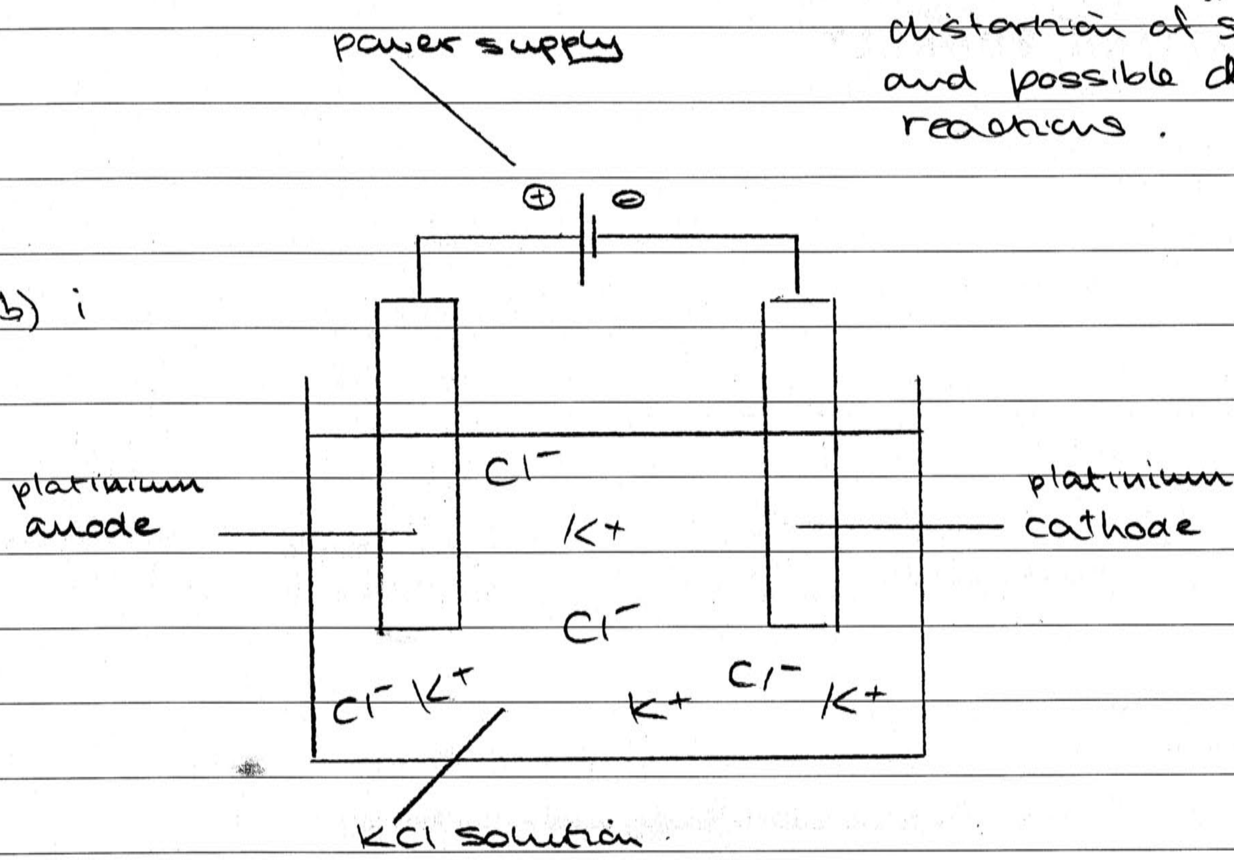
Start here.

33 a) This artefact is wood. During this period, many chloride and sulfate salts would have become impregnated within the wooden structure. The ~~iron~~ metal support (presumably iron) would have undergone some level of corrosion. ~~Some decomposition of the wooden structure by aerobic bacteria~~ Drying would cause cracking, distortion of shape and possible chemical reactions.

b) i



Note: K+ is never reduced as its standard potential is too low. However, Cl^- can be ~~reduced~~ oxidised when its concentration is high enough. ∴ two possible oxidation rxns.

~~Anode (oxidation) rxn:~~

~~$2H_2O_{(l)} \longrightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$~~

~~Cathode (reduction) rxn:~~
~~high concentration~~
~~$2Cl^- + e^- \longrightarrow$~~

Anode (oxidation) rxn:

high concentration:

$2Cl^-_{(aq)} \longrightarrow Cl_{2(g)} + 2e^-$

low concentration:

$H_2O \longrightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-$

Cathode (reduction) rxn:

$2e^- + 2H_2O \longrightarrow H_{2(g)} + 2OH^-_{(aq)}$

overall

low concentration:

$4H_2O_{(l)} + H_2O_{(l)} \longrightarrow 4OH^+_{(aq)} + 4H^+_{(aq)} + O_{2(g)} + 2H_{2(g)}$

$5H_2O_{(l)} \longrightarrow 4H_2O_{(l)} + O_{2(g)} + H_{2(g)}$

$H_2O_{(l)} \longrightarrow O_{2(g)} + H_{2(g)}$

ie electrolysing water.

ii Terminal of power supply or testing gas with 'pop test'

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c) ① This is a mild steel. It is ~~hard~~ soft and malleable, ~~Uses include~~ but corrodes very quickly. Uses include ~~some~~ ship building, cars and some nails. Carbon content ~~[illegible]~~ increases hardness, ∴ although 'soft', ① is ~~softer~~ harder than pure iron.

② Is is (cast) wrought iron. Its carbon content is too high to be a structural steel. ② is rather hard and brittle. Uses include decorative lattice and some furniture. Its industrial use is limited because of its brittleness.

③ This is a metal of high mechanical strength, but extremely brittle. The manganese and silicon impurities are large atoms which distrupt the lattice structure. Uses would be very specific.

