CLIL
Content and Language Integrated Learning

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Nottingham, March 2007

My school: IES Cassà de la Selva

- My school has started with CLIL this year (06-07) with 3rd ESO and Batxillerat under the name English and Technology
- The current CLIL team is composed of 3 teachers: 1 English teacher and 2 technology teachers

CLIL targets for 08/09

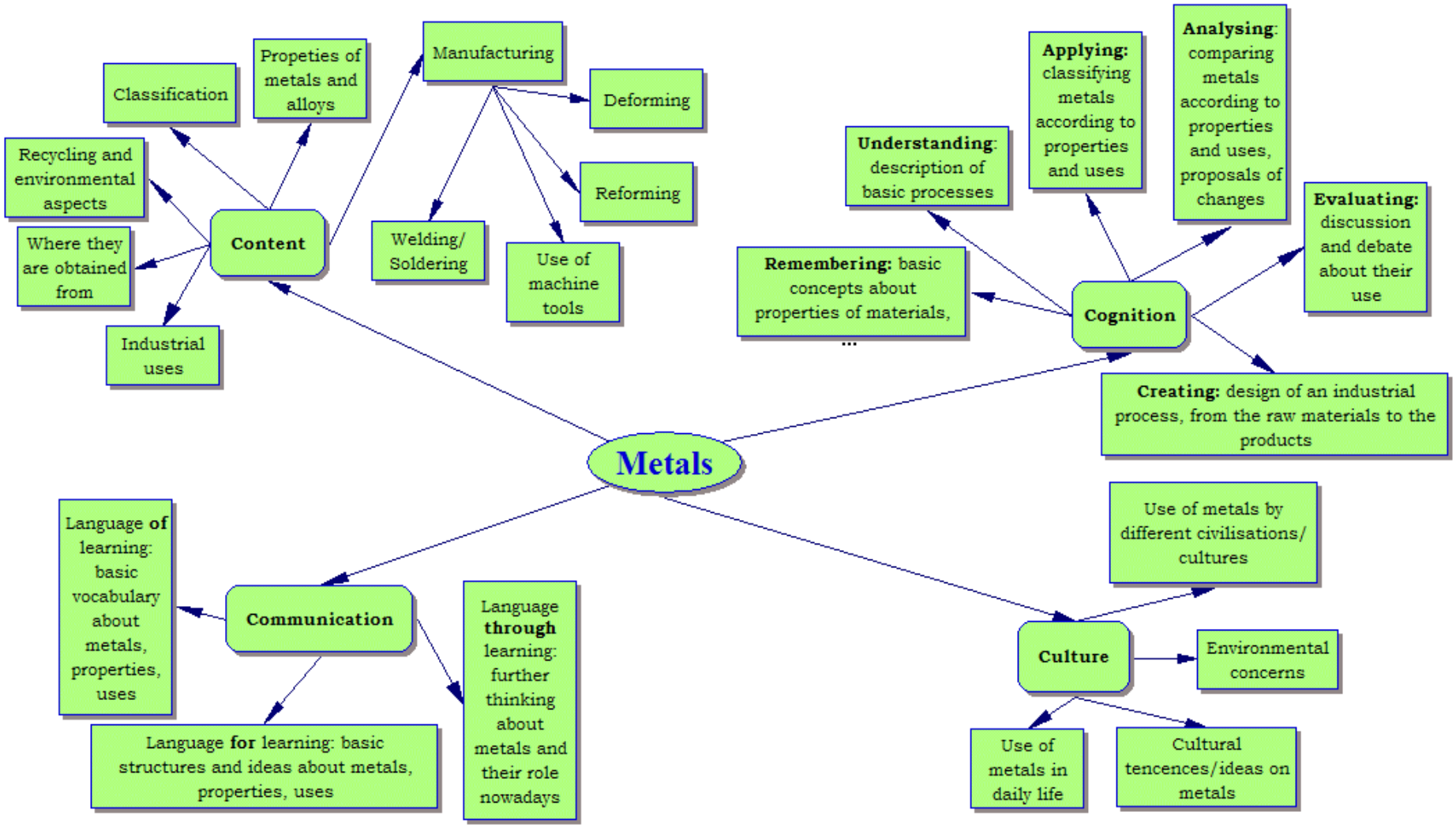
Stage	Subject	Number of hours taught in English (08-09)
3r ESO	***Technology***	35 hours x number of groups, usually 2 or 3. (1/3 of the time)
1r BAT	***New Technologies***	70 hours (all year long)
1r BAT	***Industrial Technology***	70 hours (2/3 of the time)
2n BAT	***Industrial Technology***	5 hours (1 unit + 1 visit to a factory with an English speaking guide)
2n BAT	***Electrical Technology***	35 hours (1/3 of the time)
	Total annual hours ESO (GCSE)	35h x number of groups (usually 2 or 3)
	Total annual hours Batxillerat (Bacc)	180 hours
	Total annual hours ESO + Batxillerat	**250 hours – 285 hours**

