UNIVERSITY OF KERALA
Ph.D. Entrance Examination (November 2016)

Subject-Chemistry
Model Question Paper

Time: 3 hours Maximum Marks: 100

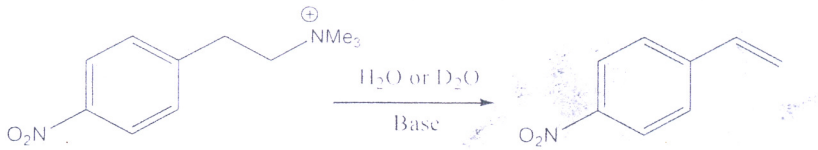
Part A
Answer any ***ten*** questions. (5 x 10 = **50** marks)

1. Briefly describe the different steps involved in a research process.
2. Discuss the format of thesis and dissertation.
3. Discuss the use of various primary sources in literature survey.
4. What is meant by report? What are various stages of writing report?
5. Enumerate the different methods of collecting data giving one example each.
6. Explain how sampling and statistical inference are useful for any research work.
7. Differentiate :
   (i) Precision and accuracy.
   (ii) Students *t*-distribution and *t*-test.
8. What is Chi-Square test? Explain the significance in statistical analysis of any research problem.
9. Write notes on :
   (i) Random and normal errors
   (ii) Mean and standard deviation.
10. Differentiate between linear regression and multiple linear regression.
11. Distinguish between correlation and regression.
12. Explain the different ways of presenting the data.
13. Briefly Discuss the theory, instrumentation and applications of Mass spectroscopy
14. How TEM and SEM techniques differ in their principle and application for material characterization?
15. Briefly explain the principle, instrumentation and uses of steady state fluorescence spectrometer in chemistry and biochemistry.

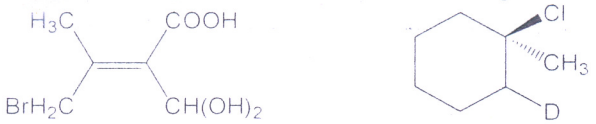
Part B
Answer any ***ten*** questions (5 x 10 = **50** marks)

16. What is Zeise's salt? Show its structure and describe the bonding.
17. Sketch the structures of $Co_4(CO)_{12}$ and Ir_4CO_{12}.
18. Draw the structures of S_4N_4 and P_4S_{10}.
19. Copper(I) iodide is a stable species, while copper(II) iodide does not exist. Explain.
20. What change in the position of iron in haemoglobin occurs upon binding to oxygen and why?
21. The fundamental and first overtone transitions of NO are centred at 1876 cm^{-1} and 3724 cm^{-1} respectively. Calculate the equilibrium vibration frequency and anharmonicity constant.
22. Discuss the features and kinetics of chain reaction using $H_2 - Br_2$ as an example.

23. Calculate the standard molar entropy of gaseous argon at 25 °C.
24. Set up the group multiplication table for C_{3V} point group.
25. You are given the cell
    $Zn \mid Zn^{2+}_{a\ 0.0004} \| Cd^{2+}_{a\ 0.2} \mid Cd$
    The standard electrode potential of Zn and Cd are -0.767 and -0.403 V. Calculate ΔG and ΔG°.
26. The k_H/k_D of base catalysed elimination reaction given below in H_2O and D_2O was found to be 0.13. Write suitable mechanism consistent with this observation.



27. Assign E/Z and R/S configurations for the following:



28. Explain a named reaction that involves carbene intermediate.
29. Explain the following reactions:
    (i) Heck reaction (ii) McMurray reaction
30. How is singlet oxygen generated? Why is it more reactive than triplet oxygen? Discuss the reactions of singlet oxygen.