



**RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES**

**B.Sc. (Honors) Degree in Chemistry
Fourth Year - Semester I Examination – June / July 2018**

CHE 4204 – ADVANCED INORGANIC CHEMISTRY I

Time: Two (02) hours

Answer **only four (04)** questions.

Use of a non-programmable calculator is permitted.

1. a) State advantages of silicones over organic polymers. (10 marks)
- b) Explain how you would get linear chain silicones by polymerization of SiCl_4 . (30 marks)
- c) Suggest a suitable siloxane which can be used to terminate the above polymerization. (10 marks)
- d) Write a short note on Nuclear Quadrupole Resonance spectroscopy (NQR). (30 marks)
- e) Stretch the net reaction catalyzed by the enzyme carbonic anhydrase. (20 marks)

2. a) Predict the number of peaks and the splitting patterns for the compounds given below.

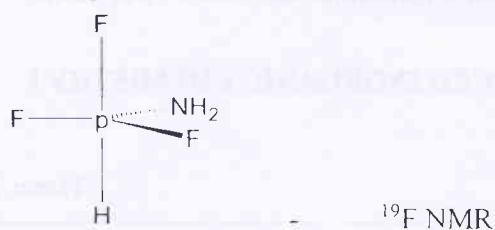
i. CH_2F_2 - ^{19}F NMR

ii. PD_3 - ^{31}P NMR

iii.



iv.



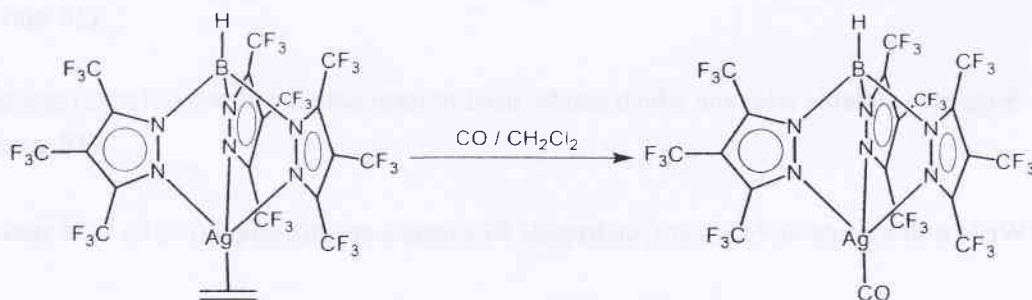
^{31}P ($I=1/2$), ^{19}F ($I=1/2$), ^{14}N ($I=1$), ^{127}I ($I=5/2$)

(20 marks)

b) Explain the use of following two spectroscopic methods to determine the completion of the reaction below.

i. ^1H NMR

ii. IR



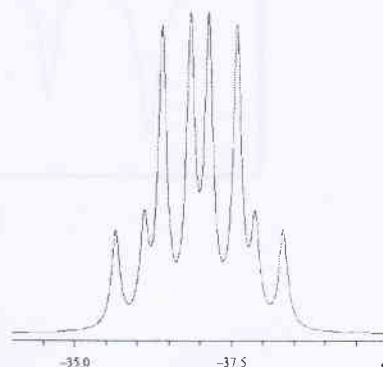
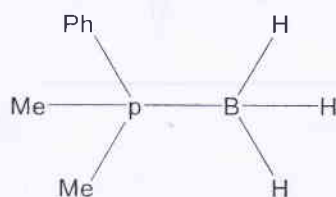
(30 marks)

c) Following reaction gives a mixture of products. ^{31}P NMR spectrum of the products yields a septet as the only peak. Identify the product which contains phosphorus.



(25 marks)

- d) ^{11}B NMR spectrum of the $\text{PhMe}_2\text{P}(\text{BH}_3)$ is given below. Explain the splitting pattern using an energy level diagram and redraw the spectrum indicating the relevant coupling constants. Values of the coupling constants are not expected [^{31}P ($I=1/2$)].



(25 marks)

3. a) ^{19}F NMR spectrum of BFCl_2 shows a quartet with the intensities of 1:1:1:1. Comment [^{11}B ($I=3/2$)]. **10 marks)**

b) Consider the H_2^+ ion.

- With the aid of an energy level diagram, show the transitions corresponding to the ESR spectrum of the H_2^+ ion.
- Draw the relevant ESR spectrum.

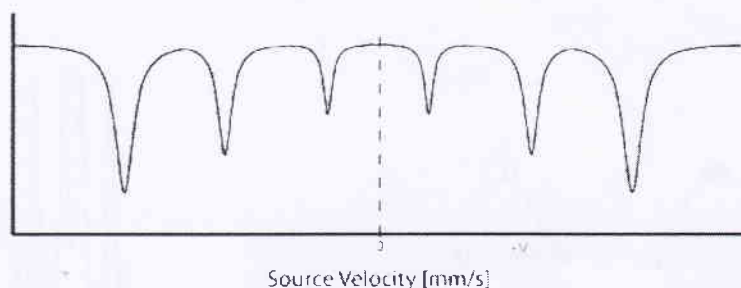
(30 marks)

- c) Metastable crystalline phase PCl_5 shows an NQR spectrum with three ^{35}Cl resonances with intensities 1:1:3. Explain the observed spectrum correlating with the structure of the metastable crystalline phase.

(30 marks)

Cont.

- d) Account for the given Mossbauer spectrum corresponding to ^{57}Fe nuclei using an energy level diagram and showing the transitions relevant to the spectrum.
(^{57}Fe , $I=1/2$ - ground state and ^{57}Fe , $I=3/2$ - excited state)



(30 marks)

4. a) Hemoglobin (Hb) and myoglobin (Mb) facilitate the activities of oxygen in the biological systems.
- Illustrate the active site of hemoglobin giving a schematic diagram with a bound oxygen molecule.
 - Describe the oxygen transportation and the storing in the human body with the aid of oxygen binding curves of Hb and Mb.

(70 marks)

- b) Illustrate the active site of the multi-copper enzyme which catalyzes the reaction given below.



(30 marks)

5. a) Brief the roles of following enzymes giving suitable examples

- Hydrolases
- Two electron reductases
- Multipair oxidoreductases

(34 marks)

- b) Write down the function of the enzyme, carboxy peptidase and propose a mechanism to explicate/ illustrate the activity of the enzyme.

(36 marks)

- c) Tyrosinases oxidize phenole to *o*-quinone. Draw the catalytic cycle.

(30 marks)

— END —