LAST NAME_____ FIRST NAME_____
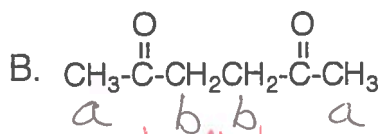
SS#_____   Circle SECTION: M/W   or   T/Th

Determine the number of nonequivalent sets of protons and label each set (a, b, etc.).
Predict the multiplicity of each signal (i. e., how many peaks is each signal split into)
for each set of protons in the ^{1}H NMR of each compound.

A. CH$_3$-C-Ha with CH$_3$ b groups
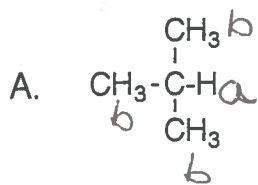
$$H_a \Rightarrow N+1 = 9+1 = 10 \text{ (10 line pattern)}$$

$$H_b \Rightarrow N+1 = 1+1 = doublet$$

B. CH$_3$-C(=O)-CH$_2$CH$_2$-C(=O)-CH$_3$
    a   b b   a

$$H_a \Rightarrow N+1 = 0+1 = singlet$$

$$H_b \Rightarrow N+1 = 0+1 = singlet$$

equivalent
protons do NOT split each other

C. a CH$_3$ b ← septet
    CH$_3$-CH-CH-CH$_3$ a ← d
    a   CH$_3$ a
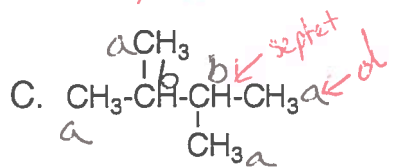
$$H_a \Rightarrow N+1 = 1+1 = doublet$$

$$H_b \Rightarrow N+1 = 6+1 = 7, septet$$

D.

CH$_3$CH$_2$CH$_2$ — C=C — Ha
f e d | |
          CH$_3$ H b
            c

6 signals

singlet
exchangeable
NH$_2$
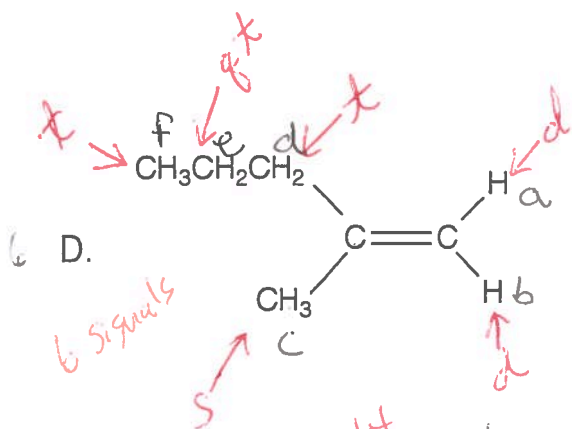
$$H_a \Rightarrow N+1 = 1+1 = doublet$$

$$H_b \Rightarrow N+1 = 1+1 = doublet$$
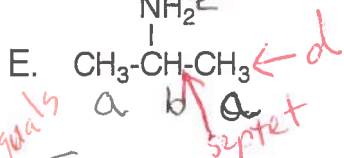
$$H_c \Rightarrow N+1 = 0+1 = singlet$$

$$H_d \Rightarrow N+1 = 2+1 = triplet$$

$$H_e \Rightarrow (N+1)(N+1) = (2+1)(3+1) = 12 \text{ lines}$$
$$\uparrow \qquad \uparrow \qquad or \; qt$$
$$H_d \qquad H_f$$

$$H_f = N+1 = 2+1 = triplet$$

E. CH$_3$-CH-CH$_3$ ← d
    a   b   a ← septet

3 signals
normal
purity

$$\left(H_a \Rightarrow 1+1 = doublet \right.$$
$$H_b = 6+1 = septet \left. \right\}$$ clue for
isolated isopropyl group
$$H_c = singlet \text{ (exchangeable — does NOT couple} \right)$$ unless
ultra pure