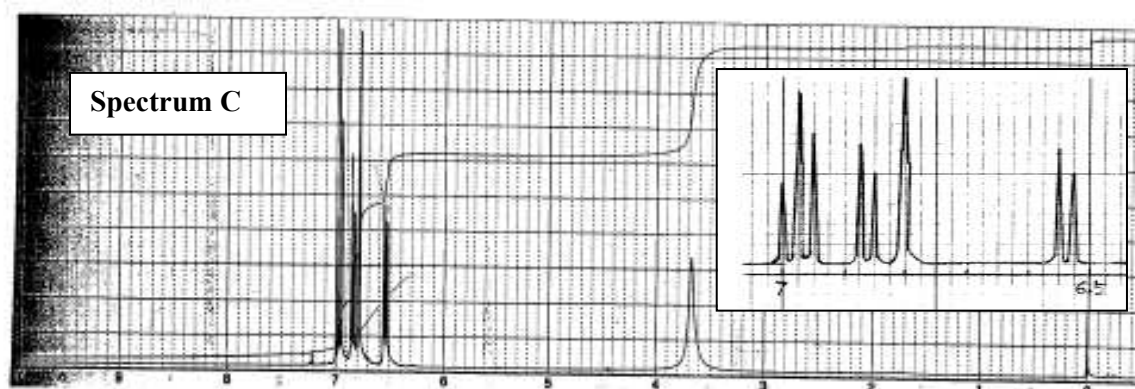
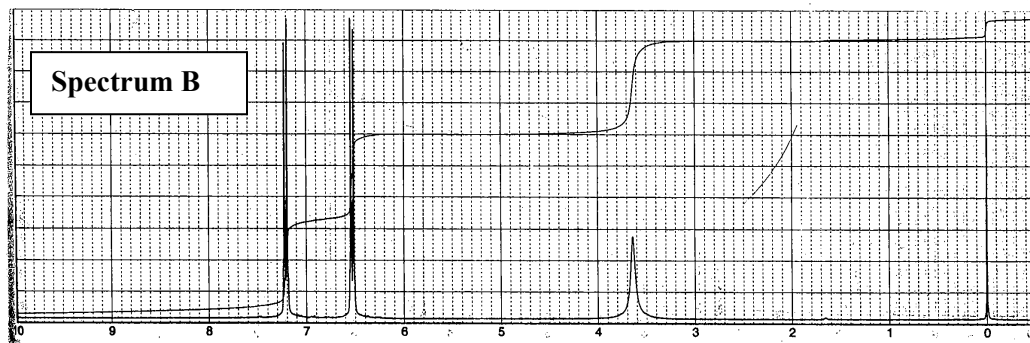
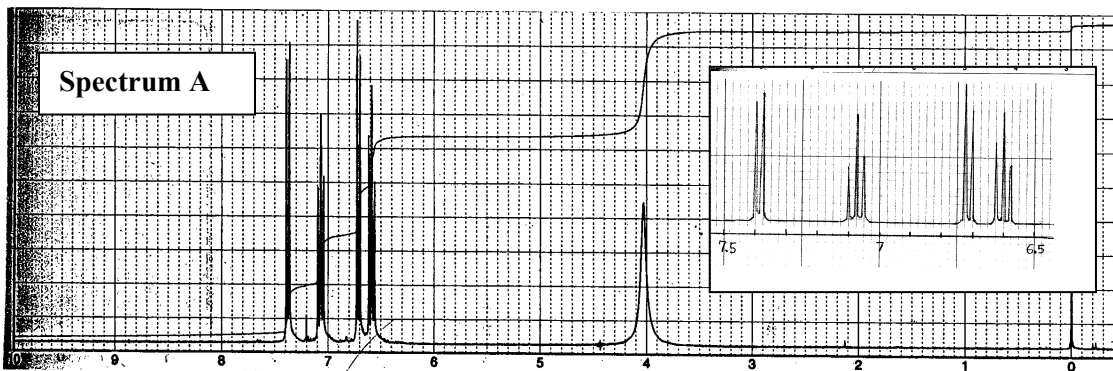
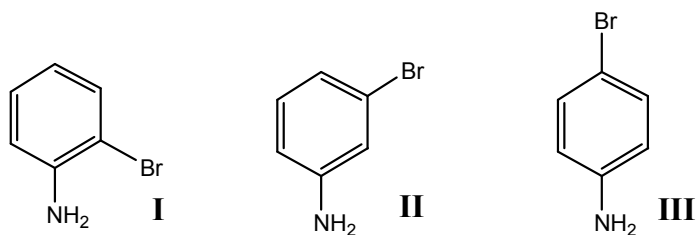
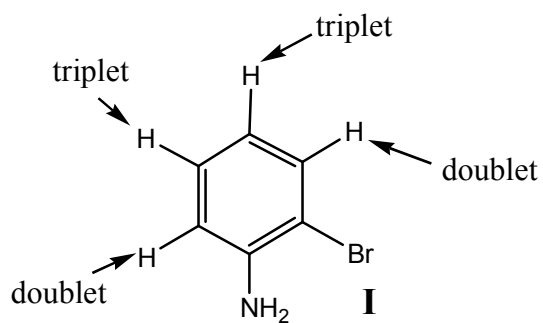


