

## Lesson 5 - Teacher's notes

- ✓ The students must have the handouts with the power point presentation in front of them in order to take notes on them. The power point file is *L5.Iron and ferrous-metals*
- ✓ The teacher must remark the difference among wrought (forged) iron, steel and cast iron
- ✓ *Vocabulary*

### Words

*Slag car, magnetite, hematite, siderite, oxide, carbonate, carburization, Iron age, Bronze age, plough, locomotive, blacksmith, wrought iron, forged iron, pure iron, steel, cast iron, carbon steel, alloy steel, coke coal, limestone, pig iron, crude steel, molten steel, impurity, blast furnace, scrap, hot-blast stove*

### Structures

*'...are the major iron ore producers', Carbon acts as a hardening agent, burning off spare carbon, to take out the impurities*

### Task 1

Magnetite, oxide, hematite, oxide, siderite, carbonate

### Task 2

<b>Pure iron</b>	<b>has less than 0.02% of C</b>
<b>Steel</b>	<b>has less than 1.76% of C</b>
<b>Alloy steel</b>	<b>contains Fe, C and other elements</b>
<b>Steel</b>	<b>is the more used ferrous metal</b>
<b>Carbon steel</b>	<b>contains only Fe and C</b>
<b>Carbon</b>	<b>acts as a hardening agent in steel</b>
<b>Cast iron</b>	<b>has more than 1.76% of C</b>
<b>Pure iron</b>	<b>Has not many uses nowadays</b>

### Task 3

- a) It is a binary eutectic phase diagram
- b) 1535°C
- c) Yes, there is one:  
T = 1145°C  
Percentage of C=4.7%

d)

- i) 2% C, 1150°C: L+S
- ii) 3% C, 1600°C: Liquid
- iii) 1% C, 1500°C: Solid
- iv) 4.7% C, 1100°C: Solid
- v) unknown % of C, 1800°C: liquid
- vi) unknown % of C, 1000°C: solid
- vii) 0% C, 1540°C: liquid

- i) An alloy Fe-C with 2%C at 1150°C is in liquid + solid state
- ii) An alloy Fe-C with 3%C at 1600°C is in liquid state
- iii) An alloy Fe-C with 1%C at 1500°C is in solid state
- iv) An alloy Fe-C with 4.7%C at 1100°C is in solid state
- v) An alloy Fe-C with an unknown percentage of C at 1150°C is in liquid state
- vi) An alloy Fe-C with an unknown percentage of C at 1000°C is in solid state
- vii) An alloy Fe-C with no C at all at 1540°C is in liquid state

#### Task 4

<b>Limestone</b>	<b>is a raw material of blast furnace</b>
<b>Iron ore</b>	<b>is a raw material of blast furnace</b>
<b>Molten slag</b>	<b>comes from the reaction of the impurities of the ore with the limestone</b>
<b>Oxygen converter</b>	<b>converts iron into crude steel</b>
<b>Pig iron</b>	<b>is iron with too much carbon and it's brittle</b>
<b>Electric furnace</b>	<b>takes out the impurities from crude steel</b>
<b>Molten iron</b>	<b>is the same than pig iron</b>
<b>Oxygen converter</b>	<b>burns off spare steel from pig iron</b>

## Task 5



- ✓ C comes from the coke carbon
- ✓  $\text{O}_2$  comes from the hot air blast



- ✓  $\text{CO}_2$  comes from the previous reaction
- ✓ C comes from the non-burnt coke



- ✓ CO comes from the previous reaction
- ✓  $\text{Fe}_2\text{O}_3$  comes from the iron ore

## Task 6

Hephaestus and Vulcan

## Task 7

a) Find out which statements are **True (T)** or **False (F)**:

Statement	T/F?
China is currently one of the major producers of iron ore	<b>T</b>
Humans used first iron than bronze to make tools	<b>F</b>
Pure iron has no carbon at all	<b>F</b>
Wrought iron and forged iron is the same material	<b>T</b>
A blacksmith produces cast iron	<b>F</b>
Hot-blast stove provides hot air for the production of molten iron	<b>T</b>
The USA is currently one of the major producers of iron ore	<b>F</b>
An oxygen converter converts the pig iron into molten steel	<b>F</b>
The molten iron (also called <i>pig iron</i> ) has no carbon at all	<b>F</b>
An alloy steel has more than 6.67% of carbon in its composition	<b>F</b>

b)

Humans used first bronze than iron to make tools

Pure iron has up to 0.02% of carbon

A blacksmith produces wrought or forged iron

The USA is not one of the major producers of iron ore

An oxygen converter converts the pig iron into crude steel

The molten iron (also called *pig iron*) has quite a lot of carbon at all

An alloy steel has less than 1.76% of carbon in its composition