a) i) Galvanic cell

ii) $Fe \rightarrow Fe^{2+} + 2e^-$ (anode) $E^\circ = 0.44\ V$

$Cu^{2+} + 2e^- \rightarrow Cu$ (cathode) $E^\circ = 0.34\ V$

The anode is the iron electrode where oxidation occurs and the cathode is the copper electrode where reduction occurs.

EMF° = reduction + oxidation

= 0.34 V + 0.44 V

= 0.78 V

b.) Luigi Galvani - connected 2 dissimilar metals together and their ends on a freshly extracted muscle of a frog. Discovered a vital force called 'animal electricity'. Concluded that muscle have electricity because when the metals were pressed muscle contracted.

Alessandro Volta - demonstrated that it was the wires in solution that produced electricity. Experiment involved sandwiching a piece of cardboard soaked in brine solution between two dissimilar metals. First galvanic cell was made. Proved his experiments through voltaic pile.

Humphry Davy - demonstrated through experiments that it was hydrogen and not oxygen is the responsible for the characteristic properties of acid.

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Michael Faraday - discovered that the amount of substance (metal) deposited at cathode is the same or directly proportional to the quantity of electricity passing through the cell. He developed 2 laws of electrolysis and equations to calculate the quantity of electricity - [redacted]

c) i) Acidic solutions such as HCl (hydrochloric acid) and acetic acid were used. water is used as a neutral solutions. 3 testtubes were prepared with 3 nails in HCl solutions. 3 testtubes were prepared with 3 nails in acetic acid solutions. 3 testtubes were prepared with 3 nails in water. These test tubes were placed in 3 test tube racks. The test tube racks were then left at in room temperature. The nails were recorded first, as well as the solution such as appearance and characteristic.

c.) i) Physically or mechanically removed it. Soak in water.

ii) Artefacts can be preserved by the use of electrolysis. For example in iron artefacts. once the artefacts are recovered, they are soaked in water to remove dirts and salts. For a canon artefact, it is made as an anode. $Fe \rightarrow Fe^{2+} + 2e^-$ and at the cathode reduction of water occurs. $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$. in this case,

the artefact is being cleaned because the Fe^{2+} goes into solution of 0.1M NaOH and so rust is being removed. After the electrolysis of iron, the artefact can then be ~~of~~ preserved and stabilise in the museum or wherever. If there are some rust left, mechanical hammering can be used to remove them. In this way, artefacts from wrecks can be preserved and cleaned.

d) i) ~~Gather solutions of HCl, acetic acid and water.~~
Prepare

d) i) Hydrochloric acid (HCl), acetic acid and water were gathered.

2) Three test tube racks were used and on each three test tubes are placed.

3) Solutions of HCl was placed on first test tube. Acetic acid on second and water on third.

4.) ~~Apple~~ Nails (iron) were dropped on each test tube.

5) Appearance of nails and solutions were recorded.

6) The test tubes were kept at room temperature for several weeks.

7) Every other day, they were checked and results were recorded.

11.) Nails in the HCl solution and acetic acid rusted more. The hypothesis that acidic environments accelerate corrosion was right because it was proven through the experiment. In acidic environment there are lots of H^+ ions floating around which can react with metals or other objects to form rust or to corrode. In acetic acid, although it is a weak acid H^+ ions are still floating around. water which is a conductive solvent also made the nails to rust but it is more and faster in acidic solutions. In shipwrecks, bacteria are present under deep water which make the shipwreck to rust and corrode. These bacteria (disulfovibrio family) feeds on the metal and producing pit hole. ~~The~~ when there are abundance of metal these bacteria multiply making the shipwreck to rust more. Therefore, acidic environment provides a better solution for rust to occur.

e.) Corrosion of metallic objects in greater depth ocean is worse and faster than in the surface. In the surface, corrosion is accompanied by oxygen which reacts with metal to form rust. ~~As you go~~ It was believed that as you go deeper the ocean, corrosion will be less but it was wrong. Shipwrecks at deeper depth corrodes faster when was found. This is because of the bacteria present under the

ocean. The bacteria disulfovibrio family are anaerobic bacteria which means they do not need oxygen to survive. These bacteria feeds on the shipwrecks producing more H^+ ions. These H^+ ions provide an acidic environment for the shipwrecks. when there are lots of shipwrecks at the bottom of the ocean more food for bacteria to feed on. These bacteria multiply and as they multiply, produce more H^+ ions. These hydrogen ions H^+ react with the metals of shipwrecks forming rust or corroded material. Bacteria create holes or pits on the shipwrecks as a result of corrosion. therefore, metal objects at a greater depth tend to corrode and rust more than metals on the surface.