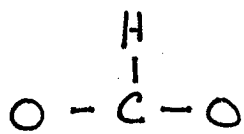
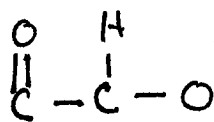


Chemical shift (ppm)  $\Rightarrow$  environment, see chemical shift table  
 deshielding effects are additive.



$$1 + 3 + 3 = 7 \text{ ppm}$$

$\uparrow$  1st O       $\uparrow$  2nd O



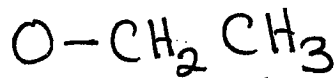
$$1 + 1 + 3 = 5 \text{ ppm}$$

$\uparrow$        $\uparrow$        $\uparrow$   
 $\begin{array}{c} \text{H} \quad \text{O} \\ | \quad || \\ \text{C} - \text{C} \end{array}$        $\begin{array}{c} \text{H} \\ | \\ \text{C} - \text{O} \end{array}$

Splitting  $\text{all}$   
 (triplet)

$n+1$  where  $n$  = number of neighbors.

Integration: number of hydrogens.

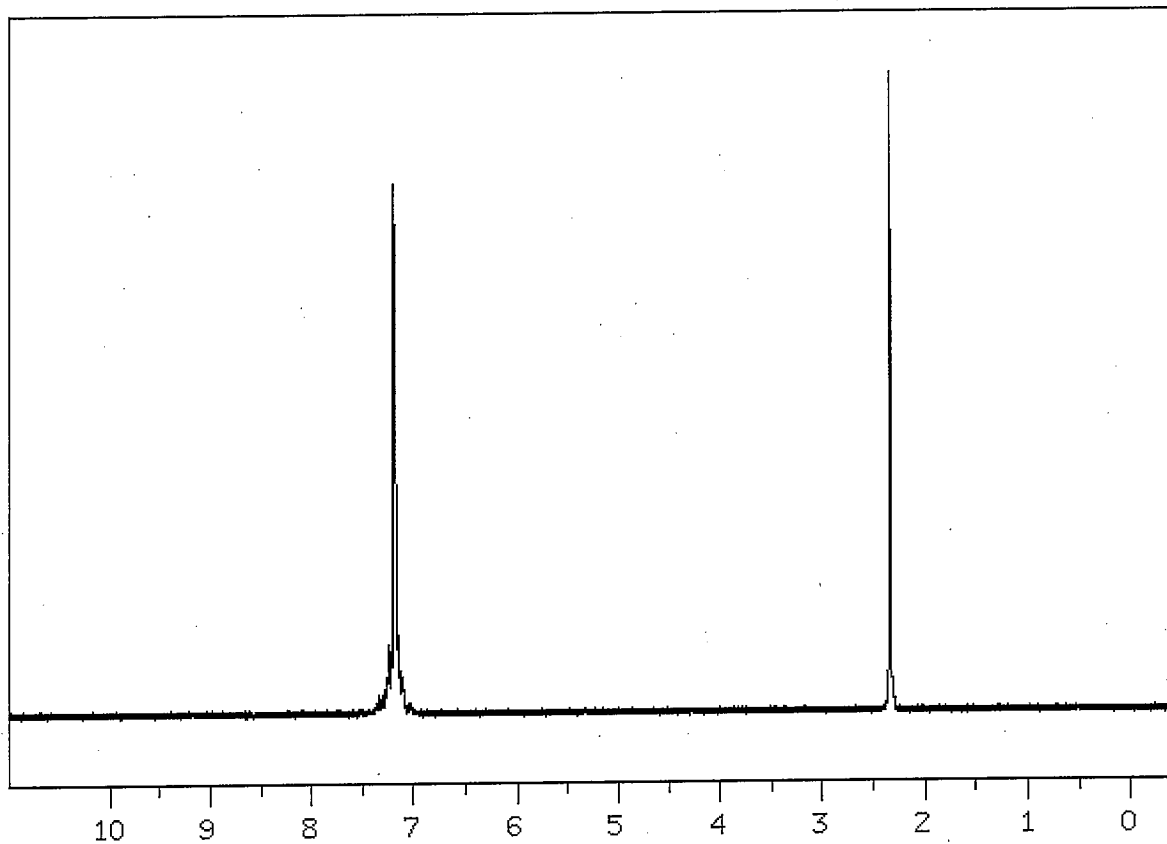


Int = 2  
 Split = 4 (quartet)

