MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

Department of Chemistry
B. Tech. I Sem 2024
CHM 1071 ENGG. CHEMISTRY, MID-TERM EXAMINATION

Time: 1.5 hr Date: 25.09.2024 Max marks: 30

Scheme of Evaluation

Q No	Question	Marks
Q1.	Which of the following statements is **NOT** true for batteries? 1. Shelf life and design life of the batteries depends on its operational conditions. 2. **Primary batteries possess longer cycle life.** 3. Nonaqueous electrolytes are essential for secondary lithium batteries. 4. Use of separator prevents the internal short circuit.	½
Q2.	Identify the **CORRECT** option from the following, 1. In chromium plating metal deposition rate is five-time faster than the metal dissolution rate. 2. The decomposition potential and over-voltage are independent of the nature of the electrode. 3. **The magnitude of overpotential is directly proportional to the extent of polarization.** 4. The deposition rate of coating metal ions in electroless plating is influenced by the current density.	½
Q3.	Chose the **INCORRECT** option from the following , 1. In decorative chromium a copper or nickel undercoat is essential. 2. In chromium plating inert anodes are used. 3. Preparation of active surface is must in electroless plating of nonconductors. 4. **The use of reducing agents is necessary to achieve metal deposition in electroplating process.**	½
Q4.	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 …… 1. 1.2345 **2. 1.1463** 3. 1.3295 4. 1.3456	½
Q5.	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 **1. -69480 J**	½

	2. -64980 J 3. -68480 J 4. -69840 J	
Q6.	Choose the CORRECT option from the following; The corrosion rate depends on, (i) Chemical affinity between the metal and corrosive medium (ii) The nature of corrosion product. 1. Statement (i) is true and (ii) is false 2. Statement (ii) is true and (i) is false **3. Both statements are true** 4. Both statements are false	½
Q7.	In which of the following galvanic combination, the rate of corrosion is more? **1. Zn is coupled with Cu** 2. Fe is coupled with Cu 3. Zn is coupled with Cd 4. Fe is coupled with Cd	½
Q8.	Which of the following reaction is frequently encountered in metallic corrosion 1. Hydrogen evolution at anode 2. **Oxygen reduction at cathode** 3. Metal oxidation at cathode 4. Metal reduction at anode	½
Q9.	The pitting corrosion is characterized by 1. Large difference in the electrode potential between the dissimilar metals. **2. small anodic area in contact with large cathodic area.** 3. Large anodic area in contact with small cathodic area. 4. Small difference in the electrode potential between the dissimilar metals.	½
Q10.	Which of the following is **NOT** a characteristic feature of intergranular corrosion? 1. Corrosion takes place due to the faster precipitation of a phase at grain boundaries. **2. Intense corrosion takes place at the grain phase or center compared to the grain boundary region.** 3. Enrichment or depletion of one of the alloying elements at the grain boundary lead to this type of corrosion. 4. Grain boundary regions are more reactive than grain phase region.	½

	Part B [Descriptive]
Q11.	(i) Any four differences between galvanic and electrochemical series 2 M (ii) Provide an explanation for the following statements: **(a) Volatility of oxidation product makes the availability of the fresh surface area of the metal to the corrosive medium thereby increasing the corrosion rate 1M** (b) Metals like aluminum and titanium desired for outdoor applications **Al and Ti are passive in nature resulted in the formation protective oxide film thereby preventing the further corrosion 1M**
Q12.	Two conditions: Presence of stress and specific corrosive medium 1M Explanation for the formation of stress (anodic) and stress free (cathodic) region. ½ M Hydrolysis of sodium carbonate to form NaOH. ½ M Reaction of sodium format in the presence of limited and excess amount of oxygen. Or proper explanation 1M
Q13.	(i) Graph **½ M** explanation for the variation of conductance **1 M** (ii)A=€bc A=log(I^o/I) =**0.60205** **½ M** €=A/bc= 0.60205/(8×0.075) =**1.0034** mol^{-1} cm^{-1} **1 M**
Q14.	Why can't an ordinary voltmeter be used to measure the electrode potential of a half-cell- Any two points **1 M** Definition liquid junction potential **1 M** using salt bridge **½ M** Explaining it. **½ M**
Q15.	Composition of bath **1M** **DC source** **Anode**- inert or coating metal (Cu), **Cathode**- article to be plated, **Electrolyte**: salt solution of coating metal $CuSO_4$ Deposition of cu^{2+} ion as Cu **with reaction 1 M** Any two factors that affects nature of plating- **1M** current density, pH, temperature, concentration. Agitation etc.

Q16.	Construction: Either schematic diagram and construction **1M** Anodic and cathodic reaction **1M.** Any **two** advantages of fuel cells over galvanic cell **1M** A fuel cell will produce a steady electric current as long as fresh reactants are available They work silently without producing any sound Environmentally favorable.
Q17.	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 $0.4029=Eg^{o}-0.0591\times3.2 -0.2422$ $Eg^{o=}$**0.8354 V 1M** $0.2394=0.8354-0.0591$ pH-0.2422 **pH=5.96 1M**
Q18.	The free energy change for the cell, $Ag \mid AgCl(s) \| KCl\ (aq) \mid Hg_2Cl_2(s) \mid Hg$ is −8782 J mol^{-1}. Calculate the enthalpy and entropy changes for the cell reaction at 298 K. Temperature coefficient for the cell is -3.38×10^{-4} V K^{-1}. $\Delta G=-nEF$ $-8782=2\times96500\times E$ **E=0.04550 V 1M** $\Delta H=nF[T(\Delta E/\Delta T-E)]$ $\Delta H=2\times96500[(298(-3.38\times10^{-4})-0.04550]$ **=-282.21 KJ 1M**
Q19	Explanation for any two forms of dry corrosion with one example. **2 M** Oxidation corrosion Corrosion due to other gases Liquid metal corrosion