My module

- The module I have developed in Nottingham is a part of the Industrial Technology subject on materials

Topic		
Metals (15 h) 	Polymers (6 h) 	Wood (4 h) 
Ceramic mat. and composites (5 h) 	Manufacturing systems (5 h) 	

My module


Metals
Content
Classification
Propeties of metals and alloys
Recycling and environmental aspects
Where they are obtained from
Industrial uses
Manufacturing
Deforming
Reforming
Welding/ Soldering
Use of machine tools
Cognition
Understanding: description of basic processes
Applying: classifying metals according to properties and uses
Analysing: comparing metals according to properties and uses, proposals of changes
Evaluating: discussion and debate about their use
Remembering: basic concepts about properties of materials, ...
Creating: design of an industrial process, from the raw materials to the products
Communication
Language of learning: basic vocabulary about metals, properties, uses
Language for learning: basic structures and ideas about metals, properties, uses
Language through learning: further thinking about metals and their role nowadays
Culture
Use of metals by different civilisations/ cultures
Environmental concerns
Use of metals in daily life
Cultural tencences/ideas on metals

My module

Unit	Lesson	
1. Materials, metals and their properties	1. Classification of industrial materials	1 h
	2. Mechanical properties	2 h
	3. Other properties	2 h
	4. Metals and alloys	1 h
2. Ferrous-metals	5. Iron and ferrous-metals	1 h
	6. Steel processes and products	1 h
3. Non-ferrous metals	7. Aluminium	1 h
	8. Copper	1 h
	9. Other metals	1 h
	10. Which metal must be used?	1 h
4. Working with metals	11. Machine tools, joining metals and other systems	3 h
	Total time	15 h

The lessons developed in Nottingham are in **blue**

Structure of a lesson

- Lesson plan
  - Power Point presentation
  - Tasks
  - Teacher's notes

Stiffness or rigidity

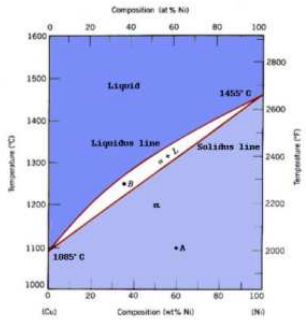
- **Stiffness** is the resistance of a body to deformation by an applied force
- In general it refers to an object that is not easily bent (no deformations occur before breaking): it is **rigid** or **stiff**

This beam is NOT STIFF at all! It can be bent very easily

Task 2

The following chart is a binary phase diagram of Copper-Nickel alloy (Cu-Ni). Using a ruler, fill the gaps in the following grid (the possible states are α, liquid or α+ liquid):

% Cu	% Ni	T (°C)	State
20		1100	
50		1300	
unknown	unknown	1500	
unknown	unknown	1050	
	60	1400	
	5	1150	
	40	1200	



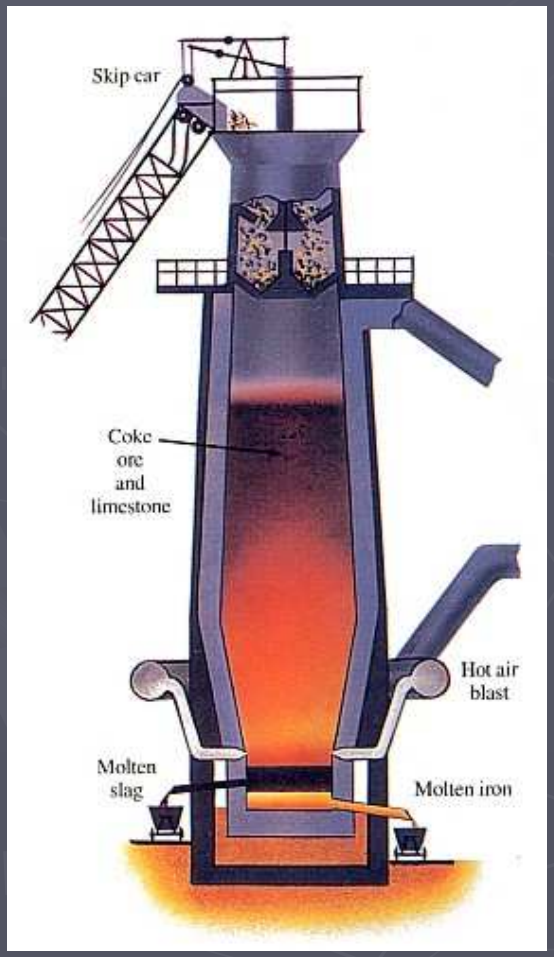
Word	Meaning	Antonym	Catalan translation
Tough (**toughness**)	Ability of a material to withstand blows or sudden shocks without breaking	**Brittle** (**brittleness**)	*Tenaç /fràgil Tenacitat / fragilitat*
Strong (**strength**)	It is equivalent to *mechanical resistant*. It is not a really a technical term	**Weak** (**weakness**) Not really a technical term	*Fort /feble*
Hard (**hardness**)	Can not be easily scratched	**Soft** (**softness**)	*Dur / tou Duresa / tovor*
Stiff or rigid (**stiffness** or **rigidity**)	Not easily bent (no deformations occur before breaking)	**Flexible** (**flexibility**) **Elastic** / **plastic**, it depends on the way it deforms	*Rígid /rigidesa Flexible flexibilitat elàstic / plàstic*