Chem shift:  $\sim 4$  ppm

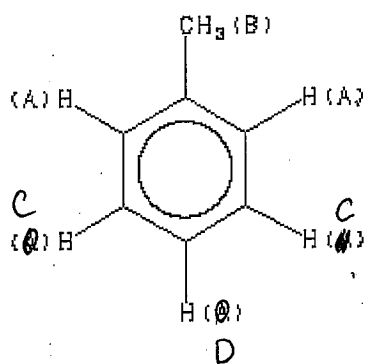
Int = 3  
 Split = 3 (triplet)

Chem shift:  $\sim 1$



HSP-00-541

ppm

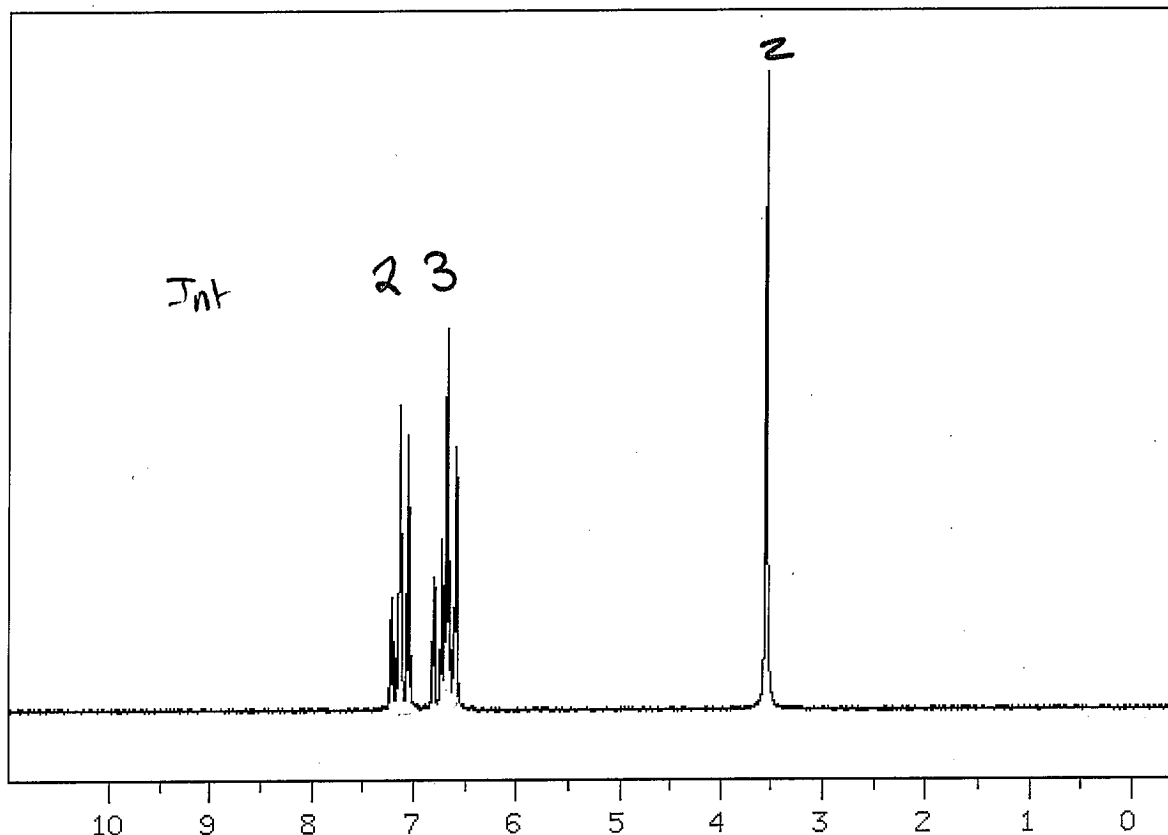


Assign. Shift(ppm)

