EXTRACTION OF METALS: INTRODUCTION

1. Aluminium makes up about 7.5% by mass of the Earth's crust, and is present in very many minerals (Wikipedia lists 192 – see https://en.wikipedia.org/wiki/Category:Aluminium_minerals), but most aluminium is extracted from the ore, bauxite. Explain the difference between a mineral and an ore.

2. Most ores contain contain rocky material as well as the metal compound you are interested in, and have to be concentrated. A common method of concentration involves froth flotation. Explain briefly and without detail how froth flotation works.

3. There are several ways of converting an ore into the metal it contains. Each of them involves reduction of the ore.

   a) Aluminium is extracted from its ore by electrolysis of a molten mixture of aluminium oxide and cryolite. The aluminium is formed at the cathode. Write the electrode equation for the production of the aluminium, and explain why this is reduction.

   b) The following equations show reactions involving several other metals, some of which you may come across again. In each case, explain why this is a redox reaction, and name the reducing agent.

   (i) $WO_3 + 3H_2 \longrightarrow W + 3H_2O$

   (ii) $TiCl_4 + 4Na \longrightarrow Ti + 4NaCl$

   (iii) $Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

   (iv) $Cu_2S + O_2 \longrightarrow 2Cu + SO_2$

   c) (i) What are the main advantages of using carbon as the reducing agent in the extraction of metals?

   (ii) What are the main disadvantages of using carbon as the reducing agent in the extraction of metals?

   d) What is the main disadvantage of using a reactive metal like sodium as the reducing agent?

   e) (i) What is the main disadvantage of using electrolysis to extract a metal?

   (ii) What is the main advantage in using electrolysis to extract a metal?