Home work Problems

1. $C_3H_8O_2$, 1 HD = 0
   \[
   \begin{align*}
   58 q & \quad \frac{1}{3} \\
   60 t & \quad 2 \\
   73 t & \quad \frac{2}{7}
   \end{align*}
   \]
   $\rightarrow$ FG's - note $\rightarrow$ all down field.
   \[
   \text{H}_3\text{C} - \text{O} - \text{OH}
   \]
   $\rightarrow$ Try an arrangement where all attached to $C_2$.

2. $C_5H_{10}O$, 1 HD = 1
   \[
   \begin{align*}
   30 q & \quad (2) \\
   71 s & \quad 0 \\
   11 t & \quad 2 \\
   147 d & \quad 1
   \end{align*}
   \]
   $\rightarrow$ FG's $\rightarrow$ alkene
   $\rightarrow$ Put together
   \[
   \begin{align*}
   \text{H} & \quad \text{H} \\
   \text{H} & \quad \text{H}
   \end{align*}
   \]

not consistent:
C5H10O2

19 q (2)
34 d
51 q
177 d

$^{1}HOD = 1$

$\text{# H's on C} \frac{5}{L} = 1$

$\frac{0}{10} \rightarrow \text{all}$

- FG's $\rightarrow$ ester (not acid)

- 3 methyl groups
  $\rightarrow$ isopropyl + methyl

Possible

Expected $\uparrow_{22}$ $\uparrow_{107}$

this structure more consistent with data
4. C₅H₁₀O  

1 HD = 1  

all Hs on Carbons  

213(s) = ketone  

note symmetry of 2 Me groups

\[ \begin{align*}
213 & \text{ s} \\
42 & \text{ s} \\
27 & \text{ s} \\
18 & \text{ s (2)} \\
H'_{\text{a on C}} & = 10 \\
\end{align*} \]

→ FG → Ketone.

→ looks like i-Pr

\[ \begin{align*}
\text{CH}_3 & \rightarrow \text{H}_3\text{C} \\
\text{CH}_3 & \rightarrow \text{CH}_3 \\
\end{align*} \]

5. C₆H₁₂O  

1 HD = 1

11 Hs on C--1 alcohol  

no unsaturated functional groups--ring  

2 symmetrical carbons

\[ \begin{align*}
\text{OH} & \rightarrow \text{CH}_3 \\
\text{NO}_2 & \rightarrow \text{CH}_3 \\
\end{align*} \]
6. $\text{C}_5\text{H}_4\text{N} \rightarrow 1\text{H} = 1$

\[
\begin{array}{ccc}
56, \delta (2) & 4 \\text{N}^+ & \\text{on} & \\text{C} \\
42, \gamma \delta & 3 \\
24, \varepsilon (2) & 4 \\
11 & \\
\end{array}
\]

- $\delta \rightarrow \varepsilon$ - must be a ring. More symmetry.

$\text{Me}$

$\text{N}$

7. $\text{C}_4\text{H}_9\text{NO}$

\[
\begin{array}{ccc}
170, \nu & 0 \\
34, \varepsilon & 2 \\
23, \varphi & 3 \\
15, \gamma & 3 \\
8 & \\
\end{array}
\]

$\text{F}_6\'2 \rightarrow$  

\[\text{Me} \delta + \text{N}^+ \delta \]

\[\quad \text{Me} \delta \quad \text{N} \delta \]

\[\text{N} \delta \quad \text{Me} \delta \]

What is left? \( \rightarrow \text{aryl or methyl} \)

if this were the structure, would expect

\[\text{Me} \quad \text{Me} \quad \text{Me} \]

\[\text{N} \quad \text{N} \quad \text{N} \]

Go to book.