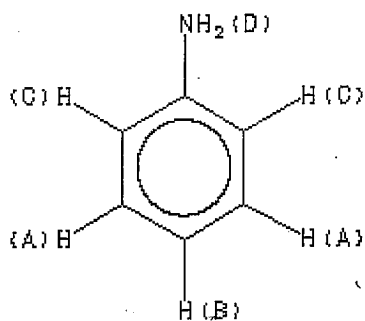
A 7.38 to 7.00

B 2.34

proton	chem shift	deshielded by	split by
A	7.2	H-	C too small to see
B	2.3	H-C-	-
C	7.2	H-	A & D not observed
D	7.2	H-	C not observed



HSP-03-391



proton	Chemical shift	Deshielded by	split by
A	7.1	A-	B & C
B	6.7	H- but shielded by -NH <sub>2</sub> by resonance	A
C	6.6		A
D	3.5	H-N-	-

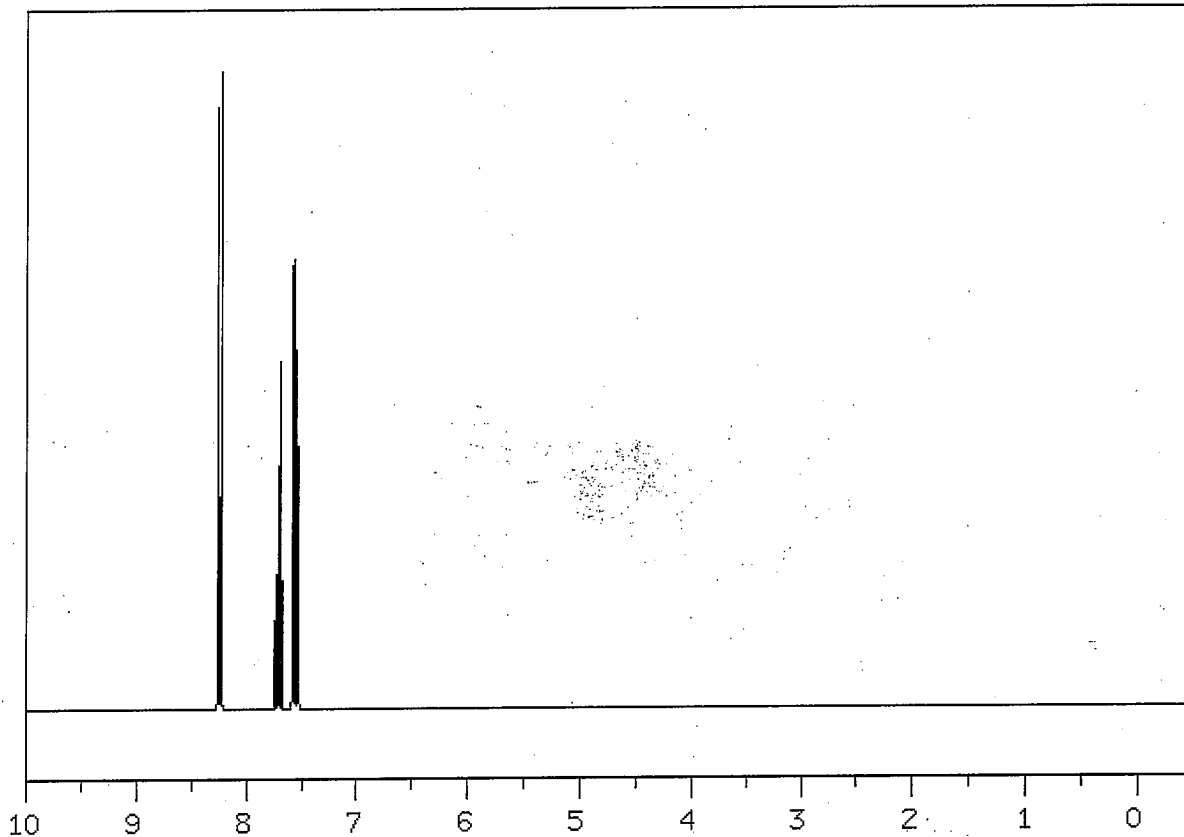
Assign. Shift(ppm)