Slides (theory)

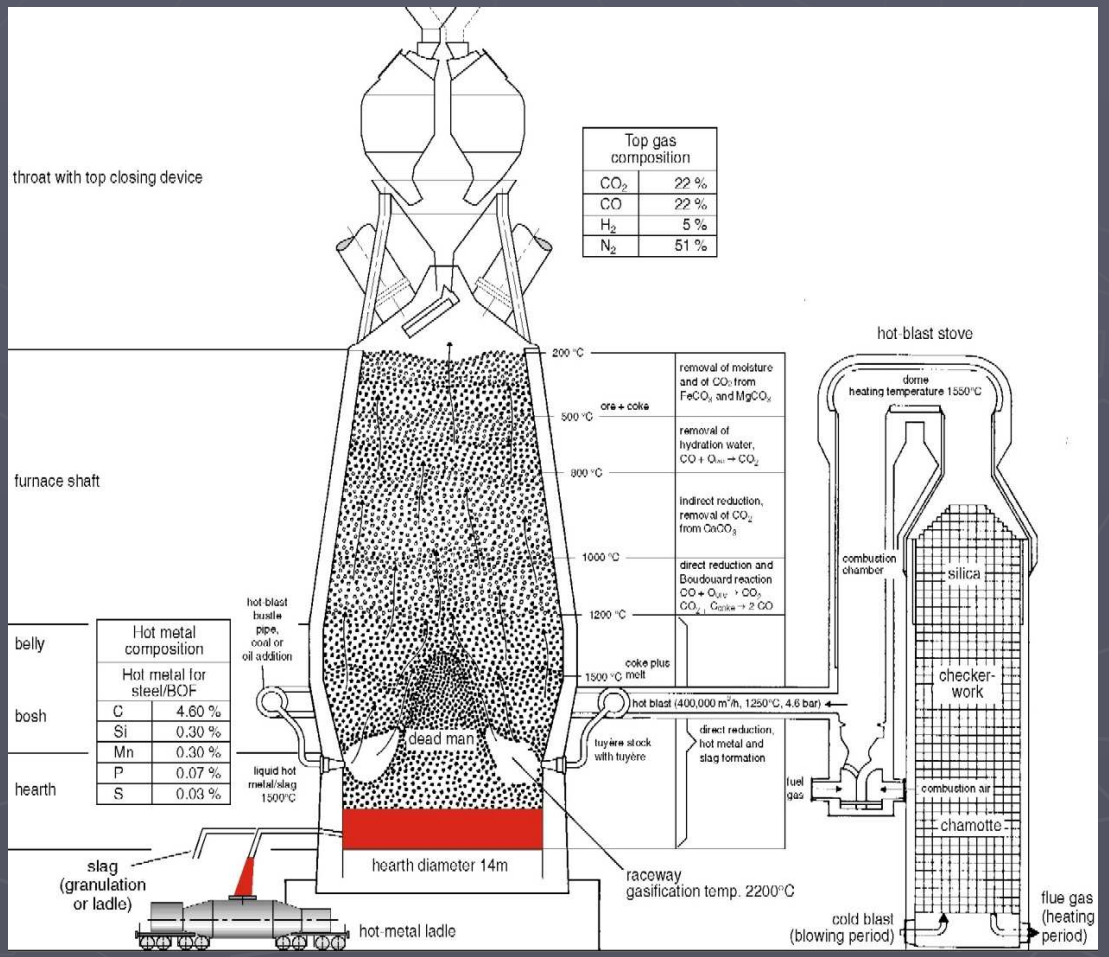
- The sentences must be short and clear
- The key and/or new words or structures must be highlighted (in bold or in another colour)
- Visual elements must not be confusing and must content the minimum number of elements to make them understandable
- Visual elements are fundamental, they help the learner to acquire the expected knowledge
- ZPD are important

