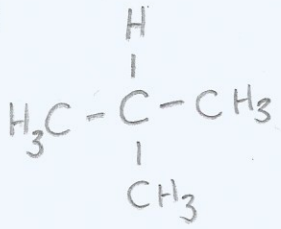
^{1}HNMR Answers

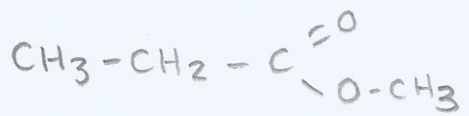
① 

methylpropane

Nmr - peak ⓐ 1.5 has 1 hydrogen so CH
peak ⓐ 1 has 9 hydrogens so $3 \times CH_3$

% mass + mass spec gives empirical formula of C_2H_5, coupled with molecular ion peak of 58 gives C_4H_{10}.

IR : Confirms C-H bonds.

② 

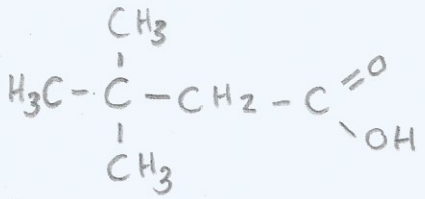
$CH_3CH_2COOCH_3$
methyl propanoate

Nmr - peak ⓐ 4ish has 3 hydrogens and using chemical shifts is $COOCH_3$
peak ⓐ 2.5ish has 2 hydrogens and using chemical shifts is CH_2-COO
peak ⓐ 1ish has 3 hydrogens and using chemical shifts is CH_3-CH_2

% mass + mass spec gives empirical formula C_2H_4O, coupled with molecular ion peak of 88 gives $C_4H_8O_2$.

IR: around $1750 cm^{-1}$ confirms carbonyl

③



3,3-dimethylbutanoic acid.

Nmr - peak @ 12 has 1 hydrogen and chemical shift suggests COOH.
peak @ 2.5 has 2 hydrogens and chemical shifts suggest CH_2-COOH
peak @ 1 has 9 hydrogens so $(CH_3)_3$

% mass + mass spec gives empirical formula of C_3H_6O, coupled with molecular ion peak of 116 gives $C_6H_{12}O_2$.

IR : around 1700-1725 cm^{-1} suggests carbonyl (ketone or COOH?)
broad peak at 2450-3150 suggests hydroxyl group (alcohols or COOH?)