**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086**
**(For candidates admitted from the academic year 2015-16 & thereafter)**
**SUBJECT CODE: 15CH/MC/PC64**
**B.Sc. DEGREE EXAMINATION, APRIL 2021**
**BRANCH IV – CHEMISTRY**
**SIXTH SEMESTER**
**COURSE: MAJOR CORE**
**PAPER: PHYSICAL CHEMISTRY III**
**TIME: 90 MINUTES** **MAX. MARKS: 50**

## SECTION – A

**Answer all the Questions** **(15x1=15 marks)**

**I. Choose the correct answer:**

1. The rate law for the reaction

$$Cl_2(g) + CHCl_3(g) \rightarrow HCl(g) + CCl_4(g)$$

$$Rate = k[Cl]^{1/2}[CHCl_3]$$

The units for k, assuming time in seconds and concentration in mol/L is

a. $L^{1/2}/mol^{1/2}$•s b. L/mol•s. c. $L^{-1/2}/mol^{-1/2}$•s. d. $L^{1/2}/mol^{1/2}$•$s^{-}$

2. The ionic strength 0.01M $Na_2SO_4$ is given as

a. 0.01m b. 0.02m c.0.03m d.0.04m

3. The specific conductance of an electrolyte of concentration 0.01 M is 1.4 X $10^{-5}$ S $m^{-1}$

Its equivalent conductance is

a. 0.14 b. 1.4 c. 14 d. 140

4. When 4 molecules undergo chemical change by the absorption of one quantum of light. The quantum yield is

a.1 b. 2 c. 3 d. 4

5. The standard reduction potential of a metal is negative. This means the metal can

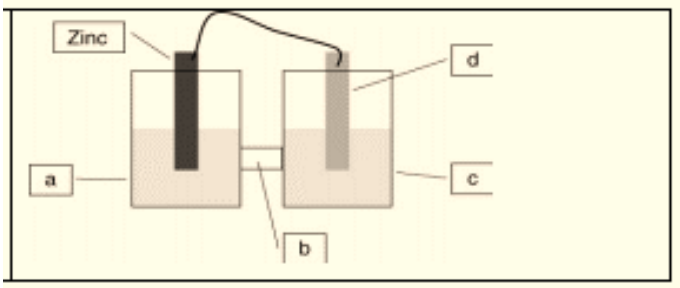
a. undergo oxidation readily b. undergo reduction readily

c. undergo displacement readily d. None of the above

6. The salt that does not undergo hydrolysis is

a. $NH_4Cl$ b. $CH_3COONa$ c. NaCl d. $CH_3COONH_4$

7. A voltaic cell is constructed based on the oxidation of zinc metal and the reduction of silver cations. Solutions of silver nitrate and zinc nitrate also were used. **Locate the zinc nitrate on the diagram, and identify the anode.**




a. Zinc nitrate = a; anode = d
b. Zinc nitrate = a; anode = Zinc
c. Zinc nitrate = c; anode = d
d. Zinc nitrate = c; anode = Zinc

**II. Fill in the blanks:**

8. pH of 0.1N solution of ammonium cyanide ($K_a$ = 4.9x10$^{-10}$, $K_b$= 1.8x10$^{-5}$) is __
9. When $NH_4Cl$ is added to a solution of $NH_4OH$, the dissociation of _____ is suppressed.
10. Ostwald dilution law is applicable to _____ electrolytes.
11. As concentration increases rate of the reaction _____.
12. An example of maxima suppressors used in polarography is _____.

**III. Answer in a line or two:**

13. Represent a cell for the following cell reaction:

$$Pb(s) + Sn^{+4}(aq) \rightarrow Pb^{+2}(aq) + Sn^{+2}(aq)$$

14. Molecularity
15. Salt bridge

**SECTION B**

**Answer any three of the following:** **(5x3 = 15marks)**

16. Discuss Lindemann's theory of unimolecular reactions.

17. Describe the determination of transport number of an ion using moving boundary method.

18. a. Calculate degree of dissociation of 0.01M $CH_2ClCOOH$, given that the $\lambda_M°$ values for HCl, KCl and $CH_2ClCOOK$ are 4.261, 1.4986 and 1.132 $Sm^2mol^{-1}$ respectively. The molar conductance at 0.01M is 2.134 $Sm^2mol^{-1}$. (3)

b. What is $E^O$ for the following balanced reaction? (2)

$Al(s) + Fe^{3+}(aq) \rightarrow Al^{3+}(aq) + Fe(s)$

Given: Standard Reduction Potential

$Fe^{3+}(aq) + 2e– \rightarrow Fe(s)$ ----------+0.771

$Al^{3+}(aq) + 2e– \rightarrow Al(s)$---------- –1.660

19. Derive an expression for pH of a salt solution of sodium acetate.

20. Give an account on DME.

## SECTION C

**Answer any two of the following:** **(2x10= 20marks)**

21. a. Explain concentration cells without transference. (6)

b. Explain the kinetics of formation hydrogen chloride. (4)

22. a. Discuss in detail the transition state theory. (6)

b. The value of $E^\circ$ for the following reaction is 0.189

$$4H^+(aq) + Fe(s) + NO_3^-(aq) \rightarrow Fe^{3+}(aq) + NO(aq) + 2H_2O(l) \qquad E^\circ = 0.189\ V$$

0.1 M 0.6 M 1.0 M 0.5 M

Evaluate Ecell and $\Delta G$ of the above cell? (4)

23. a. Explain the theory involved in use of quinhydrone electrode in the determination of strength of a given acid. (4)

b. Derive an expression for rate constant of first order reaction. (3)

c. The rate constant of a second order reaction is $5.70 \times 10^{-5} dm^3 mol^{-} s^{-}$ at 25°C and $1.64 \times 10^{-4} dm^3 mol^{-} s^{-}$ at 40°C. Calculate the activation energy and preexponential factor. (3)

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