2(a) IR Analysis

b) The fingerprint region of the IR spectrum is usually the region range 1400 - 500 cm^{-1}. From IR spectrum usually the diagnostic peak for meta-substituted ring is the presence of C-H waging pick from 810 - 750 cm^{-1} and the bending peak at 690cm^{-1}

- For ortho the C-H waging peak is 770-735cm^{-1} and there's no ring beanding peak at 690cm^{-1}
- para-substituted have strong ring-mode peak at 1516 cm^{-1} and C-H wag at 860 - 790cm^{-1} and no ring bond.

- From our IR spectrum; we have a C-H waging at 753.91 cm^{-1} and no ring bending at 690cm^{-1} and hence we can conclude that this is an ortho-substitution.

b) HNMR and ^{13}CNMR

(i - To identify the phenolic hydrogen then we need to examine the aryl protons which occur a region of 6.5 - 8 ppm. It has four signals. Which means the phenol is;

Carbon chain of the ester considering the expanded upfield.

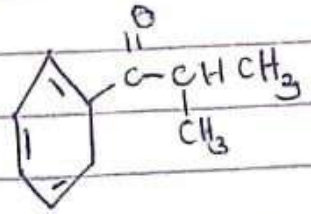
2. (ii) It has 3 signals at;

1.0 ppm → R-CH_3

1.8-1.9 ppm → CH

4.3-4.4 ppm → CH_2

From this we can deduce the structure of the ester as



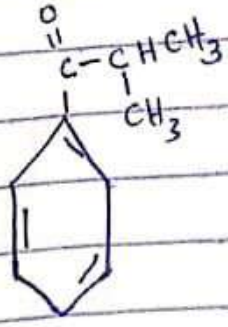
(iii) Expanded downfield Region (δ6.8-8.0ppm)

From this spectrum we can observe four signals. This usually the signal of arene protons.

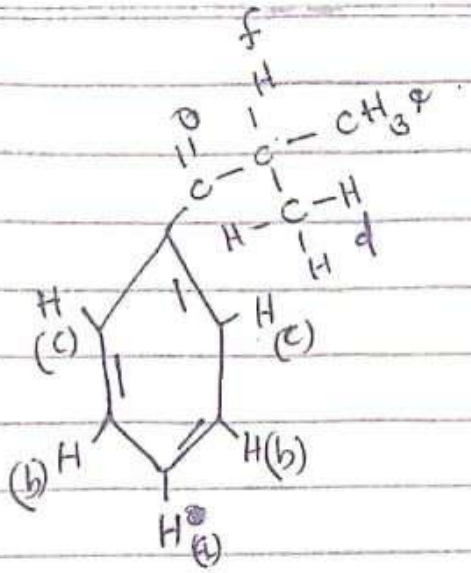
- Ortho shows six signals in substituted
- Meta shows six signals
- para shows four signals.

- We can conclude that the following is a para-substituted compound.

Therefore the structure of the ester is



3.



a) 6.573
b) 7.43
c) 6.98
d) 4.325
e) 1.059
f) 1.78

4 - The substitution by NMR differed with the substituhon IR. H NMR is more dipinitive since it explores all the factors including the electron donating and electron withdrawing which brings about the shielding and deshelding of protons.
The Magnetic power of NMR is important since the dishielded protons are usually ~~have~~ a downfield and therefore require a stronger NMR to absorb.