Total No. of Questions – [3] Total No. of Printed Pages:

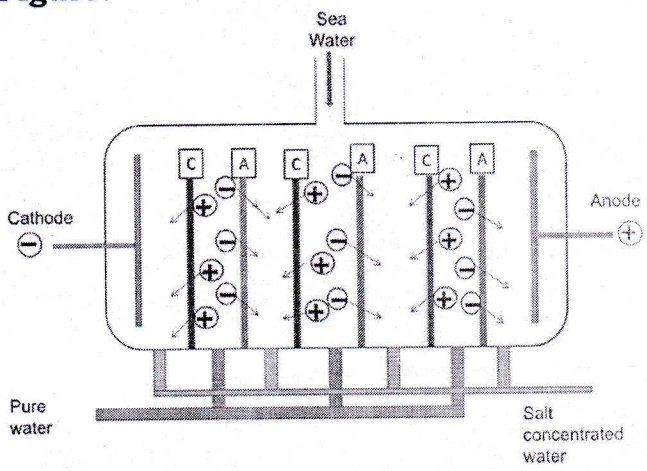
Paper code - U119 - 1011 (T1)

Solution for OCTOBER 2019 / INSEM (T1)
F. Y. B.TECH. (COMMON) (SEMESTER - I)
COURSE NAME: Engineering Chemistry
COURSE CODE: ES10184B
(PATTERN 2018)

Time: [1 Hour] [Max. Marks: 20]

(*) Instructions to candidates:

1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed.**
4) **Use suitable data where ever required**

Q.1)		Attempt any **two**	
	a)	Explain electrodialysis process with definition, figure and principle involved alongwith 2 applications **Ans:** **Definition: The process of removing ionic pollutants (salts, ionic dyes) from water by using membranes and electric field, is known as electrdialysis.** **Figure:**  **Principle:** Salt water is allowed to pass through ion selective membranes (cation and anion) under electric field to get salt free (pure) water. **Applications:** i) Removal of ionic pollutants (toxic salts, ionic dyes, etc.) from treated	[4]

industrial waste.
ii) Removal of salts from sea water, to get pure water.
iii) Removal of limited quantity of salts from sea water to get drinking (mineral) water.

b) 50 ml of an alkaline water sample requires 14.1 ml of N/50 HCl upto phenolphthalein end point and 21.4 ml for complete neutralization. Find the type and amount of alkalinity [4]

Solution:

V = Volume of water sample titrated = 50 ml

Z = Normality of H_2SO_4 = N/50 =0.02 N

V1 = Burette reading upto phenolphthalein end point = 14.1 ml

V2 = Burette reading upto methyl orange end point = 21.4 ml

$$P = \frac{V1}{V} \times Z \times 50 \times 1000 \text{ ppm } CaCO_3$$

$$= \frac{14.1}{50} \times 0.02 \times 50 \times 1000 \text{ ppm } CaCO_3$$

= 282 ppm $CaCO_3$ equivalent

$$M = \text{Total alkalinity} = \frac{V2}{V} \times Z \times 50 \times 1000 \text{ ppm } CaCO_3$$

$$= \frac{21.4}{50} \times 0.02 \times 50 \times 1000 \text{ ppm } CaCO_3$$

= 428 ppm CaCO3 equivalent

As $P > \frac{1}{2} M$, the water sample contains OH^- and CO_3^{-2} alkalinities together

CO_3^{-2} alkalinity amount =2(M-P) = 2× 146 =292 ppm $CaCO_3$equivalent.

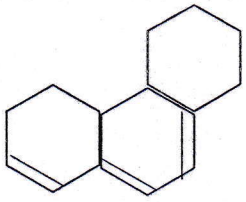
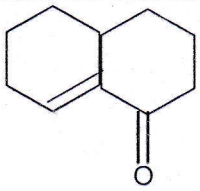
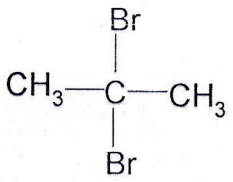
OH^- alkalinity amount = 2P-M = 564-428 =136 ppm $CaCO_3$equivalent.

c) Compare scales and sludges (Give 4 points of comparison) [4]

Sr. No.	Sludge	Scale
1	Sludges are loose slimy precipitates	Scales are hard and adherent precipitates.
2	Sludges are formed by the salts which are less soluble in cold water but soluble in hot water.	Scales are formed by salts which are less soluble in hot water but may be soluble in cold water
3	Sludges are formed at cooler parts of the boiler.	Scales are formed at hot parts or regions of the boiler
4	Sludges are formed due to increase in concentration of the salt. For e.g. $MgCO_3$, $MgCl_2$, $CaCl_2$.	Scales are formed due to decomposition of bicarbonates, hydrolysis of Mg-salts, less solubility in hot water shown by $CaSO_4$, presence of silica.
5	They can be removed by blow-down operation	They can be removed by EDTA treatment

