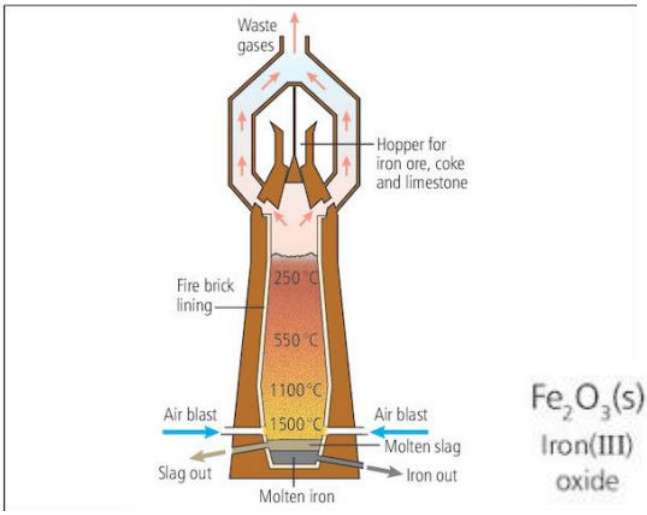
Extraction of Iron

Ore: hematite/ Fe_2O_3

Raw materials: Coke/Carbon
Lime stone/ calcium carbonate
Hematite
Hot air as a source of oxygen (added from the bottom of the furnace)



$C(s) + O_2(g) \longrightarrow CO_2(g)$

Reaction is exothermic,heat released and heat the furnace

$CO_2(g) + C(s) \longrightarrow 2CO(g)$

CO2 rises up the furnace and react with more Carbon

$Fe_2O_3(s) + 3CO(g) \longrightarrow 2Fe(l) + 3CO_2(g)$

Iron(III) oxide + carbon monoxide → iron + carbon dioxide

Or

$Fe_2O_3(s) + 3C(s) \longrightarrow 2Fe(l) + 3CO(g)$

CO is a very good reducing agent. Mainly Iron oxide reduced by CO and then by Carbon.

Why do we add lime stone?

Hematite contains sand (silicon(IV) oxide) as a major impurity. The limestone (calcium carbonate) helps remove most of the impurities in the following way:

- The heat from the furnace decomposes the limestone:

$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

calcium carbonate (limestone) → calcium oxide + carbon dioxide

- The calcium oxide reacts with the silicon(IV) oxide to form a 'slag' of calcium silicate:

$CaO(s) + SiO_2(s) \longrightarrow CaSiO_3(l)$

calcium oxide + silicon(IV) oxide → calcium silicate (slag)

Iron is more denser than Slag so slag forms a layer on molten iron so easy to separate from iron.It also prevents iron to not oxidise again by oxygen provided in furnace.