

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted from the academic year 2019-20 and thereafter)

SUBJECT CODE: 19CH/PE/CP15

M. Sc. DEGREE EXAMINATION, APRIL 2023
BRANCH IV- CHEMISTRY
FOURTH SEMESTER

COURSE : MAJOR ELECTIVE
PAPER : CORROSION AND ITS PREVENTION
TIME : 3 Hours

MAX MARKS: 100

Section – A

Answer ALL the questions:

20 × 1 = 20 marks

Choose the Correct Answer:

- The standard electrode potentials for the calomel electrode in saturated KCl solution at 25 °C is
a. 0.3338 V b. 0.2800 V c. 0.2415 V d. 0.1542 V
- Which of the following is anodic inhibitor?
a. Na₂CrO₄ b. NaNO₂ c. Na₂HPO₄ d. all of these
- The SI unit to express corrosion rate is
a. g.m⁻²d⁻¹ b. μA/cm² c. mm/y d. μm/y
- Which one of the following ion can act as sacrificial anode?
a. Li⁺ b. Mg²⁺ c. Ca⁺ d. K⁺
- A plot of η vs $\log i$ is known as
a. Stern model b. Tafel plot c. CV diagram d. OCP

Fill in the blanks:

- The equilibrium constant of a cell reaction can be calculated using the equation ____.
- ____ diagram provides information about the stability of a metal as a function of pH and potential.
- The potential produced when a liquid is forced through a diaphragm or a capillary tube is known as _____.
- Effective corrosion inhibitor organic compound is _____.
- _____ is a popular test used to study corrosion.

True or False:

- Helmholtz postulated that the electrical equivalent of the double layer is a parallel plate capacitor.
- Pitting corrosion normally extended to the surface.
- Exchange current density is depending on the composition of the metal on the solution.
- Titanium exhibits very high corrosion rate in chloride environment.
- In the open circuit potential the current cannot flow from one end of the power source to the other.

Match the following:

- | | |
|-------------------------------------|---------------------------------------|
| 16. Evans diagram | - a. E vs current density (A/m^2) |
| 17. Pourbaix diagram | - b. i vs E (V vs Ag/AgCl) |
| 18. Cyclic voltammetry | - c. E(V vs SHE) vs $\log I$ |
| 19. Polarisation resistance | - d. current density vs E (V vs SCE) |
| 20. Electron impedance spectroscopy | - e. (V vs SCE) E vs pH |

Section – B**Answer any FIVE questions $5 \times 8 = 40$ marks**

21. Calculate the emf for the cell

a. $Zn(s)/Zn^{2+}(aq, 0.1M)//Fe^{2+}(aq, 0.001M)/Fe(s)$

$$E_{Zn^{2+}/Zn}^{\circ} = -0.763 \text{ V and } E_{Fe^{2+}/Fe}^{\circ} = -0.44 \text{ V} \quad (4)$$

b. Calculate the equilibrium constant for the reaction



$$E_{Fe^{3+}/Fe^{2+}}^{\circ} = 0.77 \text{ V ; } E_{MnO_4/Mn^{2+}}^{\circ} = 1.51 \text{ V}$$

22. Explain in detailed about microbial influenced corrosion.

23. How is corrosion rate determined? Discuss in detail.

24. Enumerate with examples organic and polymer coating.

25. Draw and discuss the Tafel plot for an aluminium alloys.

26. How does AC impedance method used in corrosion testing?

27. What are the factors affect the corrosion?

Section – C**Answer any TWO questions $2 \times 20 = 40$ marks**

28. a. Derive and explain Nernst equation? (8)
 b. Describe the different types of electrochemical corrosion. (12)
29. a. What are the types of polarisation? Explain it in detail. (10)
 b. What is cathodic protection? Discuss its classification and the process involved in it. (10)
30. a. Give the Principle and experimental set up for Small Amplitude Cyclic Voltammetry. (8)
 b. Discuss slow strain rate test for the calculation of AC impedance (4)
 b. How is material surfaces protected against corrosion? What is the role of corrosion inhibitors in the field of surface engineering? (8)
