

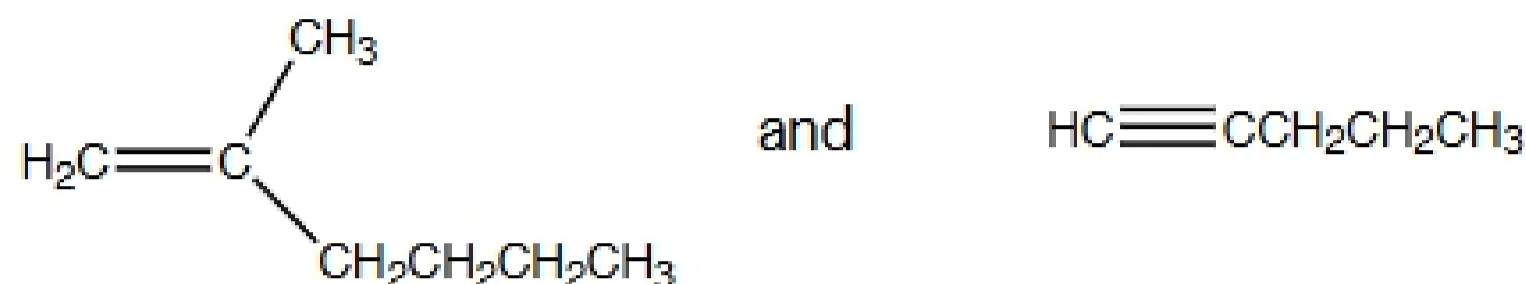
TABLE OF ATOMIC WEIGHT MULTIPLES

C ₁ 12	O ₁ 16
C ₂ 24	O ₂ 32
C ₃ 36	O ₃ 48
C ₄ 48	O ₄ 64
C ₅ 60	O ₅ 80
C ₆ 72	O ₆ 96
C ₇ 84	
C ₈ 96	N ₁ 14
C ₉ 108	N ₂ 28
C ₁₀ 120	N ₃ 42
C ₁₁ 132	N ₄ 56
C ₁₂ 144	N ₅ 70
C ₁₃ 156	
C ₁₄ 168	
C ₁₅ 180	
C ₁₆ 192	
³⁵ Cl ₁ 35	⁷⁹ Br ₁ 79
³⁵ Cl ₂ 70	⁷⁹ Br ₂ 158

<u>Type of H atom</u>	<u>Chemical Shift (δ)</u>
saturated alkyl	0.5-1.5
C=C-C-H, O=C-C-H, C≡C-H	1.5-2.5
X-C-H; X=O, N, S, Hal	2.5-4.5
C=C-H, RX ₂ C-H	4.5-6.5
aryl H	6.5-8.5
O=C-H	7.8-10.5
alkyl O-H	varies
alkyl N-H	varies
RCO ₂ H	11.0-14.0

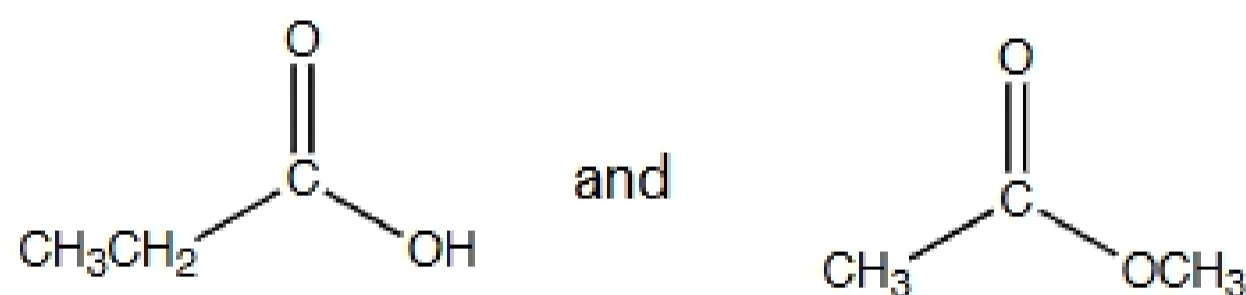
1. (15 pts) How would each of the following pairs of compounds differ in their IR spectra? Describe precisely the differences in IR data of the two compounds that would allow you to unambiguously distinguish between them. Be thorough but brief (no more than two sentences).

(a)



The alkene will show a C=C stretch at 1650 cm^{-1} and a $\text{Csp}^2\text{-H}$ stretch at $3000\text{-}3150\text{ cm}^{-1}$; each of these stretches will be absent in the IR spectrum for the alkyne, which will instead contain C≡C and Csp-H stretches at 2250 cm^{-1} and 3300 cm^{-1} , respectively.

(b)



The carboxylic acid will show a strong and broad O-H absorption between $2500\text{-}3500\text{ cm}^{-1}$, which will be absent in the IR spectrum for the ester. It is also possible to distinguish the compounds by their carbonyl stretches: $\nu(\text{CO})$ for $\text{RCOOH} \approx 1710\text{ cm}^{-1}$ while $\nu(\text{CO})$ for $\text{RCOOR} \approx 1735\text{-}1745\text{ cm}^{-1}$.