Question 29 - Shipwrecks and salvage

(a) (i) galvanic cell.

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

$Fe^{2+} + 2e^- \rightleftharpoons Fe_{(s)}$ reduction. -0.44

$\therefore$ EMF = $-0.34 + (-0.44)$

= -0.78 V

(b) Galvani, Volta, Davy and Faraday, the four scientists have now increased our understanding of electron transfer reactions, Galvani first assumed that when he placed a brass wire through a spine of a dead frog to its leg's muscle and passed current it contracted, this made Galvani assume that the muscle produce electricity, Volta further elaborated his experiment by using [Cu and Sn] soaked with NaCl solution and said that the wires soaked in the salt solution conducted electricity $\therefore$ the muscle contracted due to friction between the brass wires, Davy further explained that these electrodes which they call wires conduct electricity in molten form & in solution & their pure metal, then came Faraday how explained that its the more reactive

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metals which react with the less reactive metals to form their metal ions and this he showed by the movement of electrons from one electrode to another.

(c) (i) Boiling (evaporation) of the artefact in water or distilled water.

(ii) Chemical procedures used to clean and preserve artefacts from wrecks are performed so as to keep the artefact from further corrosion and disintegration. for example. cleaning the artifact by boiling the artifact in a solution or rather distilled water, so as to evaporate the water, which leaves the salt and other organic compounds attached to the artefact, reweigh the artifact and keep it away from water and air (oxygen) inorder to prevent further or start a corrosion again. or also by electroplating.

Please turn over for (d)

(i) After having carefully worn safety glasses and gloves different materials i.e different metals were placed in different solutions, each placed in an acidic and ~~all~~ neutral solution. Metals used were iron, Copper, Zinc and aluminium. The masses were weighed before placing the metals in the solutions and were recorded, than the experiment was left for several weeks {4weeks}, after 4weeks the mases were removed from the solutions cleaned and re-weighed and the results were observed. and resorded.

(ii) With Iron it was seen thet metal corroded significantly in the acidic solution, this is because of the availability of H^+ ions as acid desociate in solution to give many H^+ ions. This react with water to form more O_2 since oxygen increases the rate of corrosion so this supported the hypothesis to acidic enviroments accelerate corrosion as similar results ware obtained with Zinc.

(c) The greater the depth of the ocean, the greater the solubility of Oxygen as water currents bring in more oxygen levels to the bottom, this accelerates the rate of corrosion. It is often thought that corrossion would be least at the bottom as respiration from living organism e.g fish decrease the level of oxygen and increase the level of Carbondioxide but this is not so, ∴ the solubility of oxygen increases as depth increases ∴ the further down a metallic object goes in an ocean the faster the rate of corrossion, another is the presence of more salt in the bottom of the ocean, as many living organism and even amoeba diffuse salts out of their bodies in order to maintain a constant internal enviroment ∴ the amount of salt at the bottom is slightly greater to that at the top, this again accelerates corrosion of metallic objects. The low temperature is another cause of further acceleration of metallic objects as the depth increases. The salts act as an electrolyte which causes further deteroation of the object.