Examples of visuals

Good example



Bad example



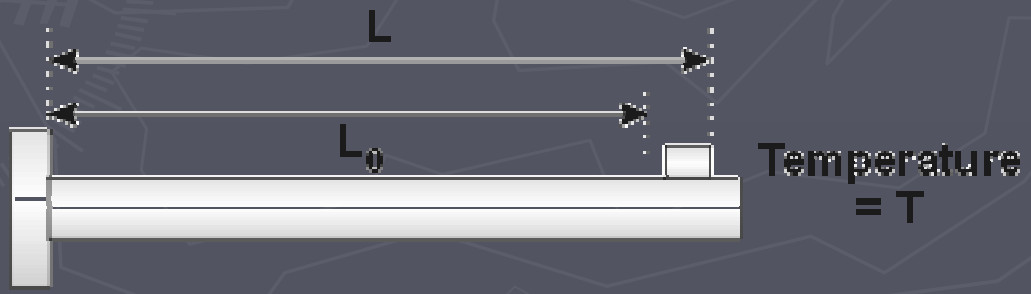
Bad example

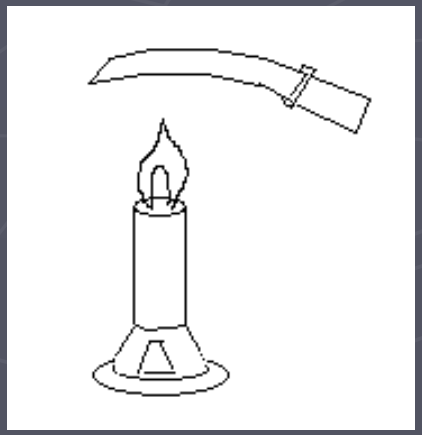
Examples of slides

- Most materials expand as they are heated and contract if they are cooled. Thus their length is a function of temperature. If the length of an object is **L** and the temperature changes by a differential amount **dT**, then the differential change in the length **dL** is given by:

$$dL = L\,dT$$

In the figure we show an aluminium rod. The length of the rod is defined in the figure, and is similar but not identical to the definition you will use in the experiment. The rod is at a temperature T0 and has a length of L0. We heat the rod up to a temperature T > T0, and its length increases to L.

