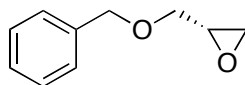
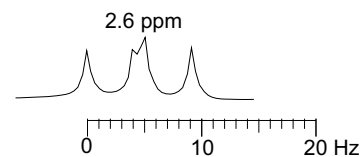
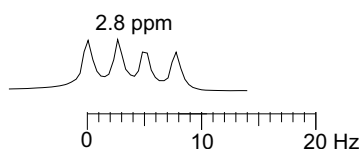
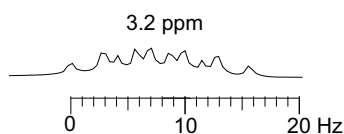
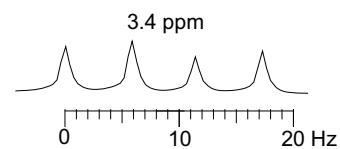
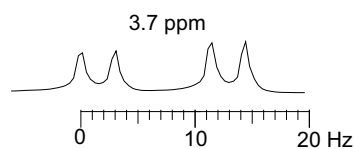
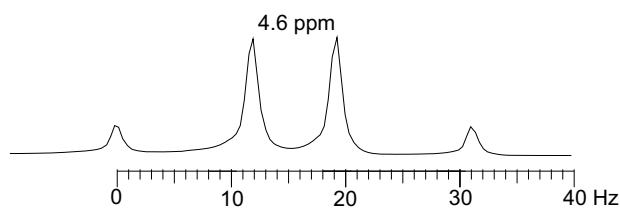
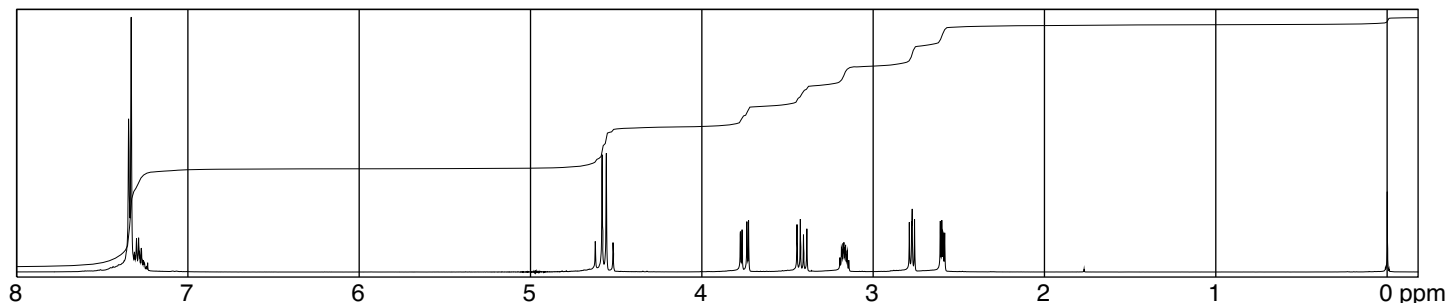


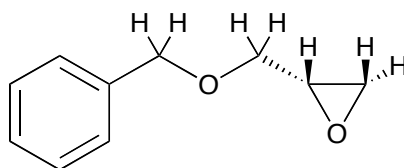
3. The ^1H NMR spectrum of (*S*)-glycidyl benzyl ether (300 MHz in CDCl_3 , with TMS) is shown below, along with expansions of the resonances at 4.6, 3.7, 3.4, 3.2, 2.8, and 2.6 ppm. (20 points)



(*S*)-glycidyl benzyl ether



a. Assign the resonances at 4.6, 3.7, 3.4, 3.2, 2.8, and 2.6 ppm to the various protons in the molecule, by writing the chemical shift next to the protons on the diagram below. Appendix F from Silverstein is provided at the end of this problem to help you.



b. Describe the multiplets and measure the coupling constants for the resonances at 3.7, 3.4, 2.8, and 2.6 ppm:

3.7 ppm (description and coupling constants): _____

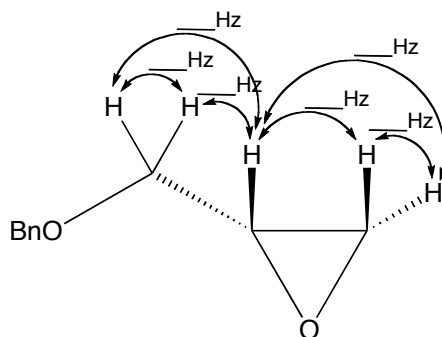
3.4 ppm (description and coupling constants): _____

