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Reg. No. : ....

Name : ....

Sixth Semester B.Sc. Degree Examination, March 2021

First Degree Programme under CBCSS

Chemistry

Core Course XII

CH 1643 : PHYSICAL CHEMISTRY — III

(2018 Admission Regular)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** questions. Each question carries **1** mark.

1. Define ionic product of water.

2. Write van't Hoff reaction isotherm and explain the terms.

3. The $t_{1/2}$ of a reaction is doubled as the initial concentration of the reactant is doubled. What is the order of the reaction?

4. What are consecutive reactions? Give one example.

5. Define degree of freedom.

6. What are conjugate layers?

7. Write Nernst equation. Explain the terms in it.

P.T.O.

8. What are fuel cells? Give one example.

9. What is meant by consolute temperature? Give one example for systems having both upper and lower consolute temperature.

10. Mention the limitation of quinhydrone electrode.

(10 × 1 = 10 Marks)

PART – B (Short answer type)

Answer **any eight** questions. Each question carries **2** marks.

11. Show that for a first order reaction, the time required for 99.9% completion of the reaction is 10 times that required for 50% completion.

12. Derive the integrated rate equation for a zero order reaction.

13. What would be the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate and making the volume equal to 1 litre? Dissociation constant of acetic acid at 25 °C is 1.75×10^{-5}.

14. Explain common ion effect with an example.

15. Prove that an invariant system has no degree of freedom by taking water as an example.

16. What is meant by chemiluminescence? Give one example.

17. Explain the construction of hydrogen electrode.

18. What type of molecules will show large negative deviation from ideal behaviour? Give one example.

19. What is meant by over voltage?

20. Differentiate primary and secondary cells with one example each.

21. Calculate the solubility of $Al(OH)_3$ in water at 25°C if Ksp = 8.5×10^{-32}.

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22. Explain Grothus-Draper law.

23. Explain levelling effect.

24. Draw the vapour pressure-composition curves of completely miscible liquid systems.

25. What are reference electrodes?

26. What are photosensitized reactions?

$(8 \times 2 = 16 \text{ Marks})$

PART – C (Short essay)

Answer **any six** questions. Each question carries **4** marks.

27. The rate constant of a second order reaction is 5.7×10^{-5} dm^3 mol^{-1} s^{-1} at 25°C and 1.64×10^{-4} dm^3 mol^{-1} s^{-1} at 40°C. Calculate the activation energy.

28. Derive an expression for the rate constant of a bimolecular reaction based on intermediate compound formation theory.

29. Calculate the Kc and Kx for the reaction

$N_2 O_4 (g) \rightleftharpoons 2 NO_2$ (g) for which $K_p = 0.157$ atm at 25°C and 1 atm pressure.

30. Discuss the phase diagram of water system.

31. Define quantum yield. Discuss the reasons for very low and very high quantum yields with examples.

32. Write a note on potentiometric titrations involving redox reactions.

33. The molar conductance at infinite dilution of NH$_4$Cl, NaOH and NaCl are $149.7 \Omega^{-1}$ cm^2 mol^{-1}, $248.1 \Omega^{-1}$cm^2 mol^{-1}, $126.5 \Omega^{-1}$ cm^2 mol^{-1} respectively. Calculate the molar conductance at infinite dilution of NH$_4$OH?

34. Explain Deby-Falkenhagen effect.

35. Discuss the effect of solvents on ionic strength.

36. Write a note on corrosion and its prevention.

37. Write a short note on conductometric titrations involving strong acid-strong base and weak acid-strong base.

38. Explain the law of mass action.

<div align="right">**(6 × 4 = 24 Marks)**</div>

PART – D (Long essay)

Answer **any two** questions. Each question carries **15** marks.

39. (a) Discuss the collision theory and derive the rate equation for a 2nd order reaction based on collision theory. **7**

    (b) Derive the Nernst equation for electrode potential. **8**

40. Discuss the hydrolysis of four different types of salts and derive the hydrolysis constant in each case.

41. (a) Discuss the phase diagram of $FeCl_3$-Water system. **7**

    (b) Describe the moving boundary method for the determination of transport number. **8**

42. Write an essay on Nernst distribution law, its derivation and applications.

43. Write an essay on enzyme catalysis.

44. (a) What are the different types of electrodes? Explain their electrode reactions. **8**

    (b) Explain the terms fluorescence, phosphorescence and eutectic point. **7**

<div align="right">**(2 × 15 = 30 Marks)**</div>

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