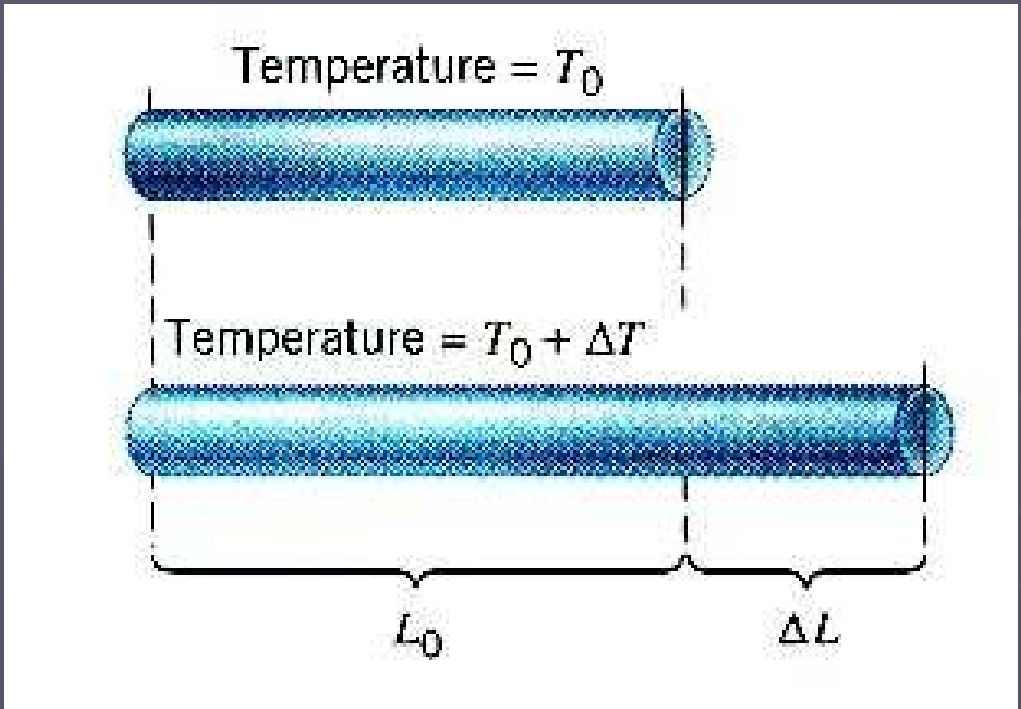




Good example

Examples of slides

- Thermal expansion is the tendency of matter to increase in volume when heated
- When an object is long (a bar, a wire) its length increases when heated. The phenomenon is called linear expansion



Lo = initial length

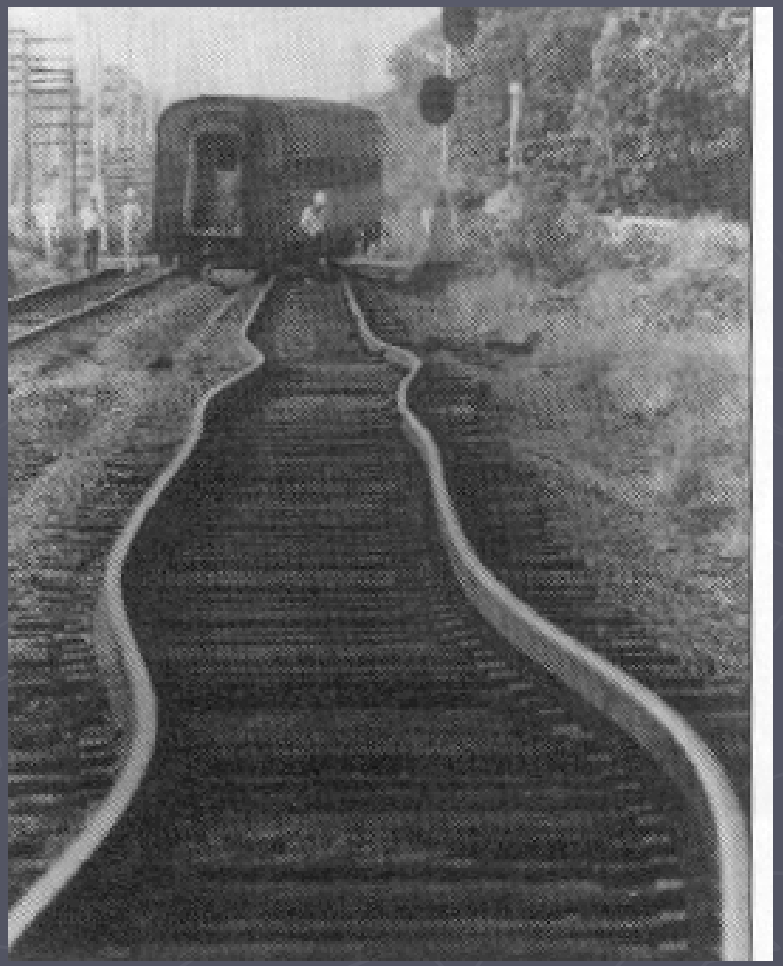
ΔL = change in length

To = initial temperature

ΔT = change in temperature

Examples of slides

- Rail track expansion joints are necessary. In summer the length of the tracks increase



If tracks did not have expansion joints they would become distorted in summer

Examples of slides

- For solid materials with a significant length like rail tracks or cables, the amount of thermal expansion can be described by the ratio $\varepsilon_{thermal}$
- α is the coefficient of thermal expansion in $^{o}K^{-1}$ (or $^{o}C^{-1}$)

$$\epsilon_{thermal} = \frac{(L_{final} - L_{initial})}{L_{initial}}$$

$$\epsilon_{thermal} = \alpha \Delta T$$

Coefficients of Linear Expansion (α) of some materials

Material	$^{o}K^{-1}$
Aluminium	23.6×10^{-6}
Copper	16.5×10^{-6}
Steel	13.0×10^{-6}
Glass	5.9×10^{-6}
Wood	5.0×10^{-6}

Tasks

Tasks are useful to understand the theory and going further and should use the same vocabulary and structures

They can be done individually, in pairs or in groups

- Matching word with description
- Filling gaps in a given text
- Matching *heads* and *tails*
- Labelling visual elements
- Making a diagram from a given text
- Understanding and analysing a diagram
- Understanding and analysing a text
- Working out an analytic exercise
- True/False list
- Using a substitution table to write sentences

