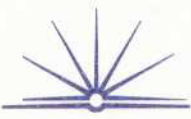


- 29a) i) main metal to construct ships = Iron
- ii) Aluminium is a passivating metal
this means that when exposed it forms an impervious ~~the~~ layer on its surface (by oxidising). This layer does not allow further oxidation.

- b) i) magnesium
- ii) Sacrificial anodes are added to metal hulled ships as they are more active metals and will therefore corrode in preference to the iron.
- $$\text{Mg(s)} \rightarrow \text{Mg}^{2+} + 2\text{e}^{-}$$
- $$\text{Fe}^{2+} + 2\text{e}^{-} \rightarrow \text{Fe(s)}$$

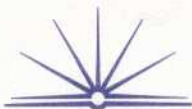
This donation of electrons eliminates the possibilities of rust by eliminating any Fe^{2+} ions on the surface.

- c) Adding other elements to iron changes all its properties from



The speed that rust occurs to the strength of the metal. Mixing other elements (like carbon) with iron will speed up the rate at which it corrodes, it will also in the case of chromium donate some of its characteristics to the steel (chromium is a passivating metal and is used in stainless steels). The addition of carbon can increase the strength of the iron but will also increase its brittleness. And although these mixtures readily rust they are widely used in car bodies and train rails, protected with paints or by galvanising.

Stainless steel is widely used in kitchen appliances for its strength and durability. With its



ability to resist corrosion it is ideal for use around water. It is however still too expensive to use on such things as ships.

d i) Corrosion - is the decay of a substance so that can no longer fill the purpose it was designated to do.

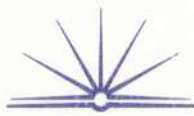
ii) Gather as many different metals/ alloys as desired these could include iron wrapped in zinc and iron wrapped in copper to simulate an alloy. These should then be placed on an agar plate and left in moist conditions for greater than 2 days. The control that should be used is pure iron on the standard agar plate. After the

prescribed number of days all plates should be examined and observations made.

iii) To maintain accuracy and prevent plates being contaminated once the metal is placed in the agar it should be stored in an area which is not contaminated and will not become so.

All specimens should be placed in identically prepared agar so as not to bias results.

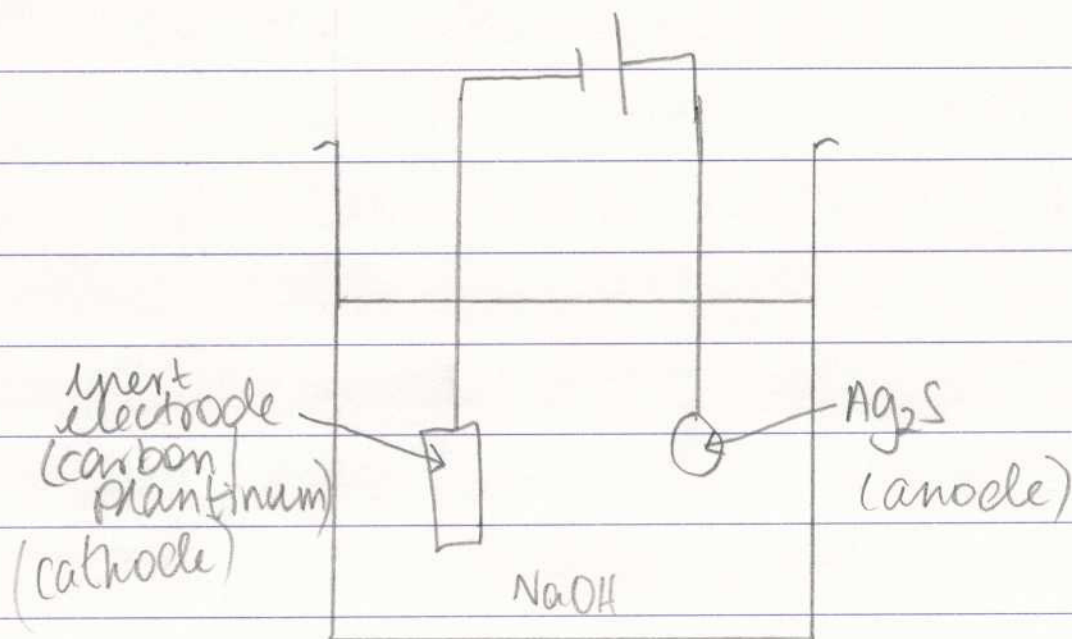
e) Silver is a metal commonly found on shipwrecks that cannot be cleaned using abrasive methods as they are generally found in the form of coins or other objects which have detailed inscriptions

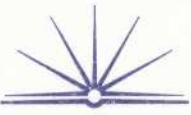


on them that would be damaged by scrubbing.

In shipwrecks silver coins can often be found covered in a hard Ag_2S covering. This can be removed via electrolysis. This is done by making the silver the anode and an inert electrode the cathode.

This is generally done in a solution of dilute sodium hydroxide





There are many methods that can be used to preserve these artefacts to prevent further decay. Some of these include coating the metal with a thin layer of plastic to prevent oxygen reaching the surface, also sealing the artefacts in airtight bags to prevent oxygen reaching them and protect them from oils on human hands.