Finding Out About Aluminium

A science based cross-curricula unit brought to you by New Zealand Aluminium Smelters Limited

NZAS

INTRODUCING ALUMINIUM

- Hold up a roll of tinfoil and a soft drink can. Do the students know the name of the material that these products are made from? Tell the class that we call this material 'aluminium' and in the USA and Canada it is called 'aluminum' – but it is exactly the same material.
- Run a five minute class or group brainstorming session to determine students' current knowledge of aluminium. Starter questions to pose could include?
  - *is it a metal or an element?*
  - *where is it found?*
  - *how do we make products from aluminium?*
  - *how many everyday things are made out of aluminium?*
  - *why is aluminium used to make so many products?*
- Record student answers on a chart for future reference.

Bins of aluminium ingots ready for shipping

- Introduce the idea that aluminium is a mineral – that is, something mined from the earth like tin or iron. Tell students that there are hundreds and hundreds of different minerals and if something is not made from a plant or animal material then it has come from a rock or a mineral. Can they name some common minerals?
- Tell students that minerals are so important in our everyday lives and that we may not even realise where and how we use them. Conduct online research at: ***www.minsocam.org/MSA/K12/uses/uses.html*** to find out where minerals can be found in our homes, ***eg***
  - *copper wiring in a lamp or computer*
  - *silver and high grade aluminium in computers or mobile phones*
  - *aluminium in golf clubs or bike frames …*
- Do students know that all things on the earth are made of atoms? What does the dictionary tell us that an atom is? Introduce the idea that a metal is something made up of the same atoms and that aluminium is a metal. Research the difference between an alloy and a metal. Tell students that aluminium is often mixed with other metals to form an alloy for extra strength.

LET'S FIND OUT MORE – WEB RESEARCH

http://science.jrank.org/pages/270/Aluminum.html
www.historyofaluminum.com

- Use the following sections of the above websites for students to conduct basic online research about aluminium or print out and assign a section to a group.

Curriculum Links:

Science: Material World. Learning about the physical, chemical properties, production and uses of aluminium and the important role it plays in our lives.
English: Using language and research skills to engage with text on scientific topics to increase understanding using reading, speaking and writing.
Links: Technological Knowledge and the Visual Arts.
Levels: 3-5

- Through research and discussion focus on the following:

General Properties:

- *why is aluminium one of the most useful metals we have?*
- *why do we often need to make aluminium stronger and how do we do this?*
- *list some of the uses of aluminium alloys you discover*
- *what benefits are there for using aluminium more and more in building automobiles (cars/trucks etc.)?*

Where Aluminium Comes From:

- *what percentage of the earth's crust is aluminium?*
- *aluminium is not found as a pure metal but is mixed with other earthy and rocky minerals. List some of these. (Tell students that a red, earthy clay called bauxite is the world's main source of aluminium oxide – also called alumina).*

How Aluminium is Obtained:

- *discuss the reason why the existence of aluminium remained unknown for centuries*
- *be able to describe in simple form the break-through process that made large scale aluminium production possible and cheap to produce compared with other alloys such as steel*
- *how long is it thought the world's supply of bauxite will last?*

Uses of Aluminium:

- *discover and list the properties of aluminium that make it such a useful and versatile metal*
- *why will aluminium not rust like iron and steel?*
- *list some of the most common and 'surprising' uses of aluminium.*

EXTRA FOR EXPERTS

- ***www.explainthatstuff.com/aluminum.html*** is highly recommended reading for students and includes a history of aluminium timeline.
- ***http://science.howstuffworks.com/aluminum.htm*** has an excellent series of articles including mining, refining, smelting, using and recycling aluminium suitable for older students.
- ***www.gcsescience.com/ex16.htm*** gives a succinct summary of properties and uses of aluminium.