Tasks

Understanding and analysing a diagram

Task 2

The following chart is a binary phase diagram of Copper-Nickel alloy (Cu-Ni). Using a ruler, fill the gaps in the following grid (the possible states are α, liquid or α+ liquid):

% Cu	% Ni	T (°C)	State
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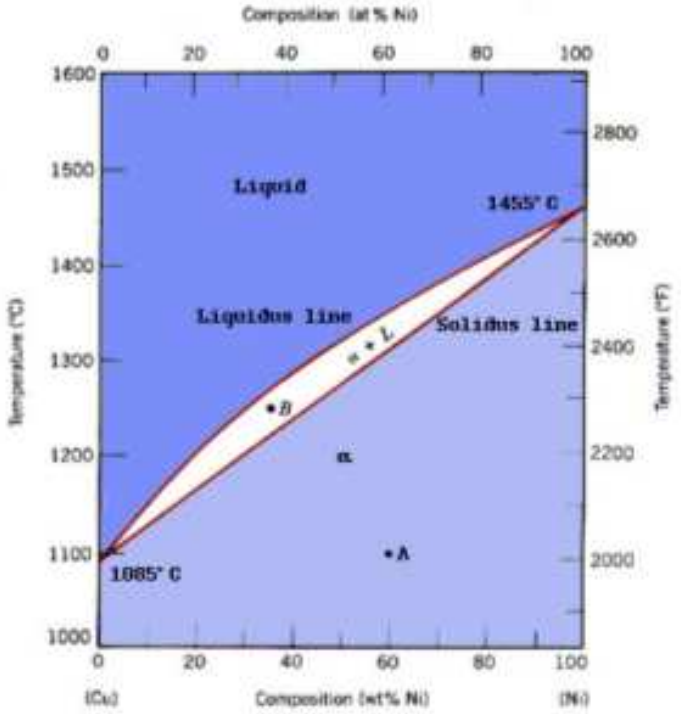


Tasks

Find out if the following statements are true or false

Statement	**T/F?**
Aluminium is a very usual substance and it can be found free in the nature	
Alumina is aluminium oxide	
From 5 tonnes of bauxite we can get some 1 tonne of aluminium at the end of the process	
The Bayer process is used to obtain aluminium from alumina	
Bauxite is the main ore of aluminium	
The modern production of aluminium doesn't pollute at all	
Using recycled aluminium to produce aluminium we need only 5% of the energy needed than if we produce it from the ore	

Tasks

Match up the following lists

Grinding the ore means that		gangue
Through the electrolysis		Blister copper forms
Sulphurs are removed		The gangue is removed and therefore the ore is enriched
The unwanted material from the ore is called		When the ore is heated (roasting)
The raw material is melt		When it heated to 1200°C
Concentrating means that		Is almost pure copper
In the furnace		The ore is crushed into powder
Blister copper		The copper is purified to 99.99%

Tasks

Analysing a text

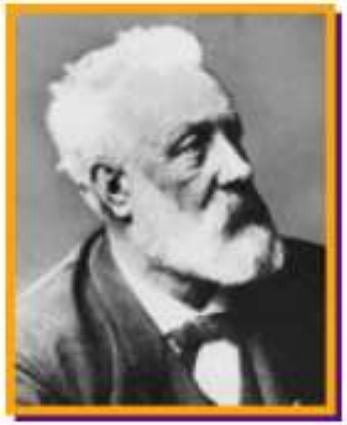
1857. *The famous British writer Charles Dickens wrote about aluminium:*

'Within the course of the last two years a treasure has been unearthed and brought to light ... what do you think of a metal as white as silver, as unalterable as gold, as easily melted as copper, as tough as iron, which is malleable, ductile, and with the singular quality of being lighter that glass? Such a metal does exist and that in considerable quantities on the surface of the globe.'

Charles Dickens

1865. *The famous French writer Jules Verne writes From Earth to the Moon. In the novel we can find this text about aluminium (the protagonists' space craft is to be fired from a giant gun and they decide there is one material which is perfect – aluminium):*

'This valuable metal possesses the whiteness of silver, the indestructibility of gold, the tenacity of iron, the fusibility of copper, the lightness of glass. It is easily wrought, is very widely distributed, forming the base of most of the rocks, is three times lighter than iron, and seems to have been created for the express purpose of furnishing us with the material for our projectile.'



