Question 29 - Shipwrecks and Salvage

a) i) An electrochemical cell that produces a spontaneous reaction is a Galvanic cell.

ii) $Fe_{(s)} \rightleftharpoons Fe^{2+} + 2e^-$ $-0.44\,V$

$Cu^{2+} + 2e^- \rightleftharpoons Cu_{(s)}$ $-0.34\,V$

$Fe_{(s)} + Cu^{2+} \rightleftharpoons Fe^{2+} + Cu_{(s)}$ $-0.78\,V$

b) Lavoisier - He stated that all substances was non-metallic and contained the element hydrogen.

Davy - He disapproved this idea and concluded that substances contained the element $[H^+]$.

Arrhenius - He built on this idea and found that acids contain $[H^+]$ and bases contain $[OH^-]$

Brønsted-Lowry - They discovered that acids are proton acceptors and base are proton recieves

$$HF + H_2O \rightleftharpoons H_3O^+ + F^-$$

Lewis - He discovered that electrons are transfued in pairs. Acids donate protonpairs bases recieve. He also expressed that Brønsted-Lowry acids and bases could all

act as a Lewis acid and base.

c)i) A method for removing salt from an artefact recovered from a wreck would be to kept washing it with freshwater not allowing it to dry out. If allow to dry out the salt crystals within the artefact would crystalise, beging to grow and cause large cracks to appear over time.

ii) A chemical procedured used to clean and preserve artefacts would be the a electrolytic cell.
An example of this would be the cleaning of tarnished copper or brass artefacts. The procedure is the opposite from electroplating as it is removing the oxide that has formed. A more reactive metal is placed with the copper causing the oxide film to form on the more reactive metal.

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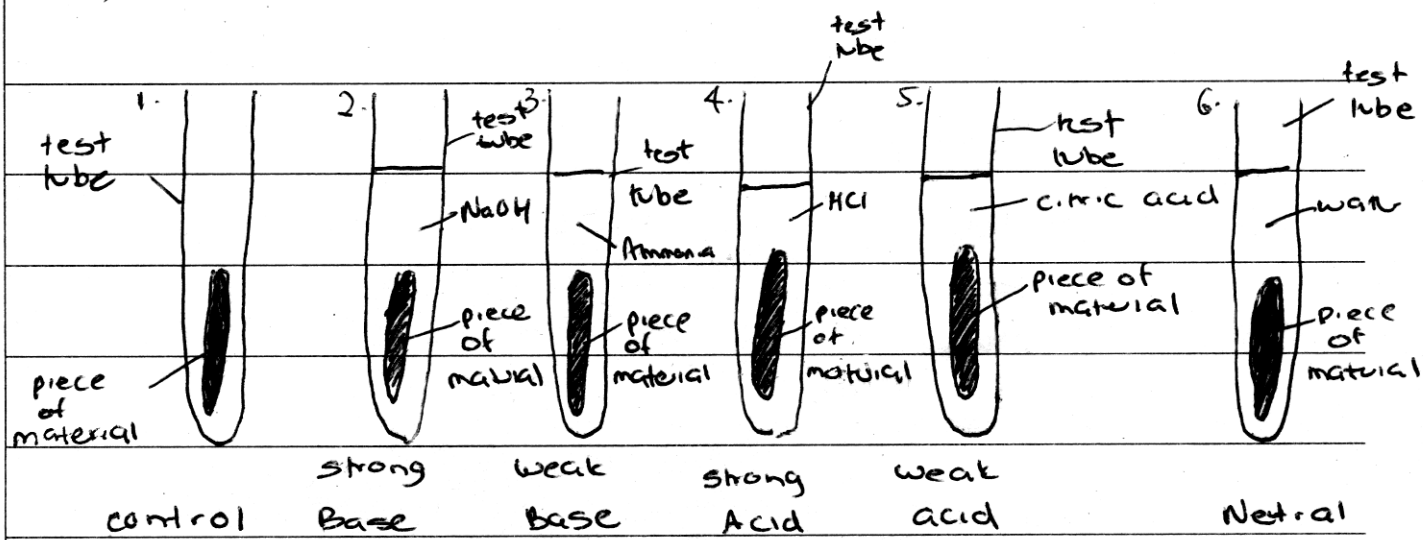
d) i)



Materials used: wood
plastic
metal
paper.

Controls: • same amount of each solution.
• same time left for
• same size piece of material.
• Control to compare with.
• Strong and weak strengths used.

NOTE: Experiment was left for 4 weeks 2 over the holidays and 2 at school.

ii) From our results we are able to see that acidic environments accelerate the corrosion of shipwrecks. ~~provide more evidence of the hypothesis.~~

Our results concluded that the stronger the acid the more corrosion would occur.

The material that was in the netural solution showed no signs of corrosion as did any of the materials found in the basic solutions.

The solution of HCl had the most effect. The objects placed in it were nearly corrode right though.

Since each experiment was set up and controls were looked after we can see that over the period of time the acids speeded up the reactions rate of corrosion.

Therefore the experiment supports the hypothesis "acidic environments accelerate the corrosion of shipwrecks"

e) Corrosion of metallic objects needs oxygen and moisture to be present. The close to the surface of the ocean the more gases lans dissolve in the water. More corrosion occurs at shallow depths as once the depths become to deep oxygen is not there which is a major factor of corrosion. The small amount of oxygen that is available is used by marine organisms. Titanic is a ship resting at the bottom of the ocean at a depth of 3000 metres plus. Many of the artefacts that have been recovered have shown little to no corrosion effect at all. This is due to the lack of oxygen available at that depth

In some caves deep in the ocean anerobic organisms live. They live in conditions that no other organisms can tolerate or survive in. The organisms use the little oxygen avaible and produce $[H^+]$ as a result of there activities. These animals will have

some affect on corrosion of ships at great depths. but only if they are present.

Ships which are resting at greater depths where no oxygen is available will have more chance of being preserved than ships found in shallow water.

A shallow water example would be the Merio or cherry venture ship found in the shallow waters on fraser island. It has suffered the many years and effect of corrosion which can be seen by the rust.

Therfore the deeper in the ocean the ship rest will determine how well things are preserved and/or corroded.