CONCEPT: ^{1}H NMR – SPIN-SPLITTING WITHOUT J-VALUES

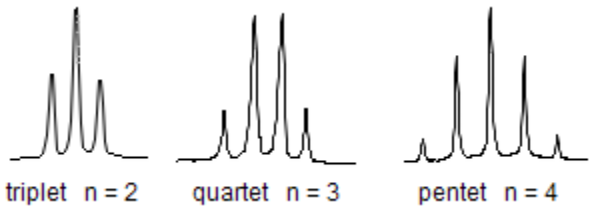
Also known as *spin-spin coupling*, or *J-coupling*, this describes the distances between different protons.

Note: This topic can be taught with or without J-values. Check with your professor to determine how much detail you should learn. For now, we will start with the *simplest explanation,* (should suffice for 90% of professors), which is without J-values.

- Adjacent, _____ - _____ protons will split each other's magnetic response to the NMR
  - □ We use the _____ rule to determine how many splits we will achieve
  - □ *Pascal's Triangle* predicts the shape of the splits we will get

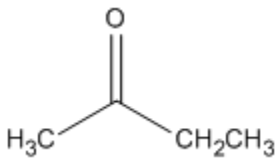
Pascal's Triangle with the (n + 1) Rule

n									
0	singlet				1				
1	doublet				1	1			
2	triplet			1	2	1			
3	quartet			1	3	3	1		
4	quintet		1	4	6	4	1		
5	sextet		1	5	10	10	5	1	
6	septet	1	6	15	20	15	6	1	
7	octet	1	7	21	35	35	21	7	1

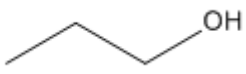


EXAMPLE: How will the following protons be split?

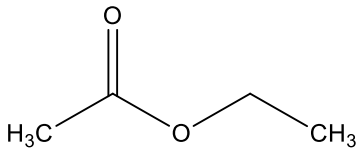
a.



b.



PRACTICE: Predict the splitting pattern (multiplicity) for the following molecule:



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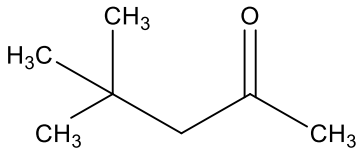

PRACTICE: Which of the following compounds gives a ^{1}H NMR spectrum consisting of only a singlet, a triplet, and a pentet?

a) $CH_3OCH_2CH_2CH_2CH_2OH$

b) $CH_3OCH_2CH_2OCH_2CH_3$

c) $CH_3OCH_2CH_2CH_2OCH_3$

d) $CH_3OCH_2CH_2OCH_3$