Jules Verne

Tasks

Analysing a text and filling in a chart

d) Fill in the chart with the statements of both writers.

	Dickens	Verne
Colour		
Does it rust?		
Can it be melted?		
Comparison with iron		
Is it abundant?		
Density (compared with...)		
Can it be easily shaped?		

e) Decide which statements were false or exaggerated

f) Who was more realistic in his statement, Dickens or Verne?

Tasks

To produce 1 tonne of aluminium it is necessary to use 5 t of bauxite and 15MWh of electric energy, among other resources. The process produces aluminium, other by-products and CO_2.
Look at the following table of CO_2 emissions according to the source of energy:

Fuel	Amount of CO_2 emitted
Natural gas	450 kg
Oil	500 kg
Coal	1000 kg

Emissions of CO_2 by 1MWh of consumption of energy

Analytic exercise + drawing conclusions

a) The weight of a beverage can is usually 15 gr. Work out the amount of CO_2 emitted when producing it for every type of energy

b) Let's suppose that the can is produced from recycled aluminium, with a 95% reduction of the energy. Work out the CO_2 emitted when producing it for every type of energy in this case

Tasks

Analytic exercise (answer)

a) For Natural Gas:

Amount of CO_2 = 15 gr. Al $\frac{1tAl}{10^6 grAl}\frac{15MWh}{1tAl}\frac{450KgCO_2}{1MWh} = \frac{15x15x450}{10^6}$ kg CO_2 =

= 0.10125 kg CO_2 = **101.25 gr. CO_2**

For Oil:

Amount of CO_2 = 15 gr. Al $\frac{1tAl}{10^6 grAl}\frac{15MWh}{1tAl}\frac{500KgCO_2}{1MWh} = \frac{15x15x500}{10^6}$ kg CO_2 =

= 0.1125 kg CO_2 = **112.5 gr. CO_2**

For Coal:

Amount of CO_2 = 15 gr. Al $\frac{1tAl}{10^6 grAl}\frac{15MWh}{1tAl}\frac{1000KgCO_2}{1MWh}$ =

$= \frac{15x15x1000}{10^6}$ kg CO_2 = 0.225 kg CO_2 = **225 gr. CO_2**

b) For Natural Gas:

5% (101.25 gr.) = **5.06 gr.**

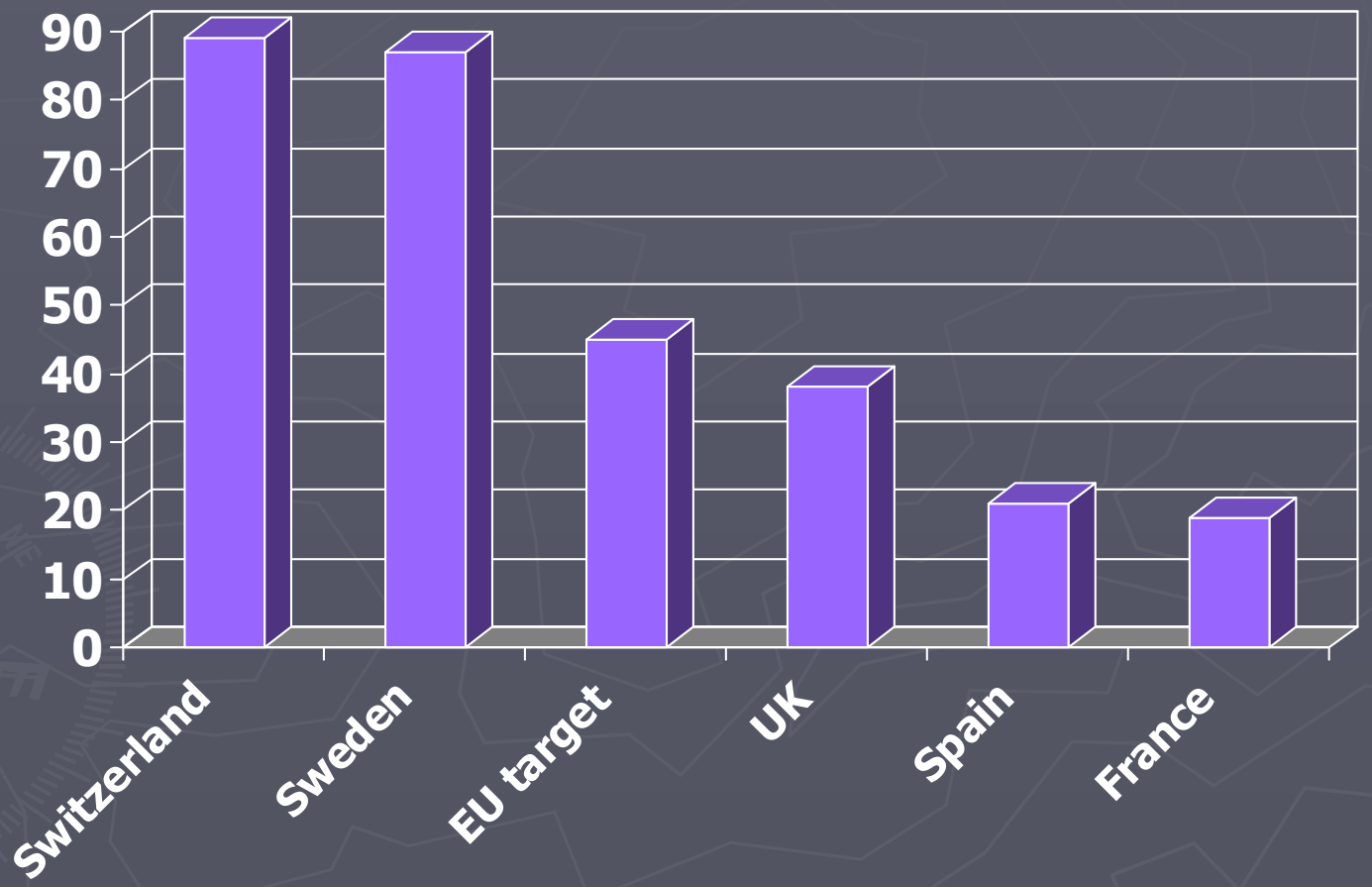
For Oil:

