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a) i. Galvanic Cell

ii. $Fe^{2+} + 2\bar{e} \rightarrow Fe_{(s)}$

$Cu^{2+} + 2\bar{e} \rightarrow Cu_{(s)}$

Iron will be Anode

$\therefore Fe_{(s)} \rightarrow Fe^{2+} + 2\bar{e}$

Copper will be Cathode.

$\therefore Cu^{2+} + 2\bar{e} \rightarrow Cu_{(s)}$

0.44V + 0.34V.

= 0.78 V are nessecery

b. Farady discovered that when a eletronic current is passed through an eletrolytic cell the current passed through (strength) is directly proportional to the yield or amount of substance formed. Scientists can use this today to determine the strength of a current that they need to achieve a certian yield or vieca versa.

ci. Soaking in H_2O, this draws out Cl^- ions and removes salt.

ii. First the artefact is removed from the site carefully then hard substances which may have formed on it such as clams on a cannon are removed with sharp strikes with a pick and smaller objects are removed with dental tools. The artefact must then be removed of salts (Cl^- ions) this can be done by soaking the object in ~~H_2O~~ NaOH which draws out the Cl^- ions & prevents further damage. The object if metallic is then restore by electralysis. for eg. iron cannon.

$$Fe^{2+} + 2e^- \rightarrow Fe_{(s)}$$

The artifacts is then coated with a protective layer to prevent it from damaging again. In wooden artifacts this is often done with wax

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di. take 3 nails & place them in 3 different test tubes, 1 containing water, 1 a highly acidic liquid such as HCl or H_2SO_4 and the last containing a low acidic solution. Place the test tubes in a test tube rack and leave them for a few days under controlled conditions and then compare the results to see the difference in the rate of rusting in different environments.

ii. When ships sink they often sink to depths where there are acidic conditions due to hydrothermal vents or anaerobic bacteria. As seen in the results of the experiment done in (d i), acidic conditions

accelerate or promote ~~rust~~ corrosion. This explains why ships that are found that have been last for long periods of time are in such bad conditions and also why ships need to be protected from seawater.

dii (cont). The results showed that the nail that was placed in the strongly acidic test tube corroded the fastest then the less acidic test tube and the one filled with H_2O the slowest.

diii (cont). Ships corrode faster in acidic conditions because of the amount of electrolytes in the solution such as Cl^- in the ocean.

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e. factors at deep ocean depths.
- low oxygen. = low temprature
- No or little light.
- Minimal aquatic life.
- Hydrathermal vents.
- Aeratoic ~~coli~~ bacteria
- High pressure.

There is low light because of the great depths that the ships sink at. At these depths because of the preasure and temprature it was expected that ships like the RMS Titanic would not carrode rapidly but when the wreck was found the opposite was proved. This is because aneratoic bacteria and hydrathermal vents that exist at these depths in the accan cause acidic candidians which accelerates corrosion. And.

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because rust is porous it acts as a catalyst for further rusting. Oxygen rich water which is carried through rents or patterns throughout the ocean from the frozen Artic seas increases the oxygen present at these depths. These waters also carry elements like Cl^- ions which then make the water surrounding the wreck like an electrolyte thus creating an electrolytic cell which is prime for rusting Because of these conditions despite previous beliefs by scientists the corrosion of metals are pretty rapid at great ocean depths.