IDENTIFYING the MAJOR FUNCTIONAL GROUP:

1. Is a carbonyl present? **Check ZONE 4.** If no carbonyl is present, go to step 3.
   - **The C=O double bond gives rise to a strong absorption in ZONE 4: 2000-1600 cm^{-1}. This peak is often the strongest in the spectrum, and characteristic of the type of carbonyl present (see spectrum below).**
2. If C=O is present, check for additional peaks to confirm the following types of carbonyls:
   - **Anhydrides have two C=O absorptions near 1810 & 1760 cm^{-1}**
   - **Esters should also have C-O stretches in ZONE 5 around 1300-1100 cm^{-1} with medium intensity**
   - **Aldehydes should also have two signals in ZONE 2: ~2800 & ~2700 cm^{-1}**
   - **Carboxylic acids should have a broad signal that extends from ZONE 1 through ZONE 2: 3500-2500 cm^{-1}**
   - **Amides (primary & secondary) should have a signal in ZONE 1: 3500-3200 cm^{-1}**
3. If C=O is absent, check for:
   - **Alcohols/Phenols have a broad signal in ZONE 1: 3600-3200 cm^{-1}**
   - **Signals for amines also show up in ZONE 1: 3500-3200 cm^{-1}**
     i. **Primary amines (RNH_2) display 2 signals**
     ii. **Secondary amines (R_2NH) display 1 signal**
   - **Ethers have signals in ZONE 5 due to C-O stretch: 1300-1000 cm^{-1}**
4. Double bonds and/or aromatic rings:
   - **Phenyl and vinyl sp2 C-H stretches occur in ZONE 1 to the left of 3000 cm^{-1}**
   - **Alkenes display weak C=C stretching signals near 1650 cm^{-1}**
   - **Medium to strong signals from 1650-1400 cm^{-1} imply an aromatic ring**
5. sp Hybridized Triple bonds:
   - **Nitrile C≡N bonds display in ZONE 3 around 2250 cm^{-1}**
   - **Alkyne C≡C bonds display in ZONE 3 around 2150 cm^{-1}**
     i. **Terminal alkynes also have a sharp signal in ZONE 1 around 3300 cm^{-1}**
6. Nitro groups, NO_2:
   - **N=O stretches observed as two signals in ZONE 5 around 1560 & 1350 cm-1**
7. Alkanes:
   - **Main signals for sp3 hybridized C-H bonds are in ZONE 2 just below 3000 cm^{-1}**