No. of Printed Pages : 4

RCHE-002

Ph.D. IN CHEMISTRY (PHDCHEM)

00431

Term-End Examination

December, 2017

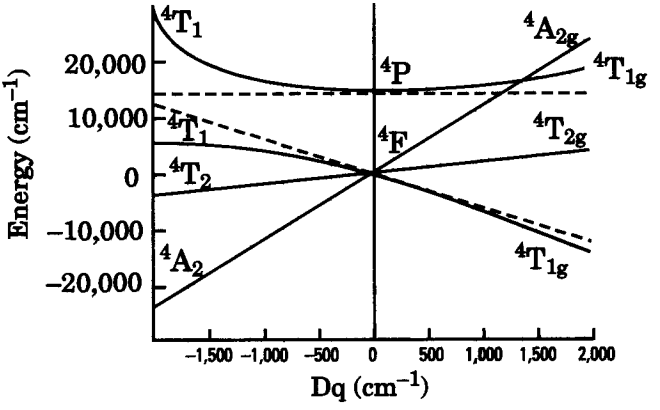
RCHE-002 : ADVANCES IN INORGANIC CHEMISTRY

Time : 3 hours *Maximum Marks : 100*

Note : *Answer **all** the questions.*

1. Illustrate the Jahn-Teller effect, with suitable examples. *10*

2. (a) What information do you get from the following Orgel diagram ? *10*



(b) Give the configurations of a d^4 metal ion in both, a weak field and a strong field, and calculate the respective CFSE in an octahedral field. *10*

3. (a) Calculate the spin-only moment and spin-plus orbital moment of manganese(II) ion. *5*

(b) "In general, orbital contribution is more likely in square planar geometry than in octahedral geometry." Critically evaluate the statement, giving reasons. *5*

(c) What will the Russell-Saunders symbol of Ni(II) ion be ? Write the steps involved. *10*

4. (a) Draw a rough sketch of the expected $^{31}P\{^1H\}$ and ^{109}Rh NMR spectra of the tetrahedral complex, $[Rh(NO)(PC_6H_5)_3]_3$ *5*

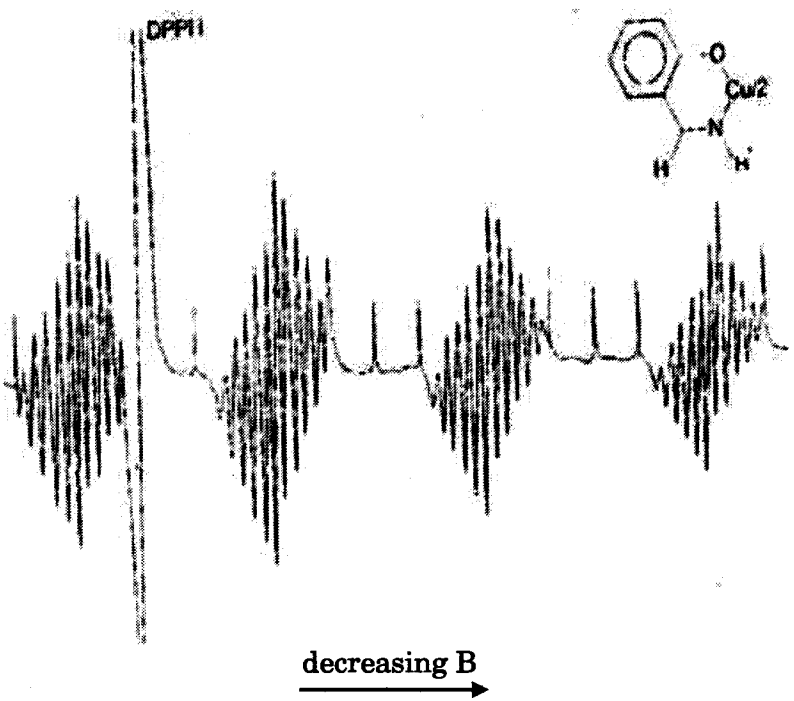
(b) Given that :

^{10}B : $Q = 8{\cdot}5^* 10^{-2}$, a = 19·6%, $r^N = 10{\cdot}7$, I = 3

^{11}B : $Q = 4{\cdot}1^* 10^{-2}$, a = 80·4%, $r^N = 32{\cdot}1$, $I = \frac{3}{2}$,

draw the ^{19}F NMR spectrum of $NaNBF_4$ molecule in D_2O, assuming that there is a coupling between the two isotopes of boron with fluorine ($I = \frac{1}{2}$ and 100% abundance). Justify your answer. *10*

(c) Explain the following first derivative ESR spectrum of bis (salicyaldiminato) copper(II) with isotopically pure ^{63}Cu. 5



5. (a) Outline the similarities and differences in the basic structure of heme in hemoglobin and chlorophyll. 5

(b) What is the Prosthetic Group in Cytochromes ? Write its physiological role. 5

(c) What makes Fe and Cu suitable for redox processes in biological systems ? 5

6. (a) "Much of the inspiration and origins of supramolecular chemistry comes from the chemistry found in living biological systems." Comment on this statement. *5*

(b) What are Zwitterions ? In biological systems, how are they found ? *5*

(c) How are the Edge-directed and Face-directed self-assembling coordination compounds synthesised ? *5*
