ISLAMIC UNIVERSITYOF SCIENCE & TECHNOLOGY
DEPARMENT OF CHEMISTRY

M Sc. (3rd Semester) (Mid term) **Max. Marks: 30**
Course Title: Inorganic spectroscopy (PCH-DCE-306) **Time: 40min**
Rollno:

Q1. The low temperature ^{19}FNMR spectrum of IF_5 molecule in solution should exhibit which of the following patterns (ignore any magnetic coupling effects to the Iodine nucleus)
- a) One singlet
- b) One singlet and one Quintet
- c) One doublet and one Quintet
- d) One quartet and one triplet

Q2. The ^{31}PNMR spectrum of $PF_4N(CH_3)_2$ at room temperature and low temperature (173K) respectively shows (assume that N & H do not couple)
- a) Triplet and Quintet
- b) Quintet and Triplet of Triplet
- c) Quintet and Triplet
- d) Triplet and Triplet of Triplet

Q3. In NMR spectrum, nuclei that are located near to electronegative atom tend to be ..... relative to nuclei that are not near to electronegative atoms.
- a) Split
- b) Have a more intense signal
- c) Shielded
- d) Deshielded

Q4. The NMR experiment consists of measuring the energy associated with what physical phenomenon?
- a) Excitation of a core electron from an atom
- b) Flipping the magnetic spin vector of a nucleus in a strong magnetic field
- c) Activation of molecular vibration
- d) Promoting of an electron from the HOMO to the LUMO

Q5. Which of the following factor does not affect the chemical shifts
- a) Inductive effect
- b) Anisotropic effect
- c) Concentration
- d) Hydrogen bonding

Q6. The ^{19}FNMR spectrum of ClF_3 shows
- a) Doublet and triplet for a T-shaped structure
- b) Singlet for a trigonal planar structure
- c) Singlet for a trigonal pyramidal structure
- d) Doublet and singlet for a T-shaped structure

Q7. The ^{31}PNMR spectrum of P_4S_3 consists of:
- a) A doublet and a quatert
- b) Two doublet
- c) A doublet and a triplet
- d) A singlet

Q8. A borane (X) is reacted with NH_4 to give a solution of borohydride (Y). The ^{11}BNMR spectrum of Y consists of a triplet and a quintet. The borane X is:
- a) B_2H_6
- b) B_3H_9
- c) B_4H_8
- d) B_5H_9

Q9. In the ^{19}FNMR spectrum of PF_5, the number of signals and multiplicity at room temperature are:
- a) One, doublet
- b) One, singlet
- c) Two, singlet
- d) Two, doublet

Q10. The signal of paramagnetic subcstances.....
- a) Broad and have wide chemical shift range
- b) Sharp and have wide chemical shift range
- c) Broad and have small chemical shift range
- d) Sharp and have small chemical shift range

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Q11. Main role of MRI contrast agent
a) Increases the T1 relaxation time of proton inside the tissue
b) Increases the T2 relaxation time of proton inside the tissue
c) Decrease the T1 relaxation time of proton inside the tissue
d) Decrease the T2 relaxation time of proton inside the tissue

Q12. The multiplicity of the signal in ^{31}PNMR spectrum in PD_3 is
a) Singlet
b) Septet with unequal intensities
c) Quartet with equal intensities
d) Septet with equal intensities

Q13. $[B_3H_8]$- is fluxional on the NMR spectroscopic timescale. In the ^{11}B and $^{11}B\{^1H\}$ NMR spectra respectively, you would observe:
a) A singlet and an octet
b) An octet and a singlet
c) A singlet and a nonet
d) A nonet and a singlet

Q14. $[(\eta^3\text{-}C_3H_5)Mn(CO)_4]$ shows fluxional behaviour. The ^{1}HNMR spectrum of this compound when it is in the non fluxional state shows:
a) One signal
b) Two signals in the intensity ratio of 4:1
c) Three signals in the intensity ratio of 2:2:1
d) Five signals of equal intensity.

Q15. The ligand that are fluxional in $[(\eta^5\text{-}C_5H_5)(\eta^1\text{-}C_5H_5)Fe(CO)_2]$ in the temperature range 221-298K, are
a) $\eta^5\text{-}C_5H_5$
b) $\eta^1\text{-}C_5H_5$
c) $\eta^5\text{-}C_5H_5$ and CO
d) $\eta^1\text{-}C_5H_5$ and CO

Q16. A major advantage of MRI is:
a) The ease with which equipment is updated or replaced
b) Its relatively low cost, compare to CT scans
c) Does not require specialized room
d) The ability to reposition the cross section through the body without repositioning the patient.

Q17. What is the relative area of each peak in a quartet spin spin splitting pattern?
a) 1:2:2:1
b) 1:2:1
c) 1:4:4:1
d) 1:3:3:1

Q18. The reference material used in BNMR spectroscopy is:
a) $BF_3.OEt_2$
b) $BF_3.OBu_2$
c) $BF_3.OEt_3$
d) None of these

Q19. The multinuclear NMR spectroscopy depends on
a) Sensitivity
b) Isotopic abundance
c) Both (a) and (b)
d) None of these

Q20. Paramagnetic shifts observed in
a) Organic radicals
b) Complexes of transition metals
c) Complexes of lanthanides and actinides
d) All of the above.

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