Question Paper

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MANIPAL ACADEMY OF HIGHER EDUCATION

B.Tech First Semester Sessional Examination September 2024

ENGINEERING CHEMISTRY [CHM 1071]

Marks: 30 **Duration: 90 mins.**

MCQ

Answer all the questions. Section Duration: 20 mins

1) Which of the following statements is **NOT** true for batteries?

Shelf life and design life of the batteries depends on its operational conditions.	Primary batteries possess longer cycle life.	Nonaqueous electrolytes are essential for secondary lithium batteries.	Use of separator prevents the internal short circuit.	(0.5)

2) Identify the **CORRECT** option from the following,

In chromium plating metal deposition rate is five-time faster	The decomposition potential and over-voltage are independent	The magnitude of overpotential is directly proportional	The deposition rate of coating metal ions in electroless	(0.5)

than the metal dissolution rate.	of the nature of the electrode.	to the extent of polarization.	plating is influenced by the current density.

3) Chose the **INCORRECT** option from the following , (0.5)

In decorative chromium a copper or nickel undercoat is essential.	In chromium plating inert anodes are used.	Preparation of active surface is must in electroless plating of nonconductors.	The use of reducing agents is necessary to achieve metal deposition in electroplating process.

4) The test cell in a Poggendorff's compensation method has shown null deflection at 65 cm, while a standard cell (with emf 1.2345 V) shows null deflection at 70 cm. The emf of the test cell is ……, (0.5)

1.2345	1.1463	1.3295	1.3456

5) If the reduction potentials for Zn and Cd are - 0.76 V and - 0.40 V respectively, Then the change in free energy for the reaction $Zn + CdSO_4 \rightarrow ZnSO_4 + Cd$ is (0.5)

-69480 J	-64980 J	-68480 J	-69840 J

6) Identify the **CORRECT** option for the following statements; (0.5)

The corrosion rate depends on, (i) Chemical affinity between the metal and corrosive medium and (ii) The nature of corrosion product

Statement (i) is true and (ii) is false	Statement (ii) is true and (i) is false	Both statements are true	Both statements are false

7) In which of the following galvanic combination, the rate of corrosion is more? (0.5)

Zn is coupled with Cu	Fe is coupled with Cu	Zn is coupled with Cd	Fe is coupled with Cd

8) Which of the following reaction is frequently encountered in metallic corrosion (0.5)

Hydrogen evolution at anode	Oxygen reduction at cathode	Metal oxidation at cathode	Metal reduction at anode

9) The pitting corrosion is characterized by (0.5)

Large difference in the electrode potential between the dissimilar metals.	Small anodic area in contact with large cathodic area.	Large anodic area in contact with small cathodic area.	Small difference in the electrode potential between the dissimilar metals.

10) Which of the following is **NOT** a characteristic feature of intergranular corrosion? (0.5)

Corrosion takes place due to the faster precipitation of a phase at grain boundaries.	Intense corrosion takes place at the grain phase or center compared to the grain boundary region.	Enrichment or depletion of one of the alloying elements at the grain boundary lead to this type of corrosion.	Grain boundary regions are more reactive than grain phase region.

DESCRIPTIVE

Answer all the questions.

11) (i) Give any four differences between galvanic and electrochemical series

(ii) Give reason for the following statements:

(a) Volatility of oxidation product influences the rate of corrosion. (4)

(b) Metals like aluminum and titanium desired for outdoor applications.

12) What are the two essential conditions required for stress corrosion to occur? Explain the caustic embrittlement of steel. (3)

13) (i)Explain the determination of equivalence point in the conductometric titration of strong acid vs strong base with suitable example.

(ii)A monochromatic radiation is incident on a solution of 0.075 molar concentration of an absorbing substance. The intensity of the radiation is reduced to $1/4^{th}$ of the initial value after passing through 8 cm length of the solution. Calculate the molar extinction coefficient. (3)

14) (i) Why can't an ordinary voltmeter be used to measure the electrode potential of a half-cell?

(ii) Define Liquid junction potential. How is it eliminated? (3)

15) Explain the theory of electroplating of copper. Mention any two factors that affects nature of plating. (3)

16) Give a brief description of the construction and working of an alkaline fuel cell. Mention any two advantages of fuel cells over galvanic cell. (3)

17)	A glass electrode dipped in a solution of pH = 3.2 offered an EMF of 0.4029 V with SCE at 298 K. When the same glass electrode was dipped in a solution of unknown pH at the same temperature, the recorded EMF was 0.2394 V. Calculate the pH of the unknown solution. Given E_{SCE} at 298 K = 0.2422 V.	(2)
18)	The free energy change for the cell, Ag | AgCl(s) ‖ KCl (aq) | Hg_2Cl_2(s) | Hg is −8782 J mol^{-1}. Calculate the change in enthalpy (ΔH) for the cell reaction at 298 K. Temperature coefficient for the cell is -3.38 ×10^{-4} V K^{-1}.	(2)
19)	Explain any two forms of dry corrosion.	(2)