

**STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086**  
**(For candidates admitted from the academic year 2019-20 & thereafter)**

**B.Sc. DEGREE EXAMINATION, APRIL 2024**  
**BRANCH IV - CHEMISTRY**  
**SIXTH SEMESTER**

**COURSE : MAJOR-CORE**  
**PAPER : PHYSICAL CHEMISTRY III**  
**TIME : 3 HOURS** **MAX. MARKS :100**  
**SUBJECT CODE : 19CH/MC/PC64**

**SECTION – A**

**ANSWER ALL THE QUESTIONS: (30x1=30)**  
**Choose the correct answer:**

1. The unit of specific conductance is  
(i)  $S\ m^2$                       (ii)  $S\ m^{-1}$                       (iii)  $S^{-1}\ m$                       (iv)  $S^{-1}\ m^{-1}$ .
2. The mobility of an ion is  
(i) less than that of the hydrated ion                      (ii) more than that of the hydrated ion  
(iii) equal to that of the hydrated ion                      (iv) none of these.
3. If the transference numbers of cation and anion of an electrolyte are equal, then liquid junction potential is  
(i) zero                      (ii) greater than one  
(iii) less than one                      (iv) lies between 0.1 and 1.0.
4. Calomel is  
(i) mercurous chloride                      (ii) mercuric chloride  
(iii) saturated KCl solution                      (iv) mixture of mercurous and mercuric chlorides.
5. The half-life time of a first order reaction with rate constant  $1.54 \times 10^{-3}\ s^{-1}$  is  
(i) 150 s                      (ii) 250 s                      (iii) 350 s                      (iv) 450 s.
6. Radiative transition from  $S_1$  to  $S_0$  is an allowed transition and occurs in about  
(i) 1 s                      (ii)  $10^{-8}$  s                      (iii)  $10^2$  s                      (iv) 10 s.
7. Adsorption depends on  
(i) temperature                      (ii) pressure                      (iii) nature of adsorbent                      (iv) all.
8. Adsorbent used as a decolouriser is  
(i) silica gel    (ii) alumina gel                      (iii) animal charcoal                      (iv) activated charcoal.
9. Catalytic poison  
(i) decreases the rate of a reaction                      (ii) increases the rate of a reaction  
(iii) does not affect the rate of a reaction                      (iv) None of the above.
10. Nernst equation explains the  
(i) effect of electrolyte concentration on electrode potential  
(ii) effect of temperature on the rate of a chemical reaction  
(iii) effect of pH on electrode potential  
(iv) effect of pH on rate of a reaction.

**Fill in the blanks:**

11. Kohlraush's law is -----.
12. Number of ions discharged at an electrode is ----- to the total quantity of electricity passing through the solution.
13. Quinhydrone is an ----- mixture of quinone and hydroquinone.
14. Eyring equation is -----.
15. Effect of temperature on the rate of a chemical reaction is given by ----- equation.

16. Debye- Huckel – Onsager equation is -----.
17. An example of a galvanic cell is -----.
18. Freundlich adsorption isotherm is -----.
19. Quantum efficiency is -----.
20. Internal conversion is also known as -----.

**State whether true or false:**

21. Ostwald's dilution law is applicable for strong electrolytes.
22. Potassium nitrate solution can be used in salt bridge.
23. Quantum efficiency of the reaction between hydrogen and bromine is 1.
24. Enzyme catalysis mechanism is explained by Michaelis – Menton.
25. Emulsion is a colloid.

**Answer in one or two sentences:**

26. Calculate the ionic strength of 0.2 m BaCl<sub>2</sub> solution.
27. What is liquid junction potential?
28. State Grotthus – Draper law.
29. Explain auto catalyst with an example.
30. Write BET equation and explain the terms.

**SECTION – B**

**ANSWER ANY FIVE QUESTIONS:**

**(5x6=30)**

31. How do specific conductance and equivalent conductance of an electrolytic solution vary with concentration?
32. Explain the determination of pH of a solution using quinhydrone electrode.
33. What are redox titrations? How are these reactions carried out potentiometrically?
34. a) Rate constant of a second order reaction is  $2.3 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$  at 25°C and  $2.23 \times 10^{-3} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$  at 40°C .calculate the Activation Energy of the reaction.  
b) Calculate the energy of photon corresponding to wavelength 375nm
35. Discuss the significance of  $\Delta H^*$ ,  $\Delta S^*$  and  $\Delta G^*$ .
36. What is the effect of temperature and pH on enzyme catalysed reactions?
37. Differentiate – Physisorption and Chemisorption.

**SECTION – C**

**ANSWER ANY TWO QUESTIONS:**

**(2x20=40)**

38. (a) How is transport number of an ion determined by moving boundary method? (10)  
(b) Derive an expression for the EMF of a concentration cell with transference. (10)
39. (a) Discuss the activated complex theory of bimolecular reactions. (10)  
(b) Explain the kinetics of unimolecular surface reactions. (10)
40. (a) What are adsorption isotherms? Derive Langmuir adsorption isotherm. (10)  
(b) (i) Describe any two methods for the determination of order of a reaction. (6)  
(ii) Calculate the transport numbers of Li<sup>+</sup> and Br<sup>-</sup> ions when a current flows through an infinitely dilute aqueous solution of LiBr at 25°C, given the ionic mobilities of Li<sup>+</sup> and Br<sup>-</sup> ions at infinite dilution are  $4.01 \times 10^{-8}$  and  $8.09 \times 10^{-8} \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$  respectively. (4)

\*\*\*\*\*