2.8 ppm (description and coupling constants): _____

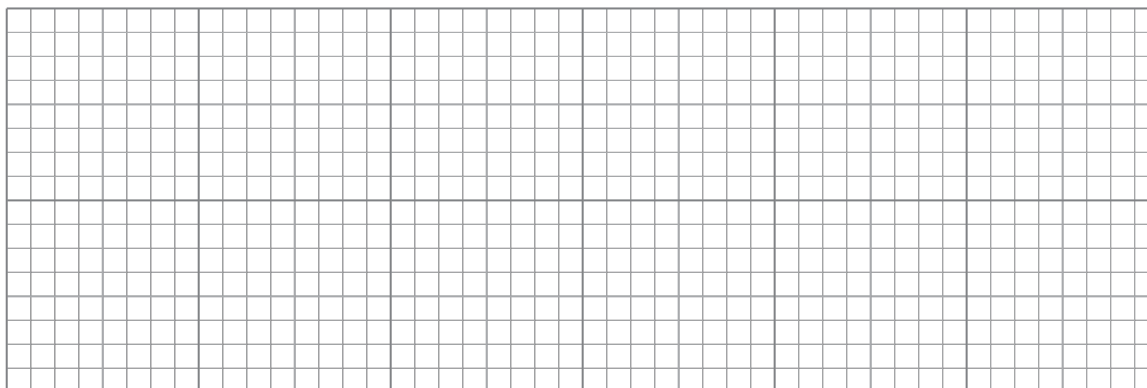
2.6 ppm (description and coupling constants): _____

c. Explain the appearance of the resonances at 4.6 ppm:

d. Based on your analysis in sections a–c, write each geminal ($^2J_{\text{HH}}$) or vicinal ($^3J_{\text{HH}}$) coupling constant on the line by the corresponding arrow.



Explain the appearance of the resonances at 3.2 ppm. Make a splitting diagram to aid in your explanation. Use a scale of 1 box is equal to 1 Hz on the horizontal axis and accurately represent the relative heights of the lines on the vertical axis.



e. What differences would you expect between the ^1H NMR spectrum of (*R*)-glycidyl benzyl ether and the ^1H NMR spectrum of (*S*)-glycidyl benzyl ether?

f. What differences would you expect between the ^1H NMR spectrum of racemic glycidyl benzyl ether and the ^1H NMR spectrum of (*S*)-glycidyl benzyl ether?

APPENDIX F PROTON SPIN-COUPLING CONSTANTS

Type	J_{ab} (Hz)	J_{ab} Typical	Type	J_{ab} (Hz)	J_{ab} Typical
	0-30	12-15		6-12	10
CH_a-CH_b (free rotation)	6-8	7		0-3	1-2
	0-1	0		4-10	7
				0-3	1.5
ax-ax	6-14	8-10		0-3	2
ax-eq	0-5	2-3	$\text{C}=\text{CH}_a-\text{CH}_b=\text{C}$	9-13	10
eq-eq	0-5	2-3		3 member	0.5-2.0
	<i>cis</i> 5-10 <i>trans</i> 5-10			4 member	2.5-4.0
(<i>cis</i> or <i>trans</i>)				5 member	5.1-7.0
	<i>cis</i> 4-12 <i>trans</i> 2-10			6 member	8.8-11.0
(<i>cis</i> or <i>trans</i>)			$\text{CH}_a-\text{C}\equiv\text{CH}_b$ $-\text{CH}_a-\text{C}\equiv\text{C}-\text{CH}_b-$	7 member	9-13
	<i>cis</i> 7-13 <i>trans</i> 4-9			8 member	10-13
(<i>cis</i> or <i>trans</i>)				2-3	
CH_a-OH_b (no exchange)	4-10	5		2-3	
	1-3	2-3			6
$\text{C}=\text{CH}_a-\text{CH}_b$	5-8	6			4
	12-18	17			2.5
	0-3	0-2		J (<i>ortho</i>)	6-10
				J (<i>meta</i>)	1-3
				J (<i>para</i>)	0-1
				J (2-3)	5-6
				J (3-4)	7-9
				J (2-4)	1-2
				J (3-5)	1-2
				J (2-5)	0-1
				J (2-6)	0-1
				J (2-3)	1.3-2.0
				J (3-4)	3.1-3.8
				J (2-4)	0-1
				J (2-5)	1-2