Biological Methods – Key Facts

• Extraction by reduction and electrolysis are really only beneficial when the ore contains sufficiently high proportions of the useful metal.
• For low grade ores (ores with lower quantities of metals) other techniques are being developed to meet global demand.
• This is happening in particular with copper as copper ores are becoming more and more **scarce.**
• **Phytoextraction** and **bioleaching** (bacterial) are two relatively new methods of extracting metals that rely on **biological phenomenon.**
• Both of these methods avoid the significant **environmental damage** caused by the more traditional methods.
• They are however very **slow** and also do require either displacement or electrolysis to make the final product.

Phytomining

• This process takes advantage of how some plants **absorb metals** through their roots.
• The plants are grown in areas known to contain metals of interest in the **soil.**
• As the plants grow the metals are taken up through the plants vascular system and become **concentrated** in specific parts such as their **shoots** and **leaves.**
• These parts of the plant are harvested, dried and burned.
• The resulting ash contains metal compounds from which the useful metals can be extracted by displacement reactions or electrolysis.

Explain how electrolysis is used to purify copper (2 marks)

Describe and explain the process of phytomining (2 marks)

State the advantages of phytomining (2 marks)

Bioleaching

• Some strains of bacteria also absorb metal compounds.
• They do this by absorbing the **bond energy** that binds metals to the atoms in their ores, thus breaking them down.
• The process produces an acidic solution called **leachate** which contains the metal ions.
• The ions can then be reduced to the solid metal form and extracted by displacement reactions or electrolysis.
• This method is often used to extract metals from sulfides e.g. CuS or Fe_2S.

Why is it important to find alternative methods to extract metals? (2 marks)

Stage the main steps involved in phytomining (2 marks)

Phytomining is often said to be a "carbon neutral" process. Explain why. (2 marks)

Create a diagram which illustrates the process of phytomining.