M. Sc. DEGREE EXAMINATION, APRIL 2024
BRANCH IV- CHEMISTRY
FOURTH SEMESTER

COURSE   :   **MAJOR ELECTIVE**
PAPER   :   **CORROSION AND ITS PREVENTION**
SUBJECT CODE :   **19CH/PE/CP15**
TIME   :   **3 Hours**   **MAX MARKS: 100**

Section – A

Answer ALL the questions: **20 × 1 = 20 marks**
Choose the Correct Answer:

1. The value of 2.303RT/F at 323 K is
   (a) 0.0642   (b) 0.0644   (c) 0.0641   (d) 0.0592
2. Equilibrium constant of electrochemical reaction represented by the cell: $Zn, Zn^{2+} \mid Cu^{2+}, Cu$ with standard EMF of 1.10 V is
   (a) 3.722×10^{37} (b) 7.578×10^{37} (c) 1.578×10^{37} (d) 1.678×10^{37}
3. which of the following metals does not corrode in aerated water?
   (a) Mg   (b) Cu   (c) Fe   (d) Au
4. which of the following does not belong to pitting type?
   (a) Silver tarnishing   (b) Rusting of iron   (c) Parting   (d) None

Fill in the blanks:
5. ---------------- metal on exposure to oxygen, tends to form surface films.
6. Duralumin type alloys on heat treatment undergo --------- type of corrosion.
7. Polarisation for H^+ ion reduction at a cathode is called ----------.
8. Non-rusting of magnificent Iron pillar at New Delhi is attributed to the ------- used in iron making.

State whether True or False:
9. Non-ferrous metals do not corrode.
10. Concentration cells contain identical electrodes.
11. Magnesium alloys are the least susceptible to corrosion.
12. Metropolitan Rail systems cause stray-current corrosion in buried pipelines.

Match the following:

13. Copper hull	a. Anodic protection
14. Inhibitor	b. KCl
15. Iron	c. Trisodium phosphate
16. Saturated Calomel electrode	d. Sir Humphry Davy

Answer in a line:
17. Corrosion tendency of gold in aerated water is negligible. Why?
18. Define over potential.
19. What is passive corrosion?
20. What is the relation between EMF and free energy?

Section – B
Answer any FIVE questions   5 × 8 = 40 marks

21. (a) Describe the working of saturated calomel electrode with its diagram.
    (b) Calculate the half-cell potential of zinc in 0.01 M $ZnCl_2$, given that $E° = -0.763$ V
        for $Zn^{2+} + 2e^- \rightarrow Zn$.
22. Derive the Nernst equation for the reaction in a Galvanic cell: lL + mM $\rightarrow$ pP + qQ
23. Discuss briefly, the theory of pitting corrosion. Mention the principal ways to reduce it.
24. Define passivity. Illustrate the effect of fuming nitric acid on iron.
25. Explain the steps involved in corrosion rate determination (MPY), giving appropriate
    equations.
26. Mention the different sources of stray-current? Describe the methods to reduce the stray-
    current corrosion.
27. Describe the short-time tests followed to check the effectiveness of cathodic protection.

Section – C
Answer any TWO questions   2 × 20 = 40 marks

28. (a) How do the factors: (i) alloy composition, (ii) acid concentration, (iii) temperature,
        and (iv) oxidizer concentration, impact passivation behaviour?
    (b) Explain: (i) Stress corrosion, and (ii) Sacrificial anode.   (16 + 4)

29. (a) What is the principle involved in cathodic protection of a corroding metal surface?
        Explain how impressed current & sacrificial anode cathodic protection are applied,
        giving examples.
    (b) State the desirable electrochemical properties of anode alloys.   (15 + 5)

30. (a) Discuss activation and diffusion controlled processes in mixed potential theory.
    (b) Explain Tafel plot for Aluminium alloys.
    (c) Discuss small amplitude cyclic voltammetry (SCAV).   (8+6+6)

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