Q.2) Attempt any **two**

a) Calculate λ_{max} for the following compounds (Explain calculations): [2+2]

		(i) 	Base value: 253 nm DEC (3): 30 nm Exocyclic double bond (2): 10 nm Alkyl substitution /ring residue(4): 20 nm Total: 313 nm	
		(ii) 	Base value: 215 nm Exocyclic double bond (1): 5 nm Alkyl substitution at α position=10nm Alkyl substitution at β position=12nm Total: 242 nm	
	b)	i) How can you distinguish between cyclohexanol and cyclohexanone by IR spectroscopy? **Ans:** Cyclohexanol – Broad peak around 3550 to 3200 cm^{-1}due to O-H stretching Cyclohexanone – peak at 1715 cm^{-1} due to C=O stretching ii) Calculate possible number of fundamental vibrations in CH_4 and H_2O For CH_4 = Non linear =(3 N -6) = 9 For H_2O= Non linear =(3 N -6) = 3		[2+2]
	c)	Draw the low and high resolution spectra of the following (i) $CH_3—CH_2—CH_2—CH_2—Br$ a b c d Draw peaks according to a) Triplet b) Sextet c) Quintet d) Triplet (ii)  singlet		[2+2]
Q.3)		Attempt any **one**		
	a)	Define corrosion. Explain hydrogen evolution mechanism of wet corrosion		[4]

Ans:

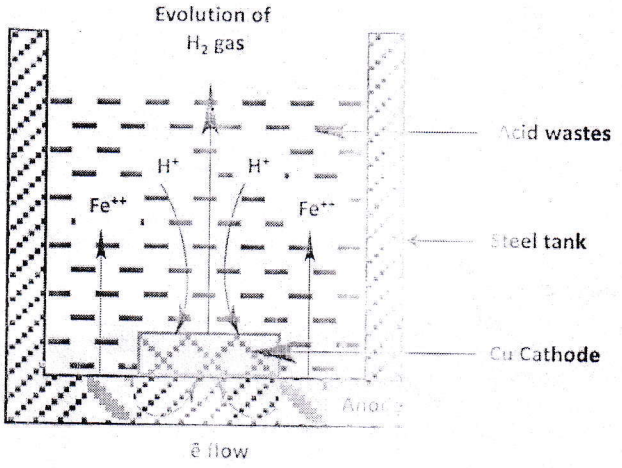
Definition:

The destruction of a metal by chemical or electrochemical attack of environment, starting at surface, is known as corrosion.

Hydrogen evolution mechanism:

This type of electrochemical corrosion occurs usually in acidic environment like industrial waste, solution of non-oxidising acids.

For example, a steel tank containing acid industrial waste and a small copper scrap are in contact is considered. Refer to Fig.



The piece of copper and steel tank in contact with each other in presence of acidic electrolyte form electrochemical cell. In this cell, steel act as anode and copper act as cathode. It is observed that the steel tank portion in contact with copper piece is corroded.

This can be explained on the basis of following reactions.

At anode: At steel tank

Iron passes into solution as Fe^{+2} ions.

$Fe \rightarrow Fe^{+2} + 2\,e^{-1}$ (Oxidation)

The free electrons are accumulated at cathode.

At cathode: At copper piece

Hydrogen ions from acidic electrolyte take up the free electrons and hydrogen gas formed is liberated in the form of bubbles at cathode.

$2\,H^+ + 2\,e^{-1} \rightarrow H_{2(g)}$ (Reduction)

Net cell reaction:

$Fe + 2H^+ \rightarrow Fe^{+2} + H_{2(g)}$

b) Explain galvanization with figure and process [4]

Ans:

(i) Definition: The process of coating of iron or steel (base metal) with a thin coat of zinc by hot dipping to prevent base metal corrosion is called galvanizing.

(ii)Method:

- The steel article is cleaned well with dil. H_2SO_4 to remove any rust or scale, washed well with water and dried.
- Then it is dipped in bath of molten zinc maintained at 425-430 °C. Surface of bath is covered with flux like NH_4Cl.Flux clean the metal surface before coating for better adhesion and prevents the oxidation

of molten coating metal after coating.

- It is then passed through pair of hot rollers to remove excess of zinc and produce coating of uniform thickness.
- Article is then annealed at 650°C and cooled to room temperature slowly.