The Amazingly Versatile Metal

New Zealand Aluminium Smelters at Tiwai Point

ALUMINIUM IN NEW ZEALAND

- Remind students of the basics of aluminium production using using a simple flow chart, ***eg***
  bauxite is mined from the ground ☛ the bauxite is taken to a refinery to get rid of waste products and comes out as a white powder called alumina ☛ the alumina is transported to a smelter where a process using electricity (electrolosis) produces aluminium ☛ the aluminium is made into ingots, billet and blocks and is transported by ship to customers around the world.
- Do students know that we have one of the largest aluminium smelters in the world? Do they know where it is located? Tell them
  - *New Zealand Aluminium Smelters Limited is owned by Rio Tinto Alcan (NZ) Limited and Sumitomo Chemical Co*
  - *it is located at Tiwai Point near Bluff*
  - *the refined alumina arrives by ship from Gladstone, Queensland*
  - *the bauxite is mined at Weipa on the western side of the Cape York Penninsula, North Queensland*
  - *aluminium from NZAS is amongst the highest purity in the world for use in mobile phones and CDs.*
- Have students locate these places using atlases and the dramatic ***Fly to*** section of Google Earth, by typing in:
  - ***Fly to Weipa Bauxite Mine Queensland*** *(bauxite is mined)*
  - ***Fly to Gladstone Queensland*** *(bauxite refined to alumina)*
  - ***Fly to Tiwai Point Aluminium Smelter Bluff New Zealand*** *(alumina is made into aluminium metal/alloys.)*
- Visit: ***www.comalco.com/31_weipa_bauxite_mine.asp*** for more information and have students click on the bauxite mining link to understand the mining process.
- Select > New Zealand aluminium smelter and have students find the reasons why Tiwai Point was chosen as an attractive location for the aluminium smelter (power, port, workers).

AMAZING ALUMINIUM – RESEARCH

- Revise and discuss the properties of aluminium that make it such an amazingly useful metal in today's world. Have students visit: ***www.historyofalumininum.com*** > click on **usage** and list the industries that use aluminium today. Have students speculate on possible/specific uses in several of these industries. Find out how aluminium helped the first powered flight of the Wright Brothers. Why is it used today in modern planes and in space flight? ***http://science.howstuffworks.com/aluminum5.htm*** is another excellent site listing the extensive uses of aluminium.
- Divide students into industry project research groups, ***eg*** …
  - *construction, building & furniture*
  - *automobiles*
  - *household goods*
  - *food & packaging*
  - *electrical industry*
  - *sporting goods*
- Have students interview people involved with these products or invite people involved in these industries (electricians, builders, plumbers, mechanics, shop owners, sports store owners, etc.) to talk to the class to find out:
  - *the percentage of aluminium and or alloy used in a product*
  - *the advantages of using aluminium in the product and why they choose aluminium products over others*
  - *the range of products and uses in that industry.*
- Have groups write an illustrated/captioned report to present to the class. Combine as a class aluminium wall display.

RECYCLING ALUMINIUM MAKES SENSE

- Share the following facts with the students:
  - *most of the aluminium ever made is still in use today*
  - *this is because it can be recycled over and over again without losing its quality*
  - *most recycled aluminium comes from drink cans and parts from old cars*
  - *in the USA, about 100 billion aluminium drink cans are produced every year and about 60% are recycled*
  - *making a product made from recycled aluminium saves 95% of the energy used to make aluminium from bauxite.*
- Have students contact their local council to find out if there is an aluminium recycling scheme in their district, where is it sent for recycling and what is it used for. If there is a scheme, encourage students to set up a recycling depot at school.
- Design posters and bumper stickers/slogans promoting recycling of aluminium cans for school and local display.

FURTHER DIRECTIONS

- Design a 'new' household product for indoor or outdoor use that makes use of the strength, lightness and appearance of aluminium.
- Have each student produce an aluminium 'fact sheet' using the knowledge they have gained from their study. Compare this with answers listed from original brainstorming session.
- Go on a school and home 'aluminium hunt' to list all products made fully or partially from aluminium. If in doubt, email the manufacturer for information.

Molten Aluminium in crucible after smelting is complete