5% (112.5 gr.) = **5.6 gr.**

For Coal:

5% (225 gr.) = **11.25 gr.**

Aluminium cans recycling rates (%)



Source: European Commission, 2001

Teacher's notes: example

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Stiff or rigid (**stiffness** or **rigidity**)	Not easily bent (no deformations occur before breaking)	**Flexible** (**flexibility**) **Elastic / plastic**, it depends on the way it deforms	*Rígid /rigidesa Flexible flexibilitat elàstic / plàstic*

Language

- Language **of** learning and language **for** learning: giving vocabulary and structures

3.2. Magnetism

- **Magnetism** is one of the phenomena by which materials exert an attractive or repulsive force on other materials
- Ferromagnetic materials (such as iron) are attracted by magnets
- Non-ferromagnetic materials (such as aluminium) are not

Magnets on a fridge. There is an attractive force between them and the fridge (made of steel)

2.1. Thermal conductivity

- **Thermal conductivity** is the ability of a material to conduct heat
- A material with good thermal conductivity is a **thermal conductor**

Copper pipes are widely used in central heating systems

Task 5
Write sentences from the following substitution list:

A material that	Conducts electricity	is	opaque
	Conducts heat		A thermal conductor
	Is attracted by a magnet		An electrical insulator
	Is not attracted by a magnet		translucent
	Doesn't conduct electricity		An electrical conductor /conductive
	lets light go through it but objects at the other side can't be clearly seen		Non-ferromagnetic
	doesn't let light go through it		ferromagnetic
	lets light go through it		transparent

Language

Reducing the iron ore to iron

- The coke burns and produces carbon dioxide:
  - $C + O_2 \rightarrow CO_2$
- The CO_2 reacts with non-burnt coke to form CO:
  - $CO_2 + C \rightarrow 2CO$
- The carbon monoxide reduces the iron ore to iron:
  - $3CO + Fe_2O_3 \rightarrow 2Fe + 3CO_2$
- The result is molten iron and CO_2
- The limestone reacts with the impurities and the reaction produces slag

Task 5
The following chemical reactions take place in a blast furnace. Work out where the reactants come from in every reaction

1. **C + O2 → CO2**
   - ✓ C comes from the coke carbon
   - ✓ O2 comes from the _____
2. **CO2 + C → 2CO**
3. **3CO + Fe2O3 → 2Fe + 3CO2**

Answer (in teacher's notes)

1. **C + O2 → CO2**
   - ✓ C comes from the coke carbon
   - ✓ O2 comes from the hot air blast
2. **CO2 + C → 2CO**
   - ✓ **CO2** comes from the previous reaction
   - ✓ **C** comes from the non-burnt coke
3. **3CO + Fe2O3 → 2Fe + 3CO2**
   - ✓ **CO** comes from the previous reaction
   - ✓ **Fe2O3** comes from the iron ore

Only the educated are free

Epictetus (55 AD - 135 AD)