A 7.12

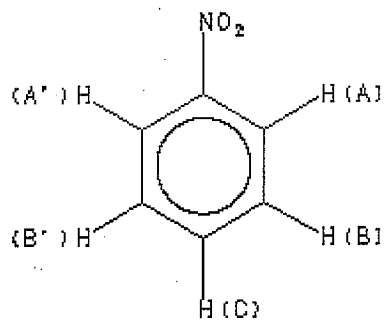
B 6.73

C 6.64

D 3.55



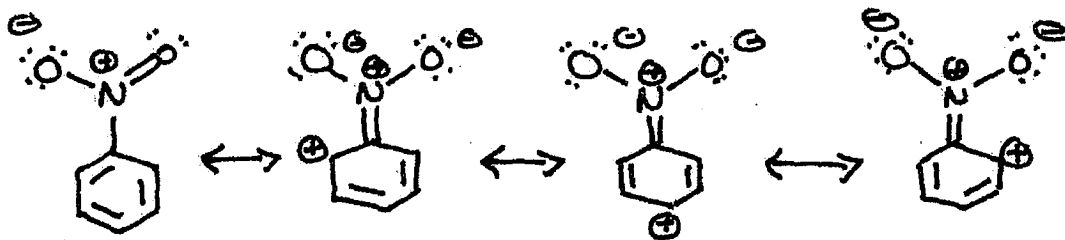
HPM-04-103  
300 MHz



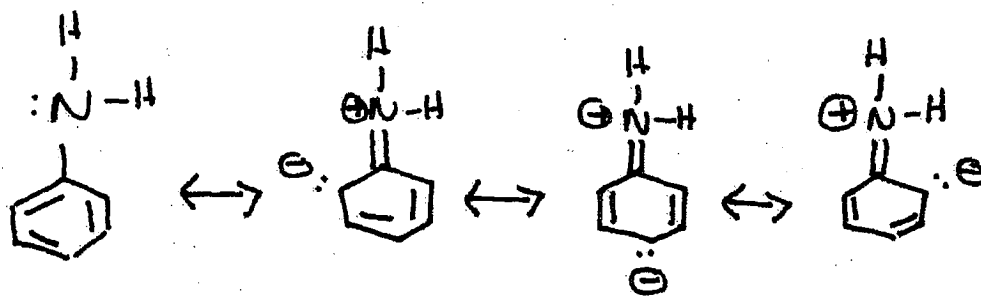
D(A) 8.245  
D(B) 7.557  
D(C) 7.705

proton	chemical shift	Deshielded by	split by
A	8.2	H- + more by nitro group.	B
B	7.5	H-	A & C
C	7.7	H- + more by nitro group	B

Effects through the p system can be explained through resonance structures.  
 Electron withdrawing group: A lack of electrons will de-shield.

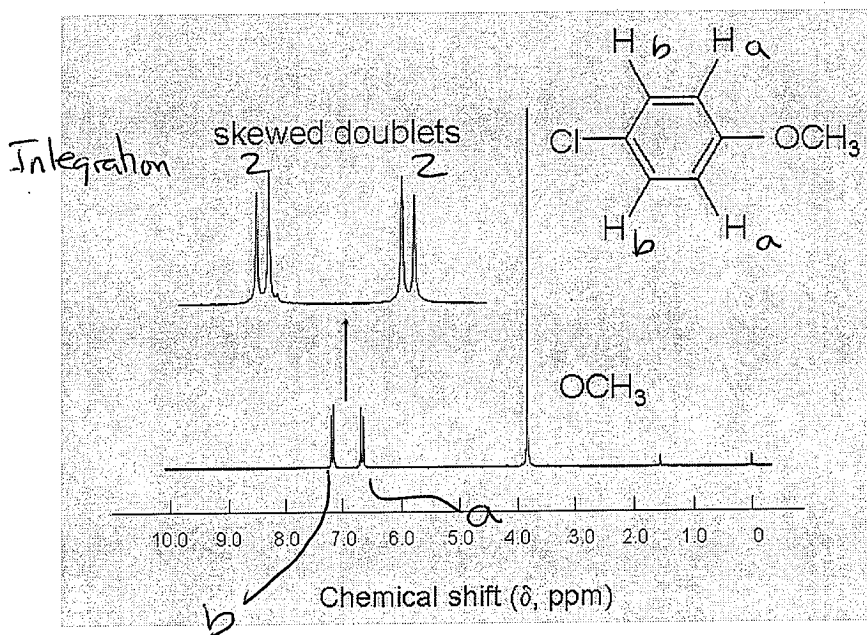


Electron donating group: Electrons will shield.



Di-substituted Aromatics

Para substitution gives a distinct splitting pattern.



4