II. Assign compounds I, II and III to their corresponding spectra (9 points). Briefly explain how you make the assignments. (6 points) Place your answer on the next page.

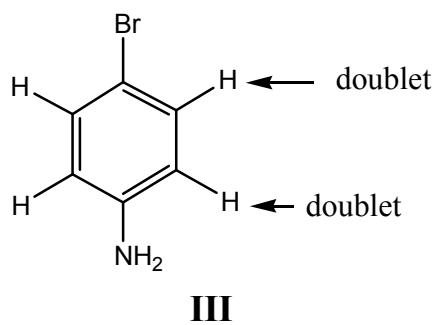


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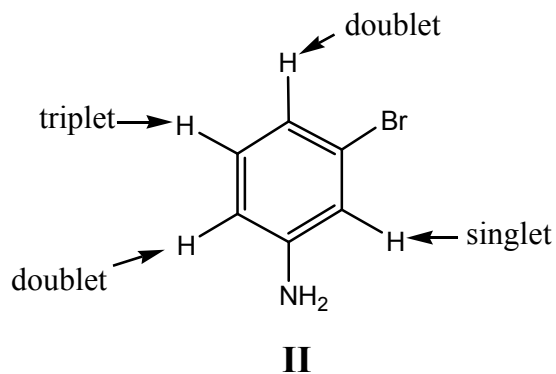
Spectrum A should be compound **I** (4 different types of aromatic H's)



Spectrum B should be compound **III** (2 different types of aromatic H's)



Spectrum C should be compound **II** (4 different types of aromatic H's)

