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M.Sc.(Chemistry) (Campus) (2015 to 2017) (Sem.-2) ELECTROCHEMICAL TECHNIQUES Subject Code : CHL-415 M.code : 51152

Time: 3 Hrs.

Max. Marks: 70

INSTRUCTIONS TO CANDIDATES :

- 1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- 2. SECTION-B contains SIX questions carrying FIVE marks each and students have to attempt ALL questions.
- 3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

- 1. What is the role of liquid junction potential?
- 2. Given that $E^0_{(Zn^{2+}/Zn)} = -0.76V$ and $E^0_{(Cu^{2+}/Cu)} = +0.34V$. Identify the cathode and anode of the electrochemical cell.
- 3. Write down the relation between specific conductance and equivalent conductance.
- 4. Why calomel electrode is called reversible electrode?
- 5. What is anodic depolarizer? Give one example.
- 6. Write Nernst equation with meaning of the parameters involved.
- 7. How do you test for the irreversibility of a redox reaction in CV?
- 8. Mention the limitation of direct current polarography.
- 9. Draw the conductometric titration curve of weak acid with strong base.
- 10. How concentration cells are different from electrochemical cells?

SECTION-B

11. For the following cells, write down the cell reactions and calculate the EMF at 298K. (a) $Ag(s)|Ag^{+}(a \pm = 0.1) || Zn^{2+}(a \pm = 0.1)|Zn$

Given the following standard potential values :

 $E^{0}_{(Ag^{+}/Ag)} = 0.799V$; $E^{0}_{(Zn^{2+}/Zn)} = -0.763V$; Predict whether the cell reaction is spontaneous or not.



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- 12. Write a short note on linear sweep voltammetry (LSV).
- 13. What is log-plot in polarography? Mention its characteristic physical significance.
- 14. The molar conductances of CH₃COONa, HCl and NaCl at infinite dilution are 91×10^{-4} , 426×10^{-4} and 126×10^{-4} Sm²mol⁻¹ respectively at 25°C. Calculate the molar conductance at infinite dilution for CH₃COOH.
- 15. Mention the merits and demerits of dropping mercury electrode (DME) used in polarography.
- 16. Write a short note on oscillometry.

SECTION-C

17. Construct the Frost diagram of manganese from the following scheme :

$$MnO_4^- \xrightarrow{1.7V} MnO_2 \xrightarrow{0.95V} MN^{3+} \xrightarrow{1.5V} Mn^{2+} \xrightarrow{-1.18V} Mn$$

From this diagram justify that :

- a) Mn^{3+} is unstable,
- b) MnO₂ is an oxidising agent,
- c) Mn^{2+} is the usual product of reduction of Mn (VII).

Can you use a nickel spatula to stir a solution of copper sulphate? Explain.

- 18. Differentiate between cathodic and anodic stripping methods. Draw a typical excitation signal and voltammogram in case of striping method. Define microelectrode and mention its advantages.
- 19. Specific conductance of a decimolar solution of KC1 at 18° C is 1.12 Sm^{-1} . The resistance of a conductivity cell containing the solution at 18° C was found to 55 Ω . Calculate the cell constant.

What is the effect of dilution on :

- a) The specific conductance
- b) The equivalent conductance of CH₃COOH.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

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