④ This ~~is~~ stainless steel. Cr content varies from between 10% and 20% and Ni 5% to 10%. These additions/ impurities help ~~the~~ with corrosion resistence. It allows it to take a high polish. Uses include cooking equipment, surgical implements, ~~and~~ kitchen appliances, ~~[illegible]~~ and razor blades.

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2010 HSC - Chemistry
Question 33 Band 5/6 sample 2

Start here.

~~33~~ 33 d) i

Oxygen:

1. Fill 2 test tubes ~~[illegible]~~ with equal amounts distilled water.
2. Place a mild steel nail in each tube and ensure they are fully covered with water.
3. Cover one ~~[illegible]~~ test tube sample with cooking oil. Leave one test tube unaltered.
4. Leave for ~~1 day~~ 5 days, analysing level of corrosion using scale 1-5 where 5 is very corroded. Compare daily changes in the scale to differentiate the rate of corrosion. (A)

Acidity / pH

1. Place three test tubes in rack. Fill one with distilled water, the other with a 0.1 mol L⁻¹ HCl and the other with a 0.1 mol L⁻¹ NaOH. Ensure equal quantities of solution are added.
2. Place ~~the~~ a mild steel nail in each test tube.
3. Leave for 5 days, analysing level of corrosion as described in (A)

Salt solutions:

1. Place two test tubes in rack. Fill one tube with 0.5 mol L⁻¹ NaCl to represent concentration in ocean, and ~~leave the other unto~~ fill the other with distilled water of same volume.

2. Place a mild steel nail in each.

3. Leave for 5 days, analysing corrosion as described in (A).

33d) ii Polymer based paints: These form a hydroxide layer called 'pyroaurite' which extends throughout the polymer and surface iron atoms. Factor ~~is reduced~~ of O_2 is reduced by preventing contact.

e) Wooden: These artifacts have have impregnated with chloride and sulfate salts. The easiest way to ~~redu~~ remove these is by leaching. This involves placing the artefact in clean quantities of water over a period of days to months, regularly replacing the water as concentrations build too high. The wooden artefact can then be preserved in a layer of polyethylene glycol which replaces the impregnated salts. The method of leaching is effective because it prevents further damage through cracking, distorting or chemical reaction. It ~~removes~~ effectively ~~removes~~ removes most of the impregnated salts, allowing for the artefact to dry. The polyethylene glycol is an effective technique for conservation because it seals the artefact from further damage from environmental factors. It also gives the object structural strength to prevent sagging.

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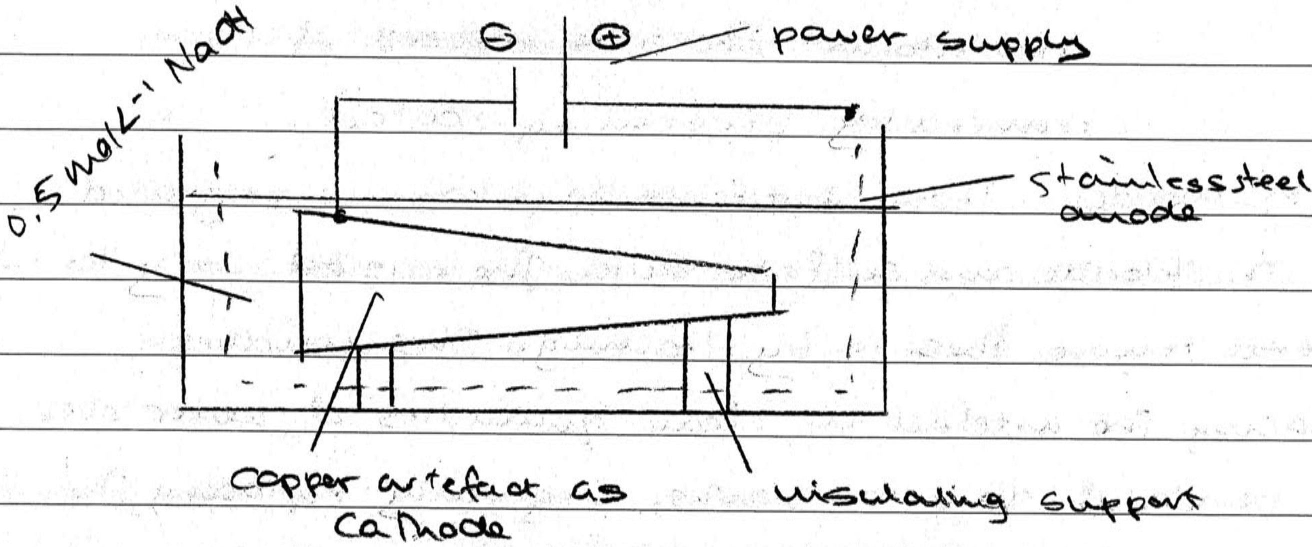
Copper:

Copper is fortunately not as badly corroded as iron as it is poisonous to marine life (including SRBs). Over time, many chlorides (and some sulfates) have become embedded in the crystal structure, forming Cu(I) and Cu(II) hydroxy chlorides.



This general electrolysis technique applied for removing hydroxychlorides from iron can also be used with copper.

$$Cu(OH)Cl_{(s)} + 2e^- \longrightarrow Cu_{(s)} + OH^-_{(aq)} + Cl^-_{(aq)}$$

Hydroxide will move towards the anode to be oxidised.

This is an effective way to restore Copper, however caution must be taken if the artefact is a copper alloy (such as bronze or brass). The NaOH solution will dissolve Sn and other metals from the alloy ∴ instead a Na_2CO_3 ~~sta~~ solution must be used to be effective.

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