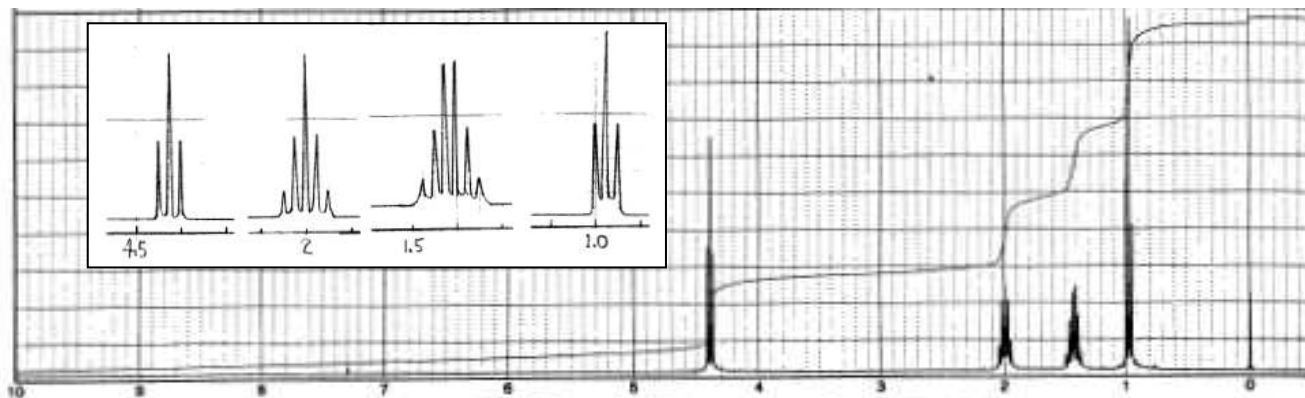
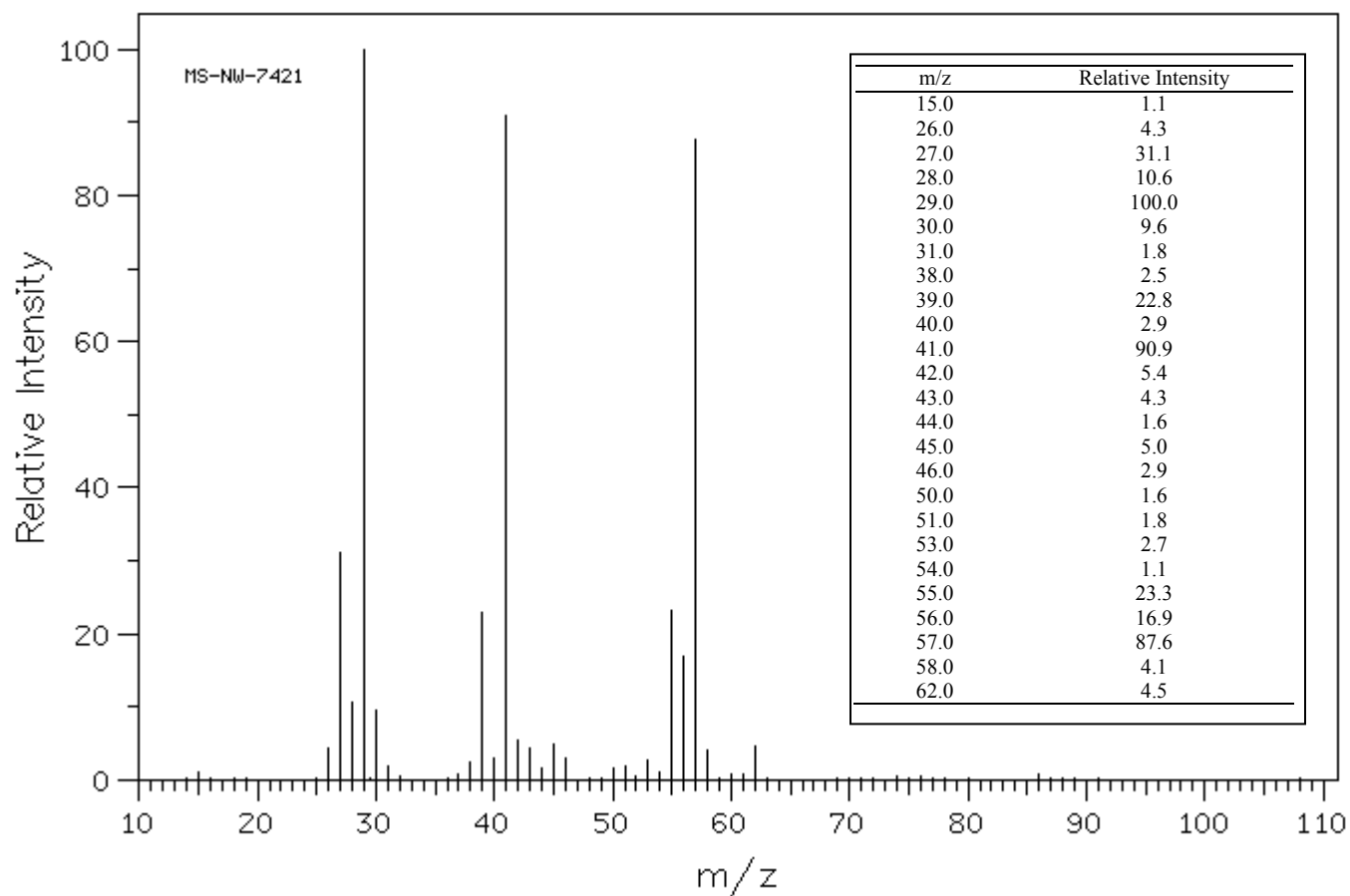


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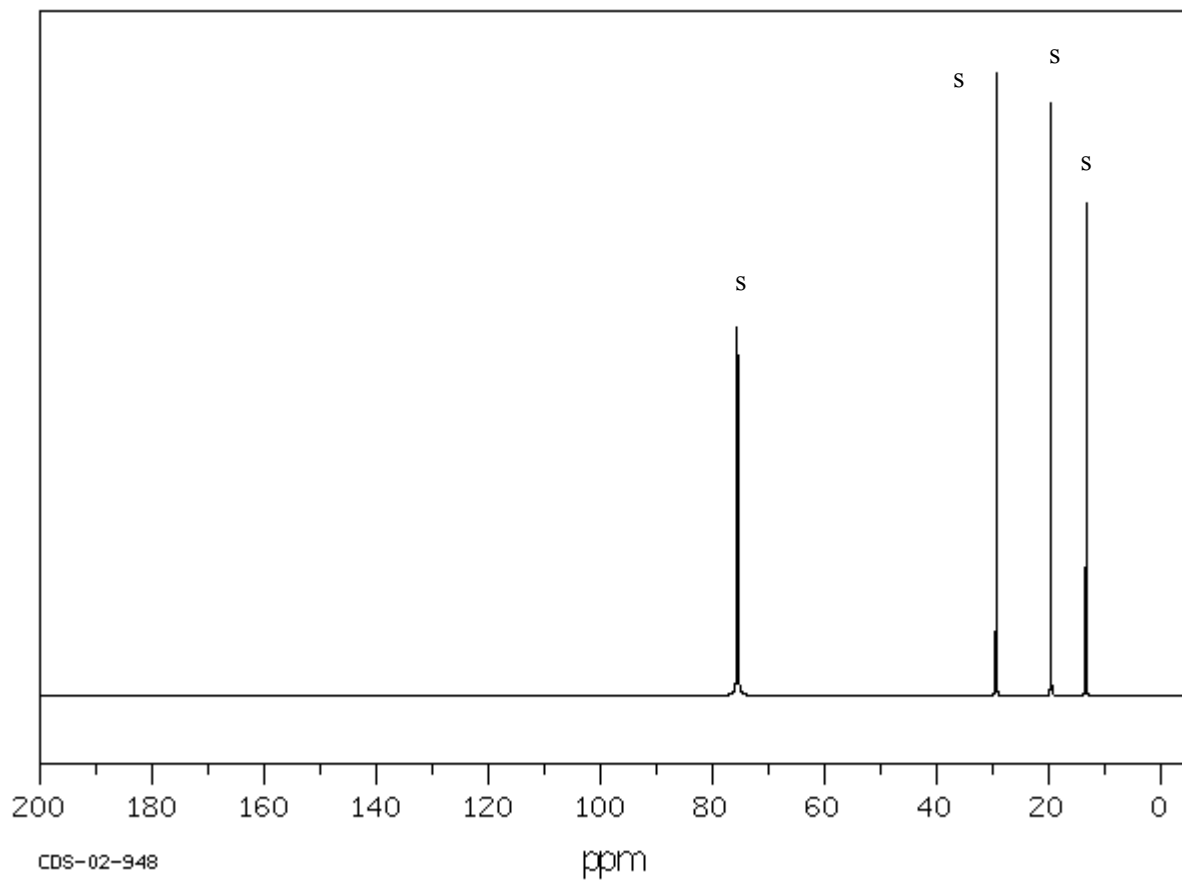
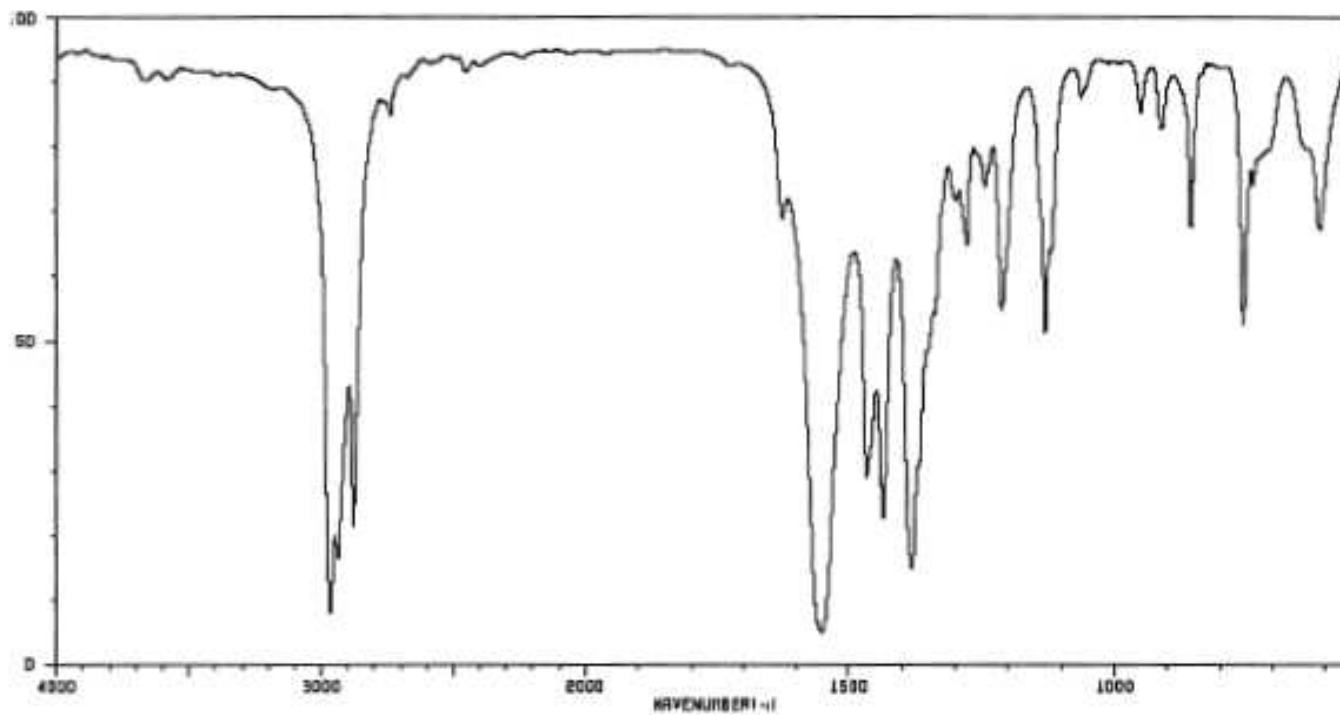
III. Provide your analysis and answers for the following questions (p14-15) based on the given spectroscopic information. **You may get partial credits even your proposed structure is incorrect.** (25 points)

***From Mass Spec: $M^+ = 103$**

***From elemental analysis: C: 46.5%; H: 8.7%; N: 13.6%.**



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1. What is the molecular formula? (3 points)



2. From the IR spectrum, is there a carbonyl group (C=O)? (2 points)

No

No OH or NH₂

Two strong peak at 1500-1600 and 1300-1400 indicating NO₂ group

3. Your analysis from ¹H NMR. Please write **clearly** how you interpret the chemical shifts and splitting diagrams. (10 points)

4 types of signals with integral ratio (from left to right) as 2:2:2:3

Chemical Shift (ppm)	Number of Proton	Splitting Pattern	Interpretation
4.4	2	triplet	-CH ₂ - CH ₂ -X Next to a CH ₂ group and electron-withdrawing functional group
2.0	2	multiplet	-CH ₂ - CH ₂ -CH ₂ -
1.4	2	multiplet	-CH ₂ - CH ₂ -CH ₂ -
1.0	3	triplet	-CH ₂ - CH ₃ CH ₃ group next to a CH ₂

No hydrogen-bond associated proton.

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4. Your analysis from ^{13}C NMR. (5 points)

4 carbons

No carbonyl group

5. Your proposed structure (5 points)

