### Aluminium & Titanium

<table>
<thead>
<tr>
<th>Property</th>
<th>Aluminium</th>
<th>Titanium</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Shiny</td>
<td>• Strong</td>
<td></td>
</tr>
<tr>
<td>• Light</td>
<td>• Resistant to corrosion</td>
<td></td>
</tr>
<tr>
<td>• Low density</td>
<td>• High melting point - so can be used at high temperatures</td>
<td></td>
</tr>
<tr>
<td>• Conducts electricity and energy</td>
<td>• Less dense than most metals</td>
<td></td>
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<tr>
<td>• Malleable - easily shaped</td>
<td></td>
<td></td>
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<tr>
<td>• Ductile - drawn into cables and wires</td>
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<table>
<thead>
<tr>
<th>Use</th>
<th></th>
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<tbody>
<tr>
<td>• Drinks cans</td>
<td>• High-performance aircraft</td>
<td></td>
</tr>
<tr>
<td>• Cooking foil</td>
<td>• Racing bikes</td>
<td></td>
</tr>
<tr>
<td>• Saucepans</td>
<td>• Jet engines</td>
<td></td>
</tr>
<tr>
<td>• High-voltage electricity cables</td>
<td>• Parts of nuclear reactors</td>
<td></td>
</tr>
<tr>
<td>• Bicycles</td>
<td>• Replacement hip joints</td>
<td></td>
</tr>
<tr>
<td>• Aeroplanes and space vehicles</td>
<td></td>
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<table>
<thead>
<tr>
<th>Extraction</th>
<th></th>
<th></th>
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<tbody>
<tr>
<td>Electrolysis</td>
<td>Displacement &amp; Electrolysis</td>
<td></td>
</tr>
<tr>
<td>• Aluminium ore is mined and extracted.</td>
<td>• Use sodium or potassium to displace titanium from its ore</td>
<td></td>
</tr>
<tr>
<td>• Aluminium oxide (the ore) is melted</td>
<td>• Get sodium and magnesium from electrolysis</td>
<td></td>
</tr>
<tr>
<td>• Electric current passed through at high temperature</td>
<td></td>
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</tbody>
</table>

→ Expensive process - need lots of heat and electricity
→ Expensive - lots of steps involved, & needs lots of heat and electricity
EXPLOITING ORES
Mining has many environmental consequences:
- Scar the landscape
- Noisy & Dusty
- Destroy animal habitats
- Large heaps of waste rock
- Make groundwater acidic
- Release gases that cause acid rain

RECYCLING METALS
- Recycling aluminium saves 95% of the energy normally used to extract it!
- This saves money!
- Iron and steel are easily recycled. As they are magnetic they are easily separated
- Copper can be recycled too - but it’s trickier as it’s often alloyed with other elements

BUILDING WITH METALS
Benefits
- Steel is strong for girders
- Aluminium is corrosion resistant
- Many are malleable
- Copper is a good conductor and not reactive

Drawbacks
- Iron & steel can rust
- Extraction causes pollution
- Metals are more expensive than other materials like concrete
CRACKING → Breaking down large hydrocarbon chains into smaller, more useful ones

SATURATED OR UNSATURATED?

We can react products with bromine water to test for saturation:

Positive Test:
Unsaturated + Bromine → COLOURLESS
hydrocarbon Water

= ALKENES

Negative Test:
Saturated + Bromine → NO REACTION
hydrocarbon Water (orange)

= ALKANES

CRACKING PROCESS

1. Heat hydrocarbons to a high temp; then either:
2. Mix them with steam; OR
3. Pass the over a hot catalyst

EXAMPLE OF CRACKING

Cracking is a thermal decomposition reaction:

\[ \text{C}_{10}\text{H}_{22} \rightarrow \text{C}_5\text{H}_{12} + \text{C}_3\text{H}_6 + \text{C}_2\text{H}_4 \]

Decane Pentane Propene Ethene

ALKENES

• These are unsaturated hydrocarbons
• They contain a double bond
• Have the general formula \( C_nH_{2n} \)
There are 2 ways to extract vegetable oils from plants:

1) PRESSING
   1. Farmers collect seeds from plants
   2. Seeds are crushed and pressed
   3. This extracts oil from them
   4. Impurities are removed
   5. Oil is processed to make it into a useful product

2) DISTILLATION
   1. Plants are put into water and boiled
   2. Oil and water evaporate together
   3. Oil is collected by condensing (cooling the gas vapours)

Lavender oil is one oil extracted this way

**FOOD AND FUEL**

Vegetable oils are important foods:

- Provide important nutrients (e.g. vitamin E)
- Contain lots of energy → so can also be used as fuels
- Unsaturated oils contain double bonds (C=\text{C}) → they decolourise Bromine water

<table>
<thead>
<tr>
<th>Food</th>
<th>Energy (kJ)</th>
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<tbody>
<tr>
<td>Veg Oil</td>
<td>3900</td>
</tr>
<tr>
<td>Sugar</td>
<td>1700</td>
</tr>
<tr>
<td>Meat</td>
<td>1100</td>
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Table for info only - don't memorise it!
No one can be sure how life on Earth first started. There are many different theories:

**MILLER-UREY EXPERIMENT**

- Compounds for life on Earth came from reactions involving hydrocarbons (e.g. methane) and ammonia
- The energy for this could have been provided by lightning

**OTHER THEORIES**

1. Molecules for life (amino acids) came on meteorites from out of space
2. Actual living organisms themselves arrived on meteorites
3. Biological molecules were released from deep ocean vents

The experiment completed by Miller and Urey.