It is very brittle.

RUSTING



Simple lab experiments show:

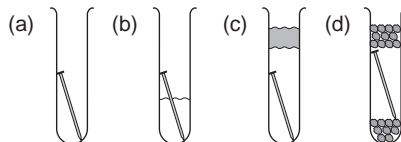
1. That air and water are needed for iron to rust. So rusting is an **oxidation reaction**.

(a) control

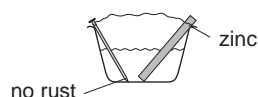
(b) air and water – nail rusts

(c) boiled water with oil on top – no rust

(d) drying agent + air – no rust



2. Iron rusts when in contact with a less reactive metal, but not when in contact with a more reactive metal.



Stopping rust

1. **Coat the iron:** paint, oil or grease, chrome plate. This prevents air and water meeting the iron.
2. **Sacrificial protection:** galvanizing (zinc plating) or zinc anodes. The zinc reacts instead of the iron, so the iron is protected.
3. **Alloying:** e.g. stainless steel. Alloying modifies the reactivity of the iron.

STEEL MAKING

Pig iron is too brittle to be useful. It is turned into steel by:

1. mixing the molten iron with 30% scrap steel
2. blowing oxygen through to burn out impurities
3. adding weighed amounts of alloying elements.