\[\begin{array}{ccc}
9 & \text{H} & \text{N} \\text{Me} + \text{N} \\
\text{Me} & 27 \\
\end{array}
\]

\[\begin{array}{ccc}
20 & \text{Me} & \text{N} \\
36 & \text{Me} & \text{N} \\
\end{array}
\]

the above chemical shifts
are for the closest structures
from tables in your book.
expect chemical shifts of 8, 35, 46, 16, 14 (see below)

numbers from book

[Diagram of a molecule with labels 30, 45, 31, 35, 14, 46]
9. $\text{C}_{5}\text{H}_{10}\text{O}$  $1\text{H}=2$  all Hs on C

\[
\begin{array}{c|c|c}
\text{J} & \text{d} & 1 \\
\text{5} & \text{d} & 1 \\
\text{27} & \text{t} (2) & 4 \\
\text{26} & \text{t} (2) & 4 \\
\text{25.6} & \text{t} & 2 \\
\text{25.3} & \text{t} (2) & 4 \\
\hline
16
\end{array}
\]

\text{aldehyde, 205(d)}

\text{no aldehyde. No methylenes} \rightarrow \text{thick ring}

\text{note symmetry.}

\text{consistent with 3-identical methyl groups}

10. $\text{C}_{5}\text{H}_{12}\text{O}$  $1\text{H}=0$  1 H not on C: alcohol

\[
\begin{array}{c|c|c}
\text{J} & \text{t} & 2 \\
\text{33} & \text{a} & 9 \\
\text{26} & \text{g} (3) & \\
\hline
9
\end{array}
\]

\text{consistent with 3-identical methyl groups}
one H not on C: alcohol
FG = 1,2-disubstituted alkene
69(d) = CH of alcohol (see below)
<table>
<thead>
<tr>
<th>Number</th>
<th>Formula</th>
<th>1HDO</th>
<th>Description</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.</td>
<td>C₆H₁₄O</td>
<td>0</td>
<td>all Hs on carbon: must be an ether, no symmetry</td>
<td>No on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>For this we would expect the Me-group</td>
</tr>
<tr>
<td>13.</td>
<td>C₅H₁₀O</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>no symmetry</td>
</tr>
<tr>
<td>14.</td>
<td>C₃H₈O₂</td>
<td>0</td>
<td>2 Hs not on C: 2 alcohols</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 OH</td>
</tr>
<tr>
<td>15.</td>
<td>C₅H₁₀O</td>
<td>1</td>
<td>1 H not on C: 1 alcohol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>symmetry: 2 carbons are identical</td>
<td>no unsaturated functional groups: we have a ring.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67(t) = CH₂ connected to alcohol</td>
</tr>
</tbody>
</table>
only 7 H's on C: must be alcohol
146 and 110 = alkene
67 = CH2 next to alcohol

16. C4H8O
   1 HD = 1
   146 s 0
   147 t 2
   67 t 2
   20 q 3
   only 7 H's on C: must be alcohol
   146 and 110 = alkene
   67 = CH2 next to alcohol

17. C5H12O
   1 HD = 0
   73 t 2
   59 q 3
   32 t 2
   19 t 2
   14 q 3
   all H's on carbon: must be ether
   59(q) = Me–O
   73(t) = –CH2–O

18. C5H12O
   1 HD = 0
   67 d 1
   42 t 2
   23 q 3
   19 t 2
   14 q 3
   only 11 H's on C: must be alcohol
   67(d) = –CH–OH
19. C\textsubscript{4}H\textsubscript{9}NO. 1H\textsubscript{D} = 1

\[ \begin{array}{c}
171 & s & 0 \\
38 & q & 3 \\
35 & q & 3 \\
22 & q & 3/9 \\
\end{array} \]

Double bond character of amide results in slow rotation: the N-Me groups are different!

\[ \begin{array}{c}
\text{22} \\
35(q), 38(q) \\
\end{array} \]

Double bond character results in slow rotation. The N-Me groups are different!

20. C\textsubscript{11}H\textsubscript{20}O\textsubscript{2}

\[ \begin{array}{c}
174 & s \\
65 & t \\
34 & t \\
26 & t \\
24.8 & t \\
24.5 & t \\
24.0 & t \\
23.9 & t \\
23.5 & t \\
23.3 & t \\
23.1 & t \\
\end{array} \]

all H's are on Carbons

174(s) = ester (or lactone